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A Science Teacher's Teaching Moves about Low and High Achieving Students: A Belief System Approach

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ABSTRACT

Closing the science achievement gap between low achieving (LA) and high achieving (HA) students has become an important part of educational policies, particularly in Turkey. Bearing this in mind, the purpose of the present study is to reveal a science teacher's teaching moves about LA and HA students and the pedagogical belief system behind these moves. This single case study relates to one science teacher (Mehmet), who performed explicit teaching moves. In order to determine the moves being used with LA and HA students, Mehmet is asked to write questions that he often uses in his lessons and explain the moves that he has applied during the questioning and solution phases. In addition, semi-structured interviews regarding teaching motivation, science teaching motivation, science teaching practices and beliefs about LA and HA students are conducted so as to reveal the belief-oriented background of these moves. The results show that the teaching moves varying according to the achievement differences is a complex phenomenon. Mehmet changes the structure of his scaffolding, his scientific practices and classroom technologies according to the achievement differences. He produces these teaching moves using a nested structure in which he contextualizes his teaching strategies in is daily science teaching practices.

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[1] This article is based on the first author's doctoral thesis, which was directed by the second author.

INTRODUCTION

The achievement gap among the students in schools, in different classroom and the students in the same classroom is among the subjects that has been given importance by teachers, researchers and policy makers for many years. The United States of America, for example, has implemented a reform named No Child Left Behind (NCLB) (2001) in order to close the achievement gap and provide quality education and create equal opportunities for every student. In Turkey, the Primary Education Program (PEP) has been initiated in order to provide equal, qualified education for all students focusing in particular on. The purpose of PEP was to educate students who do not meet the requirements of the Turkish and Mathematics curriculum in previous school years (PEP, 2018).

In the case of science education, the achievement gap is particularly alarming considering the goals and projects of developed and developing countries. PISA (Program for International Student Assessment) results, for example, showed that almost 20% of students in the Organization for Economic Cooperation and Development (OECD) countries showed a performance below the Level 2, the basic level of competence in science. These students generally confuse the main features of scientific research, apply incorrect scientific knowledge and confuse personal beliefs with scientific facts when making judgements (OECD, 2018).

Researchers agree that the reasons for the science achievement gap, are the considerable effect of science achievement acquired in early years, on achievement in later years (Morgan et al., 2016). When students are observed from the first stage of education to the middle school stage, the achievement gap between LA and HA in science increases. This is based on several pedagogical factors such as the type of alma mater and the quality of science teaching in the schools (Acar, 2018). The science teachers play a central role in these factors because some of their ‘teaching moves’ (i.e., iterative changes in classroom activities for making science meaningful for all students) and pedagogical belief set behind these moves exacerbate the science achievement gap. Researchers agree that the most important factor affecting teachers’ in-class practices is their pedagogical beliefs (Fives & Buehl, 2012; Fives & Gill, 2015; Hayes, 2010; Kilinc et al., 2014; Pajares, 1992). Kilinc et al. (2017) argue that teacher epistemologies, beliefs about student learning and teaching efficacy are the central beliefs within the teachers’ pedagogical belief systems and the teachers heuristically consult these beliefs when they make daily decisions on what to ask, how to react or whether it is necessary to conduct a particular teaching moves.

In terms of achievement differences, existing research (e.g., Zohar et al., 2001) shows that many science teachers possess problematic beliefs about how to undertake effective moves relevant for HA as opposed to LA students. Many teachers do not believe LA students to be capable of achieving higher-order learning goals (Raes et al., 2014; Zohar et al., 2001). It is considered that LA students generally lack metacognitive skills (e.g., collaborative planning, monitoring and reflection) (Yang et al., 2016, 2020). The data, for example, show teachers that seek to place greater emphasis on higher order thinking skills in classrooms with HA students in comparison to those with LA students (Page, 1990; Raudenbush et al., 1993; Zohar et. al., 2001). In one study, Raudenbush et al. (1993) determine the beliefs of science teachers (303 middle-school teachers) about higher order thinking and whether they emphasize these thinking activities in classrooms with differing levels of student achievement. It is found that while science teachers believe that HA students are able to accomplish many complex learning tasks in mathematics and science, they also think that LA students are able to complete complex learning tasks at a relatively less demanding basic level. In another study, it is observed that some science teachers asked far more difficult questions to HA students than to LA students (Zohar et al., 2001). The reason for the difference in these moves is the belief that instructional activities at a lower cognitive level were more appropriate for LA students. Almost half the science teachers in the study state that the most suitable method for LA students is the “transmission of knowledge”. In addition, it is stated in the literature that traditional science teaching approaches, such as transmission of knowledge and reading textbooks for enhancing memory, are generally applied to LA students (Juuti et al., 2010; Kouso et al., 2018).

In another study (Torff, 2006), an assessment and evaluation instrument, related to Critical Thinking Belief Appraisal, was applied to 194 middle-school teachers. The results showed that expert science teachers expressed saw higher order thinking activities more suitable for HA students than LA students. In addition, Even and Kvatinsky (2009) observed the teaching methods of two mathematics teachers in two different classrooms including one with HA students and one with LA students. The researchers stated that the teachers followed different methods in each class when teaching the same subject. For example, they applied a method based on a ‘mechanistic answer finding’ approach in the LA classroom, whereby students almost never talked, while the teacher was explaining and asking questions. In contrast, students in the HA classroom were encouraged to get involved in the learning process by implementing an ‘understanding based’ method. They were asked to reconsider and examine their own and other students’ responses. Furthermore, it was observed that the teachers did not grant the same time to LA students to present their own solutions as they did in the HA classes and teachers generally answered their own questions in LA classes. In another study, Lokan et al. (2003) analyzed the data collected in Australia as part of a TIMSS Video Study. They concluded that teachers encouraged HA students to suggest alternative solution methods more than LA students. In a study focusing on how LA students were identified and the characteristics of the supplemental support provided to them, the teachers in the sample stated that they used a simplistic approach to help students succeed and that they provided easier versions of the assignments or teaching materials than they did for HA students (Jönsson, 2018). In addition, in another research findings teachers in the sample stated that more challenging learning tasks should be given to HA students (Barbier et al., 2022).

Some researchers argue that exceptional teachers may gain high student achievement even in low-achieving schools (Felch et al., 2010; Marzano et al., 2001). Of importance here is the activities or beliefs these teachers exhibit. Schmid (2018) have studied the activities and beliefs of teachers in low-achieving schools that consistently lead to high student achievement. His findings show that all three teachers who participated this research believe that all students can and do learn and this belief has a significant impact on student achievement. Teachers in this study repeat over and over until all students understand. Teachers in this study believe that the appropriate instruction is crucial for student success. The teachers believe that they need to continuously learn new teaching strategies through professional development for LA students and that if they provide appropriate instruction to them, LA students are able to succeed.

As can be seen, even if there are some positive exceptions, the existence of achievement difference may be exacerbated by the teacher moves and the beliefs behind them. Considering limited research on the moves about LA and HA students above, we believed that it is important to deeply investigate these moves which science teachers use and their pedagogical belief systems behind them. This is particularly important in terms of improving the academic success level of students with different achievement status, closing the achievement gap and allowing every student to benefit from educational resources to the same degree. Taken together, the aim of the present study is to determine a science teacher (Mehmet)’s teaching moves about LA and HA students and uncover the pedagogical belief system behind these moves. The following research questions are put forward:

- What teaching moves about LA and HA students did Mehmet perform in his science teaching?
- What was the nature of Mehmet’s pedagogical belief system about LA and HA students?
- Which of Mehmet’s pedagogical beliefs were responsible for his teaching moves about LA and HA students?

METHOD

Research Design

A holistic single-case study design is used in this interpretive research. According to Yin (2014), case studies are the research strategies that elaborately examine a current concept, or event within its own real-life context and are applied especially when the borders between the facts and its environment are unclear. Yin (2014) has suggested that single-case studies can be used in exposure of something which is previously unknown. In this study, a real concept (teaching moves) is extensively examined in a natural setting (Lincoln & Guba, 1985) and the moves about LA and HA students, the belief systems and the relationships between them that are unknown due to limited research is investigated (Creswell, 2012; Yin, 2014).

Research Sample

Since the snowball purposive sampling method provides data-rich cases for in-depth study (Patton, 2002), it is chosen for this study being applicable to determine which teachers undertake differing achievement levels into consideration. Accordingly, a middle school in Turkey is selected using a convenience sampling procedures in the 2016-2017 academic year. Permission for access is granted to the lessons of two science teachers (Hasan and Elif) in order to conduct the observations. An in-class science teaching observation form (Ross et al., 2004) is used during the observations. Several notes were taken about the teaching practices of teachers (e.g., questioning, feedback, and teaching materials utilised). In addition, the average grade of the class in the school science examination is consulted and the students attaining a lower grade than the average are categorized as LA, while those with a higher than average grade are categorized HA. This categorization is shared with the teachers and their approvals obtained.

After four-week (16 classroom hours) of classroom observations, it was concluded that Hasan and Elif implemented the same standard teaching strategies in all classes and did not differ in their teaching move regarding the achievement differences. At this stage, three science teachers (Aslı, Mehmet and Seda) in another school, were selected according to convenience procedures, to be included in the research process. The science lessons of these teachers were observed within same class and different classes in terms of students with different achievement levels. Using the same science teaching observation form (Ross et al., 2004) and after four-weeks of classroom observations (16 classroom hours for each teacher), only Mehmet used specific teaching moves according to whether he was teaching LA and HA students. For example, he asked superficial questions to LAs, whereas for HA student the questions were much more indepth. In addition, he utilized specific examples requiring high-level computations for HA students, which was not the case for LA students. Based on this Mehmet was selected to participate in single case study it being believed that he not only seemed to benefit from a range of teaching moves about achievement differences, but also potnetially possessed a rich belief set backing these moves.

In order to uncover Mehmet's teaching moves for students with different achievement levels, a thinking-aloud interview was conducted with him. In the interview, Mehmet was asked to write three questions that he used in order to teach basic science concepts and mechanisms. For this question topics were selected with the help of an experienced science teacher and a science educator. These topics were 'lifting force', 'states of substance and heat' and 'cell division and genetics'. Mehmet was asked to write one question for each of these topics and to explain how to ask this question and organize how to solve it for LA and for HA students. For ascertaining the pedagogical belief system backing these teaching moves, four semi-structured interviews were held related to 'teaching motivation', 'science teaching motivation', 'science teaching practices' and 'achievement differences in science classrooms'.

These interviews were conducted and recorded in different weeks and took about one hour for each. The voice recording equipment was used during the interviews. Before conducting all interviews, Mehmet was informed about ethical procedures and about the fact that he could leave the study whenever he wanted. In addition, the interview questions and procedures were confirmed by an ethical committee within one of the Turkish universities.

Research Instruments and Processes

Following five interview forms (IFs) were used in the present study. First form was used in order to reveal the teaching moves about LA and HA students, whereas remaining four were used to reveal the pedagogical belief system backing the teaching moves. All of the interviews were guided by three science educators in terms of validity and the forms were transcribed into text as indicated in the **Appendix.**

Interview 1. Teaching Moves-Thinking Aloud

This form included questions inviting Mehmet to write three different questions about the topics 'lifting force', 'states of substance and heat' and 'cell division and genetics' that he used during his science teaching for 8th grade students. In addition, the form included further questions asking Mehmet to conduct teaching moves for LA and HA students in his questioning, explanations and problem solving stages.

Interview 2. Teaching Motivation

This form included nine questions intended to determine Mehmet's beliefs about teaching motivation. In addition, factors influencing his selection of teaching as a career and his perceptions about the teaching profession, such as its demanding nature, social status and financial gains were asked. The studies by Sonmez (2015) and Kilinc et al. (2013) were used in the preparation of this form.

Interview 3. Science Teaching Motivation

This form consisted of eight questions about science teaching efficacy and achievement-oriented goals by Mehmet. The studies of Georgiou et al. (2002) and Sonmez (2015) were used in the preparation of this form.

Interview 4. Science Teaching Practices

This form included eleven questions about the nature of Mehmet's teaching practices. The questions were related to constructivist approaches, inquiry-based science teaching and process-oriented assessment-evaluation approaches. Rosenfeld and Rosenfeld (2006) and Sonmez's (2015) studies were used in the preparation of this form.

Interview 5. Achievement Differences in Science Classrooms

This form included three questions. Mehmet was asked to state the reasons for the achievement differences in the science classrooms, the characteristics of the LA and HA students and his teaching moves about LA and HA students.

Data Analysis

Grounded theory were utilized in the data analysis. Grounded theory is a method of systematically gathering and analyzing data and discovering new phenomena. Constant comparative analysis is one of the important features of this approach. Data collection and data analysis were carried out simultaneously (Glaser & Strauss, 1967).

In the grounded theory, coding is done for the purpose of conceptualizing the data by analyzing and to define the patterns or events in the data (Kuş, 2006). The analysis of the data obtained from the interviews consists of three stages: open coding, axial coding and selective coding. In open coding stage the data is reading and ideas or concepts that are considered important are determined by codes consisting of one or more words. In axial coding stage, categories are associated with subcategories and this relationship is tested based on data. In other words, which concepts are more important are decided and presented in a certain order. The selective coding stage, it is the process of selecting a category as the core category and associating all other categories with that core category. The core category represents the central fact about the studied situation. In this stege, final arrangements are made for the explanation of the investigated phenomenon. Finally, the research report is written by including the details of the subject and processes. In addition, some examples and quotes from the participants are included (Christensen et al., 2011).

A data set was constituted by making transcriptions of all interviews prior to the data analysis. The interview transcriptions were read separately by two authors. This made detecting the patterns easier. Memos were made and words were underlined to identify possible codes and categories. The analysis of the data obtained from the interviews consists of four phases open coding, axial coding, selective coding and model development (Kilinc et al., 2017; Strauss & Corbin, 1998).

Open coding, axial coding, selective coding stages were used for responding the first two research questions (i.e., 1. What teaching moves about LA and HA students did Mehmet perform in his science teaching? and 2. What was the nature of Mehmet's pedagogical belief system about LA and HA students?), whereas all stages were used for responding to the last research question (i.e., 3. Which pedagogical beliefs in Mehmet's pedagogical belief system were responsible for his teaching moves about LA and HA students?).

Through open coding phase of the analysis, the data obtained as a result of the interviews with Mehmet were read many times and coded by the researcher. The codes were written on paper directly next to the data. Those with similar meanings in different parts of the data were also named with the same code. In this way, the data in different parts of the data set and related to each other in terms of meaning were brought together. The codes were produced according to the meaning that emerges directly from the data. These codes were helped researchers identify categories. Conceptually similar beliefs were grouped into categories and quotations representing these categories were noted.

Axial coding requires an in-depth analysis of a category in order to uncover interactions and relationships with other categories, subcategories, and properties (Strauss & Corbin, 2002). In axial coding, the belief categories determined in open coding were then associated with subcategories and supported with quotes from Mehmet and also this relationship was tested based on data. With selective coding, a belief category was selected as the core category and all other categories were associated with this core category. Because both the teaching moves and Mehmet's pedagogical belief system were based on self-report data, the belief-oriented categorical system was used for uncovering the moves and belief system.

At the end of this categorical stage (i.e., at fourth stage), matches were made between the beliefs representing the moves and pedagogical belief system using the belief coherences (Kilinc et al., 2017) existing in the utterances. By displaying these matches with the lines, a visual model was produced, exhibiting possible relationships between the moves and the pedagogical belief system.

Trustworthiness

The methods suggested by Lincoln and Guba (1985) were used in this research to ensure trustworthiness. A longitudinal research design was planned in the field for procuring the internal validity (credibility) of research. The observations lasted approximately five months (32 weeks) and observations were conducted in each teacher's (total five science teachers) lessons for at least two hours per week. In this process, a bond of trust was established between the first author and the teachers. In addition, data triangulation and researcher triangulation were used to ensure the findings and comments were trustworthy. Peer debriefing was performed in the scheduling of all stages and data analysis. It was detected that there was an 80% compatibility between the belief categories and model building obtained by the first author and peer researcher (second author), after which repeated discussions were held until the compatibility rate increased to 100%. In addition, purposive sampling and extensive descriptions were used for the external validity (transferability). Within the scope of the research, the factors, such as data collection tools, data analysis and selection of Mehmet were explained in detail. In addition, direct quotations were made from Mehmet's opinions. In addition, two science educators, specialized in the field of science education, provided as an external audit at every stage of the research in order to ensure consistency.

RESULTS

Figure 1 represents the main results of the present study. The model has been formed by coding data according to suggestions of Strauss and Corbin (1998).This visual model not only shows the teaching moves (Research question 1) and Mehmet's pedagogical belief system (Research question 2), but also displays the relationships between them (Research question 3). In the following section, the results for each Research question are presented.

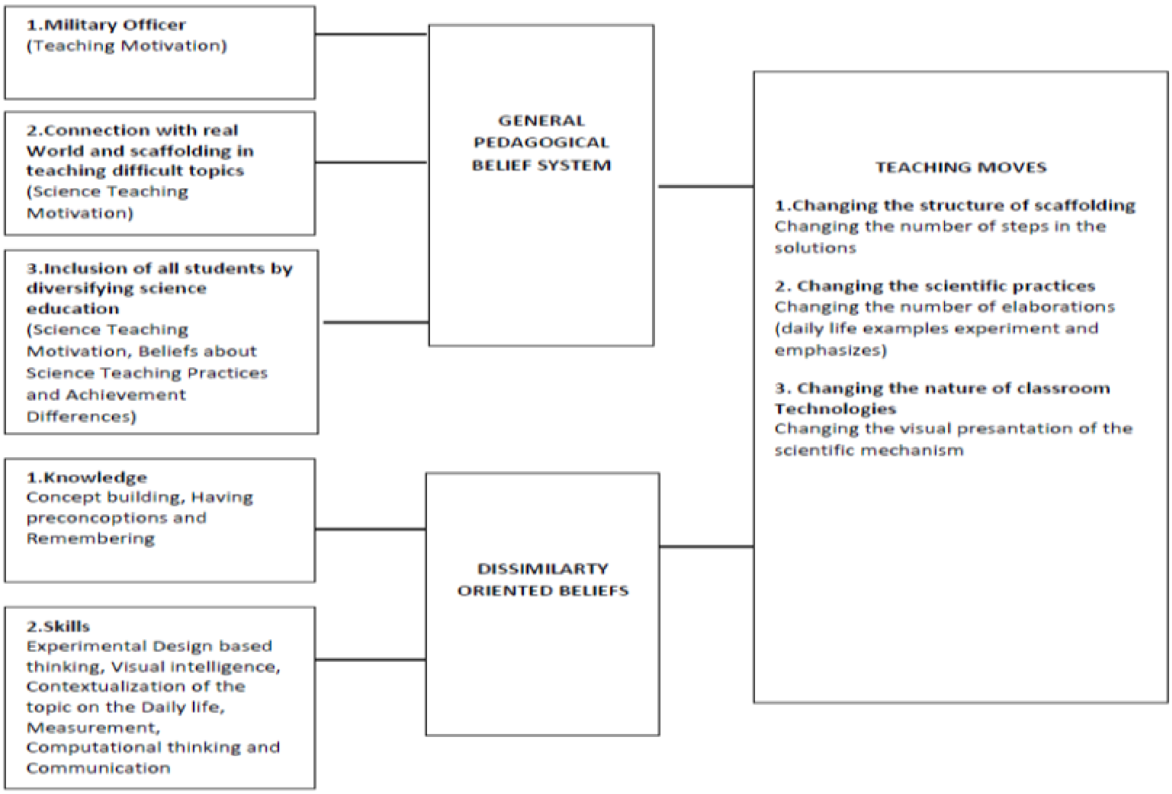

Figure 1. *The Model indicating the relations between the pedagogical belief system and the teaching moves performed by Mehmet regarding LA and HA students**

**Due to the bidirectional relationships, only lines were used for representing the relationships.*

Mehmet's Teaching Moves About LA and HA Students

Mehmet was asked to write one common question for each of the following subjects: (1) 'lifting force', (2) 'states of substance and heat' and (3) 'cell division and genetics' in order to specify the teaching moves about LA and HA students.

1. The question written for 'lifting force', referred to

'*K, L and M objects in different positions (floating, suspended, and sinking) in a liquid. He asked for the magnitudes of lifting forces to which these objects were subjected, sorted in descending order, (assuming the weights of all objects were equal)*'.

2. The question on 'states of substance and heat',

Mehmet asked *'50 ml and 100 ml of water were poured into two separate containers at equal temperatures, and he asked for the required heat quantities in order to increase the water temperature from*

20^0C to 50^0C to be compared.'

3. The question on 'cell division and genetics',

Mehmet asked the following question: "*What happens during the preparation and realization stages of mitosis cell division?*"

Mehmet was asked to express the moves he used while directing these questions to LA and HA students and for the process of solving them. At this stage, Mehmet was asked the following question:

"*What kind of alterations would you conduct if you use these questions to explain the scientific concepts and mechanisms in a class of either only LA students or HA students?*"

At the end of the data analysis, three major categories were identified:

- 'teaching moves about explanations',
- 'teaching moves about teaching strategies' and
- 'the dissimilarities causing the different teaching moves'.

The Teaching Moves About Explanations

Mehmet used three teaching moves in his explanations about scientific concepts and mechanisms: 1) changing the number of steps in the solution of the questions, 2) changing the number and the nature of the elaborations and 3) changing the nature of visual presentation of the mechanisms.

With respect to the first teaching move, Mehmet indicated he would solve the question related to the 'lifting force' in five steps for students in the LA classroom. In the HA classroom, he stated that he would combine the first three steps into one sentence in order to solve this question in a shorter time and with less detail.

Similarly, when he was asked what changes he would perform in seeking answers to the question about 'states of substance and heat', he said …

'*We solved the question in six steps here (for students in the LA classroom)'.*

However, I combined the first five steps into one in an HA classroom. Namely, "Heat is the total energy that the substance has. Temperature is the average motion energy per particle. The temperature of the heat-receiving substances increases and there is an inverse proportion between the mass and the temperature rise, that's all the correlation", this would be enough for high ability students to understand the first five steps".

Referring to the second teaching approach, in the case of the question about 'cell division and genetics', he argued that the students in the HA classroom would find the solution faster than those in the LA classroom and he therefore did not need to use elaborations in the HA classroom, whereas he used many for students in the LA classroom. He clarified this situation by saying

'*when I teach the main parts of a cell for students in the LA classroom, I certainly need to elaborate the topic by emphasizing the parts step by step, (by showing the parts of the cell on his drawing) such as this is the nucleus, that is the cytoplasm and as you remember we call this part the cell membrane'.*

On the other hand, it would be enough to express only the following for students in the HA classroom:

'My friends, as you remember, a cell has a spherical shape and it has the nucleus right in the middle.

I don't need to elaborate with a group of successful students, but we do need to elaborate and increase the number of examples with students in LA classes. '*I need to tell everything phase by phase'*.

In addition, he believed that he needed to change the nature of the elaborations. For example, he argued that the examples for students in the LA classroom particularly need to be selected from the daily life. He said ….

'First of all, the concept of heat needs to be explained to them clearly and in an easy way. Presenting the definition is not enough with this group of students; it would be adequate for a group of successful students, but you need to show that if you are with an LA class, this subject is generally taught in the winter months and the heaters are functioning.

I leave a cold metal object for 5-10 minutes on the heater and demonstrate the transfer of heat. I strive to explain the subjects with more examples from daily life in order to express that heat can be transferred between substances and the substances that lose heat becomes cold such as when you sit on benches in the winter months, when the cold bench can give you a cold because it removes heat from your body. Nevertheless, all these efforts fall short. Indeed, we need to repeat the subjects at the beginning of every lesson, and they require different examples'.

Regarding the third teaching move, for the solution of the three questions, Mehmet preferred step-by-step drawings in order to enable LA students to establish the relationships between the previous and later concepts (i.e., mechanisms), because he believed that the subject would be too abstract for LA students unless he used these drawings in turn. On the other hand, he presented the solution, solely based on definitions without benefitting from step-by-step drawings in the case of the HA students.

The Teaching Moves About Teaching Strategies

Mehmet used three teaching moves in his teaching strategies about scientific concepts and mechanisms: 1) changing the structure of scaffolding, 2) changing the nature of scientific practices, and 3) changing the nature of classroom technologies.

Regarding the first teaching move, Mehmet argued that for teaching the scientific concepts and mechanisms he needed to build a stronger scaffold, including pieces from very basic one through to a complex one for students in the LA classroom compared with the move in the HA classroom. About the question of 'cell division and genetics' he said when you say the word cell to a LA class, it would probably arouse a feeling of it being the first time they have been introduced to this word. For instance you might be faced with the question:

'Cell? What do you mean?

Therefore, here there is the need to introduce the cell, by talking about the organelles, explain their tasks, and even, if necessary, note the important ones in their notebooks as well as illustrate their shapes. Therefore, the students know what a cell is at least, and after that I can talk about cell division. With this type of class, I start from the very beginning and continue by adding steps one by one'.

Regarding the second teaching move, Mehmet stated that he needed to conduct experiments in the LA classroom, whereas the explanations without scientific practices were enough for students in the HA classroom. About the question related to 'lifting force', he said

'There would be alterations in the 1st, 2nd and 3rd steps here. It would be enough to teach the subject in a good class by saying: the density of the substance is smaller than the density of the fluid, and it is definitely enough to say that the weight is equal to the lifting force. But for students in LA classes, it needs to be expanded more. I definitely need to show the floatation of the object with an experiment and produce daily-life observations'.

Regarding the third teaching move, in the case of 'cell division and genetics', Mehmet argued that he tried to make the subject more understandable by running a video display in order to illustrate the duplication process during the preparation phase of cell division. While having HA students merely watch the video is enough, for LA students, he explained his teaching move for this example as follows: '*first of all, I want them to watch the video and mention the processes shown in the video (by pausing it) and draw attention by saying "finally we have two cells now". And this is In addition to supporting my narration with images and pictures.*

The Dissimilarities Causing the Different Teaching Moves

Mehmet was asked during the interview, which was related to question generating, to think over the reasons for the teaching moves he said that he performed. It was revealed from the answers that there were many beliefs in Mehmet's mind about the dissimilarities between LA and HA students and these clear dissimilarities were possibly responsible for the moves. These were collected under two categories: 1) knowledge and 2) skills.

Knowledge. Mehmet was asked what knowledge components students needed to know in order to solve the three questions. Afterwards, he was asked to compare LA and HA students in relation to these knowledge aspects. He stated that LA students had difficulty in building up the concepts and in remembering the pre-conceptions about the subject, while HA students did not have the same problem. For example, in the case of 'cell division and genetics', he stated '*HA students knew the main parts of a cell but LA students didn't. Thus, I was forced to repeat the subject for the LA group'.* Similarly, in the case of 'lifting force', he said *' LA students remembered the 'name' of the topic because there is a subject named 'force and motion' every year…They also remembered what could happen when a force is applied, but they had no idea about calculation of resultant forces, or balanced and unbalanced forces*. Similarly, in the case of 'states of substance and heat', he indicated that HA students remembered the concepts of 'heat' and 'temperature', while LA students only knew the 'name' of the concepts without any idea about their content.

Skills. Mehmet listed a range of skills that were essential for solving the questions he produced. In the case of 'cell division and genetics', for example, he said that students must have *the ability to make correlations between the figures and notice the differences between the images in order to solve the questions*. He stressed that an effective visual intelligence was necessary for these processes and HA students were better at this intelligence than LA students. In the case of 'lifting force', he said that the students must have *ability to measure mass, perform volumetric metering and calculate density* in order to solve the question. While having the ability of mass measurement with an equal arm scale does not depend on whether the student is HA or LA student, but in fact, LA students had difficulty in the abilities of volumetric metering and density calculation. He referred to the ability of density calculation as *an easy division operation* for the HA students. Regarding the same ability, he emphasized that for LA students … *Here we are in trouble, especially if the result is decimal; In other words, if there is any digit after the comma then they might have difficulty in the division operation. We perform the division operation step by step for them and find the solution together.* In addition, in the case of 'states of substance and heat', he indicated these abilities as follows: *s/he must be capable of carrying out temperature measurement with a thermometer, designing an experiment by which heat transfer can be shown and computing.* Regarding the first, he gave the example of the situation for LA students: *they absolutely recognize a thermometer from previous years. However, somehow, the student can place the bulb the wrong way up. S/he might dip it into air instead of the liquid.* In contrast to the LA students, *even if the HA students haven't already used a thermometer, they are able to use it appropriately by examining the order of numbers on it*.

When LA and HA students were compared in terms of computing ability, he said that *LA students aren't able to compute. They have difficulty in performing either an addition or division operation.* In other words, Mehmet considered that LA students had limited measurement and computational skills. Also, he indicated that HA students had the ability to design an experiment related to the subject in their minds, whereas LA students could not imagine such designs and needed help from him.

Mehmet's Pedagogical Belief System

In order to reveal the pedagogical belief system of Mehmet, was interviewed with him on four topics: (a) beliefs about teaching motivation, (b) beliefs about science teaching motivation, (c) beliefs about science teaching practices and (d) beliefs about achievement differences in science classrooms.

Beliefs about Teaching Motivation

On teaching motivation, Mehmet argued that he chose the teaching profession because it was a more guaranteed profession than other alternatives. When he was asked why he is in the teaching profession, he replied that he had, in fact, wanted to be an engineer, but conditions forced him to take this path. However, he stated that after he became a teacher, his perception of the profession changed; he practices his profession with love, and so he continues to do it. When he was asked whether he believed that the teaching profession requires specialization, he considered that 'teaching at the level that LA students can learn' and 'strong communication with students' are important specializations that expert teachers had. Mehmet said: '*I think people who do not have communication skills, who cannot communicate with the student with a glance should definitely stay away from this profession. If s/he cannot teach at the level of the LA students can learn, behave warmly, and give confidence to them, then s/he should not become a teacher'.* He believed that the most important feature of a person who was going to practice the teaching profession was communication skills. He thought that there should be a trust-based relationship between teacher and student. Later in the interview, he answered the question of which profession he thought was like teaching, with the following*: 'it might be military officers*. When expressing the reason, he gave explanations based on didactic teaching by saying, *I received a good military training in a short time. And then we trained the soldiers with what we had learnt. (At the end,) There is a person, an individual in front of you, thus, I think that teachers might be similar to military officers'.*

Beliefs about Science Teaching Motivation

In the case of science teaching motivation, Mehmet was asked to share his thoughts about his teaching with such questions as: whether he believes that he can teach difficult subjects or not, how he improves his teaching in a difficult subject, and what the important factors are for the students to succeed or fail in science classes. Mehmet, who believed that he could teach difficult subjects, stated that he improved his teaching in a difficult subject by making connections with the real world and scaffolding. He said that: '*Force-Motion, for example, is a subject in which the LA students have difficulty. I start with an example that a student observes in daily life. For example, s/he knows that wood floats on water and stone sinks in water. It is a good beginning point for me. Starting from that point, I combine the examples and get the students to where I want them to be'.* Although he considered the students responsible for the cause of failing, he thought that a teacher and a student were responsible 50% - 50% for the success of a student in the science class. He stated that the content knowledge and pedagogical knowledge of the teacher did not have an effect, and what was important was establishing strong communication with the students. About whether the intelligence of a student had an impact on the success in science, Mehmet said:

'*A child listens to the lesson once and learns it, another student listens to the subject once and repeat it once, then s/he learns; your child learns it by repeating it three times. In conclusion, intelligence is important.*

Mehmet gave importance to intelligence in the science achievement of students and he believed that intelligent students could be successful just by listening to the lesson even if they did not study and did not do their homework. Mehmet indicated that some students needed support during teaching, by expressing his ideas as follows: '*some children listen and learn, some children listen, observe and then learn, some of them listen, observe, read and then learn, some of them need also to write, some of them need to repeat it two or three times too. Thus, I believe that every student can learn'.*

Beliefs about Science Teaching Practices

When the science teaching practices-oriented beliefs of Mehmet were examined, it was observed that he gave importance to making connection with the real world. When he was asked about how the best science teaching should be conducted, he said:

'*For example, when explaining the reproductive system of plants, it would be nice to teach it by taking the students to the schoolyard or going to a botanical garden. Or I would be willing to go to a forest, for instance, and explain there. Otherwise, when explaining weather events, I would like to teach that by climbing up a windy hill and lying down on the hill with the children'.*

Mehmet considered that the best science teaching could be provided by explaining the subjects that students can experience by themselves with examples from daily life. On the other hand, Mehmet supported the method of his students working as a group and talking about science topics with each other. Accordingly, he expressed that he strived to provide students who were at different achievement levels to work together. When he was asked which assessment and evaluation methods he used in science teaching, he said:

'*I use different types of questions such as multiple choice, true-false, filling in the blanks, concept maps, and puzzles. I diversify the questions. You hold an examination that consists of 5 questions and each of them will be 20 points. Generally, the LA child gets a low mark, but if you prepare the questions so that they include 10 fill-in-the-blanks, 10 True-False, 10 multiple choice, a concept map, and a puzzle, the content validity of the exam will increase'*. He stated that he used different types of questions in his examinations because he wanted not only the successful students but also the other students to get a high mark. In this context, Mehmet thought that he supported LA students.

Beliefs about Achievement Differences in Science Classrooms

In terms of his beliefs about achievement differences, the results showed that Mehmet had awareness about this topic. When he was asked about the reasons for achievement in the science classroom, he said: '*first, if the student comprehends the logic of the lesson, I mean, if s/he sees the place of it in life better, it allows him/her to be successful. Second is the communication; if his/her communication with the teacher is strong during the lesson, it is also effective'.*

He also stated that presenting different examples and alternatives related to the lesson and using visuals increased the success. In addition, he acted with the understanding that he could encourage LA students by using different methods in his teaching. He stated that he used extra criteria when evaluating the success of these students*: 'If s/he has good manners, be a gentle person, not interrupt my teaching in the class excessively … students should not be extremist, be slightly interested in the lesson, keep his/her book well, I even give extra points to that'.*

Relationships between Teaching Moves and Pedagogical Belief System

Looking at Figure 1, Mehmet's teaching moves seem to have a nested nature. He seems to contextualize his teaching strategies (that are more general thinking frameworks) on his explanations regarding the three questions. In the case of teaching strategies, for example, he argued that he would increase the length of his scaffolding when teaching the concepts and mechanisms to LA students by adding several basic pieces that he would not consider for HA students. Similarly, for the three questions he produced, he argued that he would increase the number of steps during the solution of them for the LA students, whereas he would combine several steps and use only the descriptions for the HA students. In one another teaching strategy, he considered that he would change the scientific practices if he particularly deal with the LA students in compare to HA students. For example, he stressed that he would design an experiment so that LA students could easily make a connection between science and daily life and easily understand the mechanisms. Similarly, for the solution of the three questions, he argued that he would benefit from a range of daily life examples and make some emphasizes in his explanations to the LA students. In one another teaching strategy, he said that he would change the nature of classroom technologies and argued that he would sometimes pause the videos and ask the questions in order to be sure that LA students make sense of the material. Similarly, within his explanations for the three questions, he argued that he would use many visual drawings and connection lines so that LA students could build cause-effect relationships in their minds.

On the other hand, Figure 1 displays that not only the pedagogical belief system of Mehmet that we uncovered using four components (teaching motivation, science teaching motivation, science teaching practices and achivement differences in science classrooms) was responsible for the teaching moves, but also some dissimilarity-oriented beliefs that we uncovered during the thinking-aloud interviews aiming to determine the teaching moves were effective. Therefore, it can be argue that the dynamic interrelationships among pedagogical belief system, dissimilarity-oriented beliefs and the teaching moves were responsible for

Mehmet’s science teaching moves about achivement differences.

In one pathway covering these dynamic relationships, it can be argue that Mehmet’s teaching epistemology that is strongly based on a behavioristic approach shape his dissimilarity oriented beliefs about knowledge and perhaps then his teaching moves regarding scafolding activities. In the teaching motivation interview, Mehmet, for example, resembled teaching profession to be a military officer and argued that these officers could teach the military activities from basic to complex to a range of people from very different educational background. Within this core epistemology, it seems that he believes that he needs to divide the topic into pieces, categorize these pieces from basic to complex and teach them by repeating and adding each via a conceptual scafolding approach. It seems that he consistently and heuristicaly consult this core epistemology when considering the achivement differences in science classrooms. For example, he argued that LA students had problems in remembering the pre-conceptions and building the conceptual frameworks, whereas HA students had a better picture in these thinking issues. Considering his core epistemology, this was an expecting result because scafolding is particularly based on remembering previous steps/layers and applying these pre-steps/pre-conceptions on the further steps/conceptions. Perhaps because of this belief about the scafolding problem within the LA students, he plays with the structure of the scafolding and change the number of solution steps in the three questions.

In one another pathway covering several other dynamic relationships, Mehmet’s core belief about student learning within the depths of his pedagogical belief system seems to be responsible for several dissimilarity-oriented beliefs and perhaps then the teaching moves. Mehmet argued that he needs to diversify his science education by incorporating visuals and daily life examples when he considers that the students are struggling in understanding certain difficult topics. This argument may mean that he does not have any categorization in his mind as LA and HA students; rather, he may just believe that there are some difficult topics and he needs to teach them to all of the students by changing his teaching orientation. This core belief seems to have a relationship with another core belief which is his strong teaching efficacy to teach every topic to every type of student (i.e., ‘every student can learn in my classroom’ in his terms). Looking at his dissimilarity-oriented beliefs by taking into the connections between these two core pedagogical beliefs, Mehmet argued that several topics and questions required some skills that may not equally distributed among the students due to the genetical background (i.e., intelligence in his terms). However, if his emphasizes were investigated carefully, it can be argue that he attributed the difficulty to topics rather than the students. At this point, he believed that some science topics required some ‘extra’ skills such as experimental/design based thinking, visualization, contextualization of topic on the daily life, measurement and computation thinking that LA students had limited background and the practice. For helping and equalizing them with HA students, Mehmet changes the scientific practices and the nature of the classroom technologies because he believes that only the diversification of learning environment via the daily life examples, experiments, visual drawings and effective video usages can work antidotes against the skill inequalities.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

In the present study, Mehmet's story was told. After long-term classroom observations with five other science teachers, it was felt that he might possess a rich belief set and teaching moves about achievement differences. The results showed that the expectation about Mehmet was correct.

Before sharing the discussion in terms of our comments and the comparisons between our findings and the existing literature, we need to emphasize that even though teachers’ belief systems and teaching moves vary according to the teachers’ identities, psychologies and sociologies, our aim in the present study was to uncover the dynamic relationships and possible relation pathways that other teachers might follow and ensuring the theoretical generalization (Yin, 2014). Even if the existing literature is almost silent on the teachers’ perspectives regarding achievement differences except for several papers and policy documents, it was tried to map Mehmet’s belief system using a relatively rich data set (classroom observations, thinking-aloud and semi-structured interviews) and the generalizations about teacher-belief literature.

First, consistent with existing literature (e.g., Barbier et al., 2022; Even & Kvatinsky, 2009; Jönsson, 2018), Mehmet conducts teaching moves according to achievement differences. However, distinct from previous limited number of studies focusing particularly on short-time observations, it is thought that Mehmet had complex and nested teaching moves about the achievement differences. He particularly changes his teaching strategies and contextualizes them on the daily teaching practices such as solving the questions. For example, he changes the structure of his scaffolding, scientific practices and classroom technologies according to the achievement differences. In the case of question solving, he increases the number of solution steps, conducts experiments and uses visual drawings and increases the time he devoted for watching the videos for LA students. Similarly, in Jönsson's (2018) research findings, while some teachers in the sample reduced the difficulties of assignments given to LA students, some teachers were against this practice. As Mehmet, these teachers considered that LA students should be given the same assignments with different scaffolding structures because all students should have the same opportunities and that LA students should be given more support. In addition, as a result of another study, it was stated that the use of scaffolding or not using scaffolding was not decisive for HA students to benefit from the curriculum, while the use of scaffolding was decisive for LA students. It was stated that interactive and adaptive scaffolds can support especially LA students in concept teaching (Reinhold et al., 2020). It is also stated that an appropriate scaffold is required to engage in metacognitive activities with LA students (Yang et al., 2016, 2020). Similarly, Mehmet argued that for teaching the scientific concepts and mechanisms he needed to build a stronger scaffold, including pieces from very basic one through to a complex one for LA students compared with to HA students.

Second, these teaching moves seem to stem from a two-layer belief system including dissimilarity-oriented beliefs and pedagogical belief system. Even if some science and mathematics teachers considered that higher order thinking activities were more appropriate for HA students (e.g., Torff, 2006) whereas the teaching based on transmission of knowledge (e.g., Zohar et al., 2001) or mechanic-answer-finding approach (e.g., Even and Kvatinsky, 2009) were more appropriate for LA students, we noticed that Mehmet did not have such strong beliefs categorizing the students or the classrooms and possibly exacerbating achievement gaps. Yes, he believes that there are several differences between LA and HA students in terms of concept building and thinking skills. However, like positive exceptional cases in the literature (Felch et al., 2010; Marzano et al., 2001), his two strong core beliefs (i.e., teaching efficacy and beliefs about student learning) in the depths of his pedagogical belief system such as ‘every student can learn’, ‘every student can be successful in science courses if it is diversified by daily life examples, classroom technologies, etc.’ or ‘you should understand the situation of the student from only looking at his/her face’ seem to provide him a positive belief background producing persistence and courage and preventing to build the prejudices. In addition, he seems to find some topics difficult to understand for ‘all’ of the students and they required further activities particularly for the students who are struggling due to limited conceptual background and skill sets. Similarly with the results of our study, the teachers also who participated in Shcmid's (2018) study believed that all student could and would learn and that all students could be successful when they provided appropriate instruction. In another study, some teachers believe that when given the right form of support and space, LA students are as capable as high achieving students in achieving success in school and in life (Fletcher, 2016; Hambacher & Thompson, 2015).

Last, Mehmet’s teaching epistemology, one another core pedagogical belief, seems to produce the skeleton of the learning process first in his mind and then in the classroom. Even if his teaching epistemology seems to have behavioristic components such as producing knowledge pieces and teaching them from basic to complex via repetitions and scaffolding and such epistemology might make science even harder to understand for the LA students, it can be argue that this core belief may directly or indirectly diffuses into the other core beliefs, all of the dissimilarity-oriented beliefs and finally all of the teaching moves. Perhaps because of such epistemological filter developed through long-term preservice and in-service experiences (Pajares, 1992), he suggested the differences between LA and HA students in terms of knowledge and skills that are particularly important for behavioristic conceptual understanding. For example, he focused on the differences in terms of remembering pre-conceptions, visual intelligence, measurement and computation thinking and design-based experimental thinking and contextualization of the topic on the daily life evoking science teaching covering memorization and cookbook laboratory activities.

Conclusions and Implications

Considering that almost 20% of the students in OECD countries (OECD, 2018) performed under the basic level of scientific literacy and that there are many policy documents (such as NCLB, 2001 and PEP, 2018) aiming at closing the science achievement gap between the students, it was important to uncover Mehmet's, who produces explicit teaching moves taking the achievement differences into account, belief system and teaching moves in the present study. His data enabled us to see that the production of teaching moves according to the achievement differences is a complex phenomenon. Even if his teaching moves are questionable in terms of whether they are effective ones among many alternatives for closing the achievement gap and that we did not organize a longitudinal study covering the developments in his students, the findings showed that he contextualizes his teaching strategies on his daily science teaching practices and produces teaching moves according to the achievement differences using this nested set. In addition, three core pedagogical beliefs such as teaching epistemology, beliefs about student learning and teaching efficacy (Kilinc et al., 2017) seem to shape both dissimilarity-oriented beliefs and the teaching moves. At this point, first implication of the present study may be to uncover the belief system of preservice and in-service science teachers about the achievement differences. Within such reflection-oriented dialogic environments, the participants may make their core beliefs in the depths of their belief systems explicit, discuss the dissimilarities in their minds, listen different alternatives and see how their core beliefs shape dissimilarity-oriented beliefs. In follow-up activities, they may produce practical evidence in question solving (like the thinking-aloud interview) or in micro-teaching sessions (e.g., presuming that the teacher teaches same topic to one LA classroom and then one HA classroom). The science teacher educator in these dialogic and practical sessions may make the participants aware of their belief systems and the dynamic relationships between their beliefs and the teaching moves. If they can be supported by effective teaching moves tested within experimental studies, they may also evaluate the moves and suggest better ones. This point requires further research.

Even if the classroom observations about Mehmet seems to tell us the fact that he may produce some negative teaching moves possibly exacerbating the achievement gap, his belief set and the moves in question solving sessions displayed that some of his beliefs such as 'every student can be successful', 'if science teaching is diversified by daily life examples and classroom technologies, every student can understand science' and 'some topics are already difficult to understand to all of the students' might be suggested to incorporate into the science teacher educator's jargons.

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A Study To Determine The eTwinning-Related Views Of The Teachers In The eTwinning Network Countries, And Their Digital Literacy Levels

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ABSTRACT

The main aim of this study is to compare the digital literacy levels of teachers in Turkey and of those in other member countries within the European Union eTwinning network. The present study has been conducted with a mixed methods research design, in which quantitative and qualitative methods are used together. The quantitative data of the research have been collected online from a total of 181 teachers, 106 from Turkey and 75 from the member countries of the eTwinning network by using the *Digital Literacy Scale*, while the qualitative data have been obtained from a total of 111 teachers. The quantitative data have been analyzed by using descriptive statistics and independent sample *t* test, whereas the qualitative data have been analyzed in line with the descriptive analysis approach by using the MaxQDA 2020 program. As a result of the research, the digital literacy levels of the teachers working in Turkey and those in the member countries of the European Union eTwinning network have been found to be at high levels, with no statistically significant difference between the gender variable and digital literacy.

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INTRODUCTION

Recent developments in technology and digital platforms have led to the creation of new virtual networks between schools, teachers, and students. Virtual networks that allow access, collaboration, and sharing anytime and anywhere have become critical tools for teachers (Vuorikari, et al. 2011). Such networks have increased the quality of classroom training activities, the development of teachers' professional competencies, and student performance (Hofman, 2010). Teachers make use of virtual social networks for particular purposes such as fast communication, disseminating good practices, following new approaches, informing parents, exchanging ideas with colleagues on certain issues, interacting with students and keeping track of students, easy access to information and resources, giving students assignments and assessing them (Arıkan & Yünter, 2018). One of the largest virtual networks supported by the European Union (EU) based on cooperation between teachers, students, and schools is the eTwinning platform. Operated by European Schoolnet, an international partnership of European Ministries of Education, the program started in 2005 as an education program of the European Commission. In 2014, however, it was integrated with Erasmus+, the EU's Education, Training, Youth, and Sports program.

eTwinning is a program that aims to improve inter-school cooperation in Europe and provide continuing online professional development opportunities for educators through offering support, tools and services for schools using the Information and Communication Technologies (ICT). eTwinning is Europe's largest e-learning platform, where teachers carry out projects with their students, increase their personal and professional development, and share knowledge and skills by working collaboratively. Just as people meet with their old friends through Facebook to satisfy their social needs, eTwinning meets teachers' needs to share their project ideas, communicate, and cooperate by enabling them to get together (Crawley, Gerhard, Gilleran & Joyce, 2015). Through this platform, any school in Europe can use the ICT to exchange ideas with another school, establish pedagogical partnerships, and share good practices (Papadakis, 2016; Pham, Klamma & Derntl, 2012). Teachers and students interact with each other in many different ways on projects and integrate the new knowledge they have gained into the classroom environment. This integration becomes apparent in many ways such as effective collaboration, exploration, simulation, research, and problem solving, etc., and combines traditional and innovative education approaches (Komninou, 2010). The projects also motivate teachers and students, help improve language skills, and contribute to students' in-depth learning (Fernández & Tena, 2013). eTwinning projects support Web 2.0 tools, create interesting learning environments, besides contributing to the professional development of teachers (Crawley, Gerhard, Gilleran & Joyce, 2015). The projects help teachers and students develop not only their foreign language skills but also digital literacy levels (Demir & Kayaoğlu, 2021; Fernández & Tena, 2013; Leto, 2018; Papadakis, 2016; Vuorikari, et al. 2011). The European Commission sees eTwinning as a medium to develop and promote communication and cooperation between schools in Europe through the use of the ICT (Pham, Klamma, & Derntl, 2012). eTwinning projects bring together language learning, digital literacy, ICT use, and science and mathematics, as well as various social sciences (European Commission, 2013). The eTwinning projects are based on digital technologies and digital literacy, which is the ability to take advantage of them. Digital literacy has become even more important for students, teachers, and parents since the beginning of the COVID-19 pandemic. However, there is no clarity about digital literacy in education systems, its integration into the curriculum, nor its definition.

The concept of digital competence has yet to be clearly defined, and the concepts of digital literacy, digital literacy skills, media literacy, multi-literacy, and digital competence have, therefore, been used interchangeably. Among these concepts, the concept of digital literacy seems to be used as the closest in meaning to digital competence (Ilomäki et al., 2016). Erstad (2006) defined the concept of digital competence as both the ability to run technological applications and the ability to use technology to meet individual and collective needs (Erstad, 2006). Digital literacy has been defined by the

Partnership for 21st Century Learning (P21) as media and technology-related knowledge and skills that individuals should possess in the 21st century (Framework for 21st Century Learning, 2019). Digital literacy, which is an umbrella concept, is regarded as both a must-have skill and a responsibility for the youth in the 21st century (Yılmaz, 2020). It is also the ability of citizens to access, analyse, produce, disseminate and organize information using existing technologies (Couto, Lucas, Brites & Pereira, 2018). It is a basic competence for all fields where the ICTs are applied holistically at schools (Krumsvik, 2009). Widely preferred by employers in job applications and being a factor to increase employment, digital literacy is a concept that covers access to information, knowledge integration, knowledge creation, and communication skills (UNESCO, 2010). Digital literacy, which is among the development criteria of countries, includes the cognitive, sociological, and emotional skills necessary for users to be able to work effectively in the digital environment (Sağıroğlu, Bülbül, Kılıç & Küçükali, 2020). It requires the right use of different technologies as well as the ability to reach, produce, and share the right kind of knowledge, and to possess the skills to use technology in learning and teaching processes (Hamutoğlu, Güngören, Uyanık & Erdoğan, 2017). Digital literacy is a necessary competency for today's learners to meet the informational, technical, cognitive, and socio-emotional needs rooted in the digital age (List, Brante & Klee, 2020; Ng, 2012). The use of the ICT to perform daily learning activities constitutes the technical dimension of digital literacy. The cognitive dimension, on the other hand, refers to students' ability to search, find, critically analyse, and evaluate digital information. Additionally, the socio-emotional dimension of digital literacy is the capacity of students to use the ICT for communication, cooperation, and other social goals related to learning (Ng, 2012). Prensky (2001) stated that digital natives born after the 1980s lead a technology-embedded life and learn in a way different from how previous generations did. According to Prensky, digital natives have a culture of connecting and sharing online. They access information via the internet and have an e-life when it comes to communicating with others (such as blogging, playing online games, downloading music, and shopping online etc.) and socializing through social media networks.

Up to the present, 930,355 teachers, 216,905 schools, and 121.408 projects have been involved in the eTwinning network, and new ones are being added every day. The EU countries that are members of the eTwinning network are Germany, Austria, Belgium, Bulgaria, Czechia, Denmark, Estonia, Finland, France, Netherlands, Croatia, England, Ireland, Spain, Sweden, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Poland, Portugal, Romania, Slovakia, Slovenia and Greece. Besides the EU countries, Albania, Bosnia and Herzegovina, North Macedonia, Iceland, Liechtenstein, Norway, Serbia, and Turkey also participate in the eTwinning programs. Moreover, eTwinning Plus includes Armenia, Azerbaijan, Georgia, Moldova, and Ukraine, which are part of the Eastern Partnership neighbouring the EU, as well as Tunisia and Jordan, which are part of the European Mediterranean Partnership (eTwinning, 2022). Turkey joined the eTwinning network in 2009. Despite this, Turkey had the highest number of teacher members with a rate of 53.68% between 2017-2019. This rate was 2.13% in Germany during the same period. In 2019, 298 schools from Turkey took the first place in the community by receiving the eTwinning School Labels, while 4 schools from Germany received them (eTwinning Activity Booklet, 2019).

With publishing the Digital Competence Framework, the EU has specified the digital competencies that its citizens should have, and, in other words, emphasized the importance of digital literacy. The EU attaches importance to the development of digital literacy of its citizens and encourages member states in this regard (Couto, Lucas, Brites & Pereira, 2018). eTwinning projects are a platform that supports communication in foreign languages, digital and social competences, as well as interpersonal and intercultural competences (Vuorikari et al., 2011). The most notable factor in the success of a project on the eTwinning platform is the digital literacy levels of the teachers working in that particular project. In fact, the success of the projects largely depends on the teachers' adequate digital literacy levels so that they can participate in online activities, find partners, and carry out activities in eTwinning projects. Although Turkey was included in the eTwinning network in 2009, today it ranks first in terms of the number of schools, teachers, and projects among the members of the community. According to 2021 data, there have been 49,572 projects, 282,944 teachers and 51,730 schools from Turkey on this platform, while Germany, one of the strongest members of the EU, has had 12,943 projects, 29,621 teachers, and 10,048 schools. The digital literacy levels of teachers are very important in the execution and successful conclusion of eTwinning projects. The reason why Turkey ranks first in terms of the number of participating teachers, schools, and projects may be that the digital literacy levels of the teachers participating from Turkey is high. From this point of view, it is very important to compare the digital literacy levels of teachers working in Turkey and EU member states. Despite the fact that eTwinning projects involve thousands of schools and teachers, very few academic studies can be found in the literature on eTwinning projects and teachers' digital literacy levels.

The present study has aimed to determine the digital literacy levels of teachers working in Turkey and other member countries on the eTwinning platform. In addition, it has attempted to reveal the effects of eTwinning projects on students, teachers, and schools. Qualitative and quantitative methods have been used concurrently; through the quantitative method, answers have been sought to the following research questions in order to determine the digital literacy levels of teachers who carry out eTwinning projects in Turkey and EU member countries:

- What are the digital literacy levels of teachers working in the EU and Turkey?
- Is there a statistically significance in the digital literacy levels of teachers working in the EU and Turkey by gender?

The qualitative aspect of the research attempted to determine the contributions of eTwinning projects to teachers' professional development, level of technology use, and digital competencies, as well as to the spread of a European culture, and to students and educational environments.

METHOD

Research Design

This study employed a mixed-methods research design, described by Teddlie and Tashakkori (2015: 4) as an alternative scientific method, in which qualitative and quantitative research are used together. The convergent-parallel approach was used in the qualitative dimension of the study. Both quantitative and qualitative data are collected simultaneously in the convergent-parallel approach and the data is analysed separately and then combined. In such a research design, equal importance is given to both types of data (Creswell, 2018: 193).

Relational survey model was used in the quantitative dimension of the study. This model is an approach that aims to describe a past or present situation as it is (Fraenkel & Wallen, 2003; Karasar, 1999). The differences between the digital literacy levels of teachers as to the gender variable were examined by using the relational survey method in the quantitative research.

In the qualitative dimension of the research, a "case study" was used to reveal the opinions of teachers about eTwinning projects. Case studies are in-depth studies that take advantage of multiple data collection sources (interviews, observations, documents, and reports) that have integrity within a certain period of time and that individuals, events and processes are handled as a whole (Creswell & Plano Clark, 2007; Yıldırım & Simsek, 2011; Yin, 1984).

Research Group

The sample group consisted of teachers who had participated in eTwinning projects in Turkey and the EU, as well as those teachers who were project managers. The qualitative and quantitative data of the research were collected online using Google Forms in the 2020-2021 academic year. Figure 1 shows the demographic data of the teachers who participated in the quantitative dimension of the study.

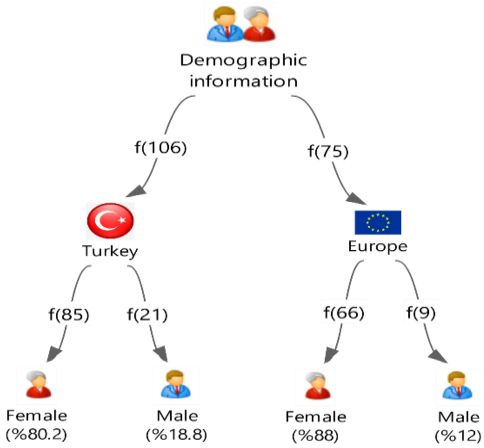

Figure 1. *Demographic data of the teachers who participated in the quantitative research*

The study included a total of 181 teachers, 106 from Turkey and 75 from Europe. Of all the participating teachers from Turkey 21 were male, while 85 were female. Of all the teachers participating from Europe, 9 were male, whereas 66 were female.

In the qualitative research, 47 teachers from Turkey and 62 teachers from the EU presented their opinions. Apart from Turkey, the other countries from which the teachers participated were as follows: Albania (2), Austria (1), Belgium (1), Bulgaria (3), Croatia (1), Czechia (1), Germany (2), Greece (4), Italy (6), Jordan (2), Latvia (2), Malta (1), North Macedonia (1), Poland (2), Portugal (4), Moldova (1), Romania (23), Slovenia (2), and Ukraine (3). In conducting the study, the researcher employed the purposive sampling, which is a method that allows in-depth study of situations that are believed to involve rich information (Patton, 1987). The diversity of the people in the group who would be a party to the problem was attempted to be maximized by using the maximum diversity method in addition to the purposive sampling (Yıldırım & Şimşek, 2011). In order to achieve this, the teachers were accessed through social media groups created about eTwinning projects and forum pages at https://www.etwinning.net. The aim here was to reveal the issues that may arise from province, country and city differences. The teachers participating in the research from Turkey were coded as T1, T2,…., T47, while the teachers participating from the EU member countries were coded as E1, E2,……, E62. Figure 2 shows the demographic data of the teachers.

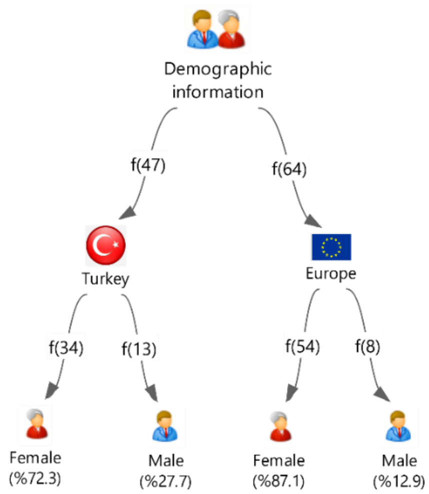

Figure 2. *Demographic data of the teachers who participated in the qualitative research*

As can be seen in Figure 2, 47 teachers, 34 of whom were female and 13 were male, participated in the qualitative dimension of the study from Turkey, whereas 62 teachers, 54 of whom were female and 8 of whom were male participated from the EU member countries.

Data collection tools

The quantitative and qualitative data were collected simultaneously in the study, in which a total of 111 teachers participated in the qualitative dimension, while 181 teachers participated in the quantitative. Necessary permissions were obtained from the scale owner prior to the data collection.

Quantitative data collection tools

The *Digital Literacy Scale*, developed by Ng (2012), was used to collect the quantitative data. The teachers working in the EU member countries were administered the English version of the scale developed by Ng (2012), whereas the teachers participating from Turkey were given the one developed by Hamutoğlu, Güngören, Uyanık, and Erdoğan (2017), who adapted the same scale into Turkish. The scale consists of 20 items and four factors (attitude, technical, cognitive and social), with a 5-point Likert rating ranging from Strongly Agree (5) to Strongly Disagree (1). There are 7 items in the attitude sub-dimension, in which the lowest score to be obtained is 7 and the highest 35. There are 6 items in the technical sub-dimension, where the lowest score to be obtained is 6 and the highest 30. There are 2 items in the cognitive sub-dimension, with the lowest score of 2 and the highest 10. There are 2 items in the social sub-dimension, with the lowest score of 2 and the highest 10. High scores received from the scale and its sub-dimensions indicate high digital literacy. The internal consistency coefficient is .93 for the overall scale, yet it is .88 for Attitude, .89 for Technical, .70 for Cognitive and .72 for Social sub-dimensions.

Qualitative data collection tools

The relevant data were collected using semi-structured interview forms prepared through Google Forms. With the interview forms, the researcher can get more detailed information about the questions, ask additional questions, make quick analyses, and make comparisons by asking the questions prepared beforehand (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel, 2012; Türnüklü, 2000; Yıldırım & Şimşek, 2011). While preparing the interview form and questions, open-ended questions that could be easily understood were chosen as much as possible in order to prevent misunderstandings, and avoid directions that followed a logical order (Yıldırım & Şimşek, 2011).

The interview questions were prepared with four teachers who had previously participated in eTwinning projects. The expert opinion of two academicians working in the field of educational sciences was sought on the academic relevance of the prepared questions. The questions were rearranged in line with the expert opinion. The questions were checked by a Turkish Language and Literature teacher and an English teacher in terms of their compatibility with Turkish and English grammar. Open-ended questions were selected in order not to have short answers as Yes/No so that the answers would reflect the real opinions. The questions are listed below:

- Do you think that eTwinning projects contribute to your use of technology? Why/Why not?
- Do you think that eTwinning projects contribute to your pedagogical methods and techniques? Why/Why not?
- Do you think that eTwinning projects contribute to cooperation and communication between schools, and to a European culture? Why/Why not?
- What kind of impact do you think eTwinning projects have on students? Why?

Data collection process

The research data were collected from the teachers accessed through social media groups about eTwinning projects as well as the forum pages at https://www.etwinning.net. The data in the study were collected between April-May 2021.

The teachers participating in the research were explained the purpose of the research, and informed that the results would only be used for scientific purposes and that their identities or any private information to indicate their schools would not be included, and pseudonyms would be used instead of the teachers' real names.

Data Analysis

Analysis of the quantitative data

Descriptive statistics were used to determine the digital literacy levels of the teachers participating in the present research. Kolmogorov-Smirnov test results were examined to decide whether the data were normally distributed; as a result, the significance value was found $p<0.05$. Also, non-parametric Mann-Whitney U test was applied as the number of male participants in the gender variable was less than 30. The data was analysed by using the SPSS.21 package software. Research hypotheses were interpreted at a confidence interval of 0.95 ($p=0.05$).

Analysis of the qualitative data

The preparation and organization of data consists of steps such as coding, association between codes, creating themes, interpreting and presenting the results as a discussion (Creswell, 2013). Themes and codes are created from the edited data, followed by the interpretation of the data. Direct quotations from the participants are frequently included, cause-effect relationships are established and themes are made more meaningful in the interpretation of the data (Yıldırım & Şimşek, 2011).

In the present study, the data obtained from the teachers participating in the eTwinning projects were transferred to a Microsoft Word file and descriptive analysis was carried out. The data were processed according to the thematic framework, and insignificant data were excluded from the study upon making meaningful and logical arrangements. Utmost attention was paid to ensure that the data were readable and understandable while describing the data. Codes were created according to the themes specified, and comments were made in accordance with the purpose of the research. The data analysis was conducted in the MaxQDA 2020 qualitative data analysis program.

Ensuring validity and reliability

In scientific research, it is of great importance that the facts are represented correctly, that they are consistent, objective, and impartial, and that validity and reliability are ensured (Yıldırım & Şimşek, 2011). Table 1 shows the efforts to ensure the validity and reliability of the current study.

Table 1. *Validity and Reliability Process*

Measure		**Methods**
Validity	Credibility	Expert review
		Participant confirmation
	Transferability	Detailed description
		Purposive sampling
Reliability	Consistency	Consistency analysis
	Confirmability	Confirmation analysis

As a result of the interviews, a framework was created to determine under which themes the data would be presented. For this purpose, the data were coded separately by an academician and a teacher, who was also an eTwinning project manager, in order to determine under which themes the data were included. The codes involving agreement and disagreement were then identified to explore the rate of agreement. The reliability formula of Miles and Huberman (1994) was used to determine the agreement rate (Reliability Formula: Agreement/(Agreement + Disagreement) x 100), which was found over 90%. When the ratio is over 90%, it is an acceptable level to ensure reliability (Saban, 2008). Given that rate, it was concluded that similar results were obtained in the analyses and that the results were reliable.

As it is well known, one of the most important criteria in research is the credibility of the study results (Başkale, 2016). In terms of validity and credibility of the research, the entire study and the data obtained were sent to an academician working in the field of educational sciences so that an expert review was obtained. In the dimension of credibility, the findings were sent to a teacher participating from Turkey to receive a participant confirmation about how much those findings matched the topics they had stated during the interview. In order to ensure validity in the dimension of transferability, direct quotations were included in the findings section in such a way that the statements of the participants were presented as they were. Moreover, the teachers involved in eTwinning projects in different provinces and countries were included in the study by using the purposive sampling method in the dimension of transferability. Finally, in the reliability dimension of the research, the data obtained through Google Forms were converted into Microsoft Excel format and kept by the researcher for confirmation review.

Ethic

All ethical principles were taken into consideration in this study. Ethical permission of the research was obtainedfrom the Human Research Ethics Committee of Zonguldak Bülent Ecevit University (Date and Protocol Number:26/02/2021-64)

FINDINGS

Quantitative analysis results

Table 2 shows the descriptive statistics regarding the digital literacy levels of the teachers participating in the present research.

Table 2. *The arithmetic means of teachers' digital literacy levels*

	Europe						Turkey					
Factors	**N**	**Min.**	**Max.**	$\bar{X}$	**Ss**	**Point**	**N**	**Min.**	**Max.**	$\bar{X}$	**Ss**	**Point**
Attitude	75	3.00	5.00	4.60	.51	I agree	106	2.86	5.00	4.67	.46	I agree
Technical	75	2.67	5.00	4.24	.63	I agree	106	3.00	5.00	4.33	.55	I agree
Cognitive	75	3.00	5.00	4.34	.65	I agree	106	2.50	5.00	4.32	.61	I agree
Social	75	2.50	5.00	4.24	.64	I agree	106	2.00	5.00	4.19	.76	I agree
Digital Literacy	75	3.00	5.00	4.40	.48	I agree	106	3.12	5.00	4.45	.43	I agree

As shown in Table 2, the responses of the teachers working in the EU member countries to the Digital Literacy scale presented the following results with respect to the mean scores: Attitude ($\bar{X}$=4.60), Technical ($\bar{X}$=4.24), Cognitive ($\bar{X}$=4.34), Social ($\bar{X}$=4.24), and Digital Literacy-General ($\bar{X}$=4.40). On the other hand, the responses of the teachers working in Turkey to the Digital Literacy scale presented the following results with respect to the mean scores: Attitude ($\bar{X}$=4.67), Technical ($\bar{X}$=4.33), Cognitive ($\bar{X}$=4.32), Social ($\bar{X}$=4.19), and Digital Literacy-General ($\bar{X}$=4.45). The digital literacy levels of the teachers in the scale and its sub-factors are at the point of "I agree". The digital literacy levels of teachers from Turkey ($\bar{X}$=4.45) were found higher than those from the EU ($\bar{X}$=4.40).

Table 3 presents the Mann-Whitney U test results regarding the difference between the digital literacy levels of teachers from the EU member countries and those in Turkey by gender.

Table 3. *Mann-Whitney U test results in relation to gender and digital literacy*

Country	Dimension	Gender	N	$\overline{X}$	Rank Total	U	p
Europe	Digital Literacy	Male	9	38.39	345	293	.95
		Female	66	37.95	2504		
Turkey	Digital Literacy	Male	21	58.57	1230	786	.39
		Female	85	52.25	4441		

As can be seen in Table 3, no significant difference was found between the digital literacy levels of the teachers either in the EU [U=293; p>.05] or in Turkey [U=786; p>.05] by gender.

Qualitative analysis results

The data related to the opinions of the teachers participating from Turkey and those from the EU about eTwinning projects were subjected to content analysis, and the MAX Maps codes of the themes obtained are shown in Figure 3.

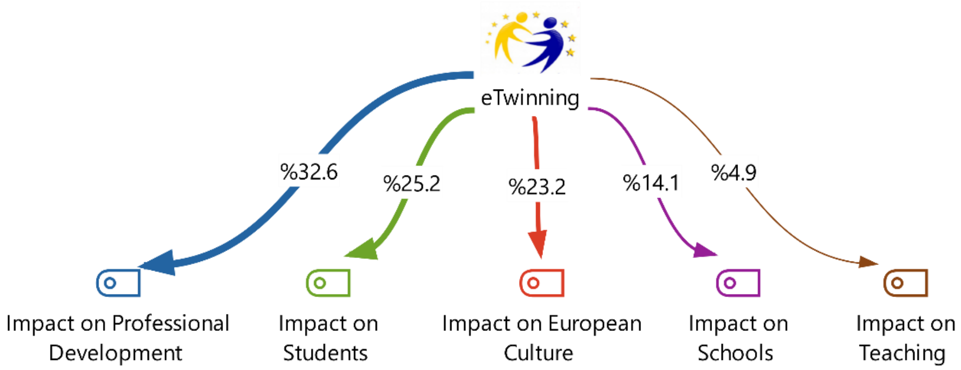

Figure 3. *MAX Maps codes for the eTwinning Project Themes*

Five themes were created as a result of the analysis of the data obtained from the teachers. Of all the five themes, the Professional Development dimension constituted 32.6%, the Impact on Students 25.2%, the Impact on European Culture 23.2%, the Impact on Schools 14.1%, and the Impact on Teaching 4.9%.

Figure 4 illustrates the MAX Maps codes for the theme of Impact on Professional Development.

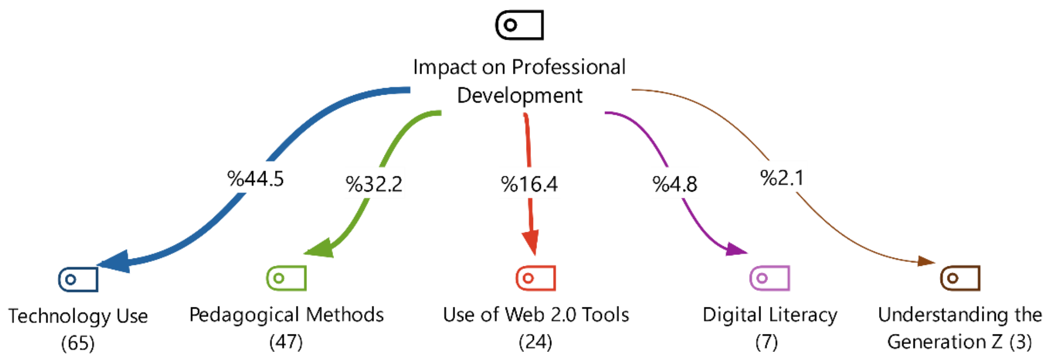

Figure 4. *The MAX Maps codes for the theme of Impact on Professional Development*

Of all the codes formed under the theme of Impact on Professional Development, 44.5% represent technology use, 33.2% pedagogical methods, 16.4% use of Web 2.0 tools, 4.8% digital literacy and, 2.1% understanding the Generation Z. The teachers participating in eTwinning projects stated that the projects contribute to them in terms of using technology at the highest rate. The teachers who participated in the research expressed their views on the codes as follows:

".....in our projects, we use many Web 2.0 tools, ranging from copying pictures to making videos and animation programs (T2). ….Since taking part in the eTwinning projects, I have learned about Web 2.0 tools, which I knew nothing about, and now, we are using technology at every stage. I spend most of my time in front of the computer. I follow the latest technologies (T3). …. I think it contributes a lot to my use of technology. Even just for this reason, I can continue to take part in an eTwinning project. Along with eTwinning, I became aware of many Web 2.0 tools. Especially such programs encouraged me to use technology more (T6). …. eTwinning projects encourage the inclusion of Web 2.0 tools at every stage, and we make use of technology (T9). ...Technology use, methods for teaching, learning and evaluate (E24). …Collaboration, new ICT tools, international student interaction (E27). …Technology use, methods, and techniques (E31). …New methods and techniques, technology use, and ICT use (E44)."

Under the pedagogical development code, 32.2% of the teachers stated that eTwinning projects make considerable contributions in many respects.

"…Thanks to the projects, we research and learn new ways and methods for both personal and professional development (T11). ...I have discovered that the methods suggested to be used by different partners during the projects are also beneficial for myself (T15). ...For example, we prepared and filmed a drama show in our project. In this way, I saw that I was able to reveal the hidden strengths of the students (T18). ...We use discussion and other methods effectively in our project (T47). ...We use new pedagogical methods and techniques, and technology (E17). ...New Pedagogical methods, student and teacher interaction, and collaboration (E61)."

Of all the teachers participating in the research, 4.8% stated that eTwinning projects contribute to their digital literacy levels.

"...projects increase the rate of technology literacy and contribute to technology-based teaching of lessons (T32). …Technology and internet safety (E20). ...I also promoted media literacy skills (E33)."

Of all the teachers participating in the research, 2.1% indicated that eTwinning projects contribute to their understanding of the Generation Z.

"...eTwinning projects open up a colourful world for teachers that appeal to the children of the Generation Z, rather than simply entering the classroom and using the current curriculum (T2). …What's more, I can keep up with my students (Generation Z) growing up in the digital age (T15). …eTwinning projects are useful in attracting the attention of the Generation Z to lessons (T31).

The MAX Maps codes for the theme, namely, the Impact on Students of eTwinning projects are given in Figure 5.

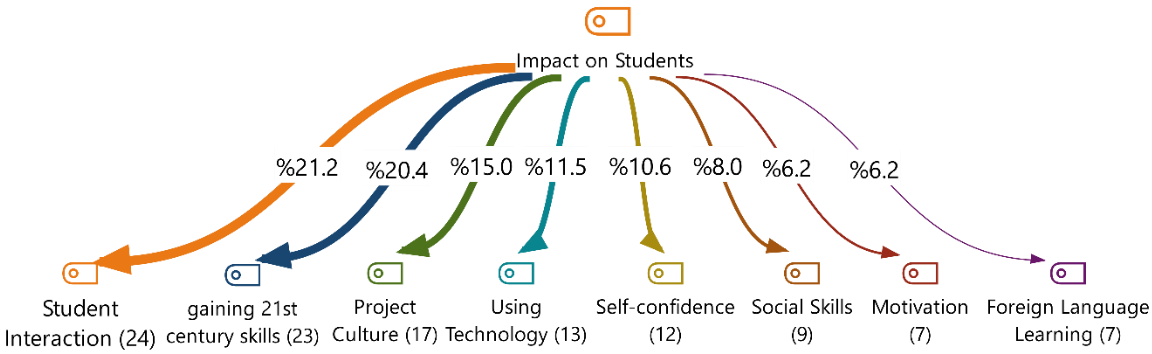

Figure 5. *The MAX Maps codes for the theme of Impact on Students*

Of all the codes formed under the category of Impact on Students, 21.2% refer to student interaction, 20.4% to gaining 21st century skills, 15.0% to project culture, 11.5% to using technology, 10.6% to self-confidence, 8.0% to social skills, 6.2% to motivation, and 6.2% to foreign language learning.

"…Students participating in eTwinning projects not only enjoy them a lot, but also gain new knowledge and make new friends (T4). …Giving my students the opportunity to work with other students. Meeting other teachers who taught me so much (E6). ...My contribution resumed in student interaction, internationalization, communication (E33)."

Regarding the aspect of eTwinning projects providing students with the 21st century skills, the teachers said "*...projects develop students' digital competence, problem solving, project creation and maintenance skills (T12). ….projects increase students' teamwork skills, technology literacy, sociability and self-confidence skills (T16). ...they can work in cooperation with other students from different schools, develop skills such as creativity and self-expression, and gain self-confidence (T21). …they boost creativity, language development, correct use of technology, communication, responsibility and teamwork skills (T31). ...they become more eager, curious, proactive, and their willingness to take responsibility increases (T32). ...the students have shown improvement in their ability to produce a common product by doing research in group work, helping each other, and taking responsibility in a collaborative manner (T3, T4, T5, T6, T8, T11, T12, T13, T14)".*

In the present study, 15% of the teachers stated that eTwinning projects contribute to students gaining the project culture.

"…I think that production and developing a project culture contributes to my students in many ways such as research, communication, planning, and duty awareness (T1). ...projects contribute to the problem identification, solution and group work (T12). …some students were worried at the beginning of the project. Later, the worries disappeared and they joined the project. The project contributed to their self-awareness (T18). ...the project has made the students feel that they are part of the team and that they are valuable (T47). …the project improved the students' ability to work together, participate in group activities and produce common products (T6). ...Cooperation, digital tool proposals, and creating final products (E16). …STEAM, interschool cooperation (E34)."

In addition, 11.5% of the teachers participating in the research mentioned that eTwinning projects improve students' use of technology skills.

"… thanks to the projects, children are able to actively use technology in a positive way (T45). ...projects develop students in terms of technology (T11). ….projects contribute to the development of students' technology literacy and socialization skills (T16). ….projects contributed to students' active use of technology and Web 2.0 tools (T41). ….the project developed students' ICT skills (E10). ….technology use and ICT use (E60).

Moreover, 10.6% of the teachers participating in the research pointed out that eTwinning projects help improve students' self-confidence.

"...the student-centred nature of the eTwinning projects enables them to develop self-confidence (T12), …projects contributed to the development of students' self-confidence and self-expression skills (T10), …with the project, students' teamwork skills, technology literacy skills, sociability and self-confidence have increased (T16). …students can work collaboratively with other students from different schools, develop skills such as creativity and self-expression, and gain self-confidence (T21). ...Projects with European partners provide morale and motivation for my students. Foreign teachers and students attract their interest. The products we create make our students happy, and improve their self-confidence, as well (T29). ...students had difficulty expressing their ideas before participating in the projects. However, after taking part in the project, they ended up being able to express themselves (T46)."

In the current study, 8.0% of the teachers emphasized that eTwinning projects positively affect students' social skills.

"…eTwinning projects have developed students' communication skills in social terms. They also contributed to students introducing themselves and establishing friendships (T2). ….working with different schools and countries contributed to the development of students' social skills (T9). …during the project, not only students' teamwork skills and technology literacy develop, but their sociability and self-confidence also increase (T16). …with the effect of technology and internet age, students who live away from sociality get together in eTwinning projects, produce common products, and socialize (T18)."

In the present research, 6.2% of the teachers stated that eTwinning projects positively affect students' motivation.

"…they like to do the same things with their peers they have never met, so their motivation increases (T15). …the students tend to become more curious and willing in their project work (T43). …the students involved in the projects are curious and proactive, and their willingness to take responsibility is increasing (T32). …applying the new things that they learned in the projects makes them more willing to learn and boosts up their motivation (T30). ...the projects provide morale and motivation for my students. Foreign teachers and students attract their interest. The products we create make our students happy and improve their self-confidence as well (T29)."

Likewise, 6.2% of the teachers participating in the research stressed that eTwinning projects contribute to students' foreign language learning capacity.

"…especially in projects with foreign partners, students communicate with other students in other countries by writing and speaking, which contributes to their foreign language learning (T15). ….my students participate in activities where they can actively use the foreign language they have learned, and they can work in cooperation with students from different schools (T21). ...the projects contribute to foreign language development (T39)."

Figure 6 presents the MAX Maps codes for the theme of eTwinning projects' Impact on the European Culture.

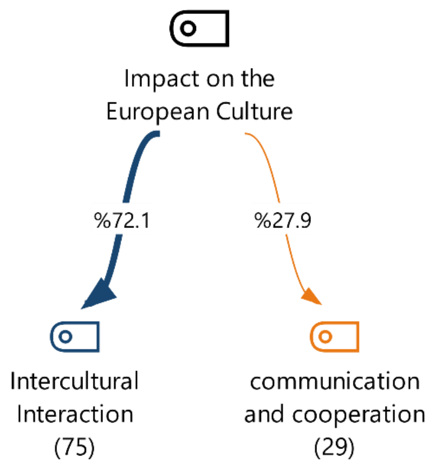

Figure 6. *The MAX Maps codes for the theme of Impact on the European Culture*

Of all the codes formed under the theme of Impact on European Culture, 72.1% of them are related to intercultural interaction, while 27.9% refer to communication and cooperation.

"….eTwinning projects have enabled us to understand the cultures of schools in different provinces in our country, as well as to get to know children in different countries and establish cultural ties in international projects (T2). …. In our projects with foreign partners, we get the opportunities to

get to know different cultures and their special days. We celebrate each other's special occasions (T11). ....eTwinning projects have contributed to inter-school cooperation and communication, as well as to the European culture. We became like a family of 10 teachers working in different cities. We put our children to sleep and work on the project at night. We have a great interaction (T8). ...cooperating is very important. You find out who is doing what, what is being taught in those schools and how it is taught. It changes your culture, your perspective (T14). ....I think that especially the projects with foreign partners improve the foreign language communication skills of the students. I also believe that even if they cannot go and see in person, at least they develop their sophistication by writing, speaking, and seeing (T15). ....in our project, different scenes of a play were acted, recorded, and brought together by students in different countries. Each country designed the scenes according to their own cultures. In this way, the common aspects and differences of cultures became apparent (T18). ....it is a great contribution to learn and use new methods and techniques, to internalization, and to students and teachers' interaction and communication (E1). ....European culture, student interaction (E7), ...More European cooperation (E9), ...Pedagogical methods, development of students' ICT skills, cooperation, communication, intercultural awareness (E10), ...pedagogical methods and techniques, technology use, inter-school cooperation, communication, internationalization, European culture, student interaction (E17), ...digital communication, making friends, getting to know different European cultures, improvement of interaction among students (E43), ...communication with teachers from other countries to share different views how to make lessons interesting, fun and interactive (E18), ...my contribution resumed in student interaction, internationalization, communication and European culture. I also promoted media literacy skills (E33). ....new Pedagogical methods, student and teacher interaction and collaboration, communication skills (E61).

Figure 7 shows the MAX Maps codes for the theme of eTwinning projects' Impact on Schools.

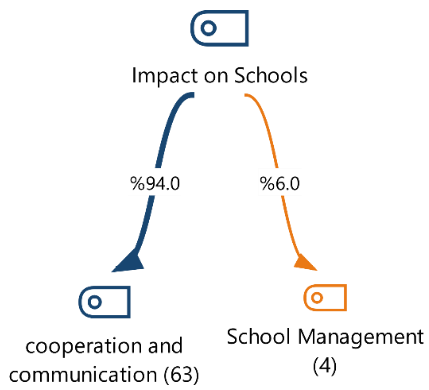

Figure 7. *The MAX Maps codes for the theme of Impact on Schools*

Of all the codes formed under the category of Impact on Schools, 94% of them were related to cooperation and communication, while 6.0% to school management. The teachers participating in the research stated that eTwinning projects contribute to communication, cooperation and school management between schools, both nationally and internationally.

"....we got the chance to understand the cultures of schools in different provinces in our country, as well as to get to know children from different countries and establish cultural ties in international projects (T2). ....we have seen a lot of cooperation, communication, and intercultural interaction. It's great to cooperate and collaborate. We interact with teachers and students from a city at the far end of Turkey, in the same way with foreign countries. It affects both the teachers and the students positively (T30). .... at least two schools need to come together to carry out a project. In this way, inter-school cooperation and communication increases (T31). ....Inter-school cooperation (E12), ...inter-school cooperation, communication, internationalization, student interaction, school management (E17), ...communication with teachers from other countries to share different views on how to make lessons

interesting, fun, and interactive (E18), ...Erasmus plus inter-school cooperation, school education, student interaction (E41), ...communication, internationalization, student interaction, school management (E42)."

Figure 8 illustrates the MAX Maps codes under the theme of eTwinning projects' Impact on Teaching.

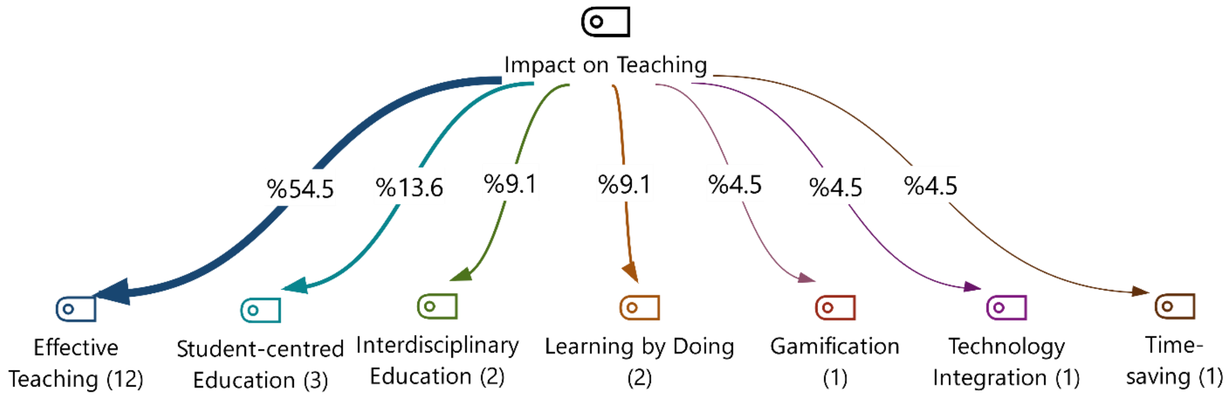

Figure 8. *The MAX Maps codes for the theme of Impact on Teaching*

Of all the codes formed under the category of Impact on Teaching, 54.5% of them were related to effective teaching, 13.6% to student-centred education, 9.1% to interdisciplinary education, 9.1% to learning by doing, 4.5% to gamification, 4.5% to technology integration, and 4.5% to time-saving.

The teachers participating in the research stated that eTwinning projects contribute to effective teaching in classrooms.

"....I specially use the most common Web 2.0 tools and other technological tools. In this way, I can teach more effectively (T15). ....eTwinning projects contribute to the development of learning skills, which is reflected positively on the lessons (T22). ....the lessons are more effective, active and interactive thanks to the projects (T21). ....Great contribution to learn and use new methods and techniques, internalization, students and teachers' interaction and communication (E1), ...Communication with teachers from other countries to share different views how to make lessons interesting, fun, and interactive (E18)."

The teachers participating in the research indicated that the projects apply the interdisciplinary and student-centred principles of teaching such as gamification and learning by doing, and these practices contribute to the increase in students' self-confidence. They further stated that such practices provide technology integration and save time.

"...We include student-centred practices in eTwinning projects, which increases students' self-confidence (T12). ....while preparing lesson plans, we make interdisciplinary and student-centred designs (T16). ... during the project activities, students learn by doing (T30). ....especially throughout the distance education period, I helped the students to learn through questionnaires, quizzes, and gamification in accordance with the themes (T2). ....I can teach my lessons more effectively, especially by using the Web 2.0 tools and other technological tools. I also save time by using those applications (T15). ...the main expectation while running the project is the integration of technology into education. We can achieve them through the projects. We come together with students from different provinces and schools, and take advantage of technological opportunities in the execution of project studies. Also, our proficiency in using technology increases (T1)."

DISCUSSION, CONCLUSION, RECOMMENDATIONS

The current study attempted to determine the digital literacy levels of the teachers who carry out eTwinning projects in Turkey and the EU, and to reveal the effects of eTwinning projects on cooperation between students, teachers, and schools. The research was conducted using qualitative and quantitative data. The quantitative data were used to determine the digital literacy levels of teachers, while the qualitative data obtained from interviews with teachers were used to identify the effects of eTwinning projects on students, teachers, and schools.

The results of the research show that the views of the teachers working in Turkey and the EU regarding their digital literacy levels are at the level of "I agree". In this respect, it could be assumed that the digital literacy levels of teachers working in Turkey and the EU are high. In particular, the comparison between the digital literacy levels of the teachers working in Turkey and the EU revealed that the digital literacy levels of the teachers working in Turkey are higher than those working in the EU.

With the Digital Competence Framework for Educators (DigCompEdu) published in 2017, the EU defined 22 common competencies in 6 areas that educators should have (Redecker, 2017). The EU also continues to carry out monitoring and evaluation activities to ensure that teachers in member countries possess the specified competencies. In a similar manner, the Movement of Enhancing Opportunities and Improving Technology (FATIH) project was initiated in Turkey in 2010. This project aimed to provide hardware and software infrastructure to all classes, to prepare educational e-contents, to provide teachers with in-service training so that they could use ICT effectively, safely and consciously in teaching programs. In this context, teachers were regularly provided with in-service trainings.

As of 2021, within the scope of that project, 474,991 interactive whiteboards, 13,800 school-specific VPN connections, and 667,157 tablets and computers were distributed to 24,428 schools. In addition, a total of 963,179 teachers were provided with in-service training - 421,164 teachers with face-to-face training, whereas 541,505 teachers with distance training (Fatihprojesi, 2022). The reason for the high digital literacy of teachers working in Turkey and the EU in the study may be due to the FATIH project and DigCompEdu applications.

In the literature, most of the academic studies on digital literacy in Turkey appear to have been conducted with preservice teachers, yet the studies conducted with teachers are very few. Given the results of the studies conducted with classroom teachers in Turkey, it was found that the digital literacy levels of classroom teachers are high (Aksoy, Karabay & Aksoy, 2021; Korkmaz, 2020). Similar results were obtained in studies conducted with preservice teachers; and they reported the digital literacy levels of preservice teachers as high (Boyacı, 2019; Karakuş & Ocak, 2019; Kozan & Özek, 2019), good (Üstündağ, Güneş & Bahçivan, 2017), and moderate (Yontar, 2019).

In a study conducted with English teachers in Japan, teachers stated that they use digital technologies in their lessons and are willing to improve their digital literacy levels (Cote & Milliner, 2018). Another study conducted on teachers' digital literacy in Poland concluded that the teachers in that study had the lowest knowledge about copyright (Tomczyk, 2019). In a study in Czechia, researchers concluded that digital literacy levels of classroom teachers are not sufficient for teaching mathematics (Nocar, Dofková, Pastor & Laitochová, 2019). A study on digital literacy in primary schools in Slovenia reported that teachers play a significant role in the development of students' digital literacy. Another study indicated that motivation, knowledge and skills, teacher training, ICT knowledge, peer support, and lifelong learning are effective in the competence of teachers in digital literacy (Uršej, 2019).

The literature review on studies conducted on digital literacy reveal certain differences between countries. Such differences may result from teachers' ICT competencies. eTwinning projects may contribute to the elimination of the discrepancies and to the development of teachers' digital literacy since eTwinning projects support cooperation between schools and countries, and the use of the ICT.

In the present study, no statistical difference was found between the digital literacy levels of teachers working in the EU and Turkey by gender. Likewise, in the literature, a study conducted with classroom teachers found no difference between the digital literacy levels of male and female teachers in (Aksoy, Karabay & Aksoy, 2021), while another study concluded that male teachers' digital literacy levels were higher than those of female teachers (Korkmaz, 2020). In some other studies conducted with preservice teachers, the results support our research findings (Kozan & Özek, 2019; Karakuş & Ocak, 2019). Apart from those findings, there are studies in the literature in which the digital literacy levels of male preservice teachers were found higher than those of female preservice teachers (Sakallı, 2015; Özerbaş & Kuralbayeva, 2018; Özgür, 2016; Yontar, 2019), yet there are other studies in which female preservice teachers were found to have higher digital literacy levels than male preservice teachers (Boyacı, 2019). Some studies in the literature support our results regarding the teachers' gender and digital literacy levels, but some do not. The reason for this difference may be due to the differences in male and female teachers' digital competencies, as well as their fields, schools, and the applied curricula.

As a result of the analysis of the qualitative data of the research, five categories emerged as Professional Development, Impact on Students, Impact on European Culture, Impact on Schools, and Impact on Teaching. The teachers participating in eTwinning projects stated that the projects have the greatest impact on their professional development, and then on students, European culture, schools and teaching, respectively.

The results show that eTwinning projects contribute to the professional development of teachers in terms of the use of technology, pedagogical methods, use of Web 2.0 tools, digital literacy and understanding the Generation Z. With eTwinning projects, teachers not only produce digital content using Web 2.0 tools, but they can also combine pedagogical knowledge with technology. The projects also facilitate communication between teachers and students of the Generation Z. eTwinning projects play a motivating role in terms of teachers' communication with digital native students (Camilleri, 2016). They also provide professional development opportunities for teachers (Vuorikari, et al. 2011) and integrate Web 2.0 tools into social networks (Crawley, Gerhard, Gilleran & Joyce, 2015). Such projects enable students and teachers to acquire the competences specified in the European Digital Competence Framework and digital literacy (Carretero, Vuorikari & Punie, 2017; European Commission, 2019; Papadakis, 2016). The main aim of eTwinning projects is to improve inter-school cooperation in Europe and ensure continuing online professional development opportunities for educators by providing support, tools, and services for schools through the use of the ICT. As a result of the present research, we can assume that teachers have achieved the targets, as specified by eTwinning projects.

The teachers participating in the research emphasized that eTwinning projects tend to have positive effects on students in such a way that the interaction among students increases and students gain 21st century skills, develop a project culture, use technology more, develop self-confidence, which all, in turn, improve their social skills, increase their motivation, and contribute to foreign language learning. As they make new friends through eTwinning projects, students' social skills develop and they gain problem-solving skills, learn to work and produce together with a team, develop a project culture, and gain ICT skills, their competence in Web 2.0 tools develops and their digital literacy increases (Acar, 2021), their self-confidence improves, and their willingness increases about learning a foreign language. eTwinning projects motivate students and contribute to students' language learning as well as deep learning (Demir & Kayaoğlu, 2021; Fernández & Tena, 2013; Leto, 2018).

The teachers participating in the research further underlined that the projects provide intercultural interaction between students and teachers, develop communication and cooperation, and contribute to the formation of a European culture among them. An eTwinning project can be carried out in collaboration between teachers and students of at least two European schools working with the use of the ICT (Papadakis, 2016). Through the eTwinning platform, teachers establish partnerships, share project ideas (Pham, Klamma & Derntl, 2012), and communicate interculturally. Just as Facebook is a social media platform for getting together with old friends, eTwinning projects meet the need for an international social network where teachers can collaborate by sharing their ideas (Crawley, Gerhard, Gilleran & Joyce, 2015). eTwinning projects raise awareness of students and teachers to be global citizens and to look at the world from a multidimensional perspective (Camilleri, 2016).

The teachers participating in the current study indicated that they were able to develop the communication and cooperation between schools and contribute to school administrations. eTwinning projects are a point of contact for cooperation and communication between teachers and schools all over Europe (Pham, Klamma, & Derntl, 2012), promoting cooperation between schools using the ICT (Vuorikari et al., 2011). eTwinning projects are a key to school-wide collaboration and are cross-curricular e-activities involving language and literacy as well as the ICT skills (European Commission, 2013). eTwinning offers more opportunities for interaction by combining traditional and innovative educational approaches (Komninou, 2010).

The teachers participating in the research also noted that eTwinning projects have positive effects on educational environments. The projects contribute to technology integration in classroom environments, as well as carrying out student-centred teaching in line with a fun, active, living by doing, and interdisciplinary manner. Networks created through eTwinning give teachers the opportunity to collaborate anytime and anywhere (Vuorikari, et al. 2011), increase the quality of classroom education (Hofman, 2010), and contribute to the in-depth learning of students (Fernández & Tena, 2013).

We concluded that the teachers who are involved in eTwinning projects in Turkey and the EU have high digital literacy levels, showing no statistical significance by gender. Moreover, eTwinning projects prove to contribute to the professional development of teachers. They also help teachers develop their skills in using Web 2.0 tools, technology, and pedagogical knowledge together, and facilitates communication with the students of the Generation Z. They enable students to acquire 21st century skills, develop a project culture, improve their use of technology, boost their self-confidence, social skills, and motivation, and ease foreign language learning. They also build communication and cooperation between schools, students, and teachers at national and international levels, bring technology integration into classroom environments, and contribute to the spread of a European culture among them.

Recommendations

The current study is limited to the teachers' opinions. Further studies can be conducted by observing school administrators or in-school practices. The teachers participating in the research were those who carried out eTwinning projects. Future studies can be carried out by classifying teachers according to the school types they work in and their fields of training. Most of the studies are generally based on teacher opinions. Further qualitative studies can be conducted based on student opinions. eTwinning projects are required to be integrated into the education curriculum; consequently, further experimental studies can be conducted to identify the effects on students of eTwinning projects integrated into the education curriculum.

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Examining the Relationships between Death Anxiety, Meaning in Life, and Parental Attitude

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ABSTRACT

The aim of this study is to examine the relationship between death anxiety, meaning in life and parental attitude of university students. The survey method, one of the quantitative research methods, was used in the study. The research group consists of 325 people, 242 women and 83 men. Meaning in Life Questionnaire, Scale of Death Anxiety, Young Parenting Inventory and Personal Information Form were used as data collection tools. In the study, descriptive statistics, Pearson Product Moments Correlation coefficients, Spearman Rank Differences Correlation coefficient and multiple linear regression analysis were used. There was a significant negative correlation between the scores obtained from the presence of meaning subscale and the scores of the scale of death anxiety, and emotionally depriving mother, pessimistic/fearful mother, emotionally depriving father, pessimistic/fearful father, belittling/criticizing mother, belittling/criticizing father subscales. There was a significant positive correlation between the search for meaning subscale scores and the scale of death anxiety mean score, and conditional/achievement-focused mother and conditional/achievement-focused father subscale scores. Looking at the results of the regression analysis, it is seen that death anxiety is a significant predictor of both the presence of meaning and the search for meaning. Findings were discussed based on the literature, and recommendations were given.

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INTRODUCTION

The family is the social unit with which the child interacts the most since birth (Seven, 2008). Parent-child relationships are very important in the development of the child (Çekiç et al., 2018). It is thought that parents' attitudes towards their children have a significant impact on the development of positive personality traits and all other developmental areas (Şahin & Özyürek, 2017). The social-emotional compatibility and communicative ability of primary caregivers determine the quality of the infant's early attachment. This determination affects the individuals' perspective on the future, their behaviour and psychopathology (Sheffield et al., 2005). It may be argued that early childhood education in problem solving abilities can prevent later mental states such as anxiety, suicide or self-blame (Shokoohi-Yekta et al., 2018). In the schema therapy model, parenting style, individual needs and early maladaptive schemas are interrelated (Louis et al., 2020). Exposure of individuals to unhealthy parental attitudes and insufficient fulfilment of their psychological needs lead to the formation of early maladaptive schema/schemas (Yalçın et al., 2018). Research on child maltreatment shows that parenting can influence an individual's enduring characteristics (Belsky, 1984). Parental attitudes also influence individuals' SFM in their lives (Yüksel, 2012). Many of the most meaningful moments of life involve other individuals. Sharing a special moment with a child is a main source of meaning (Van Tongeren et al., 2015). In summary, the people in an individual's life and their experiences with these people affect the meaning they attribute to life and their SFM (Elizabeth & Chang, 2021). It is seen that family relationships are a strong source of meaning in life and increase the sense of meaning in an individual's life (Glaw et al., 2017).

The meaning in life is an innate human need that is recognised in many cultures and times (Prinzing et al., 2021). The meaning in life has long been a mystery of human existence (King & Hicks, 2021). The people have constantly endeavoured to understand the life that they consciously perceive and in which they are involved through their actions (Sezer & Saya, 2009). There are as many meanings of life as there are people. It is important to know the meaning of life, how different meanings are differentiated from each other, and how to correct the meaning in life if it is misinterpreted (Adler, 2004). This effort to understand is largely due to the individual's need to survive (Sezer & Saya, 2009). The meaning in life can be examined in two dimensions: the Presence of Meaning (FOM) and the Search for Meaning (SFM) in life. The FOM is used to indicate the existence of one's life meaning and purpose (Steger et al., 2006). The SFM in life can be defined as the intensity of people's desire to create and/or increase their understanding of the meaning in life (Steger et al., 2008). It is important for the individual to experience the "SFM" in order to come to terms with his or her feelings about his or her own death (McClatchey & King, 2015). In addition, the meaning in life also affects individuals' mental health (Orang et al., 2018). People will feel life valuable to the extent that they live a meaningful life (Kardipranoto et al., 2021). Although the meaning in life is related to concepts such as happiness, morality, worthiness and goodness, there is no clear definition (Metz, 2013). Being involved in something bigger than oneself and deriving satisfaction from it will contribute to finding life meaningful (Wolf, 2012). While the meaning in life is not short-term, but long-term satisfaction (Brogaard, 2016), the specific aspect of life that people find most meaningful to them can vary throughout life (Lane & Mathes, 2018). The meaning in life is related to many variables. These can be listed as the purpose of life (Çelik Demirbaş, 2016), optimism (Demir & Murat, 2017), values (Veysi & Hamarta, 2014), internal-external locus of control (Taş, 2011), suicide cognitions (Baltacı et al., 2021) psychological well-being (Carreno et al., 2020) and Death anxiety (DA) (Özyürek & Atalay, 2020).

People's realization that they are "beings that have to die" affects them deeply. As death is a powerful threat to existence, it is a strong human concern that has been conceptualized as the motivating force behind many creative expressions and philosophical inquiries through the ages (Lehto & Stein, 2009). DA can be thought to be an emotion that starts with the birth of individuals and lasts throughout their life and develops after individuals think that they cannot continue their existence and that they may lose themselves and the world (Öztürk et al., 2011). Because anxiety is a basic experience (Akandere, 1997), DA refers to experiencing it in daily life, not worrying about coping with immediate threats to one's life (Neimeyer, 2015). DA is a normal experience. Many people manage their anxiety about death effectively and these worries do not affect their daily lives. Some people have difficulty in managing DA and this affects their daily lives (Furer & Walker, 2008). It is accepted that DA has important behavioural and emotional consequences (Nia et al., 2016). DA is considered a fundamental fear underlying the development and maintenance of many psychological disorders (MacLeod et al., 2019). DA can vary according to many factors such as age, gender, physical health, religion and culture (Suhail & Akram, 2002). It is important to determine DA, as the negative situations of individuals are important for the correct psychological counselling process (Koç & Arslan, 2020). In line with the literature given above, the aim of the study is to examine the relationships between DA, meaning in life and parental attitude of college students.

METHOD

Research Design

This study was conducted through survey method with the aim to examine the predictive effect of students' DA and parental attitude on the meaning in life. The survey method is a quantitative model that includes a specific form of data collection and types of analysis (De Vaus, 2002; Lewin, 2005) . The dependent variable of this study was the meaning in life and the independent variables were DA and parental attitudes.

Study Group

The participants consisted of college students. Non-voluntary students were excluded from the study. The research group consisted of 325 participants, 242 females (74.5%) and 83 males (25.5%). The ages of the participants ranged between 18-38 (average age 21).

Research Instruments and Processes

In order to collect the data, "Meaning in Life Questionnaire (MLQ)", "Death Anxiety Scale (DAS)", "The Young Parenting Inventory (TYPI)" and "Personal Information Form" were administered to the participants who volunteered to participate in the study.

MLQ

MLQ was developed by Steger et al. (2006). The adaptation study for Turkish culture was conducted by Akın and Taş (2011). MLQ is a 7-point Likert type measurement tool. It is a 10-item scale and consists of two sub-dimensions: the FOM and the SFM in life. The validity and reliability values of MLQ were sufficient. As a result of the confirmatory factor analysis, goodness of fit indices were x^2= 77.77, sd= 31, RMSEA= .065, NFI= .95, CFI= .97, GFI= .96, AGFI= .93, RFI= .93, SRMR= .065. The Cronbach's alpha (α) reliability coefficients of the MLQ were .77 for the FOM Sub-Scale; .83 for the SFM Sub-Scale; and .81 for the entire scale. Based on results of the exploratory factor analysis, the factor loadings of the scale items ranged between .54 and .77 (Akın & Taş, 2011). The Cronbach's alpha (α) reliability coefficient was .85 for the FOM subscale and .85 for the SFM subscale.

DAS

DAS was developed by Sarıkaya (2013). It consists of three sub-dimensions (uncertainty of death, thinking about death and witnessing, suffering) and 20 items in a 5-point Likert type. The scale is also evaluated over the total score. It was found that the scale explained 67.27% of the total variance. As a result of the confirmatory factor analysis, goodness of fit indices were NFI: .90, NNF: I .91, CFI:.92, IF: I .92, RMSEA: .08, GFI: .86, AGFI: .83, RMR:.07, SRMR: .05. The values were at the desired level. The retest reliability of DAS is .82. The Cronbach's alpha (α) reliability coefficient of the scale was .95. In this study, the Cronbach's alpha (α) reliability coefficient of the DAS total score was .95.

TYPI

TYPI was developed by Sheffield et al. (2005). It was aimed to evaluate the parenting styles that form the basis of early maladaptive schemas defined by Young (1994). The adaptation study of the scale to Turkish culture was conducted by Soygüt et al. (2008). It was found that a common 10-factor structure was appropriate for both mother and father forms. The Cronbach's alpha (α) reliability coefficient of the scale ranged between .53 and .86 for the mother form and between .61 and .89 for the father form (Soygüt et al., 2008). In this study, the Cronbach's alpha (α) reliability coefficient was as follows: Normative Mother (NM) :.79, Normative Father (NF):.8 4, Belittling/Criticizing Mother (BCM):.72, BCF (BCF) :.72, Emotionally Depriving Mother (EDM) :.84, Emotionally Depriving Father (EDF) :.85, Exploitative/Abusive Mother (EAM) .09, Exploitative/Abusive Father (EAF) :.26, Overprotective/Anxious parenting (OAM) :.60, Overprotective/Anxious Father (OAF) :.60, Conditional/Achievement Focused Mother:(CAFM) .73, Conditional/Achievement Focused Father (CAFF):.74, Permissive/Unlimited Mother (PUM):.56, Permissive/ Unlimited Father (PUF) :.52, Pessimistic/Worried Mother (PWM):.55, Pessimistic/ Worried Father (PWF) :.55, Punitive Mother (PM):.08, Punitive Father (MF) :.59, Restricted Mother (RM):.36, Restricted Father (RF):.30. The Cronbach's alpha (α) reliability coefficient of the scales above .50 indicates that it is at an acceptable level, albeit weak, but if the value is below .50, it is at an unacceptable level (George & Ve Mallery, 2019). For this reason, the subscales of EAM , EAF , PU, RM, RF with Cronbach's alpha (α) reliability coefficients below .50

Personal Information Form

The Personal Information Form was designed to determine the the participants such as gender and age.

Procedure

The research data were collected in the 2018-2019 academic year. The application to the students was carried out on a voluntary basis in university classrooms. Before the application, the purpose of the research was explained and student volunteers were asked to participate. Students who volunteered to participate in the study filled out the scales and the application lasted approximately 45-50 minutes.

Data Analysis

The data obtained in this study were analysed using SPSS Package Programme. Before analysing the data, outliers were removed, skewness and kurtosis coefficients were checked to see whether the data followed normal distribution.

Table 2. *Skewness and Kurtosis Coefficients of Variables*

Variables	Skewness	Kurtosis
FOM	-.442	-.451
SFM	-.823	.384
DA	.379	-.320
NM	.576	-.111
BCM	1.941	3.968
EDM	.793	.032
OAM	.265	-.213
CAFM	.411	-.257
PUM	1.376	1.379
PWM	.988	.818
NF	.609	-.075
BCF	1.737	2.635

EDF	.333	-.646
OAF	.341	-.089
CAFF	.427	-.276
PUF	1.274	.957
PWF	.939	.417
PF	.764	.855

Before the analyses, 21 values that were determined to be outliers using Mahalanobis distance were removed from the data set. Mahalanobis distance was used to remove outliers (Leys et al., 2018). For the assumption of normal distribution, skewness and kurtosis values should be between -1.96 and +1.96 (Ghasemi & Zahediasl, 2012). As seen in Table 1, all scales, except Belittling/Criticising Mother and Belittling/Criticising Father subscales, meet the assumption of normal distribution. In research, parametric analysis should be performed with the scales that follow normal distribution and non-parametric analysis should be performed with the scales that do not follow normal distribution (Dixon, 1954; Ghasemi & Zahediasl, 2012). For this reason, parametric analysis was used in the sub-dimensions that meet the assumption of normal distribution and non-parametric analysis was used in the sub-dimensions that do not meet the assumption of normal distribution. In the study, descriptive statistics were used to obtain demographic information, Pearson Product-Moment Correlation coefficients and Spearman Rank Difference Correlation coefficients were calculated to determine the relationships between variables. Multiple linear regression analysis was used to determine the predictive effect of independent variables on dependent variables.

Ethic

Ethics approval of the study was obtained from the Social and Human Sciences Research and Publication Ethics Committee of Necmettin Erbakan University, dated 27.05.2019 and numbered 2019/14. The scales were transferred to a single form for the application phase of the research.

FINDINGS

Table 2. ***Pearson Correlation Results between Variables***

	FOM	SFM
DA	-.123*	.175**
NM	-.075	.072
EDM	-.212**	.001
OAM	-.058	.005
CAFM	.010	.126*
PUM	-.048	.065
PWM	-.200**	.062
NF	-.089	.037
EDF	-.197**	.029
OAF	-.058	.005
CAFF	-.003	.139*
PUF	-.057	.027
PWF	-.192**	.054
PF	-.084	-.035

****p<.01, *p<.05**

Table 2 shows that there was a significant negative relationship between the scores obtained from the FOM subscale and the DAS scores (r=-.123, p<05), EDM (r=-.212, p<.01),PWM (r=-.200, p<.01) EDF (r=-.197, p<.01), PWF (r=-.192, p<.01) subscales. İnsignificant correlation was found between the scores of the FOM subscale and the scores in the subscales of NM, OAM, CAFM, PUM, NF, OAF, CAFF, PUF, PF.

Table 2 also shows that there was a significant positive relationship between the scores in the subscale of the SFM (r=.175, p<.01) and the subscales of DAS, CAFM (r=.126, p<.05) and CAFF (r=.139, p<.05). Insignificant correlation was found between the scores in the subscale of the SFM and the scores in the subscales of NM, EDM, OAM, PUM, PWM, NF, EDF, OAF, PUF, PWF, PF.

Table 3. ***Spearman Correlation Results between Variables***

	FOM	SFM
BCM	-.210 **	-.007
BCF	-.211**	-.003

****p<.01**

Table 3 demonstrates that a significant negative relationship was found between the scores in the subscale of FOM and the scores in the subscales of Belittling/Criticising Mother (r=-.210, p<.01), Belittling/Criticising Father (r=-.211, p<.01). There was insignificant relationship between the scores in the subscale of the SFM and the scores in the subscales of BCM, BCF.

The results of the regression analysis are given in Table 4 and Table 5. Some basic assumptions need to be fulfilled for regression analysis. One of the assumptions is to look at the Durbin Watson values as an indication that there is no auto-correlation between the variables. Durbin Watson value is expected to take a value close to 2 (Mayers, 2013). To avoid multi-connection problems, tolerance and VIF values must be within certain ranges. (O'brien, 2007). Tolerance value must be greater than .20 (Cleophas & Zwinderman, 2015). The VIF value is expected to be less than 5 (Daoud, 2017). As seen in Table 4 (Tolerance: .391-.983, VIF: 1.038-2.558, Durbin Watson: 2.024) and Table 5 (Tolerance: .289-.981, VIF: 1.019-3.459, Durbin Watson: 2.019), Tolerance, VIF, Durbin Watson values are in the expected range. It is seen that the necessary assumptions for the regression analysis were provided.

Table 4. ***Regression Results for the Subscale of FOM***

Variable	***B***	***SE_B***	***β***	***T***	***p***	***Tolerance***	***VIF***
Constant	33.251	1.319		25.218	.000		
DA	-.034	.016	-.113	-2.081	.038*	.963	1.038
EDM	-.122	.063	-.149	-1.937	.054	.482	2.075
PWM	-.179	.161	-.094	-1.112	.267	.398	2.511
EDF	-.049	.058	-.066	-.854	.394	.471	2.123
PWF	-.137	.166	-.071	-.827	.409	.391	2.558

***p<.05 R =.30 R^2 =.09 F(319-5) =6.387, p< .001, Durbin Watson:2.024**

Table 4 illustrates that the FOM subscale was predicted at a significant level (R =.30, R2 =.09, F(319-5) =6.387). Considering the relevant values, the DASwas the most powerful and significant predictor of the single variable (β=-.113, T=-2.081, p<.05). EDM, PWM, EDF and PWF subscales were not significant predictors. In addition, the independent variables together accounted for 9% of the total variance of the FOM subscale.

Table 5. ***Regression Results for the Sub-scale of SFM***

Variable	*B*	*SE_B*	*β*	*T*	*p*	*Tolerance*	*VIF*
Constant	19.471	1.388		14.029	.000		
DA	.056	.019	.159	2.890	.004**	.981	1.019
CAFM	.041	.114	.036	.355	.723	.291	3.433
CAFF	.098	.113	.088	.863	.389	.289	3.459

****$p<.01$, $R = .21$, $R^2 = .05$ $F(321\text{-}3) = 4.990$, $p<.001$, Durbin Watson : 2.019**

Table 5 shows that the SFM subscale was predicted at a significant level (R = .21, R2 =.05, F(321-3) = 4.990). When the related values were analysed, DAS was the single most powerful and significant predictor variable (β=.159, T=2.890, p<.01). CAFM and CAFF subscales were not significant predictors. In addition, the independent variables together accounted for 5% of the total variance in the SFM subscale.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

In this study, DA was found to be negatively related to the FOM and positively related to SFM. In addition, DA was a significant predictor of both the FOM and SFM. In similar studies, a negative relationship was found between DA and FOM and a positive relationship was found between DA and SFM (Aghababaei et al., 2016; Latha et al., 2013; Sübeten, 2018, Dursun et al., 2022). In another study, it was found that the SFM in life was significantly positively correlated with the fear of dying and death in young adults (Lyke, 2013). Similar studies have also found a negative relationship between the meaning in life and DA (Yoon, 2009; Yüksel et al., 2017). In another study, a negative significant relationship was found between DA and attitude towards life (Azarian et al., 2016). There are studies reporting a negative relationship between fear of death and the purpose in life (Ardelt, 2008; Viswanathan, 1996). İn other articles conducted on college students, it was found that meaning in life predicted DA (Nıksırat et al., 2019). For human consciousness, ‘annihilation’, in other words, ‘the finitude of existence’ is a difficult situation to accept (Sezer & Saya, 2009). For this reason, it is thought that individuals with high DA may SFM in their lives.

Another finding of this study, a significant negative relationship was found between the FOM subscale and Belittling/Criticising Mother and Belittling/Criticising Father subscales. Belittling/Criticising parenting style reflects behaviour that belittles the child and makes the child feel defective (Sheffield et al., 2005). The love and acceptance perceived by children in the family feeds their spiritual feelings and contributes to the meaningfulness of their lives (Bilici, 2018). Most individuals gain the meaning in their lives through the closest people in their lives such as mother, father and children (Eagleton, 2012). In this respect, it can be thought that individuals with Belittling/Criticising attitude in perceived parental attitudes decrease their FOM in life.

Moreover in this study, a significant positive relationship was found between the SFM subscale and the Conditional/Achievement-Oriented Parents subscales. Conditional/Achievement-Oriented parenting style reflects the behaviour of the parent who implies that looking at the child positively depends on the child’s success. A high level of this parenting style indicates a high level of conditional acceptance of the parent (Sheffield et al., 2005). It can be argued that Conditional/Achievement-Oriented parenting style is related to approval seeking schema. Individuals’ perceptions of trying to gain the approval of others in order to maintain their self-esteem are in the approval-seeking schema (Soygüt et al., 2009). The meaning in life crisis reveals the individual’s inability to recognize important life tasks and self-actualization (Zhurba & Dokukina, 2021). Self-actualization is an internal process and involves knowing one's own goals and needs (Tekke, 2019). The reason for the positive correlation between the sub-scale of the SFM and Conditional/Achievement-Oriented parental attitude may be the inability of individuals to achieve self-actualization due to the need to gain the approval of others. In a qualitative study, the theme of unconditional acceptance was found for individuals who found life meaningful (Kılavuz Çalışkan, 2019). The related literature supports the findings of this study.

Besides İn this study, a significant negative relationship was found between the subscales of the FOM and Pessimistic/Worried Parents. Pessimistic/Worried subscales reflect worried and pessimistic characteristics in parents. An increase in these characteristics indicates a worried parent with a pessimistic view of life (Sheffield et al., 2005). Parenting styles are associated with early maladaptive schemas (Louis et al., 2018). Pessimism schema, one of the early maladaptive schemas, is related to focusing on the negative aspects of life and the expectation that things will go wrong in various areas of life (Soygüt et al., 2009). Individuals' ways of thinking and being affect each other mutually. If individuals have negative attributions towards the world, they may not live their existence sufficiently (Dökmen, 2009). Kömürcü (2014) found a significant positive relationship between the need for meaningful existence and the Pessimism sub-dimension of perceived father attitude. In another study conducted on young adults, the meaning in life of individuals with protective parental attitudes was significantly lower than individuals with democratic parental attitudes (Demir & Murat, 2017). In another qualitative study, a positive perspective theme was found for people who find life meaningful (Kılavuz Çalışkan, 2019). In addition, Dursun (2012) found a significant positive relationship between meaning in life and optimism in his study. It is seen that similar studies also support the findings of this study.

In this study, a significant negative relationship was found between the scores in the subscales FOM and Emotionally Depriving Parents. A child whose need for affection and understanding cannot be adequately met by the caregiver is likely to develop emotional deprivation (Louis et al., 2018). Emotional deprivation schema is related to the expectation that the individual's emotional needs will not be met by others (Soygüt et al., 2009). The individuals' need for parents or individuals who will replace them in childhood is important not only for care and safety but also for preparing themselves for life and perceiving their individualism (Geçtan, 2019). With self-consciousness, human beings can recognise living beings, events, objects and think that they are meaningful (Dökmen, 2009). Adult individuals may dislike loneliness because they perceive themselves in relationships with other individuals. An accompanying feeling of meaninglessness is the fear of being alone or loneliness (Geçtan, 2019). According to Adler (2004), individuals who were neglected in childhood will have problems in interpreting life. In a study conducted on young adults, a positive relationship was found between early parental support and FOM. In addition, early parental support is a significant positive predictor of FOM (Kealy et al., 2020). In a study conducted on adolescents, adolescents' satisfaction with parental and maternal social support is a significant positive predictor of meaning in life (Brassai et al., 2013). In another study, a positive relationship was found between parent-child adjustment and the meaning of life (Sun et al., 2023). The theoretical knowledge and research support the findings of this study.

In this study, ,insignificant relationship was found between the scores in the FOM subscale and the scores in the subscales of Normative Parents, Overprotective/Anxious Parents, Conditional/Achievement-Oriented Parents, Permissive/Unlimited Parents and PF. İnsignificant correlation was found between the scores in the sub-scales of SFM in Life and in the sub-scales of Normative Parents, Emotionally Depriving Parents, Over-Protective/Anxious Parents, Permissive/Unlimited Parents, PWM, PF and Belittling/Criticizing Parents. The reason for this finding may be the study group or the structure of the measurement tools. In addition, insignificant relationship was found between the Meaning in Life and parental attitudes in similar studies. In Saraç et al. (2018)'s study, İnsignificant difference was found between the scores in the sub-dimensions of FOM and the SFM with regards to perceived parental attitude. In another study, İnsignificant relationship was found between the need for meaningful existence and the sub-dimensions of Normative Parents, Protective/Anxious

Parents, Permissive/Unlimited Parents and PF (Kömürcü, 2014).

Since parental attitude was analysed in this study, individuals with both parents alive were included in the study. In this respect, it could be considered as a limitation in terms of generalisability of the study. The lack of individual psychiatric assessment for possible psychiatric disorders of the individuals participating in the study can be a limitation.

This study was conducted on college students. In future studies, the same study can be conducted on different age groups such as adolescents and older adults. In this study, a positive relationship was found between the SFM and DA, and a negative relationship was found between the FOM and DA. Individual or group psychological counselling studies can be conducted to increase the meaning in life of individuals with DA. In this study, the meaning in life and parenting styles in the schema therapy model were examined and various relationships were found. In future studies, the meaning in life and early maladaptive schemas can be studied.

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A Comparison of the Mathematics Curriculums in Turkey and Germany in the Context of Algebra Learning Domain[1]

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ABSTRACT

In this study, Turkey and German state of North Rhine-Westphalia mathematics curriculum have been examined in the context of the algebra learning area. The learning outcomes have been investigated similarities and differences of the in terms of quantity and quality; classified in terms of knowledge and cognitive process dimensions of the revised Bloom's taxonomy. This study, in which the qualitative research approach was adopted, was carried out with the descriptive screening. Document analysis technique has been used in the data collection process. As a result of the analysis, it is determined that the learning outcomes are similar in terms of knowledge dimension; difference in terms of cognitive process dimension. While it is seen that the outcomes in the Turkey curriculum are in the analyze step as the highest cognitive level; Germany curriculum also includes outcomes fof higher level skills such as evaluate and create. Moreover, it is seen that the outcomes are mainly included in the procedural knowledge and apply step for both curriculums. Although it is seen that the outcomes in the Turkey curriculum are quantitatively higher than the outcomes in the Germany curriculum, it has been determined that the outcomes in terms of content are of a nature to cover each other. When the implementation suggestions were examined, it was seen that they were included in both curriculums in a detailed and rich way. On the other hand, when the distribution of the themes used in comparative education studies in the literature according to the countries was investigated, it was determined that the studies mostly focused on the elements of the curriculum (aim/goal, content, educational situations and testing situations). In the process of making sense of basic mathematical concepts and acquisition of high-level cognitive skills, teaching environments and programs can be designed by considering real life problems and process-based teaching models. On the other hand, since technology is a part of life, the education process can be integrated with digital games and/or stories, and programs and learning outcomes can be prepared in a way that includes teaching materials with digital content. In addition, different types of representation can be used in the mathematics teaching process and appropriate activities can be designed.

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INTRODUCTION

Each country has its own education system, and the education systems of other countries are examined in order to renew this system in line with the needs of the age and to eliminate its deficiencies. In this process, where the similarities and differences between countries are determined and appropriate results are drawn for their own education systems, we come across comparative education.

Although comparative education is perceived as an interdisciplinary field that uses some tools and perspectives of other disciplines and approaches educational issues in terms of comparison, it has started to be accepted as a separate discipline over time (Manzon, 2011). Thanks to comparative education, facts, trends and problems related to education can be analyzed and resolved from a broader perspective (Iliman-Püsküllüoğlu & Hoşgörür, 2017). Comparative education, whose main purpose is to solve educational problems, deals with education in the cultural, economic, political and social context, and allows the development of ideas that will form the basis of the education policies of countries (Türkoğlu, 1984). As a matter of fact, each country has its own education policy, and this policy considers it appropriate to make some innovations in the education system in order to meet the needs of the society, increase the quality of the services offered to the individual, and strengthen the relations between students, teachers and parents (Kuzu, Kuzu, & Gelbal, 2019).

When comparative education studies are examined, it is seen that there is more focus on mathematics and science education (Sadak, İncikabı & Pektaş, 2021). It is thought that it is important for individuals to renew themselves in the mathematics and science education so that they can think more innovative, more creative, more flexible, and more productive and act more planned, more skeptical and more competitive. These two fields comes to the fore in curriculums due to its features such as objectivity, the universality of its own truths and the perceived relationship of each nation to the desire for economic development (Atweh et al., 2007). Mathematics education is used in raising individuals to think critically, creatively, multi-dimensionally, to solve problems and to make sound decisions when necessary (Sezgin-Memnun, 2013); Science education (Council of Higher Education[CoHE]-World Bank, 1997) is of great importance in understanding and interpreting the environment they live in, and in producing new knowledge using existing knowledge. In this context, the developments and advances within the scope of the International Mathematics and Science Trends Study (TIMSS), which was conducted to help the development of mathematics and science education teaching, can be shown as an important reason for conducting comparative education studies. In addition, the developments and advances within the scope of the Program for International Student Assessment (PISA), which aims to evaluate the level of students in transferring the knowledge and skills acquired at schools to daily life, may be another important reason. As a matter of fact, with the performances obtained from such international large-scale exams, countries can see their own place in international platforms and make evaluations by comparing their education systems with other countries (Doğan & Barış, 2010).

Curriculum and the learning outcomes in this curriculum have an important place in the developing of individuals' abstract thinking, performing high performance in the cognitive domains and having high-level thinking skills. Focusing on desired knowledge and skills in individuals, the preparation of a curriculum that is compatible and complementary to each other and the learning outcomes suitable for this curriculum is closely related to the effective passing of the teaching and learning process (Kuzu, Çil, & Şimşek, 2019). Thus, taking into account the needs of the age, structuring the learning outcomes for the skills required by the changing world, will enable more permanent and effective learning (Çil, Kuzu, & Şimşek, 2019). It is very important for the learning outcomes to be clear, understandable and clear, to contain a single educational action, and to write hierarchically from concrete to abstract and from simple to complex as the upper class levels rise (Kuzu, Çil, & Şimşek, 2019).

While above points to be considered while preparing the learning outcomes are valid for each course, the appropriate classification approach should also be used, taking into account the content of the relevant curriculum and the structure of the learning outcomes. Bloom's taxonomy, which is one of the classification approaches, is a one-dimensional systematic classification type arranged according to a certain hierarchical structure and complexity by Bloom in 1956. Considering that it is not sufficient to examine the achievements in the mathematics curriculum in one dimension, as in other curricula, the achievements are classified in a two-dimensional systematic way consisting of knowledge and cognitive process dimensions. For this reason, the revised Bloom's Taxonomy acquisitions are more preferred in classification (Çelik, Kul, & Çalık-Uzun, 2018). It is thought that it would be more appropriate to use cognitive taxonomy since the mathematics curriculum includes more cognitive acquisitions. It is emphasized that the revised Bloom taxonomy is preferred more by scientists than cognitive taxonomies such as SOLO, Fink and Dettmer (Arı, 2013) and it is an effective taxonomy in interpreting the standards in mathematics (Näsström, 2009). Since Bloom's taxonomy (Bloom et al. (1956) is thought to be insufficient in acquiring in-depth information, its one-dimensional structure has been revised to a two-dimensional structure, knowledge and cognitive process, as a result of various criticisms over time (Anderson et al., 2001). Cognitive process dimension steps in the horizontal column of the revised Bloom taxonomy have passed from the noun form to the action form. In addition, considering that the synthesis step includes more complex mental processes than the evaluation step, its places were changed with the evaluation step and renamed and ordered as remember, understand, apply, analyze, evaluate and create (Anderson et al., 2001). Retrieval of relevant information from long-term memory in the cognitive process dimensions, in the remembering step, creating meaning from the instructional message as a verbal, written or graphical communication in the comprehension step, applying or using the process in a given situation in the application step, separating the material into its components in the analysis or analysis step, and There are actions to determine how the parts are related to each other/whole, to make judgments based on criteria and standards in the evaluation step, to bring the elements together in a consistent or functional structure in the creation or creation step, and to rearrange the elements in a new pattern or structure (Anderson et al., 2001). The knowledge dimension, which was added in order to express the cognitive terminology more clearly, took place in the vertical column of the taxonomy and consisted of factual, conceptual, procedural and metacognitive knowledge steps (Krathwohl, 2002). From the knowledge dimension, in the factual knowledge step, the basic elements that they must know in a discipline or in which they will solve the problem, the interrelationships between the basic elements that will work together among the broad structures in the conceptual knowledge step, how to do something in the procedural information step, methods and techniques, criteria for using skills, algorithms In the metacognitive knowledge step, there is information about cognition in general, such as the individual's awareness and knowledge of his own cognition process (Anderson et al., 2001). In the knowledge dimension what students know, and how they think in the cognitive process dimension are investigated and allowed to see the process from a student perspective (Kuzu, Çil, & Şimşek 2019). In both the knowledge and cognitive process dimensions, each step includes the other steps below, and as one goes to the higher levels, the abstraction, complexity and scope increase (for detailed information, see Anderson et al., 2001; Köğce et al., 2009; Krathwohl, 2002; Kuzu, Çil, & Şimşek, 2019).

Classifying the learning outcomes in the curriculum with this taxonomy allows what to teach and how to evaluate (Anderson et al., 2001). In the literature, it is possible to come across studies examining mathematics curriculum outcomes according to the revised Bloom taxonomy (e.g., Çelik et al., 2018; Çil et al., 2019; Hasić & Romano, 2018; Kablan, Baran, & Hazer, 2013; Kácovský et al., 2022; Kuzu, Çil, & Şimşek, 2019; Pizà-Mir, 2022). It is seen that the studies examining mathematics curriculum outcomes in the context of comparative education mostly focus on similarities and differences in terms of content and scope (e.g., Böke, 2002; Çiçek, Kuzu, & Çalışkan, 2021; Duygu, 2013; Galo, 2008; Özkan, 2006). On the other hand, it has been determined that there are limited number of comparative studies examining from taxonomic aspects (e.g., Bozkurt, Çırak-Kurt, & Tezcan, 2020). On the study conducted by Weissbach (2018), the PISA results of Turkey and Germany until 2015 were compared and it was stated that Germany was close to the average of the Organization for Economic Cooperation and Development (OECD) in mathematics in 2000 and that its scores in all fields increased in recent years. Although it was observed that Turkey's PISA scores increased in all areas until 2012, it was determined that it was below the OECD average. On the other hand, studies comparing the mathematics curriculum of Germany, which is a successful country in many fields, especially in engineering and technology, and which performs better than Turkey in international large-scale examinations (e.g. PISA, TIMSS), are still limited (e.g., Çiçek et al., 2021). Germany is a country located in the middle of Europe, neighboring many developed countries and attracting attention with its strong economy. As mentioned above, Germany has achieved more success in international exams (like PISA and TIMSS) than Turkey. It is thought that a comparison of the Turkish education system and the German education system, which has different characteristics compared to the Turkish education, will contribute to the development of the education system of Turkey, which is trying to enter the European Union. In addition, the reason for choosing the state of North Rhine-Westphalia is that it is the most populated state in Germany.

When TIMSS exams are examined in the context of "numbers", "algebra", "geometry", "data and probability" learning areas, it is seen that Turkish students have the lowest performance in algebra and geometry according to the results of 2019. According to the results of 2015, Turkish students have the two lowest performances. On the other hand, when the 5-8 mathematics curriculum in the Turkish education system is examined, there are "Numbers and Operations", "Algebra", "Geometry and Measurement", "Data Processing" and "Probability". It is seen that it consists of five learning areas and these areas are parallel to the TIMSS learning areas. Of these learning areas, algebra is included in all secondary school classes except grade 5. (MoNE, 2018). It is essential to find the equations established by describing symbols and letters, or to find the relationship between unknowns. It is based on" (Yenilmez & Avcu, 2009). Algebra acts as a common bridge and language between the sub-fields of mathematics and the elements of other disciplines in terms of conceptual and theoretical aspects, by providing individuals with an abstract thinking structure (Erbaş, Çetinkaya, & Ersoy, 2009). Algebra has an important position not only in mathematics, but also in every field and every stage of life, and algebra and algebraic thinking are used everywhere, from solving problems in daily events to solving problems in other sciences (Hawker & Cowley, 1997). Moreover, it has been observed that there is no comparison in terms of both the algebra learning area and the revised Bloom taxonomy. It is thought that it is important to work on the algebra learning area, which has an important place in helping individuals get abstract thinking, and also the revised Bloom's taxonomy, which is an effective taxonomy in interpreting the standards in mathematics.

In this study, firstly, the distribution of the themes used in studies comparing the mathematics curriculum of Turkey and other countries between the years 2002-2021 by countries was examined. Then, 5-8 mathematics curriculum in Turkey and German North Rhine-Westphalia (Nordrhein-Westfalen [NRW]) state have been examined in the context of algebra learning area and they were comparednd in line with following research questions.

1) What is the distribution of the outcomes in the 5-8 mathematics curriculum of Turkey and Germany in terms of knowledge and cognitive process dimensions of the revised Bloom's taxonomy in the context of algebra learning domain?

2) What are the similarities and differences between the sub-learning areas of the algebra learning field in the 5-8 mathematics curriculum of Turkey and Germany?

3) The learning outcomes of the algebra learning area in the 5-8 mathematics curriculum of Turkey and Germany;

• What are the similarities and differences in terms of number and content?

• What are the similarities and differences between the implementation proposals?

• What is the distribution of the revised Bloom's taxonomy in terms of knowledge and cognitive process dimensions?

METHOD

In this section, information about the research design, research instruments and processes, data analysis are presented in detail.

Research Design

Since this study aims to compare the mathematics curriculum in Turkey and Germany in the context of algebra learning area, it is a cross-national comparative education study in terms of subject. This study, in which the qualitative research approach was adopted, was carried out with the descriptive model. This model is a research approach that aims to describe a past or present situation as it is (Karasar, 2012). In this study, in the descriptive process, the literature on the subject (Ministry of National Education [MoNE], 2018; Ministerium für Schule und Bildung des Landes Nordrhein-Westfalen [MSB NRW], 2019) and the official websites of the countries were scanned.

Data Collection

Document analysis technique has been used in the data collection process. Document review is expressed as a meticulous and systematic examination of the content of all documents, including printed and electronic materials (Wach, 2013). Document review carried out in five main stages: Accessing documents, checking authenticity, understanding documents, analyzing data, and using data (Forster, 1994). In the accessing documents and checking authenticity processes, the official electronic pages of the ministries of education of the countries were investigated and the curriculums were obtained from here. In the understanding documents process, these documents and education system of both countries detailed investigations have been made. In this direction, some information has been obtained. Although the general framework of Germany curriculum is formed by the ministry, schools have the right to define a unique pedagogical concept. In this context, school learning program can be formed by the decisions taken by the school administration and teachers based on the core curriculum. Although the core curriculum is narrow in scope, as the name suggests, it leaves a wide range of action and decision to teachers and schools with the determination of the general framework. In the using data process, for the mathematics curriculum in Turkey, the 2018 secondary school mathematics curriculum was used as a document. For the mathematics curriculum in Germany, the sample school program, which was created with reference to the core curriculum prepared for the Gymnasium secondary education, which is located in the state of North Rhine-Westphalia, where the most populated, was used as a document. In this study, 23 outcomes under the title of "Algebra" learning area in Turkey's 5-8 mathematics curriculum (6th grade: M.6.2.1.1-M.6.2.1.3; 7th grade: M.7.2.1.1-M.7.2.1.3, M.7.2.2.1-M.7.2.2.4, 8th grade: M.8.2.1.1-M.8.2.1.4, M.8.2.2.1-M.8.2.2.6, M.8.2.3.1-M.8.2.3.3) were examined. 5-8 in the Germany curriculum, although there are 25 outcomes in total under the "Arithmetic/Algebra" learning area title, only nine of these 25 outcomes are for algebra, and so these nine outcomes (5th-6th grades: IK4, IK6, IK7; 7th-8th grades: IK4-IK7, IK9, IK10) were taken into account. Analyzing data process took place in four stages and was presented in detail in the "Data Analysis" section.

Data Analysis

The data analysis process in this study was carried out in four step. First of all, the sub-learning areas and outcomes of the algebra learning area of the German mathematics curriculum were translated into Turkish independently by two foreign language experts whose mother is Turkish and whose foreign language is German. It is stated by Hambleton (2005) that it is necessary for the translators to be competent in both languages and to have a good command of the cultural structure of both languages. Sample translation texts regarding the translation process are presented in detail in Table 1.

Table 1. *Sample translation texts on the translation process*

Learning Area	Grade level	Original Learning Outcome Text	FLE	Translation 1/ Translation 2
Arithmetic\Algebra	5-6	IK4. Die Schülerinnen und Schüler verbalisieren Rechenterme unter Verwendung von Fachbegriffen und übersetzen Rechenanweisungen und Sachsituationen in Rechenterme.	1	IK4. Öğrenciler, teknik kavramları/terimleri kullanarak cebirsel ifadeleri sözlü olarak ifade eder, aritmetik talimatları ve sözel olarak verilen durumları cebirsel ifadelere çevirir.
			2	IK4. Öğrenciler, teknik terimleri kullanarak aritmetik terimleri sözlü hale getirir ve aritmetik talimatları ve olgusal durumları aritmetik terimlere çevirir.
	7-8	IK10. Die Schülerinnen und Schüler wählen algebraische Lösungsverfahren für lineare Gleichungssysteme zielgerichtet aus und vergleichen die Effizienz unterschiedlicher Lösungswege.	1	IK10. Öğrenciler doğrusal denklem sistemleri için uygun cebirsel çözüm yöntemleri seçer ve farklı çözüm yöntemlerinin verimliliğini karşılaştırır.
			2	IK10. Öğrenciler, lineer denklem sistemleri için cebirsel çözüm yöntemlerini hedefli bir şekilde seçer ve farklı çözüm yöntemlerinin verimliliğini karşılaştırır.

In line with the main purpose of this study, only the sub-learning areas and learning outcomes belonging to the "Algebra" learning area of the "Arithmetic/Algebra" learning area in the German mathematics curriculum were taken into account. IK: Inhaltsbezogene Kompetenzen (Skills/learning outcomes related to the content); FLE: Foreign language expert

Borsa et al. (2012) suggest that both versions obtained at the end of the translation process should be compared and examined whether there are words and complex sentences that would make it difficult to understand. In this context, the intelligibility of both translation versions obtained and the extent to which they matched the original translation were evaluated by experts and made into a single version. Experts in this process is in the form: A professor who is an expert in mathematics education whose native language is Turkish; a PhD student who is expert in the areas of Curriculum and Instruction whose native language is both German and Turkish; a foreign language expert whose native language is Turkish, whose foreign language is German. To what extent the Turkish translation obtained is understandable linguistically; the extent to which the translation corresponds to the original text in terms of meaning and content has been evaluated with expert opinions. As the results of the expert reviews, it is observed that the average score is distributed three and above. The average scores for the outcomes during the evaluation process of the translations are presented in detail in Table 2.

Table 2. *Average scores regarding the evaluation process of translations*

		5-6			7-8					
Grade level/Learning outcome		IK4	IK6	IK7	IK4	IK5	IK6	IK7	IK9	IK10
5-8	L	4,8	4,2	4,6	3,6	4,4	4,8	4,6	4,4	4
	MC	4	3,6	4,2	3,4	4,6	4,8	4,4	4	3,8

Linguistic (L) 1: Never understandable, 2: Not understandable, 3: Undecided, 4: Understandable, 5: Completely understandable; Meaning annd Content (MC) 1: Never correspond, 2: Not correspond, 3: Undecided, 4: Correspond, 5: Completely correspond

In the second stage of the analysis process, studies comparing the mathematics curriculum of Turkey and other countries between the years 2002-2021 were analyzed with descriptive analysis. The data obtained in the descriptive analysis process are presented by organizing, interpreting and classifying, summarizing and interpreting in terms of predetermined themes. In addition, there are four stages in this analysis process: “creating the framework, processing the data in terms of thematic framework, defining the findings and interpreting the findings” (Yıldırım & Şimşek, 2018). In this process, the themes determined by Çiçek et al. (2021) (see Table 3) were used, and the inter-rater reliability was found to be .94 with the reliability calculation prepared by Miles and Huberman (1994). It is recommended that the inter-rater reliability be at least 80% (Miles & Huberman, 1994) and since it is higher than .80, it is seen to be reliable. The resulting disagreements were discussed again by the researchers and the reliability was calculated as .100 by providing a consensus.

Table 3. *Themes used in the compared studies (Çiçek et al., 2021)*

A	Comparison of the program elements (aim/goal, content, educational situations and testing situations)
B	Comparison of the program in terms of educational philosophies/vision
C	omparison of the program in terms of subjects/learning areas, sub-learning areas and outcomes
D	Comparison of the program in terms of general features

E	Comparison in the context of pedagogical content knowledge components
F	Comparison in terms of paradigm reflections

In the third stage of the analysis process, the similarities and differences between the sub-learning areas of the algebra learning area of the mathematics curriculum applied in Turkey and Germany; the number and content of the outcomes and the implementation suggestions for the outcomes were examined with descriptive analysis. In the fourth stage of the analysis process, the learning outcomes of the algebra area of the mathematics curriculum implemented in Turkey and Germany were examined in terms of knowledge and cognitive process dimension of the revised Bloom taxonomy. In this process, which has been carried out with descriptive analysis, a two-dimensional structure consisting of knowledge and cognitive process dimensions created by Krathwohl (2002) has been used as the coding key. In the classification of 23 outcomes belonging to the algebra learning area of the mathematics curriculum in Turkey, it has been taken into account (MoNE, 2018) the classification of Kuzu, Çil, & Şimşek (2019). In the classification of nine outcomes (MSB NRW, 2019) belonging to the algebra learning area implemented in the German state of North Rhine-Westphalia, a total of five experts, including two mathematics education experts, two assessment and evaluation experts, one education expert, have contributed by independent of each other. In the classification of the learning outcomes, not only the educational action in the sentence, that is, the verb stem, but the entire outcome sentence is taken into account. In the classification of the learning outcomes, not only the educational action in the sentence, that is, the verb stem, but the entire outcome sentence is taken into account. In this process Miles and Huberman (1994) method (Agreement/Total Agreement) was used and if the inter-rater reliability was .80 and above the classification of the learning outcome is completed. On the other hand, for the outcomes where consensus was not reached or a low level of consensus was reached, the experts came together and at the end of the discussion process, a common denominator was reached and the final step of the outcomes was decided. If five experts choose the relevant step corresponding to the outcome:1; if four experts choose: .80; if three experts choose: .60; if two experts choose: .40; if an expert chose: .20; a score of .00 if no expert chose it (Table 4).

Table 4. *Distribution of expert opinions on the classification of the outcomes of the algebra learning area of the German mathematics curriculum in terms of knowledge and cognitive process dimensions*

	Knowledge Dimension								Cognitive Process Dimension											
	IC				D				IC						D					
	F	Co	P	M	F	Co	P	M	R	U	Ap	An	E	Cr	R	U	Ap	An	E	Cr
IK4	,40		,60				1,00			,40	,60						1,00			
IK6		,40	,60			,20	,80			,20	,80						1,00			
IK7			1,00				1,00				1,00						1,00			
IK4	,20	,60	,20			1,00				,20	,40	,40					,20	,80		
IK5	,20	,40	,40		,20		,80				,20			,80			,20			,80
IK6		,60	,40			1,00						,40	,20	,40				,80		,20
IK7			1,00				1,00				,20		,80						1,00	
IK9			1,00				1,00			,20	,20	,60					,20	,80		
IK10			1,00				1,00			,40			,60						1,00	

IC: Independent coding; D: Discussion; F: Factual, Co: Conceptual, P: Procedural, M: Metacognitive; R: Remember, U: Understand, Ap: Apply, An: Analyze, E: Evaluate, Cr: Create

Research Ethics

This study is an international comparative education study in terms of its subject, and there is a human or animal subject within the scope of the research; Data collection methods such as experiments, observations, questionnaires or interviews were not used. For this reason, it was not necessary to obtain an ethics committee report.

FINDINGS AND INTERPRETATION

In this section, first of all, the studies comparing the curricula applied in Turkey and other countries between the years 2002-2021 were examined, and the distribution of the themes covered in these studies on the basis of countries and years was presented. Then, the comparison of the 5th-8th mathematics curriculum applied in Turkey and the German state of North Rhine-Westphalia in the context of the algebra learning area is explained in line with the sub-problems of the research.

The number of comparative education studies for mathematics curriculum conducted in Turkey between 2002 and 2021 and their distribution by country, subject and year

In this section, the studies conducted in Turkey between 2002-2021 comparing the mathematics curriculum of Turkey and other countries are examined; A total of 29 academic studies, including 11 articles (Altıntaş & Görgen, 2014; Bacakoğlu & Işık-Tertemiz, 2021; Batur et al., 2021; Bozkurt et al., 2020; Çiçek et al., 2021; Erdoğan et al., 2016; Güzel et al., 2010; Kul & Aksu, 2016; Sugandi & Delice, 2014; Tan-Şişman & Karataşlı, 2020; Yağan, 2020) and 18 master's theses (Abid, 2017; Böke, 2002; Çetinbağ, 2019; Çoban, 2011; Duygu, 2013; Erbilge, 2019; Galo, 2008; Güzel, 2010; Ismail-Amet, 2021; Karakaya, 2021; Karataşlı, 2019; Kaytan, 2007; Özkan, 2006; Öztürk, 2020; Serçe, 2020; Sugandi, 2015; Tezcan, 2016; Uğur-Arslan, 2015), were found. In these studies, it was found that 4 master's theses (Güzel, 2010; Sugandi, 2015; Tezcan, 2016; Karataşlı, 2019) were presented as articles (Bozkurt et al., 2020; Güzel et al., 2010; Tan-Şişman & Karataşlı, 2020; Sugandi & Delice, 2014) at the same time. Among these four studies conducted as both thesis and article, the thesis was considered. Because the studies were only considered once, the total number of studies was set at 25. The distribution of comparative education studies conducted in Turkey for the mathematics curriculum between 2002-2021 according to countries, themes and years is presented in detail in Table 5.

Table 5. *The Distribution of comparative education studies conducted in Turkey for the mathematics curriculum between 2002-2021 by countries, themes and years*

	A	B	C	D	E	F
Germany	Güzel (2010)	Güzel (2010)	Çiçek et al. (2021)			
USA	Çoban (2011) Duygu (2013)	Duygu (2013)	Batur et al. (2021) Tezcan (2016)			
Australia	Karataşlı (2019) Yağan (2020)		Karataşlı (2019)	Yağan (2020)		
Belgium	Özkan (2006)					
Indonesia						Sugandi (2015)
Estonia	Serçe (2020)					
South Korea	Altıntaş & Görgen (2014) Duygu (2013)	Duygu (2013)	Batur et al. (2021) Uğur-Arslan (2015)	Altıntaş & Görgen (2014)	Kul & Aksu (2016)	
Hong Kong-China	Duygu (2013) Erbilge (2019)	Duygu (2013)				
England	Böke (2002) Çoban (2011) Kaytan (2007)			Kaytan (2007)		
Libya	Abid (2017)	Abid (2017)				
Canada	Çetinbağ (2019) Erbilge (2019) Güzel (2010) Öztürk (2020) Serçe (2020)	Güzel (2010)	Karakaya (2021)			
Kosova			Galo (2008)			
Singapore	Duygu (2013) Kaytan (2007) Özkan (2006) Serçe (2020)	Duygu (2013)	Bacakoğlu & Işık-Tertemiz (2021) Batur et al. (2021) Erdoğan et al. (2016) Karakaya (2021) Tezcan (2016) Uğur-Arslan (2015)	Kaytan (2007)	Kul & Aksu (2016)	
New Zealand	Duygu (2013)	Duygu (2013)	Batur et al. (2021)			
Greece	İsmail-Amet (2021)		İsmail-Amet (2021)			

A: Comparison of the program elements (aim/goal, content, learning experiences and evaluation); B: Comparison of the program in terms of educational philosophies/vision; C: Comparison of the program in terms of subjects/learning areas, sub-learning areas and achievements; D: Comparison of the program in terms of general features; E: Comparison in the context of pedagogical content knowledge components; F: Comparison in terms of paradigm reflections.

When Table 5 is examined, it is noticeable that some studies compare more than one theme (e.g.

Karataşlı, 2019; Yağan, 2020), some themes are included in more than one study for the same country (e.g. Böke, 2002; Çoban, 2011; Kaytan, 2007 for thema A in the study on England), and in some studies more than one country is compared at the same time (e.g. Güzel, 2010; Duygu, 2013). Moreover, Table 5 shows that comparative education studies conducted in Turkey between 2002 and 2021 for the mathematics curriculum were most frequently conducted on the countries Singapore (f=11), Canada (f=6) and South Korea (f=5). Considering that more than one comparison was made in some studies, it is seen that 13 comparisons have been made on Singapore, while this number is seven for South Korea and Canada. In the studies on Singapore and South Korea, it is seen that comparisons are made for five themes. It has been determined that there is no study on the F theme for these two countries with the most studies on. In studies on Germany, USA, Austria, Canada and New Zealand, comparisons were made for three themes. The study on these four countries, excluding Austria, focused on the A, B and C themes; In Austria, it was determined that the A, C and D themes were focused on. In the studies on Hong Kong-China, England, Libya and Greece, it is seen that comparisons are made for two themes. For Indonesia, Estonia and Kosovo, comparison was made on only one theme. On the theme A of the study on Estonia; it is seen that the study on Kosovo was carried out on the C theme. The point that draws attention here is that the study on Indonesia is on the F theme. As a matter of fact, no comparative education study has focused on the F theme, except for the study on Indonesia. The number of themes used in studies comparing mathematics curriculum of Turkey and other countries and their distribution by country are presented in detail in Table 6.

Table 6. *The number of themes in the mathematics curriculum studies conducted in Turkey between 2002-2021 and their distribution by country*

	Germany	**USA**	**Australia**	**Belgium**	**Indonesia**	**Estonia**	**South Korea**	**Hong Kong-China**	**England**	**Libya**	**Canada**	**Kosovo**	**Singapore**	**New Zeland**	**Greece**	**TNTU**
A	✓	✓✓	✓✓	✓		✓	✓✓	✓✓	✓✓✓	✓	✓✓✓✓✓		✓✓✓✓	✓	✓	26
B	✓	✓					✓	✓		✓	✓		✓	✓		8
C	✓	✓✓	✓				✓✓				✓	✓	✓✓✓✓✓✓	✓	✓	16
D			✓				✓		✓				✓			4
E							✓						✓			2
F					✓											1
TNS	3	5	4	1	1	1	7	3	4	2	7	1	13	3	2	

TNS: It gives the total number of studies. Some studies included more than one theme at the same time.
TNTU: It gives the total number of themes used. Some themes were included in more than one study for the same country. In addition, in some studies, more than one country was discussed for the same theme.

Looking at Table 6, it was found that the most (f=26) comparisons are made from the elements of the program (aims/goals, content, learning experiences and evaluation). At the same time, it was noted that there were quite a lot of comparison studies (f=16) made in terms of the subjects/learning areas, sub-learning areas and achievements of the program. On the other hand, it has been observed that there are also comparative studies in terms of the educational philosophies/vision of the program (f=8) and the general features of the program (f=4). In addition, it was found that there are also studies in the literature that make comparisons in the context of pedagogical content knowledge components (f=2) and paradigm reflections of the programs (f=1)

Findings on the similarities and differences between the sub-learning areas of the algebra learning area in the 5 th-8th mathematics curriculum of Turkey and Germany

In this section, the similarities and differences between the sub-learning areas of the algebra learning field in the 5th-8th mathematics curriculum of Turkey and Germany are examined, and the findings are presented in Table 7.

Table 7. *Sublearning areas of the algebra learning areas of the mathematics curriculum in Turkey and Germany*

Country	Learning Area (LA)	Grade	Sub-Learning Area (SLA)
Turkey	Algebra	5th grade	-
		6th grade	SLA1. Algebraic Expressions
		7th grade	SLA1. Algebraic Expressions SLA2. Equality and Equation
		8th grade	SLA1. Linear Equations SLA2. Algebraic Expressions and Identities SLA3. Inequalities
Germany	Arithmetic/Algebra	5th and 6th grade	SLA1. Conceptualization: Arithmetic Term
		7th and 8th grade	SLA1. Term and Variable: Variables as Variable, as Placeholder and as Unknown; Term Transformations SLA2. Solutions Methods: Algebraic and Graphical Solution Methods (Linear Equations and Systems of Linear Equations with Two Variables, Elementary Fractional Equations)

In accordance with the main aim of this study, only the sub-learning areas and learning outcomes belonging to the "Algebra" learning area of the "Arithmetic/Algebra" learning area in the German mathematics curriculum were taken into account.

According to Table 7, it is seen that there is a difference between the sub-learning areas of the algebra learning area of the 5th-8th mathematics curriculum of the countries. It can be observed that the number of sub-learning areas in the Germany curriculum is less than the Turkey curriculum. While there is no algebra sub-learning area in the 5th grade in the Turkey curriculum; there is one algebra sub-learning area in the 6th grade; two in the 7th grade; three in the 8th grade, so six sub-learning areas are determined for four grade levels in total. In the Germany curriculum, it is seen that there is no separation for the 5th and 6th grades and a sub-learning area for algebra is determined for both grade levels. It is observed that there is no separation in the same way for the 7th and 8th grades, and there are two sub-learning areas for algebra for both grade levels. Although the sub-learning areas of the Turkey curriculum differ quantitatively, it can be said that the sub-learning areas mostly overlap. For istance, the "SLA1. Algebraic Expressions" sub-learning area of the 6th grade level of the curriculum in Turkey and the "SLA1. Conceptualization: Arithmetic Term" sub learning area of the 5th-6th grade level of the Germany curriculum overlap each other. M.6.2.1.1. learning outcome of the SLA1 in Turkey curriculum correlates with the IK4 learning outcome SLA1 in Germany curriculum. On the other hand, it can be said that the number of sub-learning areas covered in the Germany program is small, but the content is broad. For istance, the "SLA2. Solutions Method: Algebraic and Graphical Solution Methods" sub learning area of the 7th-8th grade level of the Germany curriculum while it includes the expressions in the Turkey curriculum, it also includes the relationship with concepts such as area-volume.

Findings on the similarities and differences in the number and content of algebra learning outcomes in the 5th-8th mathematics curriculum of Turkey and Germany

In this section, the similarities and differences in the number and content of algebra learning outcomes in the 5th-8th mathematics curriculum of Turkey and Germany are examined, and the findings are presented in Table 8. As mentioned before, only the sub-learning areas and learning outcomes belonging to the "Algebra" learning area of the "Arithmetic/Algebra" learning area in the German mathematics curriculum were taken into account.

According to Table 8, it is seen that Turkish and German mathematics curriculum have a similar approach in terms of algebra learning outcomes. Learning outcomes that should be taught to students in both curricula are expressed in short, clear and simple present tense. While the outcomes in the Turkey curriculum are separated on a class basis, there is no such separation in the Germany curriculum. The learning outcomes in the Germany curriculum are included by combining two grade levels, like 5th-6th and 7th-8th grade. In addition, before the learning outcomes are given in the Germany curriculum, the 5th-6th and 7th-8th topics and concepts of the grade are included. In the Turkey curriculum, the subject headings are given separately for each grade level and the learning outcomes are listed under each subject. There are quantitatively more learning outcomes in the Turkey curriculum compared to the Germany curriculum. There are 23 learning outcomes in the learning area of algebra in the Turkish mathematics curriculum for the 5th-8th class levels. Although there are 25 learning outcomes in total under the "Arithmetic/Algebra" learning area in the Germany curriculum, only 9 of them are for algebra. The Turkey curriculum assigns more learning outcomes but the Germany curriculum includes the content of the Turkey curriculum.

Table 8. *Learning outcomes of the algebra learning area of the mathematics curriculum in Turkey and Germany*

Turkey	Germany
5th Grade Learning Outcomes - **6th Grade Learning Outcomes** **SLA1. Algebraic Expressions** M.6.2.1.1. Writes an algebraic expression suitable for a verbally given situation and a verbal situation suitable for a given algebraic expression. M.6.2.1.2. Calculates the value of the algebraic expression for different natural number values that the variable will take. M.6.2.1.3. Explain the meaning of simple algebraic expressions. **7th Grade Learning Outcomes** **SLA2. Algebraic Expressions** M.7.2.1.1. Makes addition and subtraction operations with algebraic expressions. M.7.2.1.2. Multiplies an algebraic expression by a natural number. M.7.2.1.3. Expresses the rule of the number patterns with a letter, finds the desired term of the pattern whose rule is expressed with a letter. **SLA3. Equality and Equation** M.7.2.2.1. Understands the principle of conservation of equality. M.7.2.2.2. Recognizes an equation with a first degree unknown and sets up an equation with a first degree unknown in accordance with given real-life situations. M.7.2.2.3. Solves first degree equations with one unknown. M.7.2.2.4. Solves problems that require establishing an equation with a first degree unknown. **8th Grade Learning Outcomes** **SLA4. Algebraic Expressions and Identities** M.8.2.1.1. Understands simple algebraic expressions and writes them in different formats. M.8.2.1.2. Multiplies algebraic expressions. M.8.2.1.3. Explain identities with models. M.8.2.1.4. Factors algebraic expressions. **SLA5. Linear Equations** M.8.2.2.1. Solves first degree equations with one unknown. M.8.2.2.2. Recognizes the coordinate system with its properties and shows ordered pairs. M.8.2.2.3. Expresses how one of the two variables, which have a linear relationship between them, changes depending on the other, with a table and an equation. M.8.2.2.4. Draws the graph of linear equations. M.8.2.2.5. Creates and interprets equations, tables and graphs of real life situations with linear relationships. M.8.2.2.6. Explain the slope of the line with models, relate linear equations and graphs with slope. **SLA6. Inequalities** M.8.2.3.1. Writes mathematical sentences suitable for daily life situations involving inequality with a first degree unknown. M.8.2.3.2. Represents inequalities with a first degree unknown on the number line. M.8.2.3.3. Solves inequalities with a first degree unknown.	**5th and 6th Grade Learning Outcomes** **SLA1. Conceptualization:** Arithmetic Term The students, IK4. Verbalize arithmetic terms by using technical terms and translate arithmetic instructions and factual situations into arithmetic terms. IK6. Use variables to describe simple factual relationships and to phrase calculation rules. IK7. Put numbers into expressions with variables and calculate their value. **7th and 8th Grade Learning Outcomes** **SLA2. Term and Variable:** Variables as Variable, as Placeholder and as Unknown; Term Transformations **SLA3. Solutions Methods:** Algebraic and Graphical Solution Methods (Linear Equations and Systems of Linear Equations with Two Variables, Elementary Fractional Equations) The students, IK4. Interpret variables as variables to describe relations, as placeholders in terms and arithmetic laws, and as unknowns in equations and systems of equations. IK5. Set up terms as a calculation rule for relations and for calculating areas and volumes. IK6. Set up equations and inequalities to phrase conditions in factual situations. IK7. Transform terms, including fractional terms, purposeful, and correct incorrect term transformations. IK9. Determine solution sets of linear equations and systems of linear equations as well as fractional equations using suitable methods and interpret them in the factual context. IK10. Select algebraic solution methods for systems of linear equations purposefully and compare the efficiency of different solution methods.

The reason for this difference is that the outcomes in the Turkey curriculum are given in more detail and the Germany curriculum more generally. In the Germany curriculum, some learning outcomes are combined and expressed as a single learning outcome. In other words; a learning outcome in the Germany curriculum is expressed in two or three different learning outcomes sentences in the Turkey curriculum. It is noteworthy that the 6th grade algebra learning outcomes of the Turkey curriculum are both quantitatively and qualitatively similar to the 5th and 6th grade algebra learning outcomes of the Germany curriculum. When the 7th and 8th grade learning outcomes of both countries are examined, it is seen that there are quantitative differences. In addition, when the relationship between the uses of algebra in real life situations is examined, it is seen that both countries include activities and experiences related to real life situations at the level of learning outcomes.

Findings on the similarities and differences between the implementation suggestions for the learning outcomes of the algebra learning area in the 5th-8th mathematics curriculum of Turkey and Germany

In this section, the similarities and differences between the implementation suggestions for the learning outcomes of the algebra learning area in the 5th-8th mathematics curriculum of Turkey and Germany are examined, and the findings are presented in Table 9.

Table 9. *Implementation suggestions for the algebra learning area of the mathematics curriculum in Turkey and Germany*

Turkey	Germany
• Appropriate models are used in addition and subtraction with algebraic expressions. • Studies/activities to find the rule by transforming the relationships in daily life situations or shape patterns into patterns are also included. • Scales or similar equilibrium models are used to show that equality is maintained in addition and subtraction. • Studies on multiplication with algebraic expressions with models are included. • Studies on associating real-life situations with locating on the coordinate system are included. • Appropriate information and communication technologies are used when necessary.	• Area formulas and perimeter formulas in different variants enable a first, clear encounter with terms and term transformations. • First set up terms with one variable for illustrative situations (matches, packaging tape, pattern...) and calculate values. • Set up and solve equations through systematic experimentation, tables, graphs and equivalent transformation (scale model). • Problem solving exercises with equations (number puzzle, age puzzle, daily life situations). • Use spreadsheet to check substitution equality and clarify variable aspect. • Investigation of term transformations with computerized algebra systems (Computer Algebra Systems: CAS).

According to Table 9, it is seen that the implementation suggestions prepared for the algebra learning outcomes of both countries are given in detail and richly in both curricula. In addition, it is noteworthy that the implementation suggestions of both countries are similar. For example, using appropriate models in transactions, including studies for associating them with real-life situations, using appropriate information and communication technologies (computer algebra systems, spreadsheets, ...) are the common points of the implementation suggestions of both countries.

Distribution of the learning outcomes of the algebra learning area in the 5th-8th mathematics curriculum of Turkey and Germany in terms of knowledge and cognitive process dimension of the revised Bloom's Taxonomy

In this section, the distribution of the learning outcomes of the algebra learning area in the 5th-8th mathematics curriculum of Turkey and Germany in terms of knowledge and cognitive process dimension of the revised Bloom's Taxonomy are examined, and the findings are presented in Table 10.

Table 10. *Percentage distribution of the Turkish and german mathematics curriculum on the classification of the learning outcomes of algebra learning area in terms of knowledge and cognitive process dimensions*

	Turkey						Germany					
	R	U	Ap	An	E	Cr	R	U	Ap	An	E	Cr
F	0	0	0	0	0	0	0	0	0	0	0	0
CoO	0	26,09	0	0	0	0	0	0	0	22,22	0	0
P	0	0	52,17	17,39	0	4,35	0	0	33,33	11,11	22,22	11, 11
M	0	0	0	0	0	0	0	0	0	0	0	0

F: Factual, Co: Conceptual, P: Procedural, M: Metacognitive; R: Remember, U: Understand, Ap: Apply, An: Analyze, E: Evaluate, Cr: Create

When Table 10 is examined, it is seen that the learning outcomes in the 5th-8th mathematics curriculum in Turkey and Germany are concentrated in the conceptual and procedural steps in terms of knowledge dimension. In terms of the cognitive process dimension, it was observed that the learning outcomes in the Turkey curriculum concentrated on the steps of understand, apply, analyze and create, while the learning outcomes in the Germany curriculum focused on the steps of apply, analyze, evaluate and create. Although it is seen that the learning outcomes in both Turkish (52.17%) and German (33.33%) curriculum are predominantly in the procedural apply step; It is noteworthy that the outcomes in the procedural evaluation (22.22%) and procedural creation (11.11%) steps in the Germany curriculum are higher than in the Turkey curriculum. In addition, it was determined that the outcomes in the conceptual knowledge level in the Turkey curriculum were more cognitively at the understanding level (26.09%), while the outcomes in the Germany curriculum in the conceptual knowledge level were more concentrated on the cognitive analyze step (22.22%). On the other hand, it has been observed that the number of learning outcomes in the procedural analyze step of the Turkey curriculum (17.39%) is higher than the number of learning outcomes in the procedural analyze step of the Germany curriculum (11.11%). In this context, while it is seen that the learning outcomes of the algebra learning area of the 5th-8th mathematics curriculum in Turkey and Germany are similar in terms of knowledge dimension; it has drawn attention that the Germany curriculum is prepared for higher level skills in terms of cognitive process dimension.

CONCLUSION, DISCUSSION and SUGGESTIONS

In this study, the studies comparing the mathematics curriculum of Turkey and other countries between 2002-2021 were examined within the framework of the determined themes and it was seen that these studies were mostly carried out with Singapore. At the same time, when examined in terms of the theme used, it was determined that the studies mostly focused on the elements of the program (aim/goal, content, educational situations and testing situations). As a matter of fact, the goal constitutes the most basic element of a program and gives direction to the content and clarifies the teaching process. In addition, determining the goal, choosing the methods and strategies suitable for the goal and the content, and evaluating the extent to which the target has been achieved are also very important in the education process. Learning outcomes, which are one of the elements of the program, have a special importance as they are the starting point for other elements. In addition, it is a necessity for the formation of a consistent education program to determine the outcomes correctly, to try to give them to the students as determined, to guide the measurements and to use them as criteria in the evaluation (Bümen, 2006).

This may be an indication of why comparative education studies in the literature mostly focus on the elements of the curriculum. On the other hand, although it had a very low performance in 1985, the fact that it has become a perfect system since 2000 with the reform movements (Bakioğlu & Göçmen, 2013) may be the reason why the Singapore education system is the most studied. In addition, its high performance in mathematics in international exams such as TIMSS and PISA (Mullis et al., 2016; Mullis et al., 2020; Mullis et al., 2015; OECD, 2010-2019) may be cited among the reasons why Singapore's prefered.

In this study, the sub-learning areas of the algebra learning area in the 5-8 mathematics curriculum of Turkey and Germany were compared and it was seen that there were some differences between the programs. According to these differences, it can be said that although the Germany curriculum has fewer algebra sub-learning areas than the Turkey curriculum, the sub-learning areas mostly overlap in content. In addition, although there is no algebra learning area in the 5th grade in the Turkey curriculum, there is an algebra learning area in the 5th grade according to the Germany curriculum. At the same time, while the 6th, 7th and 8th grades in the Turkey curriculum have separate sub-learning areas of algebra learning, there is no separation for the 5th and 6th grades in the Germany curriculum, and there is no separation for the 7th and 8th grades in these grade levels. It has been noticed that there is a sub-learning area. It was determined that the number of algebra sub-learning areas increased as the grade levels increased in both Turkey and Germany curriculum.

The similarities and differences in terms of the number and content of the learning outcomes of the algebra learning area in the 5-8 mathematics curriculum of Turkey and Germany were examined, and it was seen that the outcomes in both Turkey and Germany curriculums were expressed in short, clear and broad time sentences and associated with daily life. In this way, it can be said that students will see algebra in real life problems and realize how important and necessary it is to learn algebra. On the other hand, if the differences between the two curriculums are taken into account, it can be said that the outcomes in the Turkish program are differentiated for each grade level, while the outcomes in the Germany curriculum are divided into 5-6 and 7-8 classes. Another difference between the programs is that the outcomes in the Turkey curriculum for algebra learning area are higher than the outcomes in the Germany curriculum. Although the number of outcomes is different, the outcomes mostly cover each other. The reason for this is that the outcomes in the Turkey program are given in more detail and some of the outcomes in the German program are combined and expressed as a single achievement. In this direction, Çetinbağ (2019) states that when similar outcomes are combined and expressed in the simplest form, it will prevent the formation of learning outcome density. However, while combining the outcomes, care should be taken not to allow another educational action to enter the area covered by an educational action, and overlap should not be allowed (Çil et al., 2019; Kennedy, 2006; Kuzu et al., 2019). When the grade level increases in the curriculums of both countries, the number of outcomes increases and the content of the outcomes becomes more intense. Considering that it is necessary to progress from simple subjects to complex subjects in order for individuals to experience a sense of outcome and to realize learning more efficiently, we can associate this situation with the principle of education from simple to complex. As a matter of fact, according to the study conducted by Kuzu et al. (2019), the organization of the outcomes according to the aim and goal of the curriculum, expressing them clearly and precisely, containing a single action, writing the outcomes at different grade levels hierarchically, from concrete to abstract and from simple to complex, teaches the learning outcomes and facilitates classification. In this context, it can be said that the outcomes in both Turkey and Germany were prepared by taking these features into account. On the other hand, when the application proposals for the outcomes of the algebra learning field of the Germany and Turkey curriculums are examined, it is seen that the application proposals for the outcomes in both programs are given in detail and richly. Considering that algebra takes place in all areas of life and is a necessity (Dede & Argün, 2003), it can be said that the implementation suggestions presented in the program are very important. In addition, considering the aims and goals of the curriculum, a teaching process can be planned and implemantation suggestions can be made with the help of concept cartoons, since associating abstract and incomprehensible concepts through a character will pave the way for more meaningful and permanent learning (Karaca et al., 2020).

In this study, the learning outcomes of the algebra learning area in the 5th -8th mathematics curriculum in Turkey and Germany were classified according to the revised Bloom's taxonomy in terms of knowledge and cognitive process. It was observed that the outcomes in both curriculums mainly on the conceptual and operational steps in terms of knowledge. In terms of cognitive process dimension, it was seen that there were differences as well as similarities between both programs. For example, it is seen that the outcomes in the Turkey and Germany curriculums are predominantly in the operational implementation phase. On the other hand, at the cognitive level of understanding the outcomes in the conceptual knowledge level in the Turkey curriculum; it is determined that the outcomes in the conceptual knowledge level in the Germany program are more at the analysis level. Although it is seen that the number of learning outcomes in the operational analysis step of the Turkey curriculum is higher than the number of outcomes in the operational analysis step of the Germany curriculum, it has attracted attention that the outcomes in the procedural evaluate and procedural create steps of the Germany curriculum are higher than those in the Turkey program. In this context, while it is seen that the outcomes of the algebra learning area of the 5-8 mathematics course curriculum in Turkey and Germany are similar in terms of knowledge; it has drawn attention that the Germany curriculum is prepared for higher level skills in terms of cognitive process dimension. The questions and/or outcomes prepared at lower cognitive levels lead students to memorization and increase their anxiety levels; It has been emphasized that the outcomes and/or questions prepared for high-level cognitive skills prepare the ground for using existing information and effective thinking and increase motivation (Doğanay & Ünal, 2006; Kuzu & Çalışkan, 2018). In this context, it can be emphasized that the curriculum outcomes and implementation suggestions are aimed at high-level cognitive skills. According to the study conducted by Kuzu (2020), it is stated that the use of multiple representations in concept teaching and problem solving process will contribute to the development of cognitive process skills, so different types of representation can be used in the mathematics teaching process and appropriate activities can be designed. In addition, in the process of making sense of concepts and acquiring high-level cognitive skills, teaching environments and programs can be designed by considering real life problems and process-based teaching models. As a matter of fact, it is emphasized that designing a learning environment and teaching process suitable for students' understanding in the education process is important in making sense of basic mathematical concepts (Kuzu et al., Sıvacı, 2018). On the other hand, it has been emphasized that a more permanent and effective learning environment will occur (Kuzu & Sıvacı, 2018), the narration will be easier and learning will take place with fun (Özüdogru, 2021) thanks to the integration of technology with digital games and/or stories and integrating it into the education process. In this context, the use of teaching materials with digital content can be included while preparing the programs and learning outcomes.

It is stated that comparative education is a field of study related to education, which includes the researches carried out to determine the similarities and differences by examining the education systems of the countries and to find solutions by comparing the countries that have faced similar problems (Tatlı & Adıgüzel, 2012). From this point of view, it is thought that it is important to focus on comparative education studies for the development of the education system. For this reason, it is recommended to researchers to conduct a comparative education study on the education systems of countries that have been more successful than our country in important exams such as TIMMS and PISA. It is also among the suggestions to compare the achievements of the same learning areas in the education programs of these countries.

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Science Teachers's and Science Teacher Candidates's View about Using Cartoon Movies in Science Teaching[1]

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ABSTRACT

The aim of this study is to determine the opinions of science teachers and science teacher candidates about using cartoon movies during science instruction. Phenomenology pattern which is a qualitative research method was used in this research. Research was conducted with 52 science teachers and 48 pre-service science teachers. Data were collected with an open-ended survey which is created by the researcher. Gained data were analyzed with the content analyze method. As a result of this research, science teachers and pre-service science teachers stated that both cartoon films and cartoon characters have a significant effect on children, help concretize the science subject and help permanent learning. It was also emphasized that it could create an enjoyable learning environment by attracting students' attention. Participants stated that using cartoon movies can be beneficial at the beginning of the lesson. In addition, the solar system and planets, systems, space, force and motion were presented as the most appropriate science topics in which cartoons can be used. The most given example cartoons are Tom and Jerry, Smurfs, Popeye, Jetsons, SpongeBob and Rafadan Crew. 87 of the 98 participants who participated in the study indicated that cartoons could be used during science teaching. On the other hand, some science teachers and pre-service science teachers indicated that the use of cartoon movies in science lesson can lead to distraction, loss of time and deviation from the purpose of the subject. Apart from this, the participants stated that they want to design educational-instructional, entertaining and remarkable cartoons.

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INTRODUCTION

Nowadays, children have been intertwined with technology. Therefore, it is not possible to think education without technology. Both it is necessary to take advantage of technology for an effective learning and a good education should be taken to benefit from technology. Societies have been influenced by changing and developing technology. Technological devices such as television, mobile phone, and computer have a task that to convey and disseminate information to everyone without being place and time (Kocadaş, 2004). Although many different technological devices are produced, television is still one of the most prevalence technological devices. Since it can appeal to more than one sense organ, it easily affects almost everyone, especially children. Television has an important place in children's understanding and recognition of the outside world. Therefore, it is important that using television should be beneficial for cognitive and social development of children (Büyükbaykal, 2007).

According to Turkish Statistical Institute (TUIK) 2013 data, 47.7% of boys and 51.4% of girls in the 6-10 age group watches television between 0-2 hours a day. Watching TV time of 11-15 age group children also shows similarity with other children (Bursa Eskişehir Bilecik Development Agency (BEBKA), 2018, s.24). This case shows that television is an important place in children's lives.

Cartoon movies are also one of the most watched TV programs. According to 2013 TUIK data, 95 % of children in the 6-10 age group prefers watching cartoon movies (BEBKA, 2018, s.23). Even though, children's preference of TV program changes as children get older, approximately 50% of 11-15 age group of children still prefer watching cartoon movies on TV (BEBKA, 2018, s.24). According to this result, although the rate of preference shows a decline as children get older, cartoon movies are still preferred by children at important rate.

Reasons of preference cartoon movies are that they have simple expression, stimulate imagination of children, easily identify with the events, give pleasure and events go beyond living environment (İnce, 1991, s.67). Although cartoon movies are produced for the aim of entertainment at the beginning, they have many usage area. They can use for advertisement, education, even propaganda (Can, 1995, s.61; Kaba, 1992, s.19). Characters of cartoon movies can also be used in industry of music, furniture, stationary and clothing (Türkmen, 2012).

Cartoon movies provide benefit to educational process. Cartoon movies contribute to both development of linguistic and cognitive skills of children and enlargement of children's perspectives about life. Besides, cartoon movies enable children to learn concepts at an early age. Visual and auditory expressions in cartoon movies help learning to become more effective and permanent (Yağlı, 2013). As in cartoon movies, characters of cartoon movies are effective in conveying message and acquiring behavioral skills (Aydın, 2018). All of these show that cartoon movies can be used in the educational field.

Science education contains both abstract and concrete concepts together. Technological opportunities contribute to the teaching of abstract and complex subjects that are difficult to teach (Kahyaoğlu, 2011). Cartoon movies can contribute to the teaching of science because both they are easily accessible and they are preferred by most of students. In addition, subjects of science education are related to daily lives. All these make it important to investigate the effectiveness of the use of cartoon movies that children watch fondly in science teaching. In both national and international studies, it has been revealed by semi-experimental studies that the use of cartoon movies in science education contributes to the academic success of students (Abdüsselam, 2013; Barak, Ashkar and Dori, 2011; Çelik, 2015). In addition, the study of Dalacosta, Paparrigopoulou-Kamariotaki and Pavlatou (2011) emphasize that cartoon films can be beneficial in order to teach scientific concepts. Apart from this, when the literature was examined, no study was found to determine the opinions of science teachers about the use of cartoon movies in science education. This case also increases the important of this research. When considered all these cases, the aim of this research is to determine the opinions of science teachers and science teacher candidates about using cartoon movies in science education.

The problem of research

What are the views of science teachers and pre-service science teachers about the place of cartoon movies in science education?

The subproblems of research

1. What are the effects of cartoon movies on children according to science teachers and pre-service science teachers?

2. What are the advantages and disadvantages of using cartoon movies in science teaching according to science teachers and pre-service science teachers?

3. How would you design cartoon movies as science teachers and pre-service science teachers?

4. Which science subjects should be benefited from cartoon movies according to science teachers and pre-service science teachers?

5. In which part of science teaching should cartoon movies be used according to science teachers and pre-service science teachers?

6. What are the effects of cartoon movies' characters on children according to science teachers and pre-service science teachers?

7. Would science teachers and prospective teachers teach science using cartoon characters? Why?

8. Which cartoon movies characters and/or cartoon movies can be used in science teaching according to science teachers and pre-service science teachers?

METHOD

Research Design

Qualitative research method was used in this study in which the opinions of science teachers and teacher candidates were questioned about the use of cartoons in science education. In this study, phenomenology pattern was chosen from qualitative research methods. Phenomenology studies focus on phenomena that we are aware of but we do not have an in-depth and detailed idea of it (Yıldırım & Şimşek, 2018). When all these were examined, the phenomenology design was chosen from the qualitative research method in accordance with the problems and sub-problems of this research.

Research Sample/Study Group/Participants

In this study, purposive sampling method, which is one of the non-random sampling approaches, was used to conduct in-depth research for the purpose of the research (Büyüköztürk et al., 2018). 52 Science teachers and 46 pre-service science teachers participated to this study.

Research Instruments and Processes

Open ended questionnaire form which developed by researcher was used in this research. Open ended questions were formed as a result of literature review (Berber et al., 2019; Özeskici, 2014; Seçkin Kapucu, 2014). The questions of the questionnaire were examined by 1 professor who is the head of mathematics and science education department and 2 science teachers and necessary corrections were made. The open-ended questionnaire, which was originally prepared as 10 questions, was reshaped as 8 questions after expert opinions and corrections. Later, this questionnaire was sent to the participants as an e-mail. At the beginning of the questionnaire, brief information about the study was given to participants and thanked to participants.

Data Analysis

Content analysis method was used to analyze the data obtained from the open-ended questionnaire. The aim of content analysis is to reach the concepts and relationships that can explain the obtained data. In the content analysis, it is tried to reach the hidden truths in the data (Yıldırım & Şimşek, 2018, s. 242).

Codes were formed from the obtained data from open ended questionnaire. The codes were brought together and categories were formed. The interrelated categories were also combined under the themes created on the basis of the research questions. Codes, categories and themes are presented in tables with frequencies.

Information about Validity, Reliability and Ethic

In order to ensure internal validity in the study, the literature was scanned in detail before the open-ended questionnaire questions were created. In addition, it is aimed to increase the validity of this research by explaining the research method chosen in accordance with the purpose of the research, the data collection tool and the analysis process of the obtained data in detail.

The fact that the open-ended questionnaire is filled in personally by the science teachers and pre-service science teachers, each of the questionnaires filled by the participants is numbered and kept separately, more than one person participates in the coding while making the data analysis, the data analysis which is carried out in accordance with the research problem, and the quotations from the participants' statements are included in the findings contribute to the reliability of the research. The fact that the coding made by people who are unaware of each other is close to each other contributes to the reliability between the evaluators. In order to have similar codes to be reliable, the compliance percentage should be 70% or higher (Şencan, 2005). The percentage of compliance of the coding created in this study was calculated with the formula specified by Miles and Huberman (1994). The compliance percentage of the study was calculated as 92.77%. This indicated that the study is reliable. Ethics committee approval is not required for this study because it was made in 2019.

FINDINGS / RESULTS

The views of science teachers and prospective science teachers about the use of cartoon movies and characters in lessons were analyzed and presented in tables. While expressing an opinion; teachers were coded as "T1, T2,…" and pre-service teachers were coded as "S1,S2,…".

1. Findings about the Opinions of Science Teachers and Teacher Candidates on the Effect of Using Cartoon Movies in Science Teaching on Children

During science teaching, the opinions of teachers and prospective teachers about the effect of using cartoons on children are obtained, and the data are analyzed and the results are presented in Table 1.

Table 1. *Opinions of teachers and pre-service teachers on the effect of cartoon movies on science teaching*

Theme	Category	Code	Frequency(Teacher)	Frequency(Preservice teacher)
The effect of cartoon in science teaching	Effect on children	Age related	2	1
		Positive	11	9
		Negative	2	-
		Increase imagination	4	7
		Interesting	4	1
		Intriguing	8	7
		Visual and sensory memory	3	-
		Success	-	1
		Thinking skill	1	4
		Self-confidence	-	1
		Influence	-	2
		Readiness level	1	1
		Prejudice	1	-
		Appropriate for the level	5	3
		Perspective	-	2
		Questioning	-	1
		Cognitive skill	-	1
		Psychomotor skill	-	1

In the Table 1., the opinions of science teachers and teacher candidates are presented by creating 18 codes under the category of "Effect on children". The most reported opinions under the category of the "Effect on children" are; positive ($f_{teacher}$=11, $f_{teacher\ candidate}$=9), intriguing ($f_{teacher}$=8, $f_{teacher\ candidate}$=7), increase imagination ($f_{teacher}$=4, $f_{teacher\ candidate}$=7), appropriate for the level ($f_{teacher}$=5, $f_{teacher\ candidate}$=3), interesting ($f_{teacher}$=4, $f_{teacher\ candidate}$=1) and thinking skill ($f_{teacher}$=1, $f_{teacher\ candidate}$=4).

Sample statements of science teachers and prospective teachers about the effect of cartoons on children are presented below:

T11: The use of cartoons in science teaching has intriguing and interesting effects on students.

T15: I think that cartoons will entertain children and make learning effective while having fun, but I think that this will not be effective for 8th grade students, and children who feel that they have grown up at that age will act prejudiced.

S11: It has lots of positive effect. Because science lesson is related to daily life and I think it will be very useful in terms of attracting students' attention to the lesson.

S24: It enables children to think more creatively and critically.

S38: ……. There are positive effects on learning concepts more quickly, developing imagination and creative thinking.

2. Findings about the Opinions of Science Teachers and Teacher Candidates about Advantages and Disadvantages of Using Cartoon Movies in Science Teaching

The opinions of teachers and prospective teachers about the advantages and disadvantages of using cartoons during science teaching are taken, and the data are analyzed and the results are shown in Table 2.

Table 2. *Opinions of teachers and pre-service teachers about advantages and disadvantages of cartoon movies on science teaching*

Theme	Category	Code	Frequency(Teacher)	Frequency(Preservice teacher)
Cartoon movies on science teaching	Advantages	Attract attention	26	16
		Concretizing the topic	18	7
		Permanent learning	25	20
		Easy learning	16	5
		Break down the prejudices	1	-
		Interesting	18	14
		Learning fun	21	20
		Related to daily life	4	4
		Motivation	5	8
		Positive attitude	2	6
		Misconception remover	1	1
		Ease of use	1	-
		Visuality	3	-
		Reinforcing the topic	2	-
		Technological	1	-
		Helping the topic	10	9
		Including science process skills	3	5
		Active participation	-	3
		Economic	1	2
		Different method	-	3
		Focusing	2	2
		Actuality	1	-
		Getting feedback	1	-
		Suitable for individual differences	-	1

Table 2. (Continue)

Theme	Category	Code	Frequency(Teacher)	Frequency(Preservice teacher)
Cartoon movies on science teaching	Disadvantages	Unsuitable for the subject	4	3
		Distractibility	7	7
		Boring	3	2
		Disregard	3	1
		Deviation from the target	11	17
		Laziness	1	-
		Waste of time	8	3
		Confusion of perception	5	3
		Misconception	7	5
		Technological shortcomings	1	1
		Resource shortage	1	-
		Addiction	7	3
		Noise(Classroom management)	1	2
		Health problem	1	1
		Focusing problem	1	4
		Ordinariness	1	-
		Inappropriate for every age	2	5
		Loss of interest	-	1
		Behavioral problem	-	1
		Miscommunication	-	1
		Negative character	-	2

When examined the Table 2, it is seen that the ideas about the benefits and harms of using cartoon films in science teaching are expressed under the headings of "advantages" and "disadvantages". The codes with the most stated in the “Advantage” category; permanent learning ($f_{teacher}$=25, $f_{teacher\ candidate}$=20), attract attention ($f_{teacher}$=26, $f_{teacher\ candidate}$=16), learning fun ($f_{teacher}$=21, $f_{teacher\ candidate}$=20), interesting ($f_{teacher}$=18, $f_{teacher\ candidate}$=14), concretizing the topic ($f_{teacher}$=18, $f_{teacher\ candidate}$=7), easy learning ($f_{teacher}$=16, $f_{teacher\ candidate}$=5) and helping the topic ($f_{teacher}$=10, $f_{teacher\ candidate}$=9). Under the “Disadvantage” category, deviation from the target ($f_{teacher}$=11, $f_{teacher\ candidate}$=17), distractibility ($f_{teacher}$=7, $f_{teacher\ candidate}$=7), misconception ($f_{teacher}$=7, $f_{teacher\ candidate}$=5), waste of time ($f_{teacher}$=8, $f_{teacher\ candidate}$=3) and addiction ($f_{teacher}$=7, $f_{teacher\ candidate}$=3) are the codes that are signified frequently.

Sample statements of science teachers and prospective teachers about the advantages and disadvantages of cartoons during science teaching are presented below:

T5: Advantages: It draws attention to the subject. It provides a better understanding of the subject.

T12: Disadvantages; carelessly prepared cartoons can lead to misconceptions

T15: Moving away from the main topic, confusing the school with the game, and thinking that the information is not real may have negative aspects.

T19: Advantages include motivation, learning in a fun environment, and permanent learning.

T25: Advantages; Children learn by having fun. Thanks to the cartoon character which they love, they watch without getting bored and they learn without realizing it.

T32: Disadvantages, it can cause distraction on children after a certain period of time.

S20: It helps make the lesson fun. It is effective in permanent learning.

S41: As an advantage; it provides permanent learning, it is more suitable for individual differences since there are different techniques and methods, and it motivates students to the lesson.

3. Findings about the Opinions of Science Teachers and Teacher Candidates on the Elements to be considered in Designing Cartoon Movies

The opinions of the science teachers and pre-service teachers about how they want to design cartoon movies as an educator are taken and the data are analyzed and the results are presented in Table 3.

Table 3. *Views of teachers and teacher candidates on the elements to be considered while designing cartoon movies as educators*

Theme	Category	Code	Frequency (Teacher)	Frequency(Preservice teacher)
Elements to consider in cartoon movie design as an educator	Effect on children	Age appropriate	5	1
		Remarkable	5	8
		Entertaining	6	11
		Dream world expander	1	-
		Intriguing	4	1
		Positive effect	1	-
		Suitable for student level	-	1
		Awareness raising	-	1
	Science education	Relevant to the topic	8	11
		Concretizing the topic	2	-
		Misconception-free	2	-
		Containing scientific knowledge	1	3
		Containing experiment	6	4
		Educational-instructive	9	10
		Related to daily life	4	2
		Containing activity	1	-
		Excogitative	-	2
		Containing scientific process skills	-	9
		Containing engineering skills	-	2
		Increase the attitude towards science	-	1
		Developing creativity skills	-	5
	Appropriate science topics	Space	1	-
		Sexual reproduction in plants	1	-
		Scientists	2	1
		Vitamins	1	-
		Our body	2	-
		Circulatory system(Systems)	1	1
		Living things	3	1
		Photosynthesis	1	-
		Pressure	1	-
		Meiosis-Mitosis division	1	-
		Lunar phase	1	-
		Environment	1	3
		Planet	1	2
		Energy sources	-	1
		Nutrition	-	1

Table3. (Continue)

Theme	Category	Code	Frequency (Teacher)	Frequency(Preservice teacher)
Elements to consider in cartoon movie design as an educator	Cartoon film	Quality of image	1	-
		Containing game	3	-
		Like a documentary	1	-
		Containing song	1	-
		Gripping	1	-
		Comic	1	-
		Exciting	1	-
		With a story	4	2
		Animated	5	3
		Clear and precise	1	4
		Adventurous	2	-
		Technological	-	1
		Fantastic	-	1
		Reflecting the truth	-	1
		Visual	-	2
		Mysterious	1	-
		Ethical	1	2
	Characters	Popular	3	1
		Using scientific process skills	2	-
		Conforming to social values	2	-
		Interesting	2	1
		Up to date	1	-
		Suitable for student level	-	1

According to Table 3, the opinions of science teachers and teacher candidates about the elements to be considered in cartoon film design from the perspective of the educator are united under 5 categories. Under the category of "Effect on children"; entertaining ($f_{teacher}$=6, $f_{teacher\ candidate}$=11) and remarkable ($f_{teacher}$=5, $f_{teacher\ candidate}$=8) codes are the codes with the highest number of comments. The codes with the highest number of opinions in the "Science teaching" category respectively; relevant to the topic ($f_{teacher}$=8, $f_{teacher\ candidate}$=11), educational-instructive ($f_{teacher}$=9, $f_{teacher\ candidate}$=10), containing experiment ($f_{teacher}$=6, $f_{teacher\ candidate}$=4) and containing scientific process skills ($f_{teacher\ candidate}$=9). Under the category of "Appropriate science topics"; environment ($f_{teacher}$=1, $f_{teacher\ candidate}$=3), living things ($f_{teacher}$=3, $f_{teacher\ candidate}$=1), planet ($f_{teacher}$=1, $f_{teacher\ candidate}$=2), scientists ($f_{teacher}$=2, $f_{teacher\ candidate}$=1) and our body ($f_{teacher}$=2) are the most preferred codes. In the "Cartoon film" category; animated ($f_{teacher}$=5, $f_{teacher\ candidate}$=3), with a story ($f_{teacher}$=4, $f_{teacher\ candidate}$=2), clear and precise ($f_{teacher}$=1, $f_{teacher\ candidate}$=4), containing game ($f_{teacher}$=3) and ethical ($f_{teacher}$=1, $f_{teacher\ candidate}$=2) are the most codes. In the "Characters", popular ($f_{teacher}$=3, $f_{teacher\ candidate}$=1) and interesting ($f_{teacher}$=2, $f_{teacher\ candidate}$=1) are the most commented codes.

Sample statements of science teachers and prospective teachers about the items to be considered while designing cartoon films are presented below:

T12: I want to design cartoon films that will not lead students to misconceptions, generally related to daily life.

T25: I would design a cartoon that is intriguing and that the child can learn cognitively as a result…..

T39: Appropriate to the topics

T43: For example, I could show beneficial vitamins or elements with better visuals, and harmful vitamins with bad characters.

S2: I used to make cartoons that appealed to the creativity of the students, directed them to research and questioning, and also developed their engineering practices.

S18: I would create cartoon characters suitable for the student's level for science teaching…..

S21: It would be fantastic cartoons absolutely. Extraordinary, irrational situations and events have always attracted the attention of humanity.

S43: I used to design interesting and catchy short cartoons that would explain the science units visually.

4. Findings about the Opinions of Science Teachers and Teacher Candidates on Science Topics that can be told with Cartoon Movies

The opinions of teachers and pre-service teachers about which science subjects can explain with cartoon movies are taken and the data are analyzed and the results are presented in Table 4.

Table 4. *Opinions of teachers and teacher candidates on science subjects that can be told with cartoon movies*

Theme	Category	Code	Frequency (Teacher)	Frequency(Preservice teacher)
Science topics that can be explained with cartoon	Living things and Life	Living Things	8	4
		DNA and Genetic Code	5	-
		Virus and Bacteria	2	-
		Meiosis and Mitosis	1	-
		The Plant	2	2
		The Cell	3	-
		Systems	12	13
		Human Body	4	-
		Nutrition	4	7
		Biodiversity	1	2
		Photosynthesis	-	1
		Biotechnology	1	-
		Vitamin	1	1
		Classification	2	1
		Cell Division	1	1
		Growth and Development	-	1
		Respiratory	-	1
	Physical Events	Velocity/Speed	7	4
		Simple Machine	5	2
		Pressure	2	2
		Mass and Weight	1	-
		Mirrors	1	1
		Force	7	6
		Work, Power and Energy	3	3
		Electricity	2	1
		Buoyancy	-	3
		Expansion	-	1
		The Magnet	-	1
		The Sound	1	1
		The Light	1	-
	The Matter and its Nature	Density	2	-
		The Structure of Matter	4	-
		Matter and Change	3	3
		Heat and Temperatures	2	-
		Periodic Table	2	-
		Acid-Base	1	-
		Matter and its Properties	2	1
	The Earth and The Universe	Space	9	4
		Climate	3	-
		Solar System and Planets	15	8
		Natural Events	1	1
		Environment	1	4
		Phase of the Moon	1	3
		Seasons	2	1
		Solar and Lunar Eclipse	1	-
	General	All	9	8
		Abstract topic	14	2
		Topics with experiment	3	3
		Observable topic	1	-
		Invisible things	3	-
		Socio-scientific issues	1	1
		Scientists	2	-

In the Table 4, the opinions of teachers and pre-service teachers about science subjects in which cartoon movies can be used are stated in 5 categories. Under the category of "Living things and Life", the most frequently mentioned science topics are systems ($f_{teacher}$=12, $f_{teacher\ candidate}$=13), living things ($f_{teacher}$=8, $f_{teacher\ candidate}$=4) and nutrition ($f_{teacher}$=4, $f_{teacher\ candidate}$=7). In the category of "Physical Events", force ($f_{teacher}$=7, $f_{teacher\ candidate}$=6), velocity/speed ($f_{teacher}$=7, $f_{teacher\ candidate}$=4) and work, power and energy ($f_{teacher}$=3, fteacher candidate=3) are the most preferable topics. Under the title of "Matter and its Nature", matter and change (fteacher=3, fteacher candidate=3) and the structure of matter ($f_{teacher}$=3) are the most exemplary subjects. Under the "The Earth and The Universe" category, solar system and planets ($f_{teacher}$=15, $f_{teacher\ candidate}$=8) and space ($f_{teacher}$=9, $f_{teacher\ candidate}$=4) are the most preferable topic. In the "General" category, the most commented codes are abstract topics ($f_{teacher}$=14, $f_{teacher\ candidate}$=3) and all ($f_{teacher}$=9, $f_{teacher\ candidate}$=8).

Sample expressions of examples given by science teachers and teacher candidates about science topics that can be explained with the help of cartoon movies:

T4: In the unit of living things, we can benefit from cartoons in order to understand the living things more and its characteristics that children cannot encounter in daily life.

T14: It will be more advantageous to use it on non-formula subjects that can be learned by observing more.

T21: Films with daily events such as planets, solar and lunar eclipses can be advantageous. Because events that we have seen before and maybe we are not aware of them. In this way, we can be aware of them.

T41: I think it will be more beneficial in terms of atoms and systems because it will be beneficial to watch them multidimensional.

S12: For example, subjects such as the digestive and excretory system seem abstract to students and there are studies in the literature that they have difficulty in understanding. Cartoons can be used for permanent learning in these subjects.

S43: ……… Force and Motion, Sound and its Properties, Energy, Simple Machines

5. Findings about the Opinions of Science Teachers and Teacher Candidates about which Stage of the Science Lesson can be used cartoon movies

The opinions of science teachers and pre-service teachers about which part of the science lesson to be used with cartoon movies are examined, and these are divided into themes, categories and codes and these are presented in Table 5.

Table5. *Opinions of teachers and teacher candidates on which stages of the lessons cartoon movies can be used*

Theme	Category	Code	Frequency (Teacher)	Frequency(Preservice teacher)
Stages in which cartoon movies are used in teaching	Before teaching the subject	Introduction	24	24
		Draw attention	18	25
		Inform the target	1	-
		Curiosity	2	4
		Readiness	2	1
		Motivation	-	5
		Detection of misconception	2	-
	While teaching the subject	Explanation	4	1
		Practice	1	-
		Exploring	8	5
		Concept teaching	3	3
	After teaching the subject	Elaboration	14	7
		Reinforcement	8	7
		Summarize	3	1
		Associating with daily life	2	4
		Evaluation	1	-
		After topic	3	3
		Sampling	-	1
		At every stage	5	1

According to Table 5, the opinions of science teachers and teacher candidates about the stages in which cartoon movies are used in education are grouped under 3 categories. Codes that are frequently commented on under the category of "Before teaching the subject"; introduction ($f_{teacher}$=24, $f_{teacher\ candidate}$=24), draw attention ($f_{teacher}$=18, $f_{teacher\ candidate}$=25), curiosity ($f_{teacher}$=2, $f_{teacher\ candidate}$=4) and motivation ($f_{teacher\ candidate}$=5). Under the "While teaching the subject" category, codes with the highest number of comments are exploring ($f_{teacher}$=8, $f_{teacher\ candidate}$=5) and concept teaching ($f_{teacher}$=3, $f_{teacher\ candidate}$=3). In the "After teaching the subject" category; elaboration ($f_{teacher}$=14, $f_{teacher\ candidate}$=7) and reinforcement ($f_{teacher}$=8, $f_{teacher\ candidate}$=7) are the most preferable codes. 5 science teachers and 1 pre-service teacher state that cartoon movies can be used at every stage.

Sample expressions from the views of science teachers and pre-service teachers about the stages at which cartoon films can be used in the teaching process:

T28: I would use it in the elaboration part. After teaching the subject, I would make the children learn better by having fun.

T40: After the theoretical knowledge, it can be used for explanation and detailedness.

T43: I use it at all stages as long as I can. Because I think it is more effective training.

T45:……… It can be applied in the introduction to detect misconceptions about the subject.

S18: I can use cartoons at every stage of the teaching process. It varies depending on the nature of the subject.

S28: I use it at the introductory phase to draw attention to the subject and arouse curiosity.

S35: I use it to make the subject more permanent when we process the subject and move on to the repetition stage.

S40:……….. cartoon film seems like a good tool for a student to learn the subject during the exploration phase……….

6. Findings about the Opinions of Science Teachers and Pre-service Teachers on the Effect of Cartoon Characters on Science Teaching

The themes, categories and codes obtained from the analysis of the opinions of the science teachers and pre-service teachers about the effect of cartoon characters on science teaching are shown in Table 6.

Table 6. *Opinions of teachers and prospective teachers about the effect of cartoon characters on science teaching*

Theme	Category	Code	Frequency (Teacher)	Frequency(Preservice teacher)
The Effect of Cartoon Characters in Science Teaching	Effect on children	Imagination	4	1
		Self-expression	1	-
		Identification	18	13
		Positive effect	10	9
		Negative effect	10	5
		Being a role model	16	19
		Depends on the character	1	-
		Perception confusion	1	-
		Age	6	1
		Character development	1	1
		Change of perspectives	-	2
		Permanent effect	1	3
		Enjoyable	7	1
		Motor development	-	1
		Mental development	-	2
		Raise consciousness	-	1
		Digital generation	1	-

Table 6. (Continuous)

Theme	Category	Code	Frequency (Teacher)	Frequency(Preservice teacher)
The Effect of Cartoon Characters in Science Teaching	Effect on the lesson	Fun learning	5	7
		Attract attention	5	7
		Helping to learn	6	5
		Permanent learning	10	7
		Interesting	11	5
		Visuality	1	-
		Positive attitude	2	2
		Concretization	2	-
		Curiosity	1	-
		Reinforcement	1	-

Looking at Table 6, opinions about the effect of cartoon characters in science teaching are grouped under two categories. In the category of "Effect on children", the opinions of teachers and prospective teachers are listed with the codes respectively; being a role model ($f_{teacher}=16$, $f_{teacher\ candidate}=19$), identification ($f_{teacher}=18$, $f_{teacher\ candidate}=13$), positive effect ($f_{teacher}=10$, $f_{teacher\ candidate}=9$), negative effect ($f_{teacher}=10$, $f_{teacher\ candidate}=5$), enjoyable ($f_{teacher}=7$, $f_{teacher\ candidate}=1$), age ($f_{teacher}=6$, $f_{teacher\ candidate}=1$). Under the "Effect on the Lesson" category, codes with the highest number of comments are permanent learning ($f_{teacher}=10$, $f_{teacher\ candidate}=7$), interesting ($f_{teacher}=11$, $f_{teacher\ candidate}=5$), fun learning ($f_{teacher}=5$, $f_{teacher\ candidate}=7$), attract attention ($f_{teacher}=5$, $f_{teacher\ candidate}=7$) and helping to learn ($f_{teacher}=6$, $f_{teacher\ candidate}=5$).

Sample expressions taken from the opinions of science teachers and teacher candidates regarding the effects of cartoon characters on children and the lesson:

T2:…………….. It is very good in terms of making the subject easy to understand.

T8:………….. It can cause children to think that everything is simple, easy or doable.

T30: Children can learn in a fun way without getting bored.

T50: I can use it to attract students' attention to the lesson.

S9: They can take her as an example since they love the character so much.

S27:……. For example, children may think that they can fly by taking the example of Superman, and this affects them badly………….

S37: It enables children to learn permanently.

S41: First of all, children can see their favorite cartoon characters as idols and try to do what they do, so cartoon characters should be chosen carefully and their content should be suitable for children.

7. Findings about the Ideas of Science Teachers and Teacher Candidates on the Science Teaching with Cartoon Characters

The views of science teachers and prospective teachers about the use of cartoon characters in science lessons are presented in Table 7.

Table 7. *Situation of teaching science lesson with using cartoon characters of science teachers and pre-service teachers*

Theme	Category	Frequency (Teacher)	Frequency (Preservice teacher)	Reason for "No"
Situation of Teaching with Cartoon Characters	YES	44	37	
	NO	5	5	Waste of time, Density of Curriculum, Distractibility, Lack of appropriate cartoon movies and characters
	SOMETIMES	3	3	
	INDECISIVE	-	1	

When Table 7 is examined, most of the science teachers (f=44) and teacher candidates (f=37) expressed their opinions under the category of "Yes". Under the category of "No", 5 science teachers and 5 prospective science teachers offered their ideas. While 3 teachers and 3 pre-service teachers expressed their opinions on the "Sometimes" category, 1 pre-service teacher expressed an opinion under the "Indecisive" category.

Sample expressions of science teachers and teacher candidates about the using cartoon characters:

T4: No. It could be a waste of time because of the curriculum density.

T16: Yes. It's a great way to get the student's attention.

T29: Sometimes. In order to teach the subject by attracting attention.

T52: Yes. When it combined with the case study method, it stimulates imagination and multi-faceted thinking.

S3: I wouldn't do it because it may cause inattention to the lesson in children.

S15: Yes, I do. In order to develop their imagination and observation skills.

S17: I'm undecided.

S32: It is difficult to find a cartoon character that appeals to all students, so I do not think I will use it.

8. Findings about the Examples Given by Science Teachers and Teacher Candidates about Cartoons and/or Cartoon Characters That Can Be Used in Science Lesson

Sample cartoon films and characters given by science teachers and prospective teachers about cartoons and/or cartoon characters that can be used in science lessons are given in Table 8.

Table 8. *Examples of cartoons and/or cartoon characters that can be used in science teaching*

		Frequency (Teacher)	Frequency (Preservice teacher)
Example Cartoon Movies/ Cartoon Characters	Vikings	1	-
	Batman	1	-
	Jetsons	4	-
	Spiderman	1	1
	Sponge Bob	4	2
	Pepe	3	1
	The wise uncle in the brain	1	-
	Inspector Gadget	1	-
	Popeye	4	4
	Smurfs	6	1
	Elif's World	1	1
	Rafadan Crew	4	-
	Cars	1	1
	Road Runner	2	1
	Kakuli	1	-
	Caliuo	1	-
	Teletubbies	1	1
	Bugs Bunny	2	3
	Mickey Mouse	2	-
	Heidi	3	-
	Tarzan	1	-
	Sonic	1	-
	Scientists	3	-
	Pac man	1	-
	Tom and Jerry	3	7
	Transformers	1	-
	King Shakir	1	-
	Ben 10	-	1
	Pijamasks	-	1
	Masha and the Bear	-	1
	RedKit	-	1
	Mint and Lemon	-	1
	Iron Man	-	1
	Tweety	1	1
	Beyblade	-	1
	Monkey D.Luffy	-	1
	Garfield	-	1
	Keloğlan	-	1
	Scooby do	-	1
	Fish Nemo	-	2
	Bee Maya	-	2
	Rick and Morty	-	1
	Aqua man	-	1
	Superman	-	1
	Yogi Bear	-	1
	The Cat in the Hat	-	1
	Phineas	-	1
	Time Travelling	-	1
	Once upon a time	1	-

When Table 8 is examined, the cartoon films and its characters that teachers mostly said are Smurfs (f=6), Jetsons (f=4), SpongeBob (f=4), Popeye (f=4), Rafadan Crew (f=4), Heide (f=3), Scientists (f=3), Pepe (f=3), Tom and Jerry (f=3). On the other hand, the pre-service teachers mostly state the cartoon movies such as Tom and Jerry (f=7), Popeye (f=4), Bugs Bunny (f=3) and their characters, respectively.

Opinions of teachers and pre-service teachers about Sample Cartoons/ Cartoon Characters:

T10:……… I could have explained the issue of healthy eating with the Popeye character. I can make the importance of eating vegetables more effective by using a character.

T25: To give an example, while Kamil is about to hit the ball in one of the cartoons Rafadan Crew, the motionless ball moves due to the wind and Kamil cannot hit the ball properly and washes Rüstem brother's Meatball car. Here, I would associate it with the lesson, based on the fact that the wind exerts a force on the ball and Kamil does not calculate it.

T35: I would explain the subject of the Earth and space with the Jetsons.

S13: I can explain the relationship between pressure and depth with the SpongeBob.

S27: I would explain the 5 sense organs with the Pepe cartoon film.

S41: I can use the Bugs Bunny in the healthy diet thanks to the eating carrots. Popeye can be in the topic of power and movement.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

Views of 52 science teachers and 46 pre-service science teachers were received about using cartoon movies in science education. By comparing obtained data with studies in literature, similarities and differences are tried to be revealed in this research.

Science teachers and pre-service teachers mentioned that cartoon movies have positive effects on children such as being intriguing, contributing to their imagination, increasing their interest, and expanding their thinking skills mostly. On the other hand, it has been stated that children may be prejudiced against cartoon movies as they get older, and that they may be influenced excessively by cartoon movies and harm themselves. The result of this study is compatible with the results of Eskandiri's (2007) study. In Eskandiri's study; cartoon movies can have educational, entertaining and imaginative effects in terms of positive. On the other hand, it is stated that it could encourage violence and inhibit the reading books and the lessons negatively.

Science teachers and pre-service teachers stated that the advantages of using cartoon movies during science teaching outweigh the disadvantages. The advantages of cartoon movies are mostly emphasized such as attracting attention, concretizing the subject, providing permanent learning, helping learning, contributing to a fun learning environment, facilitating learning. Disadvantages of the use of cartoon movies in science lessons are mentioned such as distraction, causing misconceptions, the subject to move away from its purpose, and waste of time.

As in this study, in Berber, Anılan, Odabaş and Alkan (2019) study, 16 pre-service science teachers emphasized on features about using cartoon movies in science education. These are interesting, beneficial for physical personal development, making education fun, developing imagination, and providing permanent learning. In another study conducted by Aslan (2020) with science of life teachers, the science of life teachers who expressed their opinions state that cartoon movies concrete the subject, visualize it, help knowledge transfer and contribute to permanent learning. Religious culture teachers also reported that the use of cartoons in lessons would be beneficial by increasing the quality of in-class activities (Sancak, 2018). In Sajana (2018) study; it stated that cartoon movies contribute to English speaking and writing skills and provide a fun learning environment. Apart from these studies, in the study conducted by Seçkin Kapucu (2014), science teachers reported that the use of visual media in the lesson may cause some negative consequences such as inability to concentrate, unsuitable for the level of the student, not setting the time and being irrelevant to the subject. The opinions are similar to the disadvantages stated regarding the use of cartoon movies in the lesson.

Science teachers and teacher candidates participated in this research stated that cartoon films should be designed as educational-instructive, attractive, entertaining, suitable for science subjects, containing experiments, scientific process skills, clear and precise, containing plenty of animation and fun characters. These results support the study of Yağlı. The research of Yağlı (2013) stated that positive cartoon movies can contribute to the development and imagination of children. In addition, in the study of Özeskici (2014), visual art teachers and pre-service teachers stated that cartoon movies can cause negative effects such as leading to violence, causing laziness, causing confusion, causing addiction and creating addiction. These results show that cartoon films should be designed carefully.

Most of the science teachers and pre-service teachers who participated in this study emphasized that cartoon movies can be used during the teaching of science. Especially, the solar system and planets, systems, space, living things, force, nutrition and velocity/speed are the prominent science subjects. In the study of Berber, Anılan, Odabaş and Alkan (2019), it indicated the human body, force and motion, space, living things, the sun and nature as examples in the study like this research. In addition, it was emphasized that almost all science subjects can be instructed with cartoon films.

Most of the science teachers and pre-service science teachers stated that they can benefit from cartoon films for introduction to topic and drawing attention before starting the subject in science lesson. During the science lesson, it was emphasized by the participants that cartoon films can be used to discover, teach, explain the concepts and make applications. At the end of the topic; it has been stated that cartoon films can be used to elaborate the subject, to reinforce the subject, to summarize the subject, to establish a relationship between the subject and daily life, to evaluate the subject, and to give examples about the subject. As in this study, as a result of Aslan's (2020) study, teachers emphasized that cartoon movies can be used at the beginning, development, end and every stage of life studies lessons. In addition, Dalacosta, Paparrigopoulo-Kamariotaki and Pavlatou (2011) expressed in their study that cartoon films can be used as an assessment tool in science teaching.

Science teachers and pre-service teachers who participated in this study explained that children identify with cartoon characters easily and take them as role models. They also emphasized that teaching with cartoon characters is interesting, helps permanent learning, attracts attention and contributes to a fun learning environment. As in this research, Oruç, Tecim, and Özyürek's (2011) research also concluded that children take the positive features of cartoon characters as role models. In addition, another study concluded that popular cartoon characters are effective in conveying messages to children and internalizing behavior (Aydın, 2018).

When the data of this study is examined; 47 science teachers and 40 pre-service science teachers stated that they can teach with cartoon characters. 5 science teachers and 5 science teacher candidates stated that they would not use cartoon characters in science lessons because of the fact that cartoon characters can cause a waste of time, cannot finding suitable cartoons and characters, cause distraction, and worry about educating the curriculum. One pre-service science teacher also stated that s/he was undecided on this issue. As in this study, in the study conducted by Erdem (2019), 43 of 45 teachers said that they can use cartoon films while teaching Turkish to foreigners. Contrary to this study, more than half of the life studies teachers participating in Aslan's (2020) study stated that they do not use cartoon movies in the lesson. This situation explains that the use of cartoon films/characters in teaching may vary according to the course.

When the data of this study is examined, it was stated by the participants that many different cartoon films and/or cartoon characters could be used in science teaching. The most given example of cartoon movies and characters are Tom and Jerry, Smurfs, Popeye, Jetsons, SpongeBob and Rafadan Crew. According to these results, it strikes that many different cartoon movies and cartoon characters can help to teach science concepts. The fact that so many cartoon movies and their characters are given as examples is an indication that cartoon movies can be used in science teaching easily.

Recommendations

- Opinions of secondary school students can be taken about the use of cartoons in science teaching.
- A scale can be developed about the use of cartoon films in science education.
- Preschool and primary school teachers' opinions can be obtained on the use of cartoon movies in the teaching of science subjects in their curriculum
- By bringing together cartoon film producers and science teachers, cartoon films that are suitable for science subjects and will not lead to misconceptions can be designed.
- A study can be made about whether cartoon movies are used in science lessons abroad.
- The opinions of the academicians in the education faculties of universities can be obtained about the use of cartoon films in science teaching.
- The effect of the using of cartoon movies on other courses can be investigated.
- Cartoon movies can be determined by science teachers according to the science subjects and grade levels.

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Challenges Faced by Teachers during the Covid-19 Pandemic: A Scale Development Study[1]

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ABSTRACT

This research aims to develop a perception scale for the challenges faced by teachers in distance education applied during the Covid-19 pandemic. In addition, using the scale developed within the scope of the research, teachers' perceptions of the difficulties they encountered in this process were revealed. A descriptive survey, one of the quantitative research designs, was used in the research. First, a semi-structured interview form was applied to 40 teachers from different branches and age groups, who were determined voluntarily to create an item pool. The draft measurement form thus obtained was applied to 955 teachers who were working in public schools in Turkey, giving live lessons from all levels and branches, and selected by the convenience sampling method. The data were collected over the internet with the "Perceptions Scale towards the Challenges Faced by Teachers in Distance Education (DE)" prepared by the researcher, and validity and reliability analyzes of the scale were made. The scale was examined in terms of suitability and content validity by three field experts who have a Ph.D. in Computer Education and Instructional Technologies and a Turkish Language expert. According to the results of the pilot scheme, the scale has a two-factor and valid structure. According to the results of the research, it was determined that teachers' perceptions towards the challenges they faced in distance education applied during the pandemic period were at a high level. This study is important in that it will open the door to research on the challenges faced by teachers in distance education in the future.

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[1] This study was produced in the first author's non-thesis master's graduation project with the same title.

1. INTRODUCTION

The COVID-19 virus was first seen in Wuhan, Hubei Province, China at the end of December 2020, and spread to the whole world in a short time. The disease caused by this virus, which affects all countries economically, psychologically, sociologically, and in many other ways, was declared a "pandemic" by the World Health Organization (WHO) on March 11, 2020 (WHO, 2020a). Education has also been one of the areas most affected by this global pandemic. In this process, many educational institutions all over the world were partially or completely closed and more than one and a half billion students at all levels faced various challenges (UNESCO, 2020a; UNESCO, 2020b). Distance education, which is an alternative method in the pandemic process, has been included in education systems as a practical solution method by governments (Demir and Özdaş, 2020). In distance education, the learner and the teacher are provided with the opportunity to learn in different places and periods by using technologies synchronously and asynchronously. Technologies used for instruction may include the following: One-way and two-way transmitters through internet, open broadcasts, closed circuits, cable, microwave, broadband lines, fiber optics, satellite or wireless communication devices (Allen and Seaman, 2017). Distance education is a system that offers space and time options within a certain program and plan, supports existing education, increases the efficiency and quality of education with the effective use of technology, and requires countries themselves to reveal the most appropriate original content in this sense also in the digital age (Anderson ve Rivera-Vargas, 2020). The COVID-19 global pandemic caused some disruptions in education, making it compulsory to include almost all students in the distance education system instead of face-to-face education (Kurnaz, Kaynar, Şentürk Barışık, & Doğrukök, 2020). In Turkey, the first case was seen on 10 March 2020 (WHO, 2020a). During the pandemic period, the education calendar in Turkey was re-planned, and the Education Information Network (EBA) platform, which constitutes the content component of the FATIH Project launched in 2011, was combined with the national channel TRT, and various studies for distance education were initiated (Gençoğlu and Çiftçi, 2020). On March 23, 2020, distance education was started at all levels within the Ministry of National Education (Koç, 2021).

While distance education has undeniable benefits (Rice, Lowenthal, & Woodley, 2020), it also has problems to consider (Hongmei, 2002), and this is also true for the pandemic period. Turkey has made and continues to make necessary updates and improvements in distance education in the process. However, there is a need for longer-term plans, including distance education, and both current and past positive and negative experiences are of great importance to make these plans (OECD, 2020). According to Hodges, Moore, Lockee, Trust, and Bond (2020): A well-planned distance education process is not synonymous with planned live lessons in a crisis. Effective and efficient online teaching and learning, which has been studied for decades, results from carefully planned instructional design. However, emergency distance education (EDE) is a temporary intervention that is usually applied in a crisis. There are differences between the concepts of distance education and emergency distance education (Canpolat and Yıldırım, 2021). While Emergency Distance Education is a concept that is used to find an emergency solution for education or to meet the need, especially in a crisis such as an pandemic or natural disaster, without the limitation of space; distance education, on the other hand, is a planned and systematic education system that aims to produce permanent solutions for lifelong learning by considering physical, interactional and psychological factors (Bozkurt & Sharma, 2020). According to Zan and N. Zan (2020): In Turkey, in line with the measures and decisions taken during the pandemic process, students of all ages and levels, from pre-school to higher education, have to continue their education from home, within the scope of emergency education and emergency distance education. In this process, public schools have carried out DE with applications such as EBA, EBA TV, and ZOOM; private schools also have carried out DE, which is an immediate and sudden transition, from their systems. Universities, on the other hand, have planned distance education in different ways, taking into account institutional systems, students, and academicians. In summary, distance education, which is compulsory and suddenly preferred due to the pandemic, has affected the entire education community. In other words, each step of education has been evaluated within itself and different solutions have been tried to be put forward.

While the COVID-19 pandemic affects all humanity in various ways (Mbunge, Akinnuwesi, Fashoto, Meftule, and Mashwama, 2020); educational institutions, experts, teachers, students, and parents were also unprepared for education in terms of managerial, technological, pedagogical, and psychological aspects (Hidayat, Suswanto, Kristanto, Wardhani, Hamdan, & Sari, 2020). Distance education was applied only as a live lesson out of necessity, without enriching the content and neglecting the preparations for transition to the process (Altunçekiç, 2021). Directing education to technology urgently during the pandemic process; it can also cause a digital divide in various aspects such as equality of opportunity, access, socio-economic differences (Sezgin and Fırat, 2020). In addition, a different teaching plan is required for each teaching level. Because in also distance education, as in face-to-face education, teaching methods and techniques suitable for all levels should be applied (Marek, Wu, & Chew, 2021). In addition, it is recommended by experts to adjust the lesson durations (Kalelioğlu, Atan, & Çetin, 2016) and hours appropriate for the levels in distance education. From another point of view; students' place of residence, family structure, socioeconomic status, class, and age are related to digital use; migrations from rural to urban areas, increasing age, and the transition to the upper-class increase digital use, but do not provide digital equalization (Nerse, 2020).

Distance education, which had to be preferred as a temporary solution to education during the pandemic period, is evaluated by many countries in terms of its advantages and disadvantages, and it is tried to be adapted, developed, or updated to their own education-training systems. Because it will not be possible to return to the "old normal life" in many respects (Schleicher, 2020). The main reason why most countries make longer-term plans for distance education, taking into account the practices all over the world, is the fact that even if the pandemic ends, distance education will always be necessary as a requirement of the technology and information age (Garrison, 2000). From this point of view, necessary evaluations should be made based on the current situation in Turkey, and according to the results obtained, plans should be made both for the present and for the future in terms of technical infrastructures, improvement, design, content development, etc.

The orientation towards different learning, knowledge, content-acquisition styles and methods requires also teachers to have the necessary competences in this context; in this way, educators are expected to blend them both pedagogically and technologically in the best way (Anderson & Dron, 2011). In distance education, which is one of the radical changes in education, teachers are expected to be "consultants or guides" (Isman, Z. Altınay, & F. Altınay, 2004). However, the fact that teachers do not have sufficient knowledge about distance education, which they have to be involved in, causes them to have problems (Kocayiğit & Uşun, 2020); on the other hand, it is thought that the level of anxiety of teachers has increased in the use of distance education environments and tools due to many reasons such as their inexperience in teaching in front of the camera despite giving face-to-face training for years (Yildiz, Çengel, & Alkan, 2021). Teachers do not have enough experience in integrating education with DE technologies or web 2.0 technologies (Eken, Tosun, & Tuzcu Eken, 2020). Teachers, whose roles in normal education differ, want to prefer the face-to-face school environment they are used to for different reasons. One of these reasons is that they have challenges in distance education in terms of giving feedback to students and making assessment-evaluation (Galusha, 1998). In addition, teachers' feelings of inadequacy in using technological tools or having challenges in incorporating technology into the lesson cause them to exhibit negative attitudes towards distance education. Moreover, authorities need to train teachers in terms of both adapting to their new roles in distance education, which takes more time and coping with the challenges they face (Valentine, 2002).

To conduct research on teachers to reveal the situation of distance education in Turkey; it will be useful in terms of revealing the experiences of teachers who continue distance education on issues such as "instructional plan and teaching a lesson, teacher competences, relations with parents and students, and technology". In addition, as a result of the literature review for the COVID-19 pandemic period, which has only been 1 year since it entered the life of humanity and the whole world is still struggling with, it has been determined that the scales for this process are almost non-existent in the literature. When we look at the literature, we found the "Attitude Scale Regarding the Use of Distance Education Environments in the Pandemic Process" regarding the attitudes of the students regarding the challenges faced. The purpose of the scale is to measure student attitudes towards distance education environments in the pandemic (Yıldız et al., 2021). Another scale in the literature is the "Distance Education Perceptions of Teachers Scale" and it aims to examine and reveal the views of teachers on distance education, which is applied urgently and suddenly during the pandemic period (Kurnaz et al., 2020). Apart from the relevant scales, no other scale has been found in the literature regarding both distance education and challenges faced in distance education during the pandemic period. The scale developed within the scope of this research draws attention to the problems faced by teachers in distance education during the pandemic period. Therefore, this study, it is aimed to develop a scale to measure the perceptions of teachers about the challenges they face during the distance education process during the pandemic period and to describe these perceptions.

1.1. Research Problem

In this study, it is sought to answer the questions: “Is the perceptions scale towards the challenges faced by teachers in distance education valid and reliable? What are their perceptions of the challenges they face in this process?’’

1.2. Sub Problems

1. Is the perceptions scale towards the challenges faced by teachers in distance education valid and reliable?
2. What are the perceptions of teachers regarding the challenges they face in distance education during the pandemic period?
3. Do teachers' perceptions of the challenges they face in distance education during the pandemic period differ according to gender?
4. Do teachers' perceptions of the challenges they face in distance education during the pandemic period differ according to age groups?
5. Do teachers' perceptions of the challenges they face in distance education during the pandemic period differ according to the teaching level they work?
6. Do teachers' perceptions of the challenges they face in distance education during the pandemic period differ according to their branches?
7. Do teachers' perceptions of the challenges they face in distance education during the pandemic period differ according to the settlements where they work?

1.3. Limitations

1. Only teachers who give live lessons were included in the study, the opinions of other teachers were not included.
2. Since the identity or pseudonym information of the participants could not be obtained during the data collection process, test-retest could not be applied, so stability analyzes could not be performed.

2. METHOD

2.1. Research Design

In this study, descriptive survey design, one of the quantitative research designs, was used. In this framework, a scale was developed in the first part of the study, and in the second part, the challenges faced by teachers during the pandemic were described through the data obtained with this scale. In this research model, which is highly preferred in the field of education, a specific group, that is, the sample, which can be generalized to the large group (the universe), is selected and it is tried to determine the opinions of the sample about a certain subject or situation with data collection tools such as questionnaires or scales (Creswell, 2017).

2.2. Participants

To create the item pool of the scale developed within the scope of the research, a semi-structured interview form was applied to 40 teachers from different branches and age groups, who were determined voluntarily. Then, draft assessment form obtained was applied to 955 teachers working in public schools in Turkey, giving live lessons within the scope of distance education from all levels and branches. The study group of the research was determined by convenience sampling method. The distribution of the teachers participating in the research by branch and gender is summarized in Table 2.1.

Table 2. 1. *Distribution of Teachers by Branch and Gender*

		Gender		
		Female	**Male**	**Total**
Branch	Mathematics	26	21	47
	Foreign Languages	310	47	357
	Turkish	77	35	112
	Science Lessons	107	30	137
	Information Technologies	6	14	20
	Arts and Sports Lessons	31	14	45
	Social Lessons	18	24	42
	Culture of Religion and Knowledge of Ethics	8	16	24
	Primary School Teaching	71	50	121
	Vocational Lessons	11	10	21
	Preschool	27	2	29
Total		**692**	**263**	**955**

As can be seen in Table 2.1, due to the low number of teachers participating in the research from some branches, these branches were grouped appropriately. English, French and German Teachers in Foreign Languages; Science, Physics, Chemistry and Biology Teachersin Science Lessons; Music, Visual Arts, Technology and Design, Physical Education Teachers in Art and Sports Lessons; Social Studies, History, Geography, Philosophy Teachers in Social Lessons, and finally, vocational high school teachers are grouped under the group of Vocational Lessons.

2.3. Data Collection Tools

A perception scale was developed within the scope of the research. For the research results to be valid and reliable, it is important to be sensitive to the quality of data collection tools (McMillan & Schumacher, cited in Turgut & Kurşun, 2019). To positively affect the validity of both the developed scale and the research, attention was paid to the compatibility between data collection tools and the study's design, purpose and sub-problems, method, the feature to be measured, and which data were desired to be obtained (Lynn, 1986). In this direction, the following stages were carried out in the development of the scale:

Phase 1: The purpose of the scale to be developed and which features it will measure are determined. The scale aims to reveal the perceptions of teachers about the challenges they face in distance education during the pandemic period. In this context, the concept of perception has been defined.

Phase 2: To create the item pool of the scale, a semi-structured interview form including the following questions was applied to 40 teachers:

- What are the challenges you faced while planning the education?
- What are the challenges you faced while teaching the lesson?

- What are the challenges you faced regarding teacher competences?
- What are the challenges you faced with educational technologies and distance education systems?
- What are the challenges you have with students' parents?
- What are the challenges you have with students?

The data obtained were examined, and the thoughts about the challenges presented by the teachers were turned into perception sentences and a draft item pool was created. There were 37 items in the item pool obtained within this framework. However, the obtained item pool was re-examined and the items determined to measure the same or similar perception were removed, thus an item pool of 24 items was created.

Phase 3: The created 24-item pool was sent to three field experts who have doctoral degrees in Computer and Instructional Technologies Education for their review in terms of both relevance and content validity. All three field experts stated that the item pool is appropriate in terms of content validity and there is no need to add new items. In addition, all three field experts suggested that nine items in total should be revised and corrected in terms of language, spelling, and clarity. The item pool was reviewed according to expert opinions and necessary corrections were made. At the last stage, the item pool, which was examined by a Turkish language expert, took its final form.

Phase 4: The 24-item item pool was arranged in a 5 point Likert type and applied to the study group through the Google Forms application. Online teacher groups were used to access the study group.

2.4. Data Analysis

Qualitative data collected through the semi-structured interview form were analyzed by content analysis method and the obtained opinions were transformed into scale items. The quantitative data obtained were subjected to a preliminary examination and 54 data that were left blank or showed a pattern were excluded from the analysis. Using the remaining 955 data, validity and reliability analyzes were performed first, and then descriptive analysis was performed.

Within the scope of the construct validity of the scale, firstly, Kaiser-Meyer-Olkin (KMO) and Bartlett analyzes were applied to determine whether factor analysis could be performed. It is stated that KMO provides information on whether the data are suitable for factor analysis and that a KMO higher than .90 is considered to be a very good value for applying factor analysis (Büyüköztürk, Çakmak, Akgün, Karadeniz and Demirel, 2017). Exploratory factor analysis (EFA) was applied to establish the construct validity and the factor structure of the scale. Exploratory factor analysis is a statistical technique widely used and applied in social sciences (Osborne et al., 2008). The factor structure of the scale was determined using the principal component analysis technique. The factor loadings of the scale were analyzed using the varimax orthogonal rotation technique. Orthogonal and oblique rotation methods are used in rotation processes. The orthogonal rotation method ensures that the factors do not interact with each other. In the oblique rotation method, the factors are not independent of each other. For this reason, the orthogonal rotation method is generally preferred. The principal component analysis is a statistical technique used to derive conceptual structures with variable subtraction (Büyüköztürk, 2018). Principal component analysis was preferred because it is more common and practical than principal axis factoring, it is more useful for calculating scores and reducing data to be used in other analyses, and it includes all of the variances for all items in the analysis. As a result of the analysis, the items with a factor load lower than .40 and items that were distributed over more than one factor were removed from the scale and the analyzes were renewed. As a result of the factor analysis applied, the discrimination of the scale was determined by applying the independent samples t-test. Item discrimination is a method that shows to what extent the items discriminate individuals according to the feature to be measured (Büyüköztürk et al., 2017). After determining the discrimination of the scale, the level of serving the purpose of the items was determined according to the item-total correlations using the Pearson's r test. In order to determine the reliability of the scale, first of all, Cronbach's Alpha, Equal Halves Correlation, Guttman Split-Half and Spearman-

Brown reliability coefficients were examined by using the internal consistency coefficient method. It has been stated that the reliability coefficient of .70 and higher is generally sufficient for the reliability of the items in the scale (Büyüköztürk, 2018). In order to determine whether parametric analyzes can be performed on the data with proven validity and reliability, it was analyzed whether the data were normally distributed and the results are presented in Table 2.2.

Table 2. 2. *Normality test results*

Factors		Kolmogorov-Smirnov (Sig.) / Shapiro-Wilk	Skewness	Kurtosis
Perceptions towards the Challenges Faced by Teachers in Distance Education	F1: Student and Parent-Oriented Challenges	,000	-1,450	1,492
	F2: Teacher Competences-Oriented Challenges	,000	-0,430	-0,327
	Total Score	,000	-1,225	1,448

When Table 2.2 is examined, it is seen that the significance level of the data collected according to the Kolmogorov-Smirnov and Shapiro-Wilk test results is less than 0,05, in other words, the data are not normally distributed. However, since the skewness and kurtosis coefficients are examined, it is seen that these coefficients are between +1,5 and -1,5, and also in this direction, the data can be considered normal (Büyüköztürk, 2018). The scores obtained in this framework were analyzed using the arithmetic mean, standard deviation, independent samples t-test , Anova, and Pearson r correlation and regression analyzes.

3. FINDINGS

3.1. Findings Regarding the Validity of the Scale

To test the construct validity of the scale, first of all, KMO and Bartlett analyses were performed on the data. As a result of the analysis, KMO value was .931; Bartlett value was $\chi 2$ = 9960,451; standart deviation (sd) was 276 (p=,000). For factor analysis, the KMO value is expected to be higher than .60 (Büyüköztürk et al., 2017). It has been concluded that factor analysis can be done on a 24-item scale within the framework of the values obtained. Principal component analysis was used to understand whether the scale had a single factor, and the varimax orthogonal rotation technique was used to understand factor loads. The resulting item loads were examined and 8 items with item loads lower than .40 were removed from the scale. The factor analysis, which was applied again after this process, was made on the remaining 16 items in the scale. The discarded items were examined in terms of content validity, and it was decided that these items would not affect content validity and it was decided to remove them from the scale after receiving expert opinion. After the analysis, it was seen that the remaining 16 items were grouped under two factors. The KMO value of the 16-items final version of the scale was ,932; Bartlett value was $\chi 2$ = 7939,416; sd was 120 (p= ,000). After the analysis with the remaining 16 items of the scale, the loads after the varimax orthogonal rotation technique were found to be between .562 and .825. As a result, it was determined that the items and factors in the scale explained 57.128% of the variance. After these results, the items in the factor were examined and the factors were named.

10 items were collected under the first factor called "Student and Parent-Oriented Challenges" and 6 items were collected under the second factor called "Teacher Competences-Oriented Challenges". The findings regarding the variance explanation amount of the remaining 16 items in the scale, the eigenvalues of the factors, and the distribution of the item loads according to the factors are given in Table 3.1.

Table 3. 1. *Exploratory Factor Analysis Results*

		Items	**Common Variance**	**F1**	**F2**
F1: Student and Parent-Oriented Challenges	i19	The negligence of some parents, their lack of cooperation with teachers in terms of attendance, homework, responsibility, "providing the study environment and other necessary conditions" negatively affect the success of the students.	,463	,825	
	i18	Some parents' unconsciousness about distance education, not taking distance education as seriously as school, and being away from technology use cause problems for students.	,550	,824	
	i21	The absence of any sanctions in terms of student success and attendance negatively affects lesson participation.	,555	,812	
	i24	In the distance education process, students do not want to do homework or take responsibility by acting as if the school is on vacation; even if they do, I think they do it without any goals and reluctantly.	,445	,805	
	i23	Students who attend live lessons irregularly for various reasons have trouble catching up with their learning outcomes and keeping up with the class level.	,618	,803	
	i15	I think that some students have problem with lesson attendance because they do not have enough opportunities (technological materials, etc.); moreover, this situation also causes integrity problem in teaching a lesson.	,566	,722	
	i17	The fact that the parents do not pay attention to the elements such as making noise while the student is in the live lesson negatively affects my lessons.	,482	,653	
	i16	The inability of some students to reconcile technology with school he fact that they perceive technology only as games, entertainment, and social media makes it difficult for me to involve them in the process.	,607	,628	
	i14	Internet, network, sound problems, etc. technical problems affect my lessons negatively.	,513	,575	
	i22	Unfamiliarity with the concept of distance education, taking time to get used to platforms such as ZOOM makes it difficult for students to adapt to the process.	,497	,562	
F2: Teacher Competences-Oriented Challenges	i11	I find it difficult in terms of planning and implementation to get immediate feedback on the topics covered in live lessons and then in assessment and evaluation.	,709		,748
	i12	Considering individual differences and different learning styles, I find it difficult to combine different teaching methods and techniques with technology and include them in live lessons.	,696		,732
	i5	I have challenge in motivating, engaging, attracting and keeping students' attention during the live lesson.	,674		,720
	i6	Compared to face-to-face education, I have more challenge in classroom management because the smallest sound, systemic and technical problems in live lessons disrupt the lesson order instantly.	,445		,705
	i2	I have challenge in determining student readiness in distance education.	,658		,680
	i8	I feel that I am not able to communicate effectively with students in live lessons due to the lack of sincerity, warmth, and eye contact as in a face-to-face classroom environment.	,662		,546
			Eigenvalue	5,627	3,513
			Explained variance	35,172	21,956

As seen in Table 3.1, the factor loads of the items collected under the first factor vary between ,532 and ,825. The contribution of this factor to the total variance is 35,172% and its eigenvalue is 5,627. The factor loads of the items collected under the second factor ranged from .546 to .748. The contribution of this factor to the total variance is 21,956% and its eigenvalue is 3,513. In this context, it can be said that the scale has a two-factor structure and this structure is valid. The correlation between the items in each factor in the scale and the scores obtained from the factors were calculated using the item factor correlation method. As a result of this analysis, the level of the items in the scale was determined in terms of serving the general purpose. The calculated item-factor correlation values of the items in the scale are given in Table 3.2.

Table 3. 2. *Item–Factor Correlations*

F1: Student and Parent-Oriented Challenges		F2: Teacher Competences-Oriented Challenges	
Item	r.	Item	r.
i19	,801	m11	,779
i18	,828	m12	,741
i21	,785	m5	,754
i24	,779	m6	,752
i23	,774	m2	,656
i15	,789	m8	,671
i17	,725		
i16	,724		
i14	,699		
i22	,682		

N = 955 **= p< .001

When Table 3.2 is examined, it is seen that the item-factor correlations of the items in the first factor are between ,682 and ,828, and the item-factor correlations of the items in the second factor are between ,656 and ,779. It is seen that the relationship between the items in the scale and the factors they contain is positive and significant (p< ,000). According to these results, it can be said that the items serve the purpose of the factor and the scale.

To calculate the discrimination strenght of the items that make up the scale, the scores of the items were ordered from the largest to the smallest. After that, groups consisting of 258 people in the upper-lower groups of 27% were determined. Independent samples t-test was applied to the scores of the formed groups to calculate the item discrimination strenght. The t-values showing the discrimination strength of each item in the scale and their significance levels are given in Table 3.3.

Table 3. 3. *Item Discrimination Strength*

F1: Student and Parent-Oriented Challenges		F2: Teacher Competences-Oriented Challenges	
Item	t	Item	t
i19	17,648	m11	27,185
i18	19,492	m12	24,176
i21	15,598	m5	22,799
i24	16,915	m6	24,757
i23	14,600	m2	16,343
i15	18,875	m8	20,600
i17	22,184	F1	27,919
i16	22,028	F2	38,699
i14	20,040	FT	41,985
i22	22,394	Df: 514; p< .001	

When Table 3.3 is examined, it is seen that the values obtained as a result of the independent samples t-test for the 16 items, factors, and the total score in the scale vary between 14,600 and 38,699, the t value of the overall scale is 41,985, and the difference between the scores for all items and factors is significant (p< ,001). Accordingly, it can be said that the discrimination level of the items in the scale and the overall scale is quite high.

3.2. Findings Regarding the Reliability of the Scale

The factors and the reliability analysis of the whole scale were examined by using Cronbach's Alpha, Equal Halves Correlation, Guttman Split-Half, and Spearman-Brown reliability coefficients. The reliability analysis results regarding the factors and the overall scale are summarized in Table 3.4.

Table 3. 4. *Factor Internal Consistency Coefficients*

Factors	Number of the Items	Cronbach's Alpha	Equal Halves Correlation	GuttmanSplit-Half	Spearman Brown
F1: Student and Parent-Oriented Challenges	10	,915	,758	,862	,863
F2: Teacher Competences-Oriented Challenges	6	,820	,695	,818	,820
Total	16	,911	,617	,763	,763

When Table 3.4 is examined, the Cronbach's Alpha value of the scale consisting of 2 factors and 16 items is ,911; Equal Halves Correlation is ,617; Guttman split-half value is ,763; Spearman-Brown value is determined as ,763. However, when the reliability values of the factors are examined, Cronbach's Alpha values are ,915 and ,820; Equal Halves Correlations are ,758 and ,695; Guttman split-half values are ,862 and ,818; Spearman-Brown values are determined as ,863 and ,820. According to these results, it can be said that each of the factors and the whole scale can make consistent measurements.

3.3. Teachers' Perceptions of the Challenges Faced in the Distance Education Process

The findings regarding teachers' perceptions of the challenges they faced in distance education during the pandemic period are summarized in Table 3.5.

Table 3. 5. *Teachers' Perceptions of the Challenges They Face in Distance Education during the Pandemic Period*

	Factors	N	Min	Max	X	Sd
Perceptions towards the Challenges Faced by Teachers in Distance Education	F1: Student and Parent-Oriented Challenges	955	10	50	42,20	7,9
	F2: Teacher Competences-Oriented Challenges		6	30	20,22	5,4
	Total Score		17	80	62,41	11,8

According to Table 3.5, while the lowest score that can be obtained in the "Student and Parent-Oriented Challenges" factor of the perceptions scale towards the challenges faced by teachers in distance education is 10, the highest score that can be obtained is calculated as 50, and the average perception score of the teachers participating in the research (N=955) is (X) 42,20. In the factor of "Teacher Competences-Oriented Challenges", the lowest possible score was 6, while the highest score was calculated as 30, and the average perception score of the teachers participating in the research (N=955) was determined as (X) 20,22. Considering the total score of the scale, the lowest possible score was 17, the highest score was 80, and the mean score (X) was 62,41. Accordingly, it can be said that teachers have a high perception of the challenges they experience in distance education, in other words, teachers have challenges in terms of both students and parents and teacher competences in distance education carried out during the pandemic period. The findings regarding whether the perceptions of teachers regarding the challenges they experienced in distance education during the pandemic period differ according to gender are summarized in Table 3.6.

Table 3. 6. *Teachers' perceptions of the challenges they faced in distance education during the pandemic period by Gender*

			N	X	Sd	t	sd	p
Perceptions towards the Challenges Faced by Teachers in Distance Education	F1: Student and Parent-Oriented Challenges	Female	692	42,5	7,5	2,425		,016
		Male	263	41,1	8,6			
	F2: Teacher Competences-Oriented Challenges	Female	692	20,1	5,4	-,311	955	,756
		Male	263	20,3	5,3			
	Total Score	Female	692	62,7	11,5	1,480		,139
		Male	263	61,4	12,4			

When Table 3.6 is examined, while it is seen that the perceptions of teachers regarding the challenges they experience in distance education according to their gender are similar in terms of both the total score (t(2-955)=1,480, p>0,05) and the teacher competences-oriented challenges (t(2-955)=-0,311, p>0.05), but there is a significant difference in terms of the student and parent-oriented challenges factor (t(2-955)=2,425, p<0,05). Looking at the averages, it is seen that the differentiation is in favor of female teachers. Accordingly, the perception levels of female teachers towards the challenges they experienced in distance education applied during the pandemic period were similar to male teachers in terms of the teacher competences-oriented challenges and total scores; on the other hand, it can be said that they have more challenges than male teachers in terms of the student and parent-oriented challenges. The perceptions of teachers regarding the challenges they face in the distance education process according to age groups are summarized in Table 3.7.

Table 3. 7. *Perceptions of Teachers on the Challenges They Faced in Distance Education during the Pandemic Period by Age Groups*

Factors	Age	N	X	Sd
F1: Student and Parent-Oriented Challenges	20-25 Ages	40	45,1	6,5
	26-30 Ages	248	43,5	7,1
	31-40 Ages	454	42,7	7,3
	41-50 Ages	167	39,1	9,1
	51 Age and above	46	38,6	9,3
F2: Teacher Competences-Oriented Challenges	20-25 Ages	40	21,9	4,7
	26-30 Ages	248	21,2	5,2
	31-40 Ages	454	20,2	5,2
	41-50 Ages	167	18,6	5,5
	51 Age and above	46	18,6	6,4
Total Score	20-25 Ages	40	67,0	9,9
	26-30 Ages	248	64,7	10,9
	31-40 Ages	454	62,9	10,9
	41-50 Ages	167	57,7	13,0
	51 Age and above	46	57,2	14,4

When Table 3.7 is examined, it is seen that there are differences in the averages in terms of age groups in the perceptions of teachers about the challenges they face in distance education. The results of the analysis of variance regarding whether these differences are significant or not are summarized in Table 3.8.

Table 3. 8. *Differentiation between Perceptions of Teachers by Age*

		The Sum of Squares	df	Mean Squares	F	p	Difference
F1: Student and Parent-Oriented Challenges	Between Groups	3057,381	4	764,345	12,853	,000	• Between 20-25 and 41-50 and 51 and above • Between 31-40 and 41-50 and 51 and above
	In-group	56493,610	950	59,467			
	Total	59550,991	954				
F2: Teacher Competence-Oriented Challenges	Between Groups	890,835	4	222,709	7,830	,000	• Between 20-25 and 41-50 and 51 and above • Between 26-30 and 31-40,41-50 and 51 and above
	In-group	27020,730	950	28,443			
	Total	27911,564	954				
Total Score	Between Groups	7160,792	4	1790,198	13,593	,000	• Between 20-25 and 31-40,41-50 and 51 and above • Between 26-30 and 41-50 and 51 and above • Between 31-40 and 41-50 and 51 and above
	In-group	125116,657	950	131,702			
	Total	132277,449	954				

When Table 3.8 is examined, it is seen that there is a significant difference in terms of the total score [f(4-950)=13,593, p<0,05) between their ages and teachers' perceptions of the challenges they experience in the distance education process. According to the results of the LSD test conducted to determine the source of the difference, it was determined that the differentiation was between the teachers in the age group of 20-25 and the teachers in the age group of 31-40, 41-50, 51 and above. When the total score averages in Table 3.7 are examined, it is seen that the teachers in the 20-25 age group compared to the teachers aged 30 and above; the teachers in the 26-30 age group compared to the teachers aged 40 and above and the teachers in the 31-40 age group compared to the teachers aged 41 and above, the perceptions of the challenges experienced in the distance education process are significantly higher. Accordingly, it can be said that the younger the teachers, the more challenges they have in the distance education process applied during the pandemic period. In other words, it can be said that older teachers have less challenge in the process.

When examined in terms of the factors, it is seen that the perception levels of teachers regarding the challenges they face in the distance education process differ significantly in terms of the student and parent-oriented challenges factor [f(4-950)=12,853, p<0,05). According to the results of the LSD test, which was conducted to determine the source of the difference: It has been determined that the differentiation is between the teachers aged 20-25 and the teachers aged 41-50, 51 and above, and between the teachers aged 31-40 and the teachers aged 41-50, 51 and above. Accordingly, when the averages of the relevant factor in Table 3.7 are examined: It can be said that the students and parents-oriented challenge levels of the teachers aged 20-25 were significantly higher than those aged 41-50, 51 and above, and 31-40-year-old teachers have significantly higher student and parent-oriented challenge levels than those aged 41-50, 51 and above. Accordingly, it can be said that as their age gets younger, teachers experience more students and parents-oriented challenges in the distance education process applied during the pandemic period.

It is seen that the perception levels of teachers regarding the challenges they experience in the distance education process according to their age differ significantly in terms of the teacher competences-oriented challenges [f(4-950)=7,830, p<0,05). According to the results of the LSD test conducted to determine the source of the difference, it was determined that the differentiation was between the teachers aged 20-25 and the teachers aged 41-50, 51 and above, and the teachers aged 26-30 and the teachers aged 31-40, 41-50, 51 and above. Accordingly, when the averages of the relevant factor are examined in Table 3.7: It is seen that the student and parent-oriented challenge levels of teachers aged 20-25 are significantly higher than those aged 41-50, 51, and above; it is seen that the students and parents-oriented challenge levels of the teachers aged 26-30 are significantly higher than those aged 31-40, 41-50, 51 and above. Accordingly, it can be said that as their age gets younger, teachers experience more challenges in terms of the teacher competences in the distance education process applied during the pandemic period. The perceptions of the teachers regarding the challenges they face in the distance education process according to the teaching levels they work are summarized in Table 3.9.

Tablo 3. 9. *Teachers' Perceptions of the Challenges They Face in Distance Education during the Pandemic Period According to the Teaching Level They Work*

Factors	Level	N	X	Sd
F1: Student and Parent-Oriented Challenges	Pre-school	20	38,1	13,0
	Primary School	185	41,0	7,9
	Secondary School	545	43,0	7,2
	High School	205	41,2	8,5
F2: Teacher Competences-Oriented Challenges	Pre-school	20	20,5	6,8
	Primary School	185	19,6	5,2
	Secondary School	545	20,1	5,4
	High School	205	20,8	5,2
Total Score	Pre-school	20	58,6	19,5
	Primary School	185	60,7	11,4
	Secondary School	545	63,2	11,1
	High School	205	62,1	12,5

When Table 3.9 is examined, it is seen that there are differences in the averages in terms of teachers' perceptions of the challenges they face in distance education in terms of the teaching levels they work. The results of the analysis of variance regarding whether these differences are significant or not are summarized in Table 3.10.

Table 3. 10. *The Difference between Teachers' Perceptions According to Teaching Levels*

		The Sum of Squares	df	Mean Squares	F	p	Difference
F1: Student and Parent-Oriented Challenges	Between Groups	1144,540	3	381,513	6,212	,000	• Between Pre-school and the others • Between Primary and Secondary School
	In-group	58406,450	951	61,416			
	Total	59550,991	954				
F2: Teacher Competences-Oriented Challenges	Between Groups	138,969	3	46,323	1,586	,191	one
	In-Group	27772,596	951	29,204			
	Total	27911,564	954				
Total Score	Between Groups	1186,309	3	395,436	2,869	,036	• Between Primary and Secondary School
	In Group	131091,140	951	137,846			
	Total	132277,449	954				

When Table 3.10 is examined, it is seen that there is a significant difference in terms of the total score [f(3-951)=2,869, p<0,05) between the teaching level they work and the teachers' perceptions of the challenges they face in the distance education process. According to the results of the LSD test conducted to determine the source of the difference, it was determined that the differentiation was between the teachers working in primary and secondary schools. When the total score averages in Table 3.9 are examined: It can be said that the averages of the teachers working in primary school are significantly lower than those working in secondary schools. Accordingly, it can be said that primary school teachers have less challenge than secondary school teachers in the distance education process applied during the pandemic period.

When examined in terms of the factors, it is seen that there is a significant difference in terms of the teaching levels between the perception levels of teachers regarding the challenges they experience in the distance education process, with the factor of student and parent-oriented challenges [f(3-951)=6,212, p<0,05). According to the results of the LSD test conducted to determine the source of the difference, it was determined that the differentiation was between the teachers working in pre-school and the others, and between the teachers working in primary school and those working in secondary schools. When the averages of the relevant factor in Table 3.9 are examined: It is seen that the student and parent-oriented challenge levels of the pre-school teachers are significantly lower than the teachers working at the other levels, and the scores of the teachers working in primary school are also significantly lower than the teachers working in secondary school. Accordingly, it can be said that in the distance education process applied during the pandemic period, secondary school teachers have fewer students and parent-oriented challenges than the teachers at the other levels, and primary school teachers have fewer students and parent-oriented challenges than secondary school teachers.

It is seen that there is no significant difference between the perception levels of teachers regarding the challenges they experience in the distance education process according to the teaching levels and the factor of teacher competences-oriented challenges [f(3-951)=1,586, p>0.05). Accordingly, it can be said that the distance education process applied during the pandemic period and the challenges faced in terms of the teacher competences with regard to the related teaching levels are similar.The perceptions of teachers regarding the challenges they face in the distance education process according to their branches are summarized in Table 3.11.

Table 3. 11. *Teachers' Perceptions of the Challenges They Face in Distance Education during the Pandemic Period by Branch*

Factors	Level	N	X	Sd
F1: Student and Parent-Oriented Challenges	1. Mathematics	47	44,0	5,5
	2.Foreign Languages	357	42,9	7,4
	3.Turkish	112	42,2	8,5
	4.Science Lessons	137	41,7	7,0
	5.Information Technologies	20	42,0	6,6
	6.Arts and Sports Lessons	45	42,7	7,9
	7.Social Lessons	42	41,3	9,1
	8.Culture of Religion and Knowledge of Ethics	24	44,5	6,7
	9.Primary School Teaching	121	40,9	8,1
	10.Vocational Lesons	21	37,1	11,4
	11.Preschool	29	38,5	10,6
F2: Teacher Competences-Oriented Challenges	1.Mathematics	47	20,9	4,1
	2.Foreign Languages	357	19,9	5,4
	3.Turkish	112	21,5	5,1
	4.Science Lessons	137	19,7	5,0
	5.Information Technologies	20	19,5	6,2
	6.Arts and Sports Lessons	45	20,6	5,4
	7.Social Lessons	42	20,5	6,4
	8.Culture of Religion and Knowledge of Ethics	24	19,7	6,1
	9.Primary School Teaching	121	20,4	5,0
	10.Vocational Lessons	21	18,0	6,5
	11.Preschool	29	19,6	6,3
Total Score	1.Mathematics	47	64,9	8,2

2.Foreign Languages	357	62,9	11,2
3.Turkish	112	63,7	12,4
4.Science Lessons	137	61,4	10,4
5.Information Technologies	20	61,5	10,8
6.Arts and Sports Lessons	45	63,3	12,0
7.Social Lessons	42	61,9	14,2
8.Culture of Religion and Knowledge of Ethics	24	64,3	10,6
9.Primary School Teaching	121	61,4	11,6
10.Vocational Lessons	21	55,1	17,3
11.Preschool	29	58,2	15,7

When Table 3.11 is examined, it is seen that there are differences in the averages of teachers' perceptions of the challenges they face in distance education in terms of their branches. The results of the variance analysis regarding whether these differences are significant or not are summarized in Table 3.12.

Table 3. 12. *The Difference between Perceptions of Teachers According to Their Branches*

		The Sum of Squares	df	Mean Squares	F	p	Difference
F1: Student and Parent-Oriented Challenges	Between Groups	1685,980	10	168,598	2,750	,002	• Between 9 and 7,8,10 • Between 11 and 1,2,3,4,6 and 7 • Except 10 and 11, among others
	In-Group	57865,011	944	61,298			
	Total	59550,991	954				
F2: Teacher Competences-Oriented Challenges	Between Groups	422,223	10	42,222	1,450	,153	None
	In-Group	27489,341	944	29,120			
	Total	27911,564	954				
Total Score	Between Groups	2617,413	10	261,741	1,906	,041	• Between11 and 1,2 and 3 • Except 10 and 11, among others
	In-Group	129660,036	944	137,352			
	Total	132277,449	954				

When Table 3.12 is examined, it is seen that there is a significant difference in terms of the total score [f(10-944)=1,906, p<0,05) between branches and teachers' perceptions of the challenges they experience in the distance education process. According to the results of the LSD test conducted to determine the source of the difference, it was determined that the differentiation was between Preschool teachers and the teachers in Mathematics, Foreign Languages, and Turkish branches, and between Vocational Lesson teachers and the other branches teachers except for Preschool. When the averages in Table 3.11 are examined in terms of total scores: It can be said that Preschool branch is significantly lower than Mathematics, Foreign Languages, and Turkish branches. It was determined that, with the exception of Vocational Lessons and Pre-School branches; Mathematics branch is significantly higher than the others; Foreign Languages branch is significantly higher than Science Fields, Information Technologies, Primary School Teaching and Social Fields; Turkish branch is significantly higher than the branches except Mathematics and Culture of Religion and Knowledge of Ethics; there is no significant difference between Science Fields and Primary School Teaching branches; Information Technologies is significantly higher than Science Fields and Primary School Teaching branches; Arts and Sports Branches are significantly higher than Foreign Languages, Science Fields, Information Technologies, Social Fields and Primary School Teaching branches; Social Fields is significantly higher than Science Fields, Information Technologies and Primary School Teaching; Culture of Religion and Knowledge of Ethics branch is significantly higher than the other branches except Mathematics; and finally, Primary School Teaching branch was significantly lower than the other branches.

When examined in terms of the factors, it is seen that there is a significant difference between the perception levels of teachers regarding the challenges they experience in the distance education process, and the students and parents-oriented challenges [f(10-944)=2,750, p<0,05). According to the results of the LSD test, which was conducted to determine the source of the difference, it was determined that the differentiation was between Primary School Teachers and Social Lessons, Culture of Religion and Knowledge of Ethics and Vocational Lessons Teachers; in addition, between Pre-School Teachers and Mathematics, Foreign Languages, Turkish, Science Lessons, Arts and Sports Lessons and Social Lessons Teachers; and among the other branches except for Vocational Lessons Teachers and Pre-School Teachers. When the averages in Table 3.11 are analyzed in terms of total scores: While the averages of the Primary School Teachers are significantly lower than Social Lesson Teachers, Culture of Religion and Knowledge of Ethics, it is seen that it is significantly higher than Vocational Lessons Teachers. It is seen that the averages of Preschool Teachers are significantly lower than Mathematics, Foreign Languages, Turkish, Science Lessons, Arts, and Sports and Social Lessons Teachers. With the exception of Vocational Lessons and Pre-School branches it was determined that; Mathematics Teachers is significantly higher than the others except Culture of Religion and Knowledge of Ethics; Foreign Languages Teachers is significantly higher than Science Lessons, Information Technologies, Arts and Sports, Primary School and Social Lessons Teachers; Turkish Teachers are significantly higher than Science Lessons, Information Technologies, Social Lessons and Primary School Teachers; Science Lessons Teachers are significantly higher than Social Lessons and Primary School Teachers; Information Technologies Teachers are significantly higher than Science Lessons, Social Lessons and Primary School Teachers; Arts and Sports Lessons are significantly higher than the other branches except Mathematics, Foreign Languages, Culture of Religion and Knowledge of Ethics; Social Lessons Teachers are significantly higher than Primary School Teachers; Culture of Religion and Knowledge of Ethics Teachers are significantly higher than the other branches; and finally, Primary School Teachers are significantly lower than the other branches.

It is seen that there is no significant difference between the perception levels of teachers regarding the challenges they face in the distance education process according to their branches and the competences-oriented challenges [$f(10\text{-}944)=1.450$, $p>0.05$). Accordingly, it can be said that the challenges experienced in terms of teacher competences in terms of the branch related to the distance education process applied during the pandemic period are similar. The perceptions of teachers regarding the challenges they face in the distance education process according to the settlements where they work are summarized in Table 3.13.

Table 3. 13. *Teachers' Perceptions of the Challenges They Faced in Distance Education during the Pandemic Period by Settlement where They Work*

Factors	Level	N	X	Sd
F1: Student and Parent-Oriented Challenges	City Center	358	41,1	8,6
	Village	207	43,9	6,5
	District Center	390	42,2	7,7
F2: Teacher Competences-Oriented Challenges	City Center	358	19,7	5,5
	Village	207	20,7	5,5
	District Center	390	20,3	5,1
Total Score	City Center	358	60,8	12,6
	Village	207	64,7	10,4
	District Center	390	62,6	11,3

When Table 3.13 is examined, it is seen that there are differences in the averages in terms of teachers' perceptions of the challenges they face in distance education in terms of the settlements where they work. The results of the analysis of variance regarding whether these differences are significant or not are summarized in Table 3.14.

Table 3.14 *Differences in Perceptions of Teachers by Settlement where They Work*

		The Sum of Squares	df	Mean Squares	F	p	Difference
F1: Student and Parent-Oriented Challenges	Between Groups	1056,859	2	528,429	8,600	,000	Between the village and the others
	In-group	58494,132	952	61,443			
	Total	59550,991	954				
F2: Teacher Competences-Oriented Challenges	Between Groups	156,697	2	78,348	2,687	,049	Between City Center and Village
	In-group	27754,868	952	29,154			
	Total	27911,564	954				
Total Score	Between Groups	1981,637	2	990,819	7,239	,001	Between all of them
	In-group	130295,812	952	136,865			
	Total	132277,449	954				

When Table 3.14 is examined, it is seen that there is a significant difference in terms of the total score [f(2-952)=7,239, p<0,05) between the settlements where they work and the perceptions of the teachers about the challenges they face in the distance education process. According to the results of the LSD test conducted to determine the source of the difference, it was determined that the differentiation was between the teachers working in the city center, village, and district centers. Accordingly, when the total score averages in Table 3.13 are examined: It can be said that the teachers working in the village are significantly higher than the teachers working in the province and district centers; it can be said that the teachers working in the district center are also significantly higher than those working in the city center. In other words, it can be said that the teachers working in the city center are significantly lower than the teachers working in the village and district centers. Accordingly, it can be said that the smaller the settlement they work, the more challenges teachers have in the distance education process applied during the pandemic period.

When analyzed in terms of the factors, it is seen that there is a significant difference between the perception levels of teachers regarding the challenges they face in the distance education process and the challenges that are focused on students and parents [f(2-952)=8.600, p<0,05) according to the settlements where they work. According to the results of the LSD test conducted to determine the source of the difference, it was determined that the differentiation was between the teachers working in the village and the teachers working in the city and district centers. Accordingly, when the averages in Table 3.13 are examined, it can be said that during the distance education process implemented during the pandemic period, the teachers working in the villages experienced more student and parent-oriented challenges than the teachers working in the city and district centers.

It is seen that there is a significant difference between the perception levels of teachers regarding the challenges they experience in the distance education process and the teacher competences-oriented challenges [f(2-952)=2.687, p<0,05) according to the settlements where they work. According to the results of the LSD test conducted to determine the source of the difference, it was determined that the differentiation was between the teachers working in the city center and the teachers working in the villages. Accordingly, when the averages in Table 3.13 are examined, it can be said that the teachers working in the city center experienced less challenge in terms of the teacher competences-oriented challenges compared to the teachers working in the villages during the distance education process implemented during the pandemic period.

4. DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

According to the results of the pilot scheme relating to the scale which is developed in the first stage of the research: By performing KMO, Bartlett analysis, factor analysis, principal components analysis, taking into account variance calculations and applying varimax orthogonal rotation technique, the 10 items for the first factor called "Student and Parent-Oriented Challenges" and the 6 items for the second factor called "Teacher Competences-Oriented Challenges" were chosen. In other words, it has become clear that the scale consists of 2 factors and 16 items. In a study conducted by Baran, Correia and Thompson (2011), it is emphasized that there are problems related to both teachers' competencies and the teacher training process in the online teaching process, and that teacher competencies are an important factor in online education. Similarly, in a study conducted by Gülbahar and Kalelioğlu (2015), it was emphasized that teacher competencies are a very important factor in the e-learning process and that it is important for teachers to keep their competencies up to date by constantly improving them. In another study by Kara and Yılmaz (2020), it is emphasized that the qualifications of faculty members are an important factor for the success of the distance education process. Research by Ferri, Grifoni, and Guzzo (2020) discusses the opportunities and challenges of emergency distance learning based on COVID-19 emergency experiences. Within the scope of the research, the lack of digital competences of teachers and students was emphasized within the scope of pedagogical difficulties. In the research conducted by Kara, Erdoğdu, Kokoç, and Çağıltay (2019) on the difficulties faced by adult learners in online distance education, it was emphasized that the lack of students' proficiency is one of the factors that negatively affect distance education. As a result, it can be said that it would be appropriate to consider the difficulties experienced in the distance education process under two factors as student and teacher competencies.

As a result of the findings of the explained variance rate of the items, the eigenvalues of the factors, and the distribution of the item loads according to the factors, the scale has a two-factor structure and this structure is valid. According to the applied item factor correlation method, the items in the scale serve the general purpose. The “Distance Education Perceptions of Teachers Scale” developed by Kurnaz et al. (2020), on the other hand, was prepared as 41 items after taking expert opinion, validity and reliability analyzes were made according to the data obtained from 356 teachers, and construct validity was tested using EFA and it calculated 62.47% of the total variance. The scale was concluded as 37 items and 5 factors. Yildiz et al. (2021) developed the "Attitude Scale Regarding the Use of Distance Education Environments in the Pandemic Process". Within the scope of the reliability and validity studies of the scale, 321 students were consulted. For the content and face validity of the scale, the opinions of 1 language, 3 field experts, 1 assessment and evaluation expert, and 1 psychological counselor were consulted. Afterward, construct validity was tested with EFA and a 24-item 4-factor scale was developed that explained 73.42% of the total variance. Kılıç Çakmak and Gök (2020) developed an online questionnaire administered to 81 instructors and explained 56.88% of the total variance as a result of EFA, and the questionnaire was concluded as 21 items, 3-factor and 5 point Likert type.

In addition, according to the results of the independent samples t-test and the ranking of the item scores from the largest to the smallest to calculate the discrimination strenght of the items, the discrimination level of the items in the scale and the scale itself is quite high. According to the analyzes made by using the factors and Cronbach's Alpha, Equal Halves Correlation, Guttman Split-Half and Spearman-Brown reliability coefficients for the scale reliability analysis, each of the factors and the whole scale can make consistent measurements. The internal consistency coefficient of the scale developed by Kurnaz et al. (2020) was calculated as .901 with Cronbach’s Alpha. The internal consistency coefficient of the developed scale developed by Yildiz et al. (2021) was calculated with Cronbach’s Alpha and found to be .93. As a result of the confirmatory factor analysis of the 4-factor scale, it was determined that the fit indices were at the desired level. Kılıç Çakmak and Gök (2020) calculated the internal consistency coefficient of the questionnaire they developed with Cronbach’s Alpha and reached the result of .91. For the reliability of the scale, the Cronbach’s Alpha value is expected to be between .70 and .95 (Brown, 2002).

Teachers have a high perception of the challenges they face in distance education; in other words, teachers are experiencing challenges in terms of both students and parents and teacher competences in distance education applications carried out during the pandemic period. In Halitoğlu's (2021) research, the attitudes of the participants are at a high level, according to the data obtained from the internet with the "Attitudes of Student Teachers towards Distance Education" scale. In the case study conducted by Eken et al. (2020), in EDE applied during the pandemic period; they have concluded that there are some problems due to reasons such as students, socioeconomic inequalities, inequality of opportunity, and geographical settlements and that the problems experienced by the teachers are because the educators do not have enough experience and knowledge on this subject yet. In the research conducted by Kılıç Çakmak and Gök (2020) on the perceptions of instructors regarding distance education, the education-teaching plan factor was found to be the highest level, access to resources and the basic perspective factors and the entire questionnaire were found to be medium level. It has been concluded that more experienced instructors have a more positive approach to DE and undergraduate graduates have more problems in DE than those who receive postgraduate education. In Demir and Özdaş's (2020) research, which aims to reveal the views of the teachers working in primary school in distance education applied in the COVID-19 pandemic, it has been concluded that teachers have problems in terms of "infrastructure, participation, planning, communication, uncertainty and EBA (Education Information Network)" in EDE. In Sezgin's (2021) research, which aims to analyze contentwise the EDE researches conducted worldwide during the COVID-19 pandemic process, it has been concluded that the concept of "digital divide" is encountered when the concepts and problems that are at the forefront of EDE process are examined. In the study of Schleicher (2020), which aims to examine the impact of the pandemic crisis on OECD countries on education, it has been concluded that 18% of teachers need to develop themselves more in terms of technology and 36% of them attend online seminars or courses. In their study, Pradas et al. (2021) concluded that with the case study method, there was an increase in the academic achievement of students in EDE and this increase supports the idea that it is beneficial to examine and consider the effective factors in the successful implementation of EDE. According to the research conducted by Trust and Whalen (2020) to reveal the experiences of instructors in EDE during the COVID-19 crisis, it was stated that 325 teachers in EDE are faced with problems such as feeling under pressure and unprepared for online lessons, technical problems for students, changing individual needs and it was stated that they faced some challenges such as coping and the uncertainty in the education systems of the countries due to the pandemic and they needed support.

In terms of the teacher competences-oriented challenges and total score, female teachers and male teachers' perception levels about the challenges they face in distance education applied during the pandemic period show similarity. On the other hand, in terms of the student and parent-oriented challenges, female teachers face more challenges than male teachers. The reason for this may be that there are more female participants in the study, taking into account the "challenges focused on student-parent and teacher competences", or it may be that women have taken more responsibility with the curfews applied during the pandemic period. This situation can be investigated with new researches. In Halitoğlu's (2021) research, there is no significant difference between the attitudes of the participants and the gender, according to the data obtained from the internet with the scale of "Attitudes of Student Teachers towards Distance Education". According to the research conducted by Kılıç Çakmak and Gök (2020) on the perceptions of instructors regarding distance education, the groups did not show a significant difference in terms of gender. Kurnaz et al. (2020) stated that there was no significant gender difference between EDE and teachers' views in their study, which aimed to examine the views of teachers on distance education, which the whole country had to implement due to the pandemic.

As their age gets younger, teachers face more challenges in the distance education process applied during the pandemic period. In other words, older teachers face less challenge in the process. As their ages get younger, teachers experience more student and parent and teacher competences-oriented challenges in the distance education process implemented during the pandemic period. The reason for all these results is, considering the factors of "student and parent-oriented and teacher competences-oriented challenges"; it may be that young teachers have less professional experience, especially inexperience in classroom management, or that they often work in rural and disadvantaged areas. This situation can be investigated with new researches. According to the research conducted by Kılıç Çakmak and Gök (2020) on the perceptions of instructors regarding distance education, the groups did not differ significantly in terms of age. Kurnaz et al. (2020) stated that there is no significant difference between EDE and teachers' opinions in terms of seniority year and teaching experience level, which aims to examine the views of teachers on distance education, which the whole country has had to implement due to the pandemic.

In the distance education process applied during the pandemic period, primary school teachers experience less challenge than secondary school teachers. Moreover, secondary school teachers have less student and parent-oriented challenges than the teachers at the other levels and primary school teachers also have less student and parent-oriented challenges compared to secondary school teachers. The challenges faced in teacher competences are also similar. In the study of Kurnaz et al. (2020), which aimed to examine the views of teachers on distance education, which the whole country had to implement due to the pandemic, it was stated that there was no significant difference between EDE and teacher views in terms of teaching level.

Pre-School Teachers have less challenge than those in Mathematics, Foreign Languages, and Turkish branches. With the exception of Vocational Lessons and Pre-School branches; Mathematics Teachers face more challenges than those in the other branches; Foreign Languages Teachers have more challenges than those in the branches of Science, Information Technologies, Primary School Teaching and Social Fields; the teachers in Turkish branch have more challenges than those in the branches other than Mathematics and Culture of Religion and Knowledge of Ethics; the challenges faced by the teachers in Science Fields and Primary School Teaching branches are similar; the teachers in Information Technologies branch have more challenges than those in Science Fields and Primary School branches; the teachers in Arts and Sports Branches have more challenges than those in Foreign Languages, Sciences, Information Technologies, Social Sciences and Primary School branches; the teachers in Social Fields branch have more challenges than those in Science Fields, Information Technologies and Primary School branches; the teachers in Culture of Religion and Knowledge of Ethics branch have more challenges than those in the other branches except Mathematics; and lastly, the teachers in Primary School branch have less challenge than those in the other branches. In the study of Halitoğlu (2021), it was concluded that there is a significant difference in favor of Turkish and Guidance and Psychological Counseling, that is, they have a higher attitude score, according to the data obtained from the internet with the "Attitudes of Student Teachers towards Distance Education" scale. In the study of Kurnaz et al. (2020), which aimed to examine the views of teachers on distance education, which the whole country had to implement with the pandemic, it was stated that there was no significant difference between EDE and teacher views in terms of the branch.

As the development level of the settlement they work decreases, teachers face more challenges in the distance education process applied during the pandemic period. In this process, the teachers working in villages experience more challenges focused on students and parents than the teachers working in the city and district centers. On the other hand, the teachers working in the city center experienced less challenge in terms of the teacher competences than the teachers working in villages. In Halitoğlu's (2021) research, there is no significant difference between the attitudes of the participants and the region they live in, according to the data obtained from the internet using the "Attitudes of Student Teachers towards Distance Education" scale. In the case study conducted by Eken et al. (2020), it was determined that there were problems in EDE applied during the pandemic period due to reasons such as student, socioeconomic inequalities, equal opportunity, and geography. In the study of Kurnaz et al. (2020), which aimed to examine the views of teachers on distance education, which the whole country had to implement due to the pandemic, it was stated that there was no significant difference between EDE and teachers' opinions in terms of settlement.

According to the results of the research, the following recommendations can be made:

- The developed scale can be used to examine and reveal the challenges faced by teachers in terms of student and parent and teacher competences during the pandemic period based on gender, age, branch, teaching level, and settlement where they work.
- Based on the conclusion that younger teachers have more challenges in distance education process implemented during the pandemic period, especially younger teachers can be supported with in-service training, group teachers meetings, or different studies.
- In the distance education process implemented during the pandemic period, support activities can be carried out for secondary school teachers because secondary school teachers have more challenges than primary school teachers.
- Excluding Vocational Lessons and Pre-School branches; because the teachers in the mathematics branch have more challenges in the distance education process applied
- during the pandemic period compared to the teachers in the other branches; Mathematics teachers can be supported in the distance education process in terms of the challenges they face.
- According to the result that teachers have more challenges in the distance education process applied during the pandemic period, as the settlement where they work gets smaller, solutions can be produced for the challenges they encounter, especially by collaborating with teachers working in disadvantaged areas.

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Examination of Digital Competences of Teachers According to Different Variables

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ABSTRACT

This study examines the digital competence of teachers according to different variables. It was thought that the variables (gender, age groups, service school, foreign language) discussed would give an idea about the status of teachers' digital competencies. In this direction, a total of 695 teachers, 352 female teachers, and 343 male teachers, working in primary, secondary, and high schools participated in the research.In order to explain the general views and characteristics of the participants on the subject, the cross-sectional survey model, one of the survey types, was used.On the other hand, the Teacher Digital Competence Scale developed by Gümüş and Kukul (2022) was used to determine the digital competencies of teachers.The digital efficacy scale used in the research was filled out online by the teachers.T-test and ANOVA tests were used for the analysis of the collected data. When the results obtained in the research were examined, the digital competencies of teachers differed according to gender and age range. However, no difference was observed in the digital competencies of teachers according to school type and foreign language level. On the general evaluation of the analyses, it is thought that although the teachers have medium-level digital competences, considering the difficulties experienced during the pandemic period, the digital competences of the teachers observed at the medium level are eventually insufficient and the teachers should develop themselves in this regard.

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INTRODUCTION

Recently, there has been a significant surge in the number of individuals using digital media and tools, leading to a pervasive influence on people's way of life. Therefore, it has become an absolute necessity to acquire the essential digital competences to navigate and effectively utilize digital environments and tools. National and international studies are being conducted to cultivate such competences in individuals. In line with this, the Eleventh Development Plan (2019) published in Turkey aims to address the society's digital competence challenges and promotes digital transformation across all fields. As the number of digital users worldwide continues to grow (Statista, 2020; Turkish Statistical Institute [TUIK], 2019; We are Social [WAS], 2020), it is critical to emphasize the importance of digital transformation initiatives that enable individuals to attain a sufficient level of digital use and maximize the efficiency of digital tools.

In today's society, an individual's ability to develop their knowledge and skills in the digital space is crucial to maintaining competitiveness both domestically and globally. It is essential that individuals have digital competencies that enable them to use technology effectively and efficiently for their own benefit. Lack of these skills can lead to a disadvantage in economic competition, both at the national and international level (Castro-Granados & Artavia-Diaz, 2020; Matli & Ngoepe, 2020). Digital competences may be said to affect and direct living standards to a significant extent and consequently be an effective factor for the quality of life. Therefore, the education and social levels of countries may differ according to their digital competence (Drossel, Eickelmann & Vennemann, 2020).

For many reasons, countries in the world are working to develop digital competence programs and it is emphasized that worldwide collaborative work should be developed (Bejakovic & Mrnjavac, 2020; Matli & Ngoepe, 2020; Radovanovic et al., 2020). The Covid-19 pandemic brought numerous challenges to the education sector worldwide (Cosofreț & Avram, 2020; Joshi, Vinay & Bhaskar, 2020; Kavuk & Demirtas, 2021), highlighting the poor digital competence of both teachers and students (Kavuk & Demirtas, 2021; Turker & Dundar, 2020). Consequently, the lack of digital infrastructure and the insufficient digital competence of teachers posed significant difficulties in implementing distance education during the pandemic (Bakioglu & Cevik, 2020; Joshi, Vinay & Bhaskar, 2020; Kavuk & Demirtas, 2021; Turke r& Dundar, 2020). During this period, it was noted that the challenges faced by teachers were not only affecting them but also their students and parents, highlighting issues in communication between these parties (Bakioglu & Cevik, 2020; Kavuk & Demirtas, 2021). Additionally, various studies have shown that the exposure of teachers to technology during this period has had a positive impact on their professional growth (Bakioglu & Cevik, 2020). As such, it is evident that the digital skills of teachers will play a crucial role in the future of education. In addition, it will be very important for teachers to be technology leaders and to emphasise the studies on this subject in the literature in terms of reflecting the digital competences of teachers (Korkmaz, Kutlu& Yavuz, 2022). Bozkurt (2020) reports that in order for teachers to have digital competencies, their current skills should be evaluated and opportunities should be provided for them to develop their skills. In this context, the International Association for Technology in Education [ISTE] (2017) standards and Digital Competencies [Dig. Comp] (2016) frameworks prepared by Vuorikari, Punie, Carretero Gomez, and Van den Brande, digital competence frameworks for teachers were developed, and a nationwide digital competence guide was prepared (Kelentric, Helland & Arstorp, 2017). These frameworks highlight the importance of teachers integrating Information and Communication Technologies (ICT) into their lessons to develop classroom management skills (McGarr, Mifsud, &Colomer Rubio, 2021). Morever, a new national education policy has been established within the framework of the international ICT competence framework developed by the United Nations Educational, Scientific and Cultural Organization [UNESCO] (2018) to improve the digital competence of teachers (McGarr et al., 2021). In this way, it is aimed to improve digital competence by providing a stronger technology integration in education. Developing digital infrastructure and implementing supportive policies, along with establishing national frameworks to enhance the digital competencies of educators, are crucial steps towards achieving higher quality and efficiency in education. In this sense, considering that the ways of raising qualified individuals with 21st-century skills are directly related to education, it can be said that teachers and even students should develop and evaluate digital competences at certain periods in education.

In this direction, on the examination of Statista (2020), We are Social (2020), and TUIK (2019) data, different statistical information is observed in terms of gender, age, social media tools, and digital tool use. On the other hand, there are differences in the literature in the digital competences of teachers according to gender, age, institutions, technologies used, and foreign language knowledge (Cebi & Reisoglu, 2020; Celebi & Sevinc, 2019; Durak & Tekin, 2020; Dias-Trindade & Moreira, 2020; Esteve-Mon et. al., 2020; Instefjord&Munthe, 2017). When the studies conducted on digital competence were examined, it was revealed that gender had an effect on digital competences (Eyo, 2016; Fidan&Yeleğen, 2022; Gökbulut, Keserci, & Akyüz, 2021; Lucas, Bem-Haja, Siddiq, Moreira, &Redecker, 2021). On the other hand, it has been observed that age or seniority has an effect on digital competences (Eyo, 2016; Fidan & Yeleğen, 2022; Gökbulut et al, 2021; Lucas, et al, 2021; Pihlainen, Korjonen-Kuusipuro & Kärnä, 2021). At the same time, studies conducted with teachers have revealed that branch has an effect on digital competences (Fidan & Yeleğen, 2022; Yılmaz & Toker, 2022). In another study conducted in terms of branch variable, Bişirici and Gülbahar (2023) recommended that the digital competences of teachers should be formed according to the branches of teachers. In other studies, it is seen that research has been conducted according to the variables of school type (Karakuş & Gürbüz, 2019) and foreign language (Aktaş, 2022; Konokman & Yelken 2014). Therefore, variables have an effect on teachers' digital competences. In this context, addressing the digital competences of teachers on these variables in an up-to-date way will give an idea to understand the current situation of teachers' digital competences. Based on statistical information and differences in the literature, these variables (gender, age, school of service and foreign language) are considered important in terms of determining teachers' digital competences to be able to evaluate and develop the same in an up-to-date manner. Therefore, the effect of the variables determined in this study on teacher digital competence is observed.

Study Problems

1. Do teachers' digital competencies differ according to their gender?
2. Do teachers' digital competencies differ according to their age groups?
3. Do teachers' digital competencies differ according to their school of service?
4. Do teachers' digital competencies differ according to their level of any foreign language?
5. What is the level of teachers' digital competencies?

METHOD

Research Model

In this study, cross-sectional survey model was used as one of the study survey types. According to Buyukozturk et al. (2018), this model aims to capture the participants' general perspectives and characteristics on a particular issue or event, together with variables covering various skills, behaviours and attitudes. A cross-sectional survey model was used to collect information on different variables at a given time. In this study, it was desired to determine how teachers' digital competencies are in the current situation in terms of different variables. This method was chosen because the data is collected and analyzed in a single time and it is cost-effective.

Participants

The convenience sampling method was used in this study. The study group consists of teachers working in the city center, district center, and village schools of Amasya in the academic year 2020-2021. A total of 695 teachers participated in the study, with 352 being female and 343 being male. When analyzed according to school type and subject area, there were 181 primary school teachers, 280 high school teachers, 192 secondary school teachers, and 42 teachers from other educational institutions. The classroom teaching branch had the highest participation, with 160 individuals. Among other subject areas, 73 teachers from information technologies, 59 from religious studies, 63 from science, 31 from music and painting, 53 from mathematics, 37 from vocational high schools, 49 from social studies, 62 from Turkish, and 63 from foreign languages participated. In addition, 45 individuals participated from other unclassified fields. The information illustrating the distribution of teachers in the study according to gender and age groups is given in Table 1.

Table 1. *Distribution of Participants according to Their Gender and Age Groups*

	Gender		
Age Group	**Female**	**Male**	**Total**
21-40 years old (Generation Y)	244	137	381
41-55 years old (Generation X)	104	176	280
56-74 years old (Generation Baby Boomers)	4	30	34
Total	352	343	695

Data Collection Tool

Teacher Digital Competence Scale: It is a scale oriented toward detecting the digital competences of teachers. The scale consisted of 6 factors and 46 items as follows: "Safety", "Data Literacy", "Problem Solving", "Digital Content Production", "Communication and Cooperation", and "Ethical." Additionally, the options of the five-point Likert-type scale are "1-Strongly Disagree", "2-Disagree", "3-Neutral", "4-Agree" and "5-Strongly Agree". In the study in which the total variance value was declared as 71.967%, the reliability coefficients of the factors were "Security" α=.95, "Data Literacy" α=.91, "Problem Solving" α=.94, "Digital Content Production" α=.93, "Communication and Cooperation" α =.95, and "Ethical" as α=.90 (Gümüş & Kukul, 2022). The information regarding the internal consistency coefficients of the Teacher Digital Competence Scale is given in Table 2.

Table 2. *Internal Consistency of the Teacher Digital Competence Scale*

Factors	**Number of Items**	**α**
Safety	10	.95
Data Literacy	9	.91
Problem Solving	9	.94
Digital Content Production	6	.93
Communication and Cooperation	7	.95
Ethical	5	.90
Total	46	.97

Data Collection Process

In this study, the digital competence scale prepared for teachers was created and filled by teachers online. Necessary permits were received from the Directorate of National Education to start the data collection process from teachers working in primary, secondary, and high school institutions in Amasya in affiliation with the Ministry of National Education in 2019-2020, and the study was applied to the teachers between the planned dates. The data obtained after the application were organized and analyzed to examine the digital competences of teachers according to different variables.

Data Analysis

The data obtained from the Teacher Digital Competence Scale were analyzed using the SPSS program. Descriptive interpretations were made on the scores of the teachers from the digital competence scale. With the provision of parametric conditions, an independent sample t-test was used to examine whether there is any difference within one dependent variable or between two variables (Taspinar, 2017). Again, one-way ANOVA was used to compare the means obtained from independent groups or at least three independent variables of the dependent variable (Taspinar, 2017). On the other hand, the normality test was applied before the analysis to perform the t-test and ANOVA tests. In the normality tests, Shapiro-Wilks test results are taken if the sample size is lower than 50, and Kolmogorov-Smirnow test results if the sample size is greater than 50 (Taspinar, 2017). In this study, the Kolmogorov-Smirnow test was used as the sample size was greater than 50. In the analyses, since 45 data, which were determined as outliers, violated the normality distribution, the data obtained from these participants were excluded from the data set and 695 data were finally analysed. In addition, when the values of the Teacher Digital Competence Scale were examined, it was seen that it showed a normal distribution, but it did not show a normal distribution when examined in terms of factors. Therefore, skewness and kurtosis values were examined for the factors that did not exhibit a normal distribution. Since the skewness and kurtosis coefficients in the examined values were between +1 and -1, it was observed that there was no significant deviation, and it was concluded that the normal distribution can be assumed (Buyukozturk et. al., 2019). In addition, Levene test was applied in ANOVA tests and Tukey test was used when variances were homogeneous (p>.05). Dunnett T3 test was used in cases where the variances were not homogeneous (p<.05). Statistical data required for the normality test analysis results are given in Table 3.

Table 3. *Descriptive statistics of Normality Test Analysis Results*

			Kolmogorov-Smirnov	
Scale	**N**	**P**	**Skewness**	**Kurtosis**
Teacher Digital Competence Scale	695	0.169	-0.018	-0.386
Safety	695	0.000	-0.423	0.076
Data Literacy	695	0.000	-0.719	1.031
Communication and Cooperation	695	0.000	-0.405	0.300
Ethical	695	0.000	-1.148	2.680
Digital Content Production	695	0.000	0.128	-0.438
Problem Solving	695	0.000	-0.277	0.054

FINDINGS

Analyses were made using the data collected from the teachers and the independent sample t-test and ANOVA test for study problems. The results of these analyses are explained below.

Examination of Teacher Digital Competence Scale Scores According to Gender

The relationship between the data obtained from the Teacher Digital Competence Scale and the gender of the teacher group participating in the study was analyzed using the independent sample t-test. The analyzed data are given in Table 4.

Table 4. *t-test Results of Teacher Digital Competence Scale Scores According to Gender*

Scale	Gender	N	$\bar{X}$	Sd	t	p
Teacher Digital Competence Scale	Female	352	3.7047	.60855	.678	.498
	Male	343	3.7374	.66511		

Safety Factor	Female	352	3.6091	.79870	.008	.993
	Male	343	3.6096	.87161		
Data Literacy Factor	Female	352	4.0461	.65333	.493	.622
	Male	343	4.0706	.65782		
Communication and Cooperation Factor	Female	352	3.8941	.69181	.080	.936
	Male	343	3.8984	.71830		
Ethical Factor	Female	352	4.3585	.59436	1.442	.150
	Male	343	4.2904	.65095		
Digital Content Production Factor	Female	352	2.9238	.92601	2.999	.003
	Male	343	3.1429	.99959		
Problem Solving Factor	Female	352	3.4795	.78697	.494	.621
	Male	343	3.5102	.85111		

When the digital competences of the teachers are examined in terms of gender, the mean of male teachers ($\bar{X}$=3.7374) is higher, although not greatly, compared with female pre-service teachers ($\bar{X}$=3.7047). An independent sample t-test was performed to determine whether this difference was significant or not. Accordingly, while no significant difference was observed between male and female teachers in the scores of the whole scale, a significant difference was observed between the genders in the digital content production factor, except for other factors, when evaluated in terms of sub-factors (Teacher Digital Competence Scale: $t(693) = 0.678$; $p>.05$, Safety Factor: $t(693) = 0.008$; $p>.05$, Data Literacy Factor: $t(693) = 0.493$; $p>.05$, Communication and Cooperation Factor: $t(693) = 0.080$; $p>.05$, Ethical Factor: $t(693) = 1.442$; $p>.05$, Digital Content Production Factor: $t(693) =2.999$;$p<.05$, Problem Solving Factor: $t(693) =0.494$;$p>.05$).

Examination of Teacher Digital Competence Scale Scores According to Age Groups

The data collected for age in the Teacher Digital Competence Scale are grouped as follows: Generation Y for the age group 21-40; Generation X for the age group 41-55, and Baby Boomers Generation for the age group 56-74. The relationship between the age groups of the teacher group participating in the study was analyzed using the One-Way ANOVA test with such arrangements. The analyzed data are given in Table 5.

Table 5. *Descriptive Statistics of Teacher Digital Competence Scale Scores According to Age Groups*

Scale	Age Group	N	$\bar{X}$	Sd
	A. 21-40 years old	381	3.8369	.61078
Teacher Digital Competence Scale	B. 41-55 years old	280	3.6096	.63208
	C. 56-74 years old	34	3.3363	.66544
	Total	695	3.7208	.63684
	A. 21-40 years old	381	3.7496	.80350
Safety Factor	B. 41-55 years old	280	3.4757	.83601
	C. 56-74 years old	34	3.1382	.84136
	Total	695	3.6094	.83487
	A. 21-40 years old	381	4.1939	.56138
Data LiteracyFactor	B. 41-55 years old	280	3.9183	.70438
	C. 56-74 years old	34	3.6895	.82777
	Total	695	4.0582	.65519
	A. 21-40 years old	381	4.0015	.65972
Communication and Cooperation Factor	B. 41-55 years old	280	3.8031	.72207

	C. 56-74 years old	34	3.4832	.80044
	Total	695	3.8962	.70450
Ethical Factor	A. 21-40 years old	381	3.1181	.98448
	B. 41-55 years old	280	2.9393	.95105
	C. 56-74 years old	34	2.8284	.84833
	Total	695	3.0319	.96856
Digital Content Production Factor	A. 21-40 years old	381	3.6360	.79741
	B. 41-55 years old	280	3.3536	.82275
	C. 56-74 years old	34	3.0719	.68596
	Total	695	3.4946	.81880
Problem Solving Factor	A. 21-40 years old	381	4.3622	.56777
	B. 41-55 years old	280	4.3164	.63946
	C. 56-74 years old	34	3.9765	.92869
	Total	695	4.3249	.62341

According to the results of the analysis, when the digital competences of teachers are individually examined according to the safety factor, data literacy factor, communication and cooperation factor, ethical factor, digital content production factor, and problem-solving factor, it is seen that the age range 21-40, which is classified as the Generation Y, has the highest mean scores (Digital Competence Scale for Teacher: $\bar{X}$=3.8369, Safety Factor: $\bar{X}$=3.7496, Data Literacy Factor: $\bar{X}$=4.1939, Communication and Cooperation Factor: $\bar{X}$=4.0015, Ethical Factor: $\bar{X}$=3.1181, Digital Content Production Factor: $\bar{X}$=3.6360, Problem Solving Factor: $\bar{X}$=4.3622). On examination in Table 6, teachers' digital competence scores differ according to their age groups. A one-way ANOVA test was applied to examine the significance of these differences. The test results are given in Table 6.

Table 6. *ANOVA Results of Teacher Digital Competence Scale Scores According to Age Groups*

Scale	Source of Variance	Sum of Squares	sd	Mean of Squares	F	p	Significant Difference
Teacher Digital Competence Scale	Intergroup	13.620	2	6.810	17.594	.000	A-B, A-C
	Intragroup	267.843	692	.387			
	Total	281.462	694				
Safety Factor	Intergroup	20.042	2	10.021	14.955	.000	A-B, A-C
	Intragroup	463.688	692	.670			
	Total	483.729	694				
Data Literacy Factor	Intergroup	17.124	2	8.562	21.101	.000	A-B, A-C
	Intragroup	280.794	692	.406			
	Total	297.918	694				
Communication and Cooperation Factor	Intergroup	12.453	2	6.227	12.978	.000	A-B, A-C
	Intragroup	331.997	692	.480			
	Total	344.450	694				
Digital Content Production	Intergroup	6.641	2	3.320	3.566	.029	A-B, A-C

Factor	Intragroup	644.402	692	.931			
	Total	651.043	694				
Problem Solving Factor	Intergroup	19.267	2	9.633	14.946	.000	A-B, A-C
	Intragroup	446.019	692	.645			
	Total	465.286	694				
	Intergroup	4.678	2	2.339	6.107	.002	None
Ethical Factor	Intragroup	265.041	692	.383			
	Total	269.719	694				

On examination in Table 6, it was observed that the teachers' digital competence scale and factors differed according to age groups. In other words, the teacher digital competence scale and its factors exhibited a significant difference in terms of age groups (Teacher Digital Competence Scale: $F(2.692) = 17.594$; $p<.05$, Reliability Factor: $F(2.692) = 14.955$; $p<.05$, Data Literacy Factor: $F(2.692) = 21.101$; $p<.05$, Communication and Cooperation Factor: $F(2.692) = 12.978$; $p<.05$, Digital Content Production Factor: $F(2.692) = 3.566$; $p<.05$, Problem Solving Factor: $F(2.692) = 14.946$; $p<.05$, Ethical Factor: $F(2.692) = 6.107$; $p<.05$). As the teacher digital competence scale and factors exhibited a significant difference in terms of age groups, the Post Hoc Analysis was applied. Dunnett T3 test was used because the variances of data literacy and ethical factors were not homogeneous ($p<.05$) according to the analysis results. According to the Dunnett T3 test results, there was a significant difference in favor of the age group 21-40 in the data literacy factor between the ages of 21-40 and 41-55, and between the ages of 21-40 and 56-74, but no significant difference was observed in the ethical factor. On the other hand, the Tukey test analysis was conducted since the variances of the scales and factors were homogeneous except for these two factors ($p>.05$). According to the results of the Tukey test, a significant difference is observed between the ages of 21-40 and 41-55, and between the ages of 21-40 and 56-74, in favor of the ages 21-40, in factors other than data literacy and ethical factors in the teacher digital competence scale.

Examination of Teacher Digital Competence Scale Scores According to School Type

The relationship between the school types of the teacher group participating in the study for the Teacher Digital Competence Scale was analyzed using the one-way ANOVA test. The analyzed data are given in Table 7.

Table 7. *Descriptive Statistics of Teacher Digital Competence Scale Scores According to School Types*

Scale	**School Type**	**N**	$\bar{X}$	**Sd**
Teacher Digital Competence Scale	A. Other Educational Institutions	42	3.8157	.55893
	B. Primary School	181	3.6875	.56534
	C. High School	280	3.6401	.68197
	D. Secondary School	192	3.8493	.62994
	Total	695	3.7208	.63684
Safety Factor	A. Other Educational Institutions	42	3.6952	.77898
	B. Primary School	181	3.6044	.71646
	C. High School	280	3.4779	.91797
	D. Secondary School	192	3.7870	.79309
	Total	695	3.6094	.83487
Data LiteracyFactor	A. Other Educational Institutions	42	4.1852	.55673
	B. Primary School	181	4.0068	.69024
	C. High School	280	4.0095	.67524

	D. Secondary School	192	4.1499	.60022
	Total	695	4.0582	.65519
Communication and Cooperation Factor	A. Other Educational Institutions	42	3.9592	.63676
	B. Primary School	181	3.9013	.64512
	C. High School	280	3.8311	.74234
	D. Secondary School	192	3.9725	.71150
	Total	695	3.8962	.70450
Digital Content Production Factor	A. Other Educational Institutions	42	3.0159	.79190
	B. Primary School	181	2.9346	.89780
	C. High School	280	2.9899	1.02905
	D. Secondary School	192	3.1884	.96505
	Total	695	3.0319	.96856
Problem Solving Factor	A. Other Educational Institutions	42	3.6587	.81220
	B. Primary School	181	3.4647	.71879
	C. High School	280	3.3889	.86798
	D. Secondary School	192	3.6412	.81380
	Total	695	3.4946	.81880
Ethical Factor	A. Other Educational Institutions	42	4.4333	.47558
	B. Primary School	181	4.2840	.61103
	C. High School	280	4.2643	.69293
	D. Secondary School	192	4.4281	.53860
	Total	695	4.3249	.62341

According to the analysis results, on the examination of the digital competences of teachers according to school types, the Secondary School type is seen to have the highest mean score (Teacher Digital Competence Scale: $\bar{X}$=3.8493). On examination in Table 7, the digital competence scores of teachers differ according to school types. A one-way ANOVA test was applied to examine the significance of these differences. The test results are given in Table 8.

Table 8. *ANOVA Results of Teacher Digital Competence Scale Scores According to School Types*

Scale	Source of Variance	Sum of Squares	sd	Mean of Squares	F	p	Significant Difference
Teacher Digital Competence Scale	Intergroup	5.575	3	1.858	4.654	.003	D-C
	Intragroup	275.888	691	.399			
	Total	281.462	694				
Safety Factor	Intergroup	11.214	3	3.738	5.466	.001	D-C
	Intragroup	472.516	691	.684			
	Total	483.729	694				
Data Literacy Factor	Intergroup	3.434	3	1.145	2.686	.046	None
	Intragroup	294.484	691	.426			
	Total	297.918	694				
Communication	Intergroup	2.474	3	.825	1.666	.173	None
	Intragroup	341.976	691	.495			

and Cooperation Factor	Total	344.450	694				
	Intergroup	6.919	3	2.306	2.474	.061	D-C
Digital Content Production Factor	Intragroup	644.124	691	.932			
	Total	651.043	694				
	Intergroup	8.549	3	2.850	4.311	.005	D-C
Problem SolvingFactor	Intragroup	456.737	691	.661			
	Total	465.286	694				
	Intergroup	3.872	3	1.291	3.354	.019	D-C
Ethical Factor	Intragroup	265.848	691	.385			
	Total	269.719	694				

On examination of Table 8 it was observed that the Teacher Digital Competence Scale differed according to school types. In other words, the teacher digital competence scale exhibited a significant difference in terms of school types (Teacher Digital Competence Scale: F (3.694) = 4.654; p<.05). As the Teacher Digital Competence Scale exhibited a significant difference in terms of school types, the Post Hoc Analysis was applied. Since the variance value was homogeneous according to the analysis results (p>.05), a Tukey test analysis was performed. According to the results of the Tukey test, a significant difference in favor of Secondary School was observed between the Secondary School type and the High School type for the Teacher Digital Competence Scale.

On the other hand, on examination in terms of factors, it was observed that there was no significant difference between the Digital Content Production and Communication and Cooperation factors, whereas the safety factor differed according to the school type. In other words, the safety factor did not exhibit any significant difference in terms of school types (Safety Factor: F (3.694) = 5.466; p<.05).

It was observed that the ethical factors differed in terms of school types. In other words, the ethical factor also exhibited a significant difference in terms of school types (Ethical Factor: F (3.694) = 3.354; p<.05). As the Safety Factor and Ethical Factor exhibited a significant difference in terms of school types, the Post Hoc Analysis was applied. Since the variance values were homogeneous in both factors according to the analysis results (p>.05), a Tukey test analysis was performed. According to the results of the Tukey test, a significant difference in favor of Secondary School was observed between the Secondary School type and the High School type for the Safety Factor and Ethical Factor.

It was observed that the Data Literacy factor differed in terms of school types. In other words, the data literacy factor exhibited a significant difference in terms of school type (Data Literacy Factor: F (3.694) = 2.686; p<.05). It was also observed that the Problem-Solving factor differed in terms of school types. In other words, the problem-solving factor also exhibited a significant difference in terms of school type (Problem Solving Factor: F (3.694) = 4.311; p<.05). As the Data Literacy and Problem-Solving factors exhibited a significant difference in terms of school types, the Post Hoc Analysis was applied. Since the variance values were not homogeneous in both factors according to the analysis results (p<.05), a Dunnett T3 test analysis was performed. According to the results of the Dunnett T3 test, a significant difference in favor of Secondary School was observed between the Secondary School type and the High School type for the Data Literacy Factor and Problem-Solving Factor.

Examination of Teacher Digital Competence Scale Scores According to Foreign Language Levels

The relationship between the foreign language levels of the teacher group participating in the study for the Teacher Digital Competence Scale was analyzed using the One-Way ANOVA test. The analyzed data are given in Table 9.

Table 9. *Descriptive Statistics of Teacher Digital Competence Scale Scores According to Foreign Language Levels*

Scale	Foreign Language Levels	N	$\bar{X}$	Sd
Teacher Digital Competence Scale	A. Beginner	188	3.6851	.63432
	B. I do not know	183	3.6201	.61168
	C. Intermediate	223	3.7670	.66501
	D. Advanced	101	3.8678	.59324
	Total	695	3.7208	.63684
Safety Factor	A. Beginner	188	3.5665	.85674
	B. I do not know	183	3.5448	.84760
	C. Intermediate	223	3.6422	.84252
	D. Advanced	101	3.7337	.74314
	Total	695	3.6094	.83487
Data LiteracyFactor	A. Beginner	188	4.0343	.67082
	B. I do not know	183	3.9872	.63180
	C. Intermediate	223	4.0369	.68613
	D. Advanced	101	4.2783	.55302
	Total	695	4.0582	.65519
Communication and Cooperation Factor	A. Beginner	188	3.8442	.71218
	B. I do not know	183	3.7744	.70961
	C. Intermediate	223	3.9814	.71372
	D. Advanced	101	4.0255	.61921
	Total	695	3.8962	.70450
Digital Content Production Factor	A. Beginner	188	3.0053	.94515
	B. I do not know	183	2.8443	.94743
	C. Intermediate	223	3.1196	.98266
	D. Advanced	101	3.2277	.97003
	Total	695	3.0319	.96856
Problem Solving Factor	A. Beginner	188	3.4462	.80677
	B. I do not know	183	3.3254	.79674
	C. Intermediate	223	3.5934	.84449
	D. Advanced	101	3.6733	.76575
	Total	695	3.4946	.81880
Ethical Factor	A. Beginner	188	4.3170	.63745
	B. I do not know	183	4.3552	.56253
	C. Intermediate	223	4.3202	.64758
	D. Advanced	101	4.2950	.65397
	Total	695	4.3249	.62341

According to the analysis results, on the examination of the digital competences of teachers according to foreign language levels, the Advanced group is seen to have the highest mean score (Teacher Digital Competence Scale: $\bar{X}$=3.8678). On examination in Table 9, the digital competence scores of teachers differ according to foreign language levels. A one-way ANOVA test was applied to examine the significance of these differences. The test results are given in Table 10.

Table 10. *ANOVA Results of Teacher Digital Competence Scale Scores According to Foreign Language Levels*

Scale	Source of Variance	Sum of Squares	sd	Mean of Squares	F	p	Significant Difference
Teacher Digital Competence Scale	Intergroup	4.755	3	1.585	3.958	.008	D-B
	Intragroup	276.708	691	.400			
	Total	281.462	694				
Safety Factor	Intergroup	2.908	3	.969	1.393	.244	None
	Intragroup	480.821	691	.696			
	Total	483.729	694				
Data LiteracyFactor	Intergroup	6.024	3	2.008	4.754	.003	D-A, D-B, D-C
	Intragroup	291.894	691	.422			
	Total	297.918	694				
Communication and Cooperation Factor	Intergroup	6.530	3	2.177	4.451	.004	C-B, D-B
	Intragroup	337.920	691	.489			
	Total	344.450	694				
Digital Content Production Factor	Intergroup	12.163	3	4.054	4.385	.005	C-B, D-B
	Intragroup	638.880	691	.925			
	Total	651.043	694				
Problem Solving Factor	Intergroup	11.079	3	3.693	5.618	.001	C-B, D-B
	Intragroup	454.207	691	.657			
	Total	465.286	694				
Ethical Factor	Intergroup	.275	3	.092	.235	.872	None
	Intragroup	269.445	691	.390			
	Total	269.719	694				

On examination of Table 10, it was observed that the Teacher Digital Competence Scale differed according to the foreign language levels. In other words, the teacher digital competence scale exhibited a significant difference in terms of foreign language levels (Teacher Digital Competence Scale: $F_{(3.694)} = 3.958$; $p<.05$). As the Teacher Digital Competence Scale exhibited a significant difference in terms of foreign language levels, the Post Hoc Analysis was applied. Since the variance value was homogeneous according to the analysis results ($p>.05$), Tukey analysis was performed. According to the results of the Tukey test, a significant difference in favor of the Advanced level was observed between those with an Advanced level and those not speaking any foreign languages for the Teacher

Digital Competence Scale.

On examination in terms of factors, it was observed that there was a difference in terms of foreign language levels in the factors other than the safety and ethical factors. In other words, all factors except the safety and ethical factors exhibited a significant difference in terms of foreign language levels (Safety Factor: F (3.694) = 1.393; p>.05; Data Literacy Factor: F (3.694) = 4.754; p<.05; Communication and Cooperation Factor: F (3.694) = 4.451; p<.05; Digital Content Production Factor: F (3.694) = 4.385; p<.05; Problem Solving Factor: F (3.694) = 5.618; p>.05; Ethical Factor: F (3.694) = 0.235; p>.05). As the factors exhibited a significant difference in terms of foreign language levels, the Post Hoc Analysis was applied. Since the variance value was homogeneous according to the analysis results (p>.05), Factors Tukey analysis was performed for all factors. According to the results of the Tukey test, a significant difference in favor of Advanced level was observed between Advanced, Beginner, I do not know, and Intermediate for the Data Literacy Factor. For Problem Solving, Communication and Cooperation, and Digital Content Production factors, a significant difference was observed between Intermediate and I do not know, and Advanced and I do not know, in favor of Advanced and Intermediate. No significant difference was observed in the Safety and ethical factors.

Examination of the Digital Competences of Teachers

A descriptive analysis was performed regarding the digital competences of the teacher group participating in the study with the data obtained from the Teacher Digital Competence Scale. The analyzed data are given in Table 11.

Table 11. *Descriptive Results of the Teacher Digital Competence Scale Scores*

Scale	N	Min.	Max.	$\bar{X}$	Sd
Teacher Digital Competence Scale Scores	695	2.00	5.00	3.7208	.63684
Safety Factor	695	1.00	5.00	3.6094	.83487
Data Literacy Factor	695	1.67	5.00	4.0582	.65519
Communication and Cooperation Factor	695	1.00	5.00	3.8962	.70450
Ethical Factor	695	1.00	5.00	4.3249	.62341
Digital Content Production Factor	695	1.00	5.00	3.0319	.96856
Problem Solving Factor	695	1.00	5.00	3.4946	.81880

On examination of Table 11, the Teacher Digital Competence Scale score consists of the lowest 2 points and the highest 5 points. Looking at the general average ($\bar{X}$=3.7208), it is seen that the digital competence levels of the teachers are at an intermediate level. On the other hand, when the digital competence levels of teachers are examined in terms of factors, it is seen that the security factor consists of the lowest 1 point and the highest 5 points, and the security factor mean score is close to, but lower than, the general mean score ($\bar{X}$=3.6094). It is seen that while the data literacy factor mean score consists of the lowest 1 point and the highest 5 points, the data literacy factor mean score is higher than the general mean score ($\bar{X}$=4.0582). It is seen that the communication and cooperation factor consists of the lowest 1 and the highest 5 points, and the communication and cooperation factor mean score is close to, but higher than, the general mean score ($\bar{X}$=3.6094). It is seen that while the ethical factor mean score consists of the lowest 1 point and the highest 5 points, the ethical factor mean score is higher than the general mean score ($\bar{X}$=4.3249). It is seen that the digital content production factor consists of the lowest 1 and the highest 5 points, and the digital content production factor mean score is close to, but lower than, the general mean score ($\bar{X}$=3.0319). It is seen that the problem-solving factor consists of the lowest 1 and the highest 5 points, and the problem-solving factor mean score is close to, but lower than, the general mean score ($\bar{X}$=3.4946).

DISCUSSION

In this study, it was aimed to reveal teacher digital competence profiles by examining teachers' digital competences in terms of different variables. In this direction, 695 teachers participated in the study, and analyses were made using the Teacher Digital Competence Scale (2021) developed by Gumus. In the study, digital competences were examined with a total of 4 different variables, including gender, age ranges, school type, and foreign language levels, and the results were reported.

On the examination of the results of the study, it was determined that 49.4% of the teachers participating in the study were male and 50.6% were female. When the digital competences of the teachers were examined in terms of gender, no statistical difference was observed between female and male teachers, although the average scores of male teachers were higher. However, when evaluated in terms of sub-dimensions, it was observed that male teachers had higher scores on the digital content production than female teachers. When the literature on this subject is examined, it is seen that the results obtained in the study exhibit similarities and differences between the results obtained in the study and other studies. Kayhan (2022) found that the level of educational technology use of male teachers was higher than that of female teachers. Cebi and Reisoglu (2020) determined in their study that there were significant differences in favor of male pre-service teachers in the sub-dimensions of information and data literacy, digital content production, security, and problem-solving. In a different study, Keskin and Yazar (2015) observed that male teachers had higher competences in the sub-dimensions of computer use, digital media use, and data acquisition of teachers. On the other hand, in a different study by Esteve-Mon, Angeles Liopis, and Adell-Segura (2020), it was seen that male teachers had higher levels of competence in issues such as solving technical problems and programming. Furthermore, in two studies conducted by Martin, Gonzales, and Penalvo (2020) as well as Gamez, Fernandez, Agapito, and Ortiz (2020), the digital competences of male pre-service teachers were observed at a higher level than female pre-service teachers. However, unlike other studies, Durak and Tekin (2020) observed that the skills of female teachers were higher than male teachers in their study, which examined the lifelong learning competences of teachers, including digital competences, personally and professionally. Generally, the higher digital competences of male teachers may be because male teachers spent more time in digital environments, are more interested than women, or have a higher computer and internet usage rate than women (TUİK, 2019).

When the digital competences of the teachers were examined in terms of age groups, it was observed that the average scores of the teachers in the age range 21-40, who are defined as Generation Y in the study, were higher than the other age groups, and significant differences were observed between the ages of 21-40 and 41-55, and between the ages of 21-40 and 56-74, in favor of the ages 21-40, in all dimensions other than ethical factor and the overall scale. On the other hand, it was observed that the competence scores of the teachers decreased as the age of the teachers increased. When the literature on this subject is examined, it is seen that the results obtained in the study exhibit similarities between the results obtained in the study and other studies. In the study by Durak and Tekin (2020), in which they examined the lifelong learning competences of teachers, no difference was observed between the ages and competence scores of the teachers, whereas the level of competence was observed to decrease as the age of the teachers increased. This may be due to the characteristics of the generations. Considering that the new generation grows in the age of technology, the fact that they interact more with technology may account for the higher digital competences of young teachers. Additionally, the computer courses that teachers took during their education may also affect the digital competences of teachers based on the basis of age.

A significant difference was found between secondary schools and high schools in favor of secondary school, except for scale-wide and digital content production and communication and cooperation factor according to the type of school the teachers work in. The fact that the digital competences of the teachers working in high schools are lower than those of secondary school teachers may be because teachers in high schools have a lower level of lifelong learning tendencies and therefore show less curiosity and interest in learning new digital skills than secondary school teachers (Ayaz, 2016).

When the digital competences of the teachers were examined according to the foreign language levels of the teachers, although the mean scores of the teachers who speak foreign languages were observed higher, no difference was observed in terms of the status of knowing a foreign language. This may be due to the availability of translation opportunities in digital media. Additionally, it may be because the videos, which serve as user guides prepared for the use of a tool or the use of any digital environment, do not require a different skill to learn in the digital sense. On the other hand, when the digital competences of the teachers were examined in terms of their level of foreign language competence, the digital competence scores of the teachers with advanced language knowledge were observed to be higher, and the digital competence scores of the teachers with advanced foreign language knowledge were higher than the teachers who did not know a foreign language. Additionally, it was observed that teachers with an intermediate level of foreign language had a higher level of digital competence than teachers who did not know a foreign language. This may be because as the level of foreign language knowledge increases, the information about the content in the digital environment or in the tools can be better understood. When the literature on this subject is examined, it is seen that the results obtained in the study exhibit similarities between the results obtained in the study and other studies. Instefjord and Munthe (2017) stated that teachers' knowledge of a foreign language provides an advantage in many areas for the skills such as problem-solving, communication and cooperation, and critical thinking of both themselves and their students. This may also be because the English language is universal and knowledge of a foreign language helps get to know different tools or environments more easily.

Generally, when the digital competence status of the teachers was examined, it was seen that the digital competence levels of the teachers were at an intermediate level. It was observed that the highest values were the competences in the ethical factor, while the lowest values were the competences in the digital content production factor. When the literature on this subject is examined, it is seen that the results obtained in the study exhibit similarities and differences between the results obtained in the study and other studies. Dias-Trindade and Moreira (2020) determined in their study that the digital competence levels of the teachers were at an intermediate level. In this study, it was observed that teachers' pedagogical competences and students' competence factors had low values, whereas the professional competences of educators factor had the highest value. Napal Fraile et al. (2018) observed that the digital competence levels of pre-service teachers were low. In this direction, it was observed that the competences of the pre-service teachers were at the lowest level in content production and problem-solving factors. Cebi and Reisoglu (2020) determined in their study that the digital competences of the pre-service teachers were at an intermediate level, while their skills in content development, digital media use, and technical problem-solving skills were at a lower level, and their skills in information and data literacy, communication and cooperation, and security was at a higher level. Esteve Mon et al. (2020), on the other hand, determined that pre-service teachers perceived their digital competences in multimedia and communication and collaboration at a high level. On the other hand, Rokenes and Krumsik (2016), Instefjord and Munthe (2017), and Napal Fraile et al. (2018) observed that the content development skills of pre-service teachers were at very low levels in terms of digital competences and identified deficiencies in their digital competences. This may be due primarily to the low and medium levels of observation of teachers' digital skills in many studies and the inadequacy of the content of teachers' in-service courses (Cebi & Reisoglu, 2020; Ceylan & Gundogdu 2017; Dias-Trindade & Moreira, 2020; Gokmen, Akgul, & Kartal, 2014). On the other hand, it may be because teachers do not make an effort to improve their digital competence. Additionally, the low level of content production and problem-solving competences may be due to the lack of training received by teachers in these fields.

CONCLUSION

According to the data obtained with the Teacher Digital Competence Scale, the digital profiles of the teachers working in primary, secondary, and high schools in the 2020-2021 period desired was observed. The differences in the digital competences of the teachers according to the variables are summarized in Figure 1.

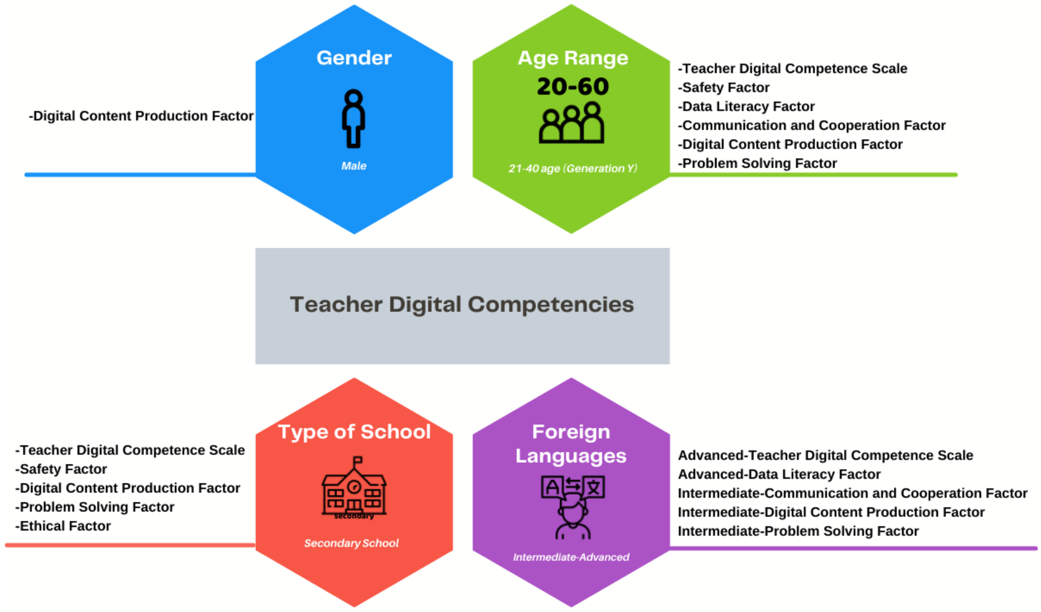

Figure 1. *The Effect of Variables on Digital Competence and Its Sub-Dimensions*

Accordingly, when examining the digital competences of the teachers based on gender, it was found that the digital competence scores of male teachers exceeded those of their female counterparts. With regards to the age range of the teachers, it was evident that the teachers belonging to Generation Y (aged 21-40) demonstrated higher digital competence compared to the more experienced teachers. Analyzing the types of schools where teachers were employed, it became apparent that the digital competence levels were higher in secondary schools compared to high schools. Additionally, an increase in foreign language proficiency corresponded to higher digital competence scores among teachers, particularly those with intermediate to advanced foreign language skills. Overall, the evaluation of the results indicated that the teachers' digital competences were at an intermediate level. This finding suggests that despite possessing moderate digital competences, the observed medium level is ultimately insufficient, considering the challenges faced during the pandemic period. Hence, teachers should strive to enhance their digital skills in this regard.

RECOMMENDATIONS

A country-wide digital competence profile can be created with study results covering different provinces. Therefore, in future studies, teacher digital competencies can be examined in different samples and in different locations, and a comparison can be made between the new data to be collected and the old data. Since the study is limited to only quantitative characteristics, it may be more effective to conduct mixed studies to evaluate the results of the digital competence of teachers in more detail. Making in-service courses more equipped so that teachers can develop their digital competences can bring the digital competences of teachers to a sufficient level. In this regard, the Ministry of National Education may get support from the departments of Information Technologies in universities and academicians working in these departments to improve the digital competences of teachers. It was observed that the digital competences of teachers decreased with an increase in their ages. Therefore, supportive activities can be organized for experienced teachers to increase their digital competences. The digital competences of female teachers can be supported by focusing on courses/in-service training on digital content production for female teachers. Foreign language education can be provided by building on problem-solving, communication and cooperation, and digital content production skills.

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A Study on the Situations Determining the Classroom Decisions of Preservice Teachers and the Criteria for Evaluating Their Decision

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ABSTRACT

This study aims to investigate the situations that determine the classroom decisions of preservice teachers and the criteria they use to evaluate their decisions during the teaching practice process. The study utilized a basic qualitative research model and employed the typical case sampling method to select the study group, consisting of ten pre-service teachers in their final year of primary education program. Data collection involved the use of reflective evaluation forms and unstructured interview forms. The pre-service teachers completed reflective evaluation forms after each implementation process for a ten-week period, and unstructured interviews based on the reflective evaluation forms were conducted with the participants in pairs every week. The analysis revealed that the situations of the candidates' classroom decisions can be analyzed under five themes: self-efficacy, students, environment, classroom management, and teaching. Furthermore, the criteria used by the candidates to evaluate their decisions can be analyzed under five themes: content knowledge, classroom management skills, student recognition, teaching-learning process, and monitoring and evaluation of learning. The findings suggest that teacher education programs should provide support to candidates to make effective decisions under the situations that are decisive on classroom decisions. Additionally, it is important to emphasize that candidates evaluate the decisions they make in the classroom on the basis of criteria that cover all components of the teaching-learning process.

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INTRODUCTION

The professional requirements of the teaching profession are considerably complex in nature. The principal reason for this is that the environment in which the teaching-learning process takes place is unstructured and dynamic (Leinhardt & Greeno, 1986). In the unpredictable situations that occur in this dynamic environment, teachers make hundreds of nontrivial decisions every day (Helleve et. al., 2021). Trevisan et. al. (2021) defined teaching as a complex endeavour that sometimes required making countless instantaneous decisions. It is important to state that the teacher's decision-making process takes place in the context of social environments grounded in continuous and complex human interactions (Blackley et. al., 2021). Decision making is a central aspect of teacher cognition (Borko & Shavelson, 1990). In this respect, understanding the nature of teachers' decision-making processes is a means of understanding their practices (Watson, 2019). Furthermore, decision making is a basic teaching skill since it is an integral part of a teacher's professional life (Shavelson, 1973). For this reason, decision making indicates one of the main goals of teacher education.

The classroom constantly thrusts the teacher into new decision-making situations. The decision-making situations that await the teacher in the classroom are related to the multifaceted issues required for effective teaching. Clough et. al. (2009) argued that teacher decisions had the greatest impact in the classroom as they were the ways in which students were cognitively and emotionally engaged in a lesson. The power that teachers' decisions have on the teaching-learning process has led many researchers to make studies on what supports teachers' effective decision-making (Lloyd, 2019; Loughran, 2019). One of the recent studies on this topic conducted by Blackley et. al. (2021) has provided evidence to support that teachers can change their decision-making habits through a reflective framework based on their classroom observations. The study has demonstrated that improving teachers' decision-making habits can be accomplished by increasing teachers' awareness by presenting them with the decisions they make and the circumstances that cause them to make those decisions.

On the one hand, research has revealed that it is critical for teachers to have a high awareness of what decisions the classroom expects them to make (Blackley et. al., 2021). On the other hand, Fullan (1996) made a thought-provoking explanation about teachers' awareness of decision-making, stating that teachers, unlike other professions, cannot simply articulate what they do professionally. This situation, which sounds quite trivial, actually raises a serious question mark about the adequacy of teacher education in developing awareness of the cognitive processes required for teaching. Besides, it is another important requirement for teachers to have self-awareness about the decisions they make. However, researchers state that teachers make decisions to a large extent unintentionally for various reasons, especially because of the complexity of the teaching process. In this regard, Olson et al. (2004) stated that teachers often tended to ignore and underestimate the behaviors that were the result of their decisions and the extent to which they affected their educational experience, although that was an important indicator of the quality of their professional life.

The influences determining teachers' decision-making of a preferred nature is another area of research within this scope. Research examining the decision-making processes of novice and expert teachers helps us to see the influences that determine teachers' decision-making. For instance, Calderhead (1983) argued that knowledge-rich schemas that allowed experienced teachers to represent the complexities of the classroom in meaningful ways were a decisive element for informed decisions made by experienced teachers. In a similar vein, Peterson and Comeaux (1987) reported that expert and novice teachers' schemas for classroom situations differed in terms of cognitive complexity. Borko and Livingston (1989) examined the planning and teaching processes of pre-service teachers and their mentor teachers. Based on their analysis, it was revealed that novice teachers had less detailed, less interconnected, and less accessible cognitive schemas. Another influence that determines teachers' decisions is claimed to be the emotions. There are studies showing the effects of positive and negative events and their related emotions on teachers' decisions about their daily activities and roles (Young, 2020). Previous studies indicate that teachers conceptualize the classroom as an emotional space and make decisions based on students' actual or predicted emotional reactions (Sheppard & Levy, 2019). The fact that teachers are informed decision-makers will make it possible for them to maximize the learning opportunities in the classroom. In this respect, finding consensual ways for teachers to become professional decision-makers should be one of the pivots of teacher education research.

From the perspective of cognitive psychology, it can be seen that a number of classifications have been made regarding decision-making processes. Decision-making is characterised as unconscious and intuitive processes (Type 1) or rational, conscious, deliberative processes (Type 2) (Evans & Stanovich, 2013). Recent studies on decision-making processes go beyond the Type 1 and Type 2 dichotomy and propose an algorithmic system for decision-making (Stanovich et. al., 2011). The algorithmic process is affected by social and cultural knowledge as well as learning and practical knowledge. Watson et al. (2018) stated that most of the decisions made in the classroom were based on the algorithmic processes. This finding clearly shows that teachers' personal experiences alone will not be sufficient for them to be aware of the complex situations that await them in the classroom or to be able to experience appropriate decision-making processes. In teacher education, theoretical knowledge plays a role in enabling preservice teachers to achieve such a competence. Theoretical content is expected to guide the teacher in analysing and solving the problems that he/she encounters in his/her professional life. However, there is a problematic relationship between theory and practice in performing this function (Korthagen, 2011). In this context, studies analyzing the causes of this problematic situation and discussing ways to overcome it are worth examining (Bayrak-Ozmutlu, 2022; Grossman et. al., 2009; Korthagen, 2011). The question of how theoretical content should be structured has a central place in a teacher education programme that will enable preservice teachers to become professional decision-makers.

Related Research Based on Decision Making in Teacher Education

The studies concentrate on various facets of teachers' decision-making processes. Some of these studies provide cognitive psychological frameworks for analyzing teachers' decision-making processes (Borko & Shavelson, 1990; Clough et. al., 2009). Some others, on the other hand, compare the decision-making processes of expert and novice teachers. In his study comparing expert and novice teachers, Westerman (1991) stated that expert teachers were able to approach learning from students' perspective, perform cognitive analysis of each learning task during planning, and adapt their knowledge to the needs of students during instruction. In stark contrast to this, it is argued that novice teachers are unable to accommodate themselves according to the needs of students during instruction. In addition to this, Peterson and Comeaux (1987) examined the differences between novice and experienced high school teachers in recalling and analyzing problematic events during interactive instruction. They stated that contrary to novice teachers, experienced teachers both recalled classroom events more and relied more on procedural knowledge and principles when analyzing classroom events. The researchers attributed the observed differences to the fact that experienced teachers had more developed schemas about classroom teaching than novice teachers. Borko and Livingston (1989) stated that the cognitive schemas of novice teachers were less detailed, less interconnected, and less accessible than those of the experts. He also claimed that novice teachers had less developed pedagogical reasoning skills. Calderhead (1983) discovered that teachers had qualitatively different types of knowledge about students. He found that inexperienced teachers had very little of such knowledge types and that the type of knowledge they acquired most quickly was general knowledge about specific children. Fogarty et. al. (1983) compared the differences between experienced and novice teachers on the basis of the criteria they used in classroom decisions-making. They found that experienced teachers exhibited more complex relationships based on their observations of students in the classroom. It was also found that experienced teachers practiced twice as many action types based on student observations and had a greater variety of targets compared to novices.

In the relevant literature, there are also studies focusing on the interactions between curricula (Siuty et. al., 2018), content categories (Klimczak et. al., 1995), and teachers' decision-making processes. Researchers found that the curriculum they developed within the scope of the research facilitated teachers' decision-making about individualizing teaching and increased their self-efficacy. Klimczak et. al. (1995) examined how content structure affected novice and experienced teachers' instructional strategy decisions. The results showed that both novice and experienced teachers modified their teaching strategies according to the content structure. It is also possible to include research that examines the personal reasons, beliefs, and dilemmas underlying teachers' decisions. Aikenhead (1984) examined the decisions-making process of science teachers while planning teaching. They stated that these decisions represented the final outcome of a conflict between a teacher's intention and their ideas about students. Similarly, research examining the thinking processes employed by teachers in making instructional decisions can be listed here. To exemplify, Perfecto (2012) scrutinized the thinking process of two teachers in making instructional decisions. The study highlighted the influences that constrained teachers' decisions and how they coped with these constraints. The findings revealed that teachers' decision-making process was iterative and cognitively demanding, as teachers needed to reconcile the stated requirements of the curriculum with the realities of the classroom. The study argued that teachers needed to accept the tentativeness of their plans in order to decide on alternative activities required by immediate situations in the classroom.

Rich and Hannafin (2008), on the other hand, explored the different decision-making and reasoning patterns of preservice teachers in depth. The study highlighted that when the preservice teachers focused on management or participation, their reasoning became more and more teacher-centered, whereas when they focused on instructional strategies, their reasoning became more and more student-centered. Moreover, the preservice teachers' pedagogical reasoning revealed their implicit beliefs and justifications for using certain teaching strategies. Recent research has examined teachers' decision-making processes in technology-rich contexts and on the basis of a wide network of factors. Trevisan et. al. (2021) have introduced two systematic approaches to the study of teachers' decision-making processes. The first is quantitative ethnography which recognizes specific disciplinary knowledge as the basis for teachers' frames of action. The second is epistemic network analysis, which is a method for analyzing epistemic frames by creating a network mode that measures how codes are connected in discourse (Oshima & Shaffer, 2021). Although qualitative research method is predominantly applied in decision-making processes, there are also studies in which quantitative research is adopted. For example, Griffith and Groulx (2014) aimed to understand teachers' beliefs and practices related to instructional decision-making with the Teacher Decision Making Profile Questionnaire. The results showed that most teachers, regardless of grade level or content area being taught, embraced student-centered beliefs.

Research Context

The aim of teacher education is to equip teachers with the necessary skills to fulfill the requirements of professional life. Considering the conditions of professional teaching life, it is possible to say that being equipped for professional life is synonymous with being a professional decision-maker. The two most basic conditions enabling a teacher to become a professional decision-maker are the ability to know the requirements of the teaching process in the classroom and to execute the knowledge and skills required for this in the classroom environment. In order to foster these two basic skills, teacher education should give preservice teachers the opportunity to analyse real classroom environments and work on fulfilling the requirements that point to them. What has been expressed in the literature makes us think about the content of teacher education programmes and how teaching methods should be taught (Korthagen, 2011; Zeichner, 2010). Relevant research clearly points out that in this field state that the academic studies that make up the content of university-based teacher education programmes are insufficient in terms of preparing prospective teachers for complex situations in the classroom. It is emphasised that academic studies should be synthesised as a meaningful whole in order for theoretical knowledge to play a functional role in preservice teachers' professional lives. In the light of what has been stated so far, it would not be wrong to suggest that focusing on candidates' decision-making processes rather than on isolated knowledge can be considered as a reasonable method in teacher education.

Theoretical knowledge does not always inform the teacher about what to do in every situation. It is the teacher who will make the most appropriate decisions by interpreting the conditions of the classroom. This reveals that teacher education should aim to improve the decision-making processes of the preservice teachers. Indeed, studies comparing novice teachers with experienced teachers in terms of decision-making processes show that novice teachers are unaware of many elements and tend to have less complex thinking (Westerman, 1991). These elements are thinking from the student's perspective, performing cognitive analysis of learning tasks, and adapting what they know to the student's needs. The extent to which scientific findings, which are regarded as separate constructs in current teacher education, guide the teacher candidate in fulfilling the complex requirements of the classroom is questionable. In fact, Westerman (1991) stated that what explains expertise in teaching was the interaction of knowledge rather than knowledge itself. In order for preservice teachers to establish interactions between knowledge, it is necessary to allow them to work in realistic contexts. This can be accomplished in a real classroom setting or through case-based activities. In every case, preservice teachers should be given the opportunity to analyse the decision-making situations that await them in the classroom and to utilise scientific knowledge in their decisions. At this point, decision-based teacher education emerges as an effective means to integrate theory and practice. Despite its importance, there is a limited number of specialised studies on preservice teachers' decision-making processes in teacher education.

This research can be regarded as a study that approaches teacher education on the basis of decision-making. The present study presents an examination of the situations that drive preservice teachers to make new decisions during the teaching practice and the criteria they use in evaluating the decisions they make. Undoubtedly, there is a long way to go in terms of integrating teacher education into a decision-based model. However, this study provides comprehensive information required for decision-based practices in teacher education programmes. The responses to the research questions of the present study provide guidance on decision-based practices in teacher education programs. It would be useful to examine this guidance information on the basis of the research questions. The first question of the present research aimed to reveal the influences that determined the decisions of preservice teachers during teaching practice. Such an approach clearly describes how the teaching process appears from the perspective of the preservice teacher. This description also reveals how complex is the decision-making process required for teaching. Furthermore, this view gives the opportunity to make significant inferences about how a teacher education programme should be planned that can fulfil the requirements of the classroom. Situations that drive preservice teachers to make decisions indicate challenging situations for candidates. These indicated points are open workspaces for teacher education. From this point on, the next step may be to develop prospective teachers' ability to make decisions based on realistic contexts and to justify their decisions on scientific grounds. The other research question was related to preservice teachers' criteria for evaluating their decisions. Prospective teachers' criteria for evaluating their decisions shed light on the complex thinking processes they acquired in relation to the teaching and learning process. The examination highlighted not only the areas that teacher candidates considered as evaluation criteria, but also those that they did not consider as evaluation criteria. The research findings also made it possible to examine whether preservice teachers' criteria for evaluating their decisions were focused on teaching or learning. Considering that teachers' transition from a teaching-oriented approach to a learning-oriented approach was regarded as an indicator of their development, the research findings revealed the current status of preservice teachers in this context. Specifically, answers to the following questions were sought in the study:

● What are the situations that determine the preservice teachers' decisions during teaching practice?

● What criteria do preservice teachers use in evaluating the decisions they make?

METHOD

This section depicts the research design, participants, research instruments and processes, ethical issues, data collection process, data analysis, and validity and reliability of the present study.

Research Design

The study was carried out with a basic qualitative research design in the qualitative research paradigm. The purpose of this design is to examine how people make sense of and interpret their lives and experiences (Merriam, 2009). In a basic qualitative research design, participants' experiences and the meanings they attribute to these experiences are the main focus (Worthington, 2013). In this study, the professional experiences of preservice teachers who had teaching experience in a real classroom context for the first time during the final year of their undergraduate education constituted the main data source. The study focused on how preservice teachers made sense of and interpreted their classroom experiences based on their decision-making processes. In this respect, it was decided that the research design was compatible with the research objectives.

Participants

The participants of the study were determined by the typical case sampling method. Typical cases are situations that contain information at a level that can explain the event or phenomenon that is generally examined among a large number of similar ones in the universe (Patton, 2014). This study aimed to examine the influences that determined the preservice teachers' decisions during the teaching practice and the criteria for evaluating their decisions. For research purposes, it was assumed that the experiences of the preservice teachers who were entitled to take the teaching practice course by fulfilling similar requirements in the same undergraduate program of a university could provide a typical view of the situations that determined the decisions of pre-service teachers. Participants also carried out their practicum in schools with similar characteristics in the same provincial center. Within this respect, it was decided that the data that the research aimed to reach could be obtained from the preservice teachers studying in the 4th grade of the elementary education program of the department of elementary education and actively attending the teaching practice course. Moreover, the typical case is used to express situations that have the ability to represent the universe and do not differ from the universe in terms of their basic characteristics (Marshall & Rossman, 2014). It was believed that the participants were suitable for typical case sampling in terms of having fulfilled the same program obligations and fulfilling their practicum in schools with similar characteristics in a program with similar expectations. In this respect, 10 preservice teachers (3 male and 7 female) who possessed these characteristics and expressed their willingness to participate in the research voluntarily were included in the study. The participants of the study were also groupmates doing practicum in five different classes in groups of two.

Research Instruments

A reflective evaluation form and an unstructured interview form were used in the data collection process. The data collection tools used in the study have been provided in the attachment. The data collection tool developed within the scope of the research was developed by the researcher herself. While the researcher was developing the data collection tool, a general evaluation was made in line with the purpose of the research and the possible results it aimed to achieve. Following this, other studies conducted in this context were examined in detail and the measurement tools used in similar studies were reviewed (Borko & Livingston, 1989; Borko & Shavelson, 1990; Calderhead, 1983; Clough et. al., 2009; Westerman, 1991). After the review, a pool of questions was created. Each question was evaluated on the basis of its capacity to obtain the information needed for the research questions. After these reviews and critical evaluations, the data collection tool was finalized in its initial form. Then, a pilot application of the draft data collection tool was conducted with a preservice teacher. After the pilot study, two academicians were consulted on the compatibility of the answers given to the data collection tool with the research question, the duration of the interview, and the comprehensibility of the questions. One of the experts is from the field of curriculum development in education and the other is from the field of primary education. After the revisions made in accordance with the feedback from the experts, the data collection tool was finalized. The data collection tool utilized in the study is shown in the appendix.

Data Collection Process

Within the scope of the study, the participants filled out a reflective evaluation form after the teaching practice every week for three months. Preservice teachers sent the completed forms to the researcher as a mail every week. 100 reflective evaluation forms were submitted to the researcher by ten participants for 10 weeks. During the research, weekly evaluation interviews were conducted with 5 groups, each consisting of 2 preservice teachers practicing in the same classroom. During the unstructured interviews with the participants, the reflective assessments submitted by the participants were discussed. In the interviews, it was aimed to reach more detailed explanations and sample situations regarding what was expressed in the form rather than obtaining new information. Ethical committee approval was granted by Ordu University Social Sciences and Humanities Research Ethics Committee for this study.

Data Analysis

The analysis of the research data was carried out on the basis of two main aspects. On the first aspect, an analysis was conducted on the influences that determined the decisions taken by the participants. On the second aspect, an analysis was made on the criteria used by the participants to evaluate the decisions they made.

In the analysis of the influences determining the preservice teachers' decisions, open coding was performed in the first step. In this process, the situations that were decisive on the participants' decisions were coded with in vivo code. The influences that had a decisive influence on preservice teachers' decisions were: (i) situations that leave them undecided, (ii) situations that make them question their decisions, and (iii) situations that push them to make new decisions. In this process, 144 in vivo coding was performed. After the open coding process was completed, the codes were classified under themes on the basis of the related topics. In this classification process, the didactic triangle was used, which provides a model of the units surrounding the teacher's professional life (Kansanen & Meri, 1999). This enabled us to make more meaningful interpretations and inferences about the situations that pushed the preservice teachers to make new decisions. Following this classification, the in vivo codes were categorized into five themes i.e., self-efficacy, student, classroom management, environment, and teaching which represented the common topics they were related to. Subsequent to this procedure, the constant comparison analysis method was employed for each theme separately on the in vivo codes. This allowed us to uncover different perspectives on common issues and to classify in vivo codes on this basis. Based on this analysis, subcategories related to the influences that were decisive on the pre-service teachers' decisions emerged.

In the analysis of the criteria used by the preservice teachers to evaluate their decisions, in order to determine the criteria used by the preservice teachers in evaluating their decisions, they were asked to explain the situations in which they judged themselves as powerful and helpless after the decision they made. It was assumed that the criteria used by the participants in evaluating these two contrasting situations would be similar so that a kind of verification of the criteria could be made in the two contrasting situations. In the first stage analysis, the situations in which the participants felt powerful were coded with in vivo code. After this coding process, 117 in vivo codes were generated. Then, the same process was used to code the situations in which the participants felt helpless after the decision they made. After this coding process, 85 in vivo codes were obtained. After the second stage analysis, each code was asked the question “Which criterion did the participants use to evaluate their decisions?” This analysis was carried out separately on the basis of the situations in which the participants felt themselves to be powerful and helpless. The analysis was carried out separately for both themes. Based on this analysis, the criteria used by the participants in evaluating the situation in which they felt powerful were classified under 14 categories, and the criteria used in evaluating the situation in which they felt helpless were classified under 12 categories. The categories obtained after the analysis were classified under five themes based on the related topics: content knowledge, classroom management skills, student recognition, teaching-learning process, and monitoring and evaluation of learning.

Validity and Reliability

In conducting this study, a number of validity and reliability requirements recommended for qualitative research studies were fulfilled. In qualitative research, the use of comprehensive data and the use of tables for recording data are expressed within the scope of reliability requirements (Thakur & Chetty, 2020). Within this framework, every document submitted by the preservice teachers in the study was recorded with a code name given to each participant. Besides, the important points in each interview process were recorded by the researcher. In addition, the analysis of the research data was performed using the MAXQDA program. In order to ensure the credibility of the research, the number and characteristics of the participants, how they were selected, the data collection tools and analysis techniques used in the research are expected to be explained in detail (Creswell & Miller, 2000). In the methodology section, all the requirements described above are explained. In order to reduce bias in research, it is recommended to interact with other researchers (Patton, 2014). In this study, the opinions of two field experts were sought. One of the experts is from the field of curriculum development in education and the other is from the field of primary education. In qualitative research studies, objectivity is defined as the requirement that the researcher takes his/her own role into account in the research. Therefore, it is stated that qualitative researchers should make a conscious effort to capture the thought processes and reflections associated with all aspects of the study in the study report (Coleman, 2022). This requirement was taken into account in all parts of the study. After the research analysis was completed, the entire data set and analysis findings were shared with a researcher, who was asked to evaluate the data analysis. After this examination, the consistency between the evaluator and the analysis findings was found to be .94 based on the Miles and Huberman formula (Miles & Huberman, 1994). A consensus study was then carried out on the findings.

FINDINGS

In the first research question, the influences determining the preservice teachers’ decisions during the teaching practice were examined. The findings of the examinations are shown in the Table. 1

Table 1. *Situations that are decisive on preservice teachers’ decisions during the teaching practice*

Theme	Category/Sub-category
Self-Efficacy	Situations when I felt inspected by the mentor teacher. Situations in which I experienced emotional triggering in the face of expectations that exceeded my competence in the classroom.
Student	Situations where they ignored me. Situations where I observed that they were indifferent. Situations where I observed that they were bored Situations where they did not want to do an activity. Situations where they were incompatible in group work. Situations where I observed mood swings. Situations in which they were overactive.
Environment	Crowded classrooms.

	Narrow class sizes. Unsuitable weather conditions.
Classroom management	Situations when I did not know how to control the class. Situations where I could not distinguish what was acceptable in the classroom. Situations where I did not know how to make them see me as an authority. Situations where I did not know how effective classroom management required me to behave.
Teaching	Situations created by certain requirements demanded by the teaching process. Time management (It exceeded the deadline, should I continue? / There will be no time left for evaluation, what should I do? / Will I be able to deliver what I planned on time? I forgot to deliver the activity at the planned time, what should I do?). Giving the Floor (How do I give the floor to everyone? / How should I go about giving the floor?). Inclusion (I forgot to include the Iraqi student in the activity, what will I do? / How will I deal with inclusive students?). Reinforcement (Which reinforcer should I use? / All students want the reward I use for reinforcement. What should I do?). Attention (They are distracted, should I continue? / There are so many distractions! How do I deal with them?). Interest (How will I keep them interested? / Will they be interested in the activity?). Level (Is the problem I prepared below the level? / They had difficulty with the questions, should I make it easier? / What do the students know about this subject? / I cannot estimate their level). Method (Should I insist on my method after all? /... should I have used the... method?). Participation (Should I stop the flow for students who are not participating? / What should I do if the lesson is paused?). Repetition (When should I stop the activity? / Should I repeat it more?). Implementation of the Method (Should I apply to peer learning? / Should I divide it or make it read as a whole? / Should I continue their work alone or with support? / Should I move on to the next activity? / Should I give them the worksheet when they are tired? / Should I take them from their breaks? / Should I let them free in the last minutes? / Should I put them on the board or intervene on the spot? / Should I have them write it in their notebooks? / Should I do it or have them do it? / Should I play that game? / Should I watch a video?). Unplanned Situations (Do I need to address extracurricular issues? / What should I do in the face of irrelevant questions? / What should I do in the face of unplanned activity requests?). Misconceptions. (... there are misconceptions about .... Should I interrupt the lesson and correct the misconceptions? / Will including misconceptions distract me from my topic?).

Based on the analysis of the first research question, five themes were determined: self-efficacy, student, environment, classroom management, and teaching.

Self-efficacy is one of the themes related to the influences that had a determining effect on the decisions of the preservice teachers in the teaching practice. In this theme, it was observed that the feeling of being under the supervision of the mentor teacher in the classroom and the emotional tensions experienced due to this were decisive on the preservice teachers' decisions. In addition, the fact that they did not feel competent to fulfill the unexpected interventions and demands from the mentor teachers left the preservice teachers undecided and caused them to question their decisions.

> I am aware that my mentor in the class finds me very inadequate. S/he is constantly questioning what I can and cannot do. Sometimes when I am lecturing, S/he shouts at the children and hushes them, supposedly to control the class. I think I am looking at these things too

> emotionally. I see this lack in myself. I think I need to be more professional. I make more wrong decisions because I am worried that I will be successful in the class.
>
> I have to change my mind all the time in class. The mentor teacher's interference in the lesson takes me out of what I am supposed to talk about. For example, this week, the mentor teacher wrote a topic on the board that I will not cover in class. S/he assigned a topic that I will not cover in the lesson, which is outside of my learning outcome. Since I did not know what the children knew and how much they knew, and since I did not fully understand what the teacher meant, I was left undecided.

Another theme related to the influences determining the decisions of the preservice teachers during the teaching practice is the student. Participants questioned their decisions and made new decisions on the basis of student behaviors that they evaluated positively or negatively during the course.

> I realized that the students were bored with the activity I had done on word prediction and using the word in sentences, so I decided to switch to a different activity. When I saw that they were very enthusiastic and actively participated in this activity, I thought I should have continued on this direction.
>
> At the beginning of the math lesson, I was planning to explain geometric shapes, but I gave up when I realized that the students were bored because they had a good grasp of the subject. I did a review using the question, and answer technique.
>
> Actually, I thought it would be a very good event, but there was very little participation. The students were generally very reluctant. Only 4 or 5 students in the class were very enthusiastic and creative.

Another theme found in the analysis conducted within the scope of this research question is the environment. In this context, it was observed that the participants could not implement what they had planned due to conditions such as the physical characteristics of the classroom, class size, and weather conditions, and that they made new decisions or questioned the decisions they had made.

> I would have obtained better results if I had taught the game in the schoolyard, but I had to play it in the classroom because of the weather conditions. I thought it was a game that could also be played in the classroom, but I was wrong. The class size was too large to play in the classroom.

Another theme related to the situations that were decisive on the preservice teachers' decisions during the teaching practice was classroom management. It was realized that the preservice teachers constantly tried new decisions, questioned their decisions, and experienced indecision in the face of management problems that arose in the classroom.

> I have a dilemma whether or not to allow students to go to the restroom during class.
>
> Since they are 1st graders, I actually want to allow them. Yet, I think I should not allow them, because it disrupts the flow of the lesson.
>
> When there was a loud noise in the classroom, for a moment I felt like I could not control the class. Then I gave up thinking how useless it was to control it.
>
> The plan was to give balloons to the students, but I only used one balloon because I thought I would not be able to control the class.
>
> Towards the middle of the Turkish lesson, I turned on music and tried to get the students' attention, but then it turned out to be challanging for them to focus on the lesson. I was undecided about that.

The last theme identified within the scope of the research question is related to the teaching. This theme includes time management, giving the floor, inclusiveness, reinforcement, attention, interest, level, method, participation, repetition, unplanned situations and misconceptions. It was observed that the teaching process exposed the participants to a wide variety of problems in terms of their decisions.

> I had planned to implement a contrasting panel as well, but then I decided to spend less time on it.
>
> I made a change in my plan. It was the right change for me (Implementing the Plan)
>
> In the sentence formation activity, I changed the method of having the students to the blackboard. They had to choose names from one of the two boxes and sentences from the other. This method did not engage the students in and they did not listen to the lesson. So I distributed the sentences to all the students, and I had the students to the blackboard again by selecting from the box. (Giving the Floor)
>
> The reason I was undecided was that I did not include Iraq in the countries section, ignoring the situation of a student coming from Iraq. I wondered if this would upset the student. I was undecided in the life science lesson. (Inclusiveness)
>
> While explaining geometric shapes in the math lesson, the children had conceptual confusions when the teacher of the class taught the circle as a sphere. Therefore, I had problems with the students during the classification of geometric shapes because they knew the concept incorrectly. At that time, I wondered whether I should have called the circle a sphere. I wondered whether I should have corrected the misconception now. I did not want to confuse the students.
>
> I could have made the problems a little more difficult. (Level)
>
> When I gave stickers as a reward, I thought whether I should have given them or not, because every student wanted stickers. Both those who solved the question and those who did not wanted. (Reinforcement)
>
> I was going to show a slide show to introduce coins in the class. Since I showed the coins first, the attention moved directly there. The students were in a hurry to start. I started the activity immediately so that everyone could participate and we would have enough time. At the beginning of the activity, I forgot the presentation I was going to show. After a student completed the activity, I remembered that I had not shown the presentation. I was undecided whether to open it or not. I opened the presentation again, but I am not sure how much they followed it. (Time Management)

Within the scope of the second research question, the evaluation criteria of the decisions made by the participants were examined. The findings related to the examination are shown in Table 2.

Table 2. *Criteria used by participants for evaluating their decisions*

	Decisions in which they felt powerful	Decisions in which they felt helpless
Mastery of Content	I was able to correct the mistake in the textbook… I had a very good command of the subject…	I made mistakes in the content.
Implementing their Plans	The fact that the lessons went as planned made me feel powerful. I achieved what I wanted to do.	I could not implement what I had planned. I mixed up the order of the information to be given.
Classroom Management	I was able to fix the problems appearing in the games. They followed the rules I set in the classroom… I was able to keep control of the class.	There were students who objected to the red cards I had prepared. Towards the end of the lesson, they stood up and made noise. I did not have enough time
Demonstrating Flexibility	Observing the process and continuing accordingly made me feel powerful.	It would have been better if there were alternative materials. I sticked to the textbook. I could not develop different activities aimed at those who had finished.
Associating with Daily Life	We set up a shopping environment in the classroom. We solved problems with examples from daily life.	I could have had them do a germination activity in the life science class.
Gaining Insight into	Seeing that I could make adjustments	I could have kept the sentences shorter… I

Students	according to the students' level…	should have demonstrated all the steps to the students… I could not exactly understand how the class learned.
Giving Individual Attention	I was able to give my students individual attention.	I did not know how to give them individual attention at that moment.
Diversifying Teaching Methods	I was able to use modelling in maths class.	Different activities for better teaching crossed my mind. I could have taught the subject in full.
Arousing Interest	When I saw the interest and affection of the children…	The students looked as if they were saying "let it be over now".
Communication	I was able to teach the lesson in a conversational atmosphere. I was able to enter the worlds of the children.	My narration remained one-sided. I could have set up discussion groups.
Enabling Engagement	I enabled the students to participate. With the tasks, I was able to involve students who did not have a say.	It would have been better if there were sections that children could accompany. I could not involve students who did not have a say.
Providing Enjoyment	When I saw that the students were all happy…	I could have taught the lesson in a more enjoyable way.
Providing Ways to Generate Ideas	When I was able to lead them to inquire by asking the right questions…	-
Engendering Learning	When they answered all my questions correctly…	-

In the second question of the study, the criteria used by the preservice teachers in evaluating the decisions they made during the teaching practice were examined. The criteria used by the preservice teachers were analyzed on the basis of the situations in which they felt powerful and helpless after the decisions they made in the teaching practice. The criteria used by the preservice teachers to evaluate their decisions were analyzed under 5 themes: content knowledge, classroom management skills, student recognition, teaching-learning process, and monitoring and evaluating learning. It was also observed that the preservice teachers predominantly evaluated their decisions depending on the teaching-learning process. In contrast, they rarely used monitoring and evaluation of learning as a criterion for evaluating their decisions. Since the aim of teaching activities is learning, learning is expected to be the first criterion that candidates should consider in evaluating their decisions. Participants expressed that they felt powerful in their decisions that resulted in learning achievement. However, there was no statement regarding the learning outcomes among the situations in which the participants felt helpless. Other criteria that did not appear among the situations that made the participants feel helpless was providing ways of generating ideas. On the other hand, participants rarely stated that realizing they developed some thinking skills in students made them feel powerful.

Preservice teachers' command of content knowledge appears to be a criterion for evaluating their decisions.

> Since I prepared the problems myself, a few punctuation errors did not escape the students' attention. I should check them in detail.

> The students asked questions that I had never anticipated about the topic I taught in class. I felt helpless when I could not answer their questions.

Another criterion used by students to evaluate themselves was classroom management. Participants expressed that they felt helpless when they could not find solutions to problem situations that arose in the classroom and when they could not dominate the classroom.

> Towards the end of the Turkish lesson, I lost control of the classroom because the students wanted to play games. I allowed it, but it was not the right decision.

In contrast to this criterion, dominating the class and managing problem situations made the participants feel strong.

> My strength is that I can manage the problems that arise in the games well.
>
> What made me feel strong was that the students followed the rules I told them in class.

One of the situations that made preservice teachers feel helpless in the classroom was the realization that they could not respond to students' learning needs. It was observed that the participants' knowledge and experience before the teaching practice was not sufficient to anticipate the learning needs of the students.

> I felt helpless at times when I could not understand how the class was fully learning.
>
> I should have shown the students all the steps when making geometric shapes with Q-tips.
>
> I could have projected all the pages of the storybook and made them follow along.
>
> Realizing that they met the learning needs of students made preservice teachers feel powerful.
>
> I think it was the right decision to make the level of my activity a bit easier.
>
> Competition between groups works well in this class. I realized that and started using it, and I am glad I did.

In evaluating their decisions in the teaching-learning process, the preservice teachers referred to implementing their plans, flexibility, connecting with life, individual interest, diversifying teaching methods, keeping interest alive, being able to communicate, participation, creating a fun learning environment and providing ways to generate ideas.

> I felt strong in the part where students wanted to continue the lesson even if the break bell rang. (Keeping interest alive)
>
> I am glad I did the activity of classifying geometric shapes in math class, because the students had fun and comprehended the subject better. (Resulting in fun/learning)
>
> I was happy that the students participated in class and that after the lesson, one of the students told the student who did not come to class today: "I wish he had come. Today was a lot of fun." This statement made me happy. It was a good evaluation for my partner and me. (Participation / Fun)
>
> The six thinking hats technique, the videos shown, the stages used in game teaching were definitely the right choice. (Diversifying Teaching Methods)
>
> I think I am glad that I taught my lesson in this way. I think it makes the most sense to observe the process well and continue accordingly. (Flexibility)
>
> With a single question I asked, they generated new ideas, criticized, and questioned each other's ideas and finally came up with a shared idea. I just listened to them and realized once again how important it was to ask the right question. (Providing Ways to Generate Ideas)

Monitoring and evaluating learning was rarely mentioned. It is quite thought-provoking that preservice teachers rarely considered their decisions on the basis of resulting in learning achievement.

> After explaining the topic, the students showed that they understood the topic by giving correct answers to all the questions I asked.
>
> The moment I realize that the students understand the topic, when I see them doing the given examples correctly.

It is striking that the participants did not refer to curriculum elements and reaching new learning outcomes from their experiences in evaluating their decisions. Preservice teachers' ability to turn every experience into a learning tool may depend on seeing it as a benchmark. On the other hand, the fact that the preservice teachers did not refer to a criterion for their decisions regarding the curriculum, which was expected to form the center of their decisions in the classroom, suggests the basis on which the preservice teachers made their decisions.

DISCUSSION CONCLUSION

In the first research question of this study, the influences determining the preservice teachers' decisions during the teaching practice were examined. As a result of the analysis, five themes were identified: (i) self-efficacy, (ii) student, (iii) environment, (iv) classroom management and (v) teaching. Each theme leads preservice teachers to engage with their decisions on various dimensions. In the context of self-efficacy, it has been observed that the preservice teachers' perception of being inspected in the classroom and under the supervision of the mentor teacher and the emotional states they experienced due to this were influential on their decisions. In addition, the fact that they believed that they did not have the knowledge and experience to be flexible enough to fulfill unexpected interventions and demands of their mentor teachers was also a decisive influence in their decision-making. In this category, it is apparent that the emotional states of the preservice teachers on the basis of their self-efficacy are crucial for their decision-making processes. Supporting this, it is stated in the literature that emotional states are significative on teachers' decisions (Sheppard & Levy, 2019; Young, 2020). It has been revealed that the preservice teachers' judgments on the behaviors they observed in the students during the teaching practice were influential on their decisions. The messages conveyed by the students through verbal or body language are decisive on the upcoming decision of the preservice teachers. Furthermore, such messages lead them to question the decisions they make. Another theme in the study emerged as the environment. In this category, it is marked that the conditions on which the preservice teachers were dependent in implementing their plans are determinative. During the planning phase, unpredictable incidences lead them to change their decisions swiftly or to question their decisions. It has been observed that the circumstances within the scope of classroom management are decisive on the preservice teachers' decisions. Besides, the study demonstrates that the preservice teachers remained indecisive about how to solve the classroom problems they faced or dominate the classroom, frequently attempted to make new decisions, and questioned the decisions they had already made. Lastly, it is noted that many factors in the theme of teaching were decisive on the preservice teachers' decision-making processes. The theme of teaching has been analyzed under such categories as time management, giving the floor, inclusiveness, reinforcement, attention, interest, level, method, participation, reviewing, implementation of the method, out-of-plan cases and misconceptions. The multi-component nature of the teaching process leads the preservice teachers to continually review, change and question their decisions and sometimes results in making unstable decisions.

In the second research question, the criteria used by the preservice teachers to evaluate their decisions during the teaching practice process have been analyzed. The criteria employed by the preservice teachers in evaluating their decisions have been categorized under 5 themes: Content knowledge, classroom management skills, identifying learners, teaching-learning process, and monitoring and evaluating learning. It has been revealed that the preservice teachers predominantly evaluated their decisions based on the teaching-learning process, whereas they rarely used monitoring and evaluating learning as a criterion in reflecting on their decisions. As the aim of teaching activities is learning, it is expected that the first criterion that preservice teachers need to consider in evaluating their decisions is learning. However, no self-critical evaluation criteria were observed on the preservice teachers' reflections in terms of the outcome of learning and providing ways of generating ideas within this research study.

Previous studies examining teachers' decision-making processes on the basis of novice and expert teachers provide significant clues for interpreting research findings. Peterson and Comeaux (1987) report that expert and novice teachers' schemas about classroom settings vary in terms of cognitive complexity. In a similar line of thinking, Borko and Livingston (1989) state that novice teachers have less detailed, less connected, and less accessible cognitive schemas. The study has revealed that preservice teachers have challenges in decision-making during the teaching practice and that they could not benefit sufficiently from their background knowledge in teacher education to overcome these challenges. Yet, preservice teachers are trained in theoretical and practical courses in teacher education programs on how to cope with the circumstances that are decisive on their decision-making processes. However, the pre-service teachers could not recall and/or use what they had learned during their undergraduate education in their decision-making processes, which may prove what Borko and Livingston (1989) suggest in relation to coginitive schemas. This issue has long been discussed in the context of the integration of theory and practice in teacher education. As indicated by the findings of this study, main drawback of this issue is the inability of preservice teachers to utilize theoretical knowledge sufficiently in their classroom instructional decisions. Therefore, relevant literature emphazises that there is a need to focus on how theoretical knowledge is taught. In fact, Bayrak-Özmutlu (2022), in her article examining the views of preservice teachers on what can be done about the integration of theory and practice, states that the problem of context and trust should be overcome in the teaching of theoretical knowledge. Teaching methods that can overcome these problems in teaching theoretical knowledge can enable preservice teachers to have more elaborated, detailed, and accessible schemas. In a similar vein, Calderhead (1983) states that unlike novices, expert teachers have knowledge-rich schemas that allow them to represent the complexity of the classroom in meaningful ways. The research findings also show that the preservice teachers did not adequately anticipate the complexity of the classroom. This was particularly evident in the theme of environment. It indicates that the preservice teachers could not foresee some of the possibilities of the classroom in terms of realizing their plans and that they had difficulty in producing alternative ways on this basis.

Fogarty et. al. (1983) report that novice teachers fail to adapt instruction in response to student tips. Moreover, Westerman (1991) states that expert teachers are able to think about learning from the student’s perspective and adapt their thinking to the needs of students during instruction. In contrast, novice teachers are unable to adapt to meet student needs during instruction. Collaborating with this argument, the findings of this study also show that the preservice teachers were uncertain about the adaptations expected from them by the students during the teaching process. A closer examination of the categories under the theme of students and teaching has revealed that the participants had difficulty in understanding what the students expected from them and what their needs were. The situations summarized in the research findings reveal that the candidates often had to make new decisions and experienced disruptions in bringing their planned practices into the real context of the classroom. The cognitive characteristics of the experts may have been influenced by the fact that they have made many decisions based on professional experience and have known many contexts and students. This provides important insights into what teacher education should look like, allowing preservice teachers to become professional decision-makers. An approach that engages preservice teachers in decision-making processes based on classroom contexts will serve them to grow as professionals who fulfill the requirements of the profession in a qualified manner. Apart from that, Borko and Livingston (1989) also claim that novice teachers have less developed pedagogical reasoning skills. This situation was quite visible in the preservice teachers’ inferences based on their observations in the classroom. The study has shown that the preservice teachers were quickly affected by the emotional states of the students and tended to attribute the causes of the events to a single reason.

In this study, the emotions that the preservice teachers felt in directing them to make new decisions emerged as a situation. Emotions are known to have a widespread, predictable, sometimes harmful and sometimes instrumental effect on decision making (Wang, 2021). In fact, Sheppard and Levy (2019) highlights the effect of emotions on teachers’ decisions in their article. The results of the study show that teachers conceptualised the classroom as an emotional space, participated in the emotional life of the classroom, and made decisions based on students’ actual or predicted emotional responses. Therefore, it is an important requirement for teacher education to recognise the emotions accompanying the teaching process and to highlight their use as an auxiliary instrument. Indeed, acknowledging the important role that emotions play in teachers’ decision-making processes, Hoy (2013) emphasises that supporting emotional self-regulation is of critical importance for teacher education. Another situation that drove the preservice teachers to make new decisions was their self-efficacy. It is known that self-efficacy perceptions are associated with preservice teachers' academic locus of control and academic achievement (Saracaloğlu et. al., 2017), communication skills (Çiftçi & Taskaya, 2010), lifelong learning tendencies (Ayra & Kösterelioğlu, 2015), educational beliefs (Ilgaz et. al., 2013), and school climate perceptions (Gündoğan & Koçak, 2017). In this study, self-efficacy also manifested itself in the participants' decision-making processes. Preservice teacher education programs should include content and teaching methods that allow teacher candidates to increase their self-efficacy and control over their emotions in order to train prospective teachers as professional decision makers.

The situations that drove the preservice teachers to make decisions are distributed over a wide variety of themes. When interpreting this research finding, it will be useful to remember that teacher education programmes should be considered on the basis of a broad context and that teaching is not a profession that can be explained only with techniques and procedures (Beyer & Zeichner, 2018). Preservice teachers must learn to interpret the context surrounding the teaching process in all its complexity. In the process of teacher education, preservice teachers try to gain such a perspective through the theoretical course contents. However, teacher education is often criticised for being too theoretical and not cultivating practice (Kagan, 1992). Accordingly, on the one hand, teacher education has to find ways to provide preservice teachers with a wide range of knowledge. On the other hand, it has to ensure that this knowledge finds a place in preservice teachers' professional practice. In this context, decision-based practices emerge as a powerful way to overcome the stated problems. In fact, the characteristics of situations driving preservice teachers to make decisions revealed in this study show that teacher education can be carried out based on the situations that preservice teachers may encounter. Every situation that brings them to the point of making a new decision is already included in theoretical courses in teacher education. However, in practice, the preservice teacher is expected to adapt this knowledge based on specialised situations. Westerman (1991) states that what explains expertise in teaching is the interaction of knowledge rather than knowledge itself. Here, it is important to remember what Clough et. al. (2009) state: decision-based studies allow preservice teachers to think of learning as a set of interrelated skills rather than as separate pieces of knowledge. The findings of this study, in which it is stated that a decision-based approach should be adopted in teacher education, indicate the situations that challenge preservice teacher and emphasize the points that need to be focused on in teacher education.

Under the theme of teaching, the present study has presented the situations that drove the preservice teachers to make new decisions in 14 different categories. In the process of teacher education, the preservice teachers learn teaching principles and methods. However, they need to acquire knowledge and experience of how to adapt these methods to the unique characteristics of the classroom environment. The study clearly shows that the teaching process requires preservice teachers to adapt their knowledge on the basis of new contexts. This requirement indicates that preservice teachers' professional competencies should be developed based on context-based practices. This necessity compels us to consider case-based practices in teacher education. Cases have the capacity to help preservice teachers deal with the contextual nature of teaching and utilise their expanding professional knowledge base. In this respect, cases have a high potential for helping teachers to gain the qualifications that the modern world demands from them (Darling-Hammond & Snyder, 2000). Through cases, teachers can better understand the principles and prototypical dilemmas of teaching (Hammond & Hammerness, 2002). Precisely for this reason, this method has the potential to be effective in helping preservice teachers become professional decision-makers. Helleve et. al. (2021) emphasise that analysing cases will help students understand that every situation in practice is unique. Moreover, studies conducted on preservice teachers reveal that case-based learning is effective in terms of cognitive load, motivation and emotion (Syring et al., 2015). In addition, there are studies showing that case-based practices also bring about great improvements in preservice teachers' pedagogical content knowledge and subject matter knowledge (Ulusoy, 2016). In this respect, an approach is suggested in which the situations described in the study are handled with a case-based approach.

In the second question of the study, the criteria for evaluating the decisions taken by the participants have been examined. The criteria used by the participants are not independent of their pedagogical reasoning. Investigating beginning teachers' perceptions of problems in teaching from a cognitive developmental framework, Veenman (1984) states that teachers at different developmental stages perceive classroom problems in different ways. Veenman claim further that beginning teachers have more difficulties in classroom management than in teaching the content. Similarly, in this present study, it has been observed that the preservice teachers were very much occupied with the situations related to classroom management. Analyzing the criteria for evaluating the decisions of the participants, it has been found that the participants mainly evaluated their decisions based on the teaching-learning process. However, they rarely used monitoring and evaluation of learning as a criterion for evaluating their decisions. Considering that the purpose of teaching activities is learning, it is expected that learning should be the first criterion that the participants should consider when evaluating their decisions. It is thought-provoking that the preservice did not make any self-critical evaluation regarding the outcome of learning. It has also been observed that the participants did not make a self-critical evaluation of their decisions in terms of "resulting in learning achievements and opening ways to generate ideas". This finding suggests that the preservice teachers are not able to focus on their thinking and learning skills while struggling with a large number of simultaneous situations in the classroom. In line with that, Borko and Livingston (1989) claim that novice teachers have less developed pedagogical reasoning skills. This claim may explain the situation in question: content knowledge underpins other teacher knowledge. In this respect, it corresponds to the most basic type of knowledge for a qualified teacher. Teachers' content knowledge is considered to be of importance, and even some evaluation frameworks have been developed to examine their current status in this regard (please refer to Kinach, 2002). In addition, the study by Akgün (2013), which establishes a positive relationship between preservice teachers' content knowledge and their perceptions of teacher self-efficacy, supports the findings of this study. In the present study, one of the criteria suggested by the participants in evaluating their decisions was flexibility. Flexibility is an important skill, because the classroom constantly confronts the teacher with unpredictable and complex problems. Indeed, explaining the thinking processes that teachers use when making instructional decisions, Perfecto (2012) underlines that teachers' decision-making process should be flexible as teachers need to balance the prescribed demands of the curriculum with the realities of the classroom.

LIMITATIONS AND RECOMMENDATIONS

In this study, the influences determining the preservice teachers' decisions and the criteria utilized by them to evaluate their decisions have been examined. However, the research does not provide any explanation for the quality and appropriateness of the decisions taken by the preservice teachers. In this respect, future researchers can conduct a detailed examination of the state of preservice teachers' decision-making processes based on observation and clinical interviews. The influences determining the preservice teachers' decisions were limited to the reflective evaluations that the participants carried out after their practices. Moreover, the influences determining the decisions were analyzed on the basis of the following measures: leaving candidates undecided, causing them to question their decisions, and pushing them to make new decisions. This study is based on reflective evaluations written by 10 preservice teachers over a period of 10 weeks. Within the scope of the study, no intervention was made related to the preservice teachers' decision-making processes. It is recommended that future researchers design intervention studies related to prospective teachers' decision-making processes. It is also recommended that they conduct studies comparing the decision-making processes of preservice and experienced teachers. The findings of the study show that the preservice teachers frequently encountere new decision-making situations in the classroom. This situation, which led the preservice teachers to experience interruptions in putting their plans into practice, has once again allowed us to see the demanding nature of the classroom. An effective teacher education should equip preservice teachers with the ability to analyse the classroom correctly, and within the framework of these requirements, to make adaptations to the plans they have made. In this respect, the challenging situations for preservice teachers indicated by the research findings can be focused on in teacher education. In future studies conducted on the basis of the situations indicated by the study, it should be emphasised that preservice teachers can benefit from theoretical knowledge and develop schemata that will enable them to implement effective decision-making processes. The study sheds light on where such practices should begin. In other words, the study reveals practical situations for developing decision-making processes in the teacher education. Another topic that the study focuses on is the criteria used by the preservice teachers to evaluate their decisions. While they are evaluating their decisions, it is expected that their focus will change from teaching towards learning, that is, from what they themselves do towards what they observe in the student. In terms of this requirement, the study reveals the current situation of the preservice teachers in this regard. In teacher education, opportunities should be created for preservice teachers to make decisions and evaluate those decisions. In this way, they can acquire a developed mental structure as professional decision-makers.

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Appendix 1. Reflective Evaluation Form

Reflective Evaluation Form
This study aims to identify the situatios determining preservice teachers' decisions during their teaching practice, as well as to examine the criteria they use to evaluate their decisions. You are expected to complete a reflective evaluation form after each week of your teaching practice, and send it to Dr. Emel Bayrak Özmutlu, the lead researcher, via email. The form contains one section and eight questions, and your responses will remain anonymous. The data will be stored on the researcher's encrypted computer and only the researcher will have access to it. Your participation is voluntary, and you may withdraw at any time. Your decision not to participate or to withdraw will not be shared with anyone. Thank you for contributing to the field of teacher education by participating in this study. Dr. Emel Bayrak Özmutlu emelbayrakozmutlu@gmail.com
How was the class this week? Can you write down the complexities and difficulties you felt from all sides?
What made you feel uncertain and in a dilemma in the classroom? Can you elaborate on the situations in which you were indecisive?
What went through your mind while teaching? What were the situations that forced you to make decisions such as “change your mind, continue, give up...” while doing your practice in the classroom?
Do you have any regrets that you wish you had done this instead of that? Could you elaborate on that?
Have you ever made a decision that you were glad you made or that you thought it was absolutely the right choice? Could you elaborate on that?
Could you describe in detail the moment when you felt the most helpless?
Could you describe in detail the moment when you felt the most powerful?
What is your improvement plan for this week to better equip yourself professionally? Can you explain your reasons?

Appendix 2. Unstructured Interview Framework

Unstructured Interview Framework
The purpose of the unstructured interviews was to obtain more detailed and specific explanations from the participants about their reflective evaluations, and to gather sample situations that support their statements. By asking open-ended questions and encouraging participants to provide examples and explanations, the interviews aimed to gain a deeper understanding of the participants' decision-making processes and criteria for evaluation.
General evaluation of classroom practices: Participants are encouraged to express their thoughts and feelings about their overall experience during the teaching practice.
Situations that left participants indecisive: Discussing specific situations that caused hesitation or uncertainty during classroom practice, and clarifying these situations during the interview process.
Situations that push participants to take new decisions: Discussing specific situations that led to making new decisions in classroom practice, and clarifying these situations during the interview process.
Reflection on decisions made: Encouraging participants to reflect on the decisions they made in classroom practice, and clarifying the criteria they used to evaluate their decisions during the interview process.

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The Use of Literary Elements in Teaching Mathematics: A Bibliometric Analysis

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Article Info | **ABSTRACT**

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Utilizing literary elements for teaching mathematics is gaining importance nowadays because it is claimed that integrating literature and mathematics supports learning process in different ways. Before using this integration in educational settings, we, teachers, and researchers, need to know that what the research tell us about this integration. Therefore, the goal of this research is to review the literature on literary elements employed in mathematics instruction. In order to accomplish this, a literature search covering the years 1951-2021 was conducted using subject-related keywords including "children's literature," "story," and "mathematics." The studies obtained from the journals which are indexed in the Scopus using the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) diagram. The studies about the topic were investigated in terms of title, keywords, and abstracts before the analysis. As a result, 484 articles that met the inclusion criteria of the research were investigated by bibliometric and descriptive analysis. The most influential authors, articles, journals, institutions, the trend of the publications by years, cooperation between institutions and cooperation between authors were determined. As a result, this study has revealed the conceptual, intellectual, and social structure of the literary elements used in mathematics instruction.

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INTRODUCTION

It is well recognized that teaching early language and literacy skills with mathematics fosters the development of each of these skills (Altındağ Kumaş, 2022). For this aim, children's literature and mathematics may be combined to assist both fields. Because children's literary elements such as picture books offer more experience comparison to textbooks (Burns & Silbey, 2000) and using these elements in the classroom is one of the best teaching approaches (Acer & Gözen, 2020). Also, including these elements like picture books and stories in the classroom enhances and differentiates mathematics instruction while considering the unique needs of each student (Forbringer et al., 2016). Thus, integrating children's literary elements into mathematics, can support high levels of interaction between teachers and students (Kaya & Haydar, 2021).

This teaching approach, which integrates of mathematics and literature content areas, not only contributes to students but also teachers in various ways (Edelman et al., 2019). According to literature, the use of literary elements in mathematics teaching provides the presentation of mathematical concepts in a (real life) context, making mathematical connections, developing mathematical language, and cognitive and affective processes related to mathematics (Columba et al., 2005; Green, 2013; Hassinger-Das et al., 2015; Lemonidis & Kaifa, 2019; Mink & Fraser, 2005). However, there are also studies that draw attention to the need to be cautious in some respects against such an approach (Forbringer et al., 2016; Nurnberger-Haag et al., 2020a). Because literary elements like picture books that are used to teach mathematics may not always achieve the needed standards because they could contain misconceptions and ignore the students' developmental processes that must be considered when teaching a mathematical subject like numbers or numeracy (Nurnberger-Haag, 2017; Powell & Nurnberger-Haag, 2015; Ward et al., 2017). So, the characteristics of the teachers who would implement the integration in their classrooms, as well as the choice of literary elements to be used, play a significant part in this method, where the two curriculum areas are combined. Researchers investigate this topic to learn more about pre-service and in-service teachers' competencies, beliefs, and classroom behaviors related to this approach (Cooper et al., 2020; Farrugia & Trakulpdetkrai, 2020; Prendergast et al., 2019; Rogers et al., 2015). These findings reveal that while though pre-service and in-service teachers have similar ideas about the context and they conduct their lessons similarly, they also have misconceptions like this approach is generally for kids not all students from all ages and it's not appropriate for teaching all areas of mathematics (Larkin & Trakulphadetkrai, 2019; Trakulphadetkrai, 2018). In-service teachers may be less hesitant to incorporate literary aspects into mathematics lessons because of these assumptions. The development of these views may have been influenced by investigations done mostly with young children and in the setting of mathematics (Edelman et al., 2019). Whereas using children's literary elements in mathematics teaching has many potentials in the context of teacher education (Can et al., 2020; Durmaz, 2022; Ginsburg & Uscianowski, 2017; Jett, 2018). Because this integration helps to increase teachers' self-efficacy in mathematics and encourages them to design innovative mathematics lessons (Jett, 2018), which is one of the important goals of a constructivist curriculum. However, research indicates that pre-service and/or in-service teachers benefit from this integration in a limited way (Rogers et al., 2015). So much so that while they rarely utilize this approach to teach a new concept or problem-solving, which are effective ways of integrating, they often care about the relavance of the book to the subject rather than the quality of the book and have lack of noticing the mathematical context of the book (Cooper et al., 2020; Prendergast et al., 2019). However, a considerable number of studies indicate that no curriculum can achieve its goal without teachers.

Whatever the reason, it is believed that it is vital to look at the studies on the subject from a wider angle since teachers may be preventing students from benefiting from this approach, which can enrich and distinguish mathematics classes. Because it is well recognized that teachers' views have a direct impact on how they teach (Staub & Stern, 2002). Based on these factors, the objective of this study is to expose the conceptual, social, and intellectual framework of the literature on the use of literary elements in mathematics instruction. It would therefore help move future research on the subject and teaching methods forward by providing a general framework for studies on the subject.

Literature Review

In the literature, studies on using literary elements in mathematics can be classified as those carried out with students at different educational levels, parents and/or caregivers, pre-service and in-service teachers, investigating some characteristics of children's literary elements in scope of mathematics, experimental studies, and reviews (such as systematic review, meta-analysis, and bibliometric analysis etc.).

Most of the studies are conducted with kindergarten and pre-school students (Björklund & Palmér, 2020; Björklund & Palmér, 2022; Capraro & Capraro, 2006; Casey et al., 2004; Casey et al., 2008; Elia et al., 2010; Green et al., 2018; Hassinger-Das et al., 2015; Hong, 1996; McGuire et al., 2020; Purpura et al., 2017; Purpura et al., 2021; Rathé et al., 2016; Segal-Drori et al., 2018; Skoumpourdi & Mpakopoulou, 2011; Van den Heuvel-Panhuizen et al., 2009; Van den Heuvel-Panhuizen & Van den Boogaard, 2008; Van den Heuvel-Panhuizen et al., 2011; Van den Heuvel-Panhuizen et al., 2016; Wijns et al., 2022; Young-Loveridge, 2004), and some of them are conducted with primary school students (Cooper et al., 2011; Lemonidis & Kaifa, 2019; McAndrew et al., 2017; Mink & Fraser, 2005; Russo et al., 2021), and middle school students (Durmaz & Miçooğulları, 2021; Günbaş, 2015; Yalçın et al., 2022). Since the focus of research with pre-school or kindergarten children is about early mathematics, studies with parents are also conducted (Gaylord et al., 2020; Godwin et al., 2016; Goldstein et al., 2016; Uscianowski et al., 2020), and some of these studies focus on parent-child interaction in the process of reading books about mathematics (Hendrix et al., 2019; Hojnoski et al., 2014; Vandermaas-Peeler et al., 2009).

There are also many studies carried out with pre-service and in-service teachers. In studies in which pre-service teachers are the participants of the research, usually (Can et al., 2020; Durmaz, 2022; Edelman, 2017; Harding et al., 2017; Jett, 2014; Leonard et al., 2014; Livy et al., 2021; Nesmith et al., 2017; Nurnberger-Haag et al., 2020b; Nurnberger-Haag et al., 2021b; Prendergast et al., 2019; Purdum-Cassidy et al., 2015; Rogers et al., 2015; Wheeler & Mallam, 2020) are examined the beliefs and opinions of pre-service and in-service teachers towards this integration, analyzed integrated activities and lesson plans with children's literary elements or focused on teacher education/professional development. The studies carried out with in-service teachers mostly deal with their views and experiences related to children's literary elements and mathematics integration (Can & Durmaz, 2023; Cotti & Schiro, 2004; Farrugia & Trakulpdetkrai, 2020; Hojnoski et al., 2016; Jett, 2018; Livy et al., 2021; Prendergast et al., 2019; Stites et al., 2020; Toh et al., 2017; Yang et al., 2022).

Research aimed at examining literary elements, which are as important as pre-service and in-service teachers in the integration process, is aimed at investigating the selected books' characteristics in the context of a specific topic such as numbers and geometry (Darragh, 2018; Fellus et al, 2022; Nesmith & Cooper, 2010; Nurnberger-Haag, 2017; Nurnberger-Haag et al., 2020a; Splinter et al., 2022; Van den Heuvel-Panhuizen & Elia, 2012; Ward et al., 2017), setting out the various field-specific guidelines or criteria for selecting qualified books for integration, and potential misconceptions that literary elements may include (Nurnberger-Haag et al., 2020a; Nurnberger-Haag et al., 2021a; Powell & Nurnberger-Haag, 2015; Van den Heuvel-Panhuizen & Elia, 2012).

Finally, there are experimental studies also related to the subject (Edelman et al., 2019). In these, it is seen that the effects of instructional interventions like early intervention or techniques such as interactive reading are employed, and their effects are reported. Some of the variables discussed in these experimental studies are verbal problem-solving ability (Günbaş, 2015), modeling ability (Wijns et al., 2022), mathematics performance (Van den Heuvel-Panhuizen et al., 2016), performance on length measurement (Van den Heuvel-Panhuizen et al., 2011), arithmetic/mathematical achievement/knowledge (Jennings et al., 1992; Purpura et al., 2017; Purpura et al., 2021), interest in mathematics (Jennings et al., 1992), using mathematical words and/or mathematical language (Jennings et al., 1992; Purpura et al., 2017; 2021), success about fraction concept (Lemonidis & Kaifa, 2019), and attitude towards geometry (McAndrew et al., 2017).

There are also reviews about this topic (Edelman et al., 2019; İnal-Kızıltepe, 2018; Op't Eynde et al., 2022b; Powell & Nurnberger-Haag, 2015) because the body of the literature about the topic has some mixed results (Edelman et al., 2019). So, some researchers conducted these kinds of studies to see the landscape of using literary elements in education and mathematics. For example, Zhang et al. (2023) aimed to examine the experimental studies on the subject, they investigated the articles published between 2000-2022. They included the studies which are indexed in EBSCO, Education Research Complete, JSTOR and Springer. They found out that a large part of the studies was related to the early childhood mathematics and there are very limited studies on high school students. Edelman et al., (2019) also examined empirical studies which were published between 1991-2016 in their meta-analysis. They used ERIC, EBSCOHOST and Google Scholar for literature review and used "children's literature" and "mathematics" keywords. Edelman et al. (2019) also figured out that empirical studies on this topic is quite few. When they analyzed these (n=23) experimental studies, they figured out that the studies were carried out under the titles of student success, motivation and engagement, mathematical discourse, and pre-service/in-service teacher education. They underlined the need of the studies which are focus on mathematics success, making international comparisons and conducting studies with a wider age range. Finally, Arizpe (2021) conducted a study in which she evaluated the studies on children's picture books between 2010-2020. To the best of our knowledge, there is no bibliometric analysis about the topic. In fact, there is limited study using bibliometric tools in mathematics education (Drijvers et al., 2020).

It has been determined that bibliometric studies, which is one of the powerful systematic review tools, conducted specifically on mathematics education are carried out on a general topic such as mathematics education or specific issues such as number sense, mathematics anxiety, instrumental orchestration, ICT in mathematics education, problem solving, primary school mathematics education (Drijvers et al., 2020; Ersözlü & Karakuş, 2019; Gökçe & Güner, 2021; Güner & Gökçe, 2021; Jiménez-Fanjul et al., 2013; Kılıç, 2023; Özkaya, 2018; Ramirez & Rodriguez Devesa, 2019; Suseelan et al., 2022; Trinh Thi Phuong et al., 2022). So, no studies related to the research topic have been encountered. For example, Wu (2018) examined the research on children's picture books without any distinction about content areas. He analyzed a total of 286 articles published between 1993 and 2015, which he obtained because of his search in Web of Science (WOS), with HistCite software. Wu (2018) used only "picture book" and "picturebook" as keywords in his study focused on bibliometric analysis and presented a more general perspective on the studies about children's picture books.

As can be seen, the studies on the subject were carried out in a way to cover certain years and keywords, while other studies were carried out in the context of meta-analysis and descriptive analysis. For this reason, it is thought that a more holistic perspective on the use of literary elements in mathematics education would be gained with the bibliometric analysis to be made within the scope of this study. Because bibliometric analysis is carried out by selecting the publications and selected keywords by the authors on this subject (Pring, 2015). Thus, in addition to the advantages of systematic review and meta-analysis studies, the change of the subject over time can be illustrated (Donthu et al., 2021), some predictions can be provided about future studies by connetting different publications related to the subject with the co-word analysis to be conducted (Marín-Marín et al., 2021), and it may be possible for interested researchers to notice research gaps in the subject (Chen et al., 2019). In light of this rationale, the following research questions were chosen:

1. How do the articles on the use of literary elements in mathematics teaching change according to the years they were published?
2. Which authors, articles, journals, institutions, and countries are the most influential in the studies on the use of literary elements in mathematics teaching?
3. Regarding the use of literary elements in mathematics teaching, what kind of intellectual, social, and conceptual structure emerges in terms of cooperation between countries, cooperation between authors and co-word network?

METHOD

Research Design

In this study, the use of literary elements in mathematics instruction was investigated using bibliometric analysis. Because systematic review studies like bibliometric analysis can be conducted in a way that is both more thorough and clearer (Andrews, 2005). Additionally, the linkages between any publication, author, or cited author with other publications and authors connected to the topic of interest can be shown through the maps produced as a result of the study (Zupic & Čater, 2015).

Research Instruments and Processes

The data were obtained through Scopus, among the international citation indexes or search engines Web of Science, Scopus, Google Scholar, Microsoft Academic and Dimensions (Moral-Muñoz et al., 2020). For this, first, in the Web of Science and Scopus indexes, which are two indexes where qualified international publications are indexed, initial search was made with the search code written based on the keywords used in the research on this subject. As more documents were reached in Scopus, the study was carried out on the articles in the Scopus index (Mongeon & Paul-Hus, 2016). Because in the first search using the same keywords, it was seen that there were more publications in Scopus than in WOS. Since Scopus is more comprehensive in terms of the relevant subject, the study was continued with it. A search was made for all times covering the date of 09/21/2021. Social Studies and Psychology filters were used because the studies that fit the scope of the study were not directly related to the field of educational sciences in the Scopus database and some studies on this subject were related to the field of psychology. The range of studies using literary elements such as children's picture books to many fields such as education, culture, psychology, and literature was effective in making this decision (Arizpe, 2021). The code used in the search is as follows:

TITLE-ABS-KEY ((math*ORgeom*ORcounting*) AND ("children's literature" OR "children's book" OR "picture book" OR "picturebook" OR "tradebooks" OR "trade book" OR "story book" OR "storybook" OR "stories" OR "storybase" OR "storyline" OR "storytell*" OR "shared book" OR "read-aloud" OR reading))

After this search code was applied, a total of 25,179 studies were reached. When the obtained studies were adjusted to be only articles according to the document type, they returned 17,213; 15776 when only in English publications are selected; when journal is selected as the source type, 15,406 articles remain. Finally, when Social Studies and Psychology filters were activated, 6885 articles remained. These articles were also re-examined in terms of the title of the publication and the abstracts to provide a more accurate result on the subject, so the data were extracted by excluding the articles that are not related to the subject. This was done to prevent the inclusion of irrelevant studies as a limitation of the bibliometric analysis (Zupic & Cater, 2015). The title and abstract were examined while performing the necessary data cleaning for studies that did not match the scope of the research (Le Thi Thu et al., 2021). Studies in which the keywords used during the data cleaning were used out of the scope of this research (for example, the use of the word story while explaining the narrative research methodology) were not included in the analysis. As a result, a total of 484 articles were included in the bibliometric and descriptive analysis. The approach used in the data collection phase is explained in the context of the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) (Pham et al., 2021) diagram (Fig. 1).

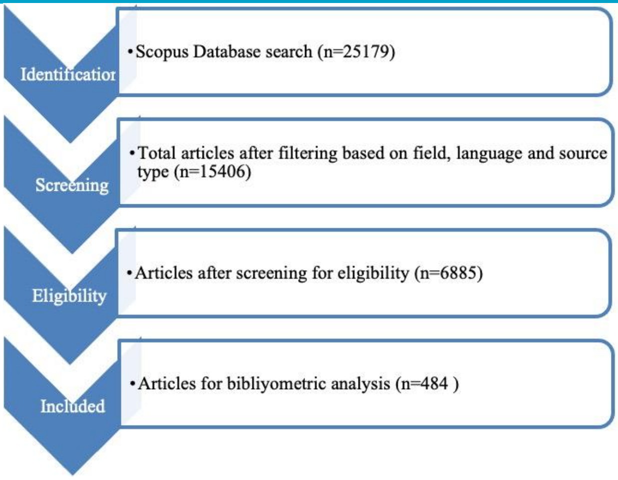

Figure 1. *PRISMA diagram for the study in SCOPUS database*

Data Analysis

Both descriptive statistics and bibliometric analysis were used to analyze the data. In this context, bibliometric analysis techniques were used to examine the distribution of studies on the use of literary elements in mathematics education by years, the top ten cited articles, the authors who contributed to the field and the number of publications, the active journals in this field, countries, and institutions. The determination of keyword analysis, source co-citation network analysis, and author co-citation network analysis was also made using collaborative network analysis. The package application VOSviewer (Version 1.6.9) (Van Eck & Waltman, 2010) was chosen as the analytical tool for cooperative network investigations.

Ethic

The "Higher Education Institutions Scientific Research and Publication Ethics Directive" was followed to the letter when conducting this study. No one engaged in any of the behaviors listed in the second section of the aforementioned regulation, "Actions Contrary to Scientific Research and Publication Ethics." Since the study used only publicly available materials and involved neither human data gathering nor any experimental procedures, it does not need permission from an ethics committee.

RESULTS

First, the distribution of 484 articles reached because of the review according to years was examined and presented in Figure 2.

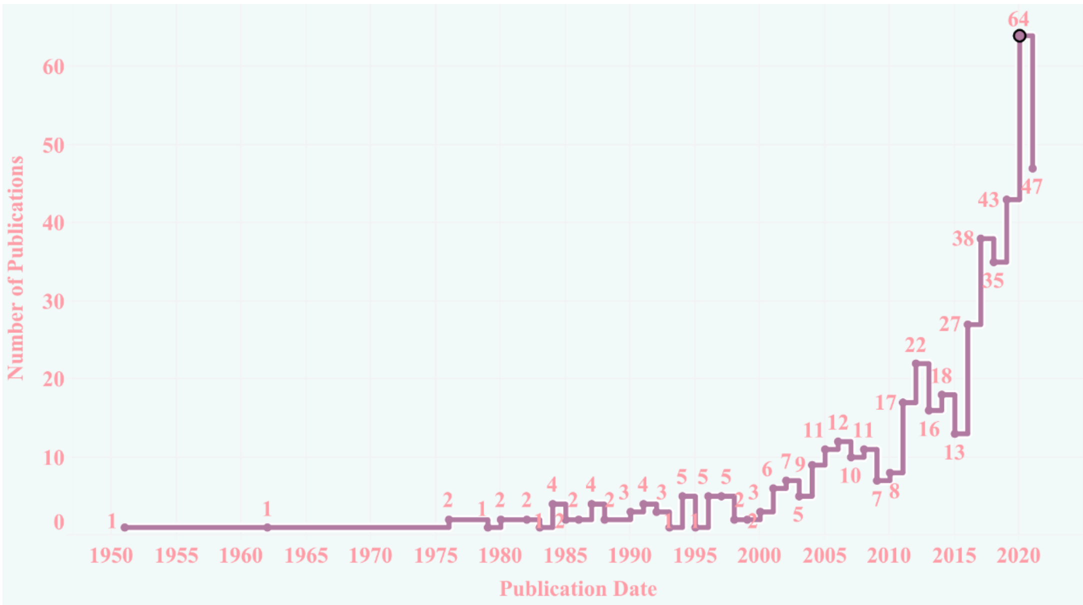

Figure 2. *Number of publications about literature elements in mathematics education between 1951 and 2021 (September)*

Accordingly, it is seen that the articles about literary elements in mathematics teaching were first published in 1951. It is seen that the number of studies on this subject has increased. But this increase does not show a regular trend. The highest number of publications (n=64) on the subject were made in 2020, and these publications constitute 13.22% of all publications on the subject.

The list of the top 10 authors who have the most publications on the use of literary elements in mathematics teaching is presented in Figure 3.

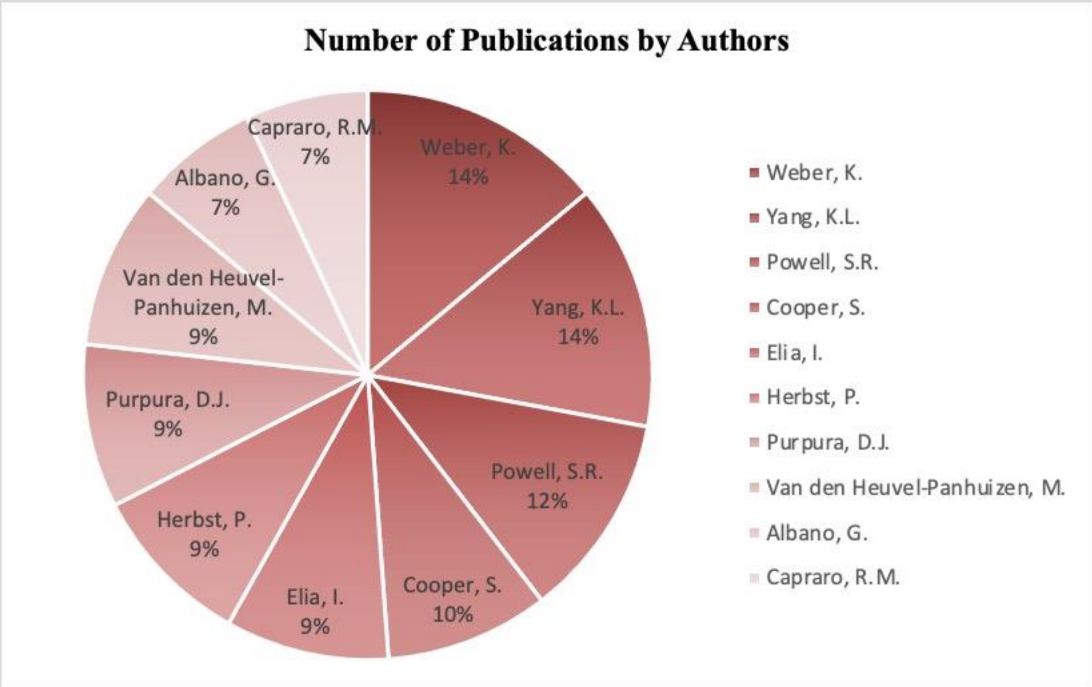

Figure 3. *Top authors of literature elements in mathematics education*

The three most prolific authors are Weber, K. (14%, n=6), Yang, K. L. (14%, n=6) and Powell, S. R. (12%, n=5), respectively. There are a total of 229 journals that include studies on using literary elements in mathematics education. Among these journals, the journals that include the most research on the subject are given in Table 1.

Table 1. *Top ten journals for using literary elements in mathematics education*

Journal	Number Of Publications	Citescore (Impact Factor)
Primus	17	0,7
International Journal of Mathematical Education in Science and Technology	14	1,9
Reading Teacher	14	1,6
Early Childhood Research Quarterly	12	4,4
Educational Studies in Mathematics	12	3,4
Journal Of Educational Psychology	11	9,5
Early Education and Development	10	3
International Journal of Science and Mathematics Education	10	4
ZDM-International Journal on Mathematics Education	10	3,6
Journal Of Adolescent and Adult Literacy	9	1,8

Accordingly, it was determined that the most publications on the subject were published in Primus (n=17) journal. This journal is followed by the “International Journal of Mathematical Education in Science and Technology”, and “Reading Teacher” with 14 articles each. However, these journals are not the journals with the highest impact factor among the top 10 journals. Co-citation analysis (with at least 20 citations) of journals that include studies on literary elements in mathematics education was also conducted in the study (Figure 4).

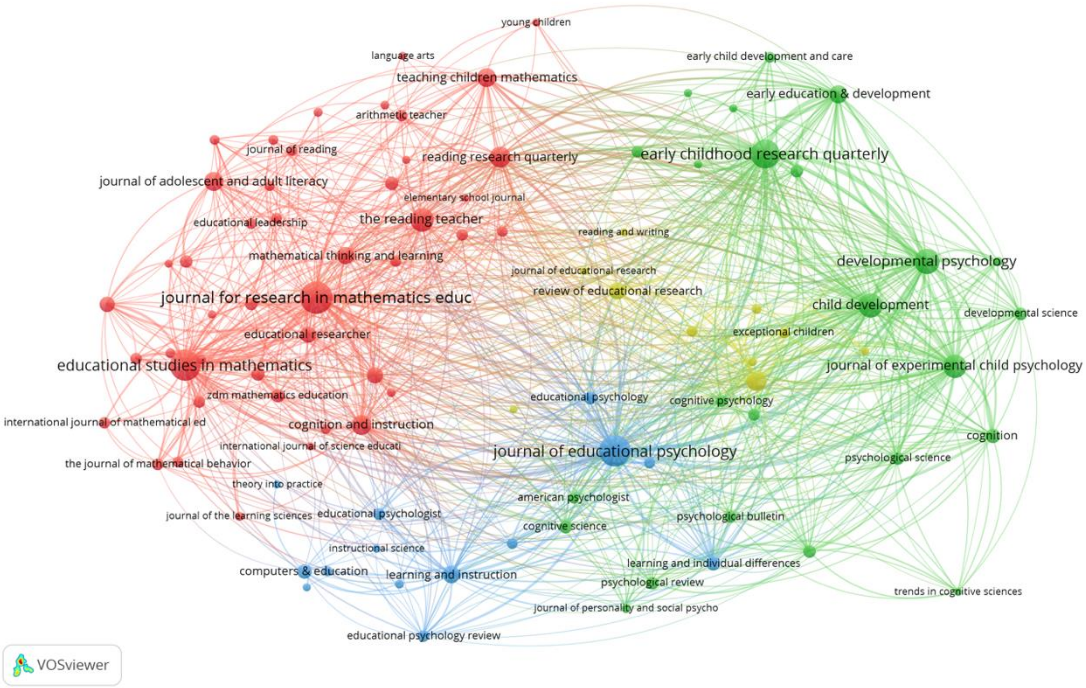

Figure 4. *Co-citation analysis on journals*

Accordingly, it was seen that the journals on this subject were collected in 4 different clusters. It was determined that the main clusters, the red cluster, mostly focused on mathematics education and reading, while the green cluster focused more on developmental psychology and special education. The distribution of studies on the using literary elements in mathematics education by institutions and countries is presented in Table 2.

Table 2. *Top affiliates and countries*

Rank	Affiliates	Record Articles	Rank	Countries/ Regions	Record Articles
1	Vanderbilt University	8	1	USA	267
1	Purdue University	8	2	UK	28
1	The University of Texas at Austin	8	3	Turkey	22
1	Texas A&M University	8	4	Canada	19
1	Michigan State University	8	5	Australia	18
1	University of Wisconsin-Madison	8	6	Indonesia	16
2	National Taiwan Normal University	7	7	Netherlands	11
2	University of Michigan Ann Arbor	7	8	Germany	9
2	Rutgers University News Brunswick	7	8	Taiwan	9
3	Florida State University	6	9	Israel Sweden	8

From the table it is seen that six universities share the first pace with eight articles each. The second place is also sharing with three universities with seven articles each. The institutions that provided the funds for the research on the using of literary elements in mathematics education were also examined in the Figure 5.

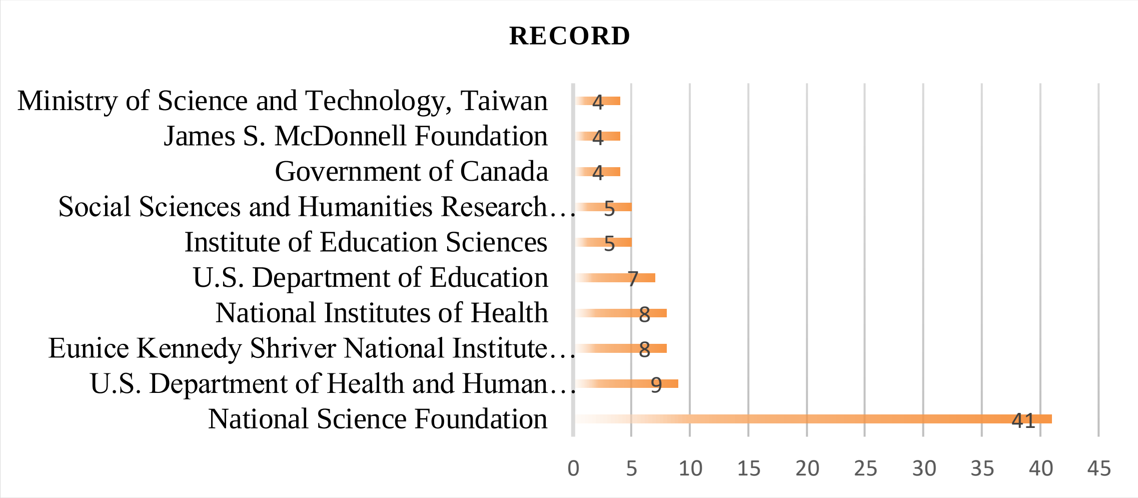

Figure 5. *Funding Agencies*

It has been determined that a total of 117 funds have been supported for research carried out in this context. Among these funding agencies, those who shared the top three places that offered the most funding was National Science Foundation (n=41), U.S. Department of Health and Human Services (n=9), Eunice Kennedy Shriver National Institute of Child Health and Human Development (n=8), National Institutes of Health (n=8) respectively. The list of the most cited publications among the studies on this subject is presented in Table 3.

Table 3. *Top articles that received the most citations*

Article	Author(s)	Published	Journal	Times Cited
1.Teaching disciplinary literacy to adolescents: Rethinking content-area literacy	Shanahan, T., & Shanahan, C.	2008	Harvard Educational Review	632
2.Number sense growth in kindergarten: A longitudinal investigation of children at risk for mathematics difficulties	Jordan, N.C., Kaplan, D., Nabors, Oláh L., & Locuniak, M.N.	2006	Child Development	363
3.A case study of computer gaming for math: Engaged learning from gameplay?	Ke, F.	2008	Computers and Education	271
4.The real story behind story problems: effects of representations on quantitative reasoning	Koedinger, K.R., & Nathan, M.J.	2004	Journal of the Learning Sciences	243
5.Formal and informal home learning activities in relation to children's early numeracy and literacy skills: The development of a home numeracy model	Skwarchuk, S.L., Sowinski, C., & LeFevre J.A.	2014	Journal of Experimental Child Psychology	219
6.Cognitive arithmetic and problem solving: a comparison of children with specific and general mathematics difficulties	Jordan, N.C., & Montani, T.O.	1997	Journal of Learning Disabilities	209
7.What is disciplinary literacy and why does it matter?	Shanahan, T., & Shanahan, C.	2012	Topics in Language Disorders	207
8.An analysis of arithmetic problem posing by middle school students	Silver, E.A., & Cai, J.	1996	Journal for Research in	197

			Mathematics Education	
9.Science as the center of a coherent, integrated early childhood curriculum	French, L.	2004	Early Childhood Research Quarterly	193
10.The development of spatial skills through interventions involving block building activities	Casey, B.M., Andrews, N., Schindler, H., Kersh, J.E., Samper, A., & Copley, J.	2008	Cognition and Instruction	169

The most cited article is published in the Harvard Educational Review with the title "Teaching disciplinary literacy to adolescents: Rethinking content-area literacy". This article was published by Shanahan T., & Shanahan, C. in 2008 and received 632 citations. When the most cited articles are examined, we are faced with a wide spectrum of research on the use of literary elements in mathematics teaching, such as problem solving, disciplinary literacy, integrated education programs (STEAM etc.), and early childhood. To represent the cooperation network between countries and authors in the context of the publications, Figure 6 is produced.

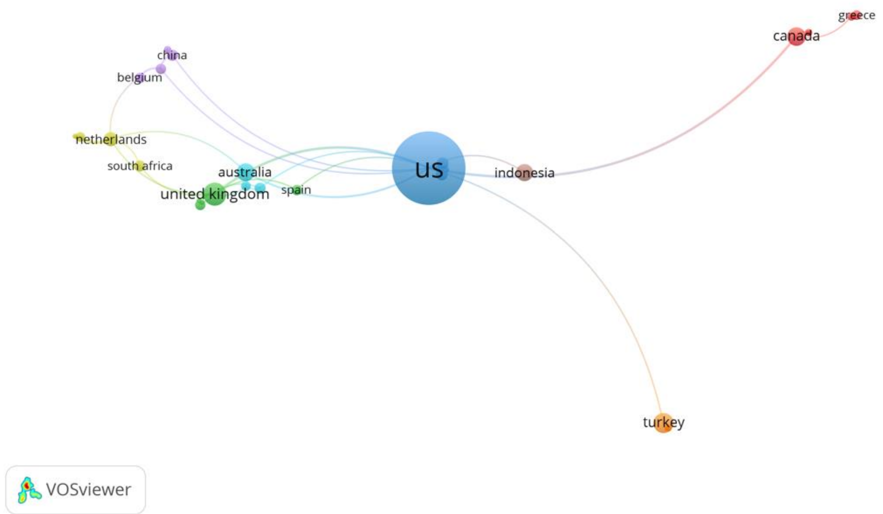

Figure 6. *Co-authorship network among countries*

The figure includes 48 countries as well as 40 links that have been formed between them. The United States (13 links), the United Kingdom (9 links), and the Netherlands (6 links) are the nations with the most connections. This demonstrates the large number of studies with an American or British focus. These nations' cooperative social networks are stronger as a result. The outcomes of the co-authorship analysis are shown in Figure 7.

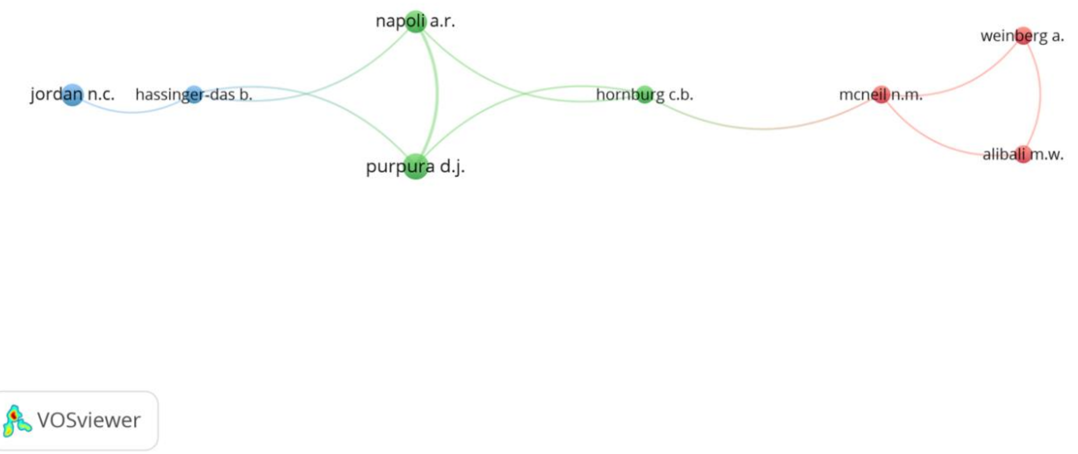

Figure 7. *Co-authorship network among authors*

A total of 10 links and 3 clusters were identified in the analysis. Authors usually appear to have 2 or 3 connections. Therefore, we can conclude that authors who carry out studies on the using literary elements in mathematics teaching mostly work alone. The authors' co-citation network analysis is presented in Figure 8.

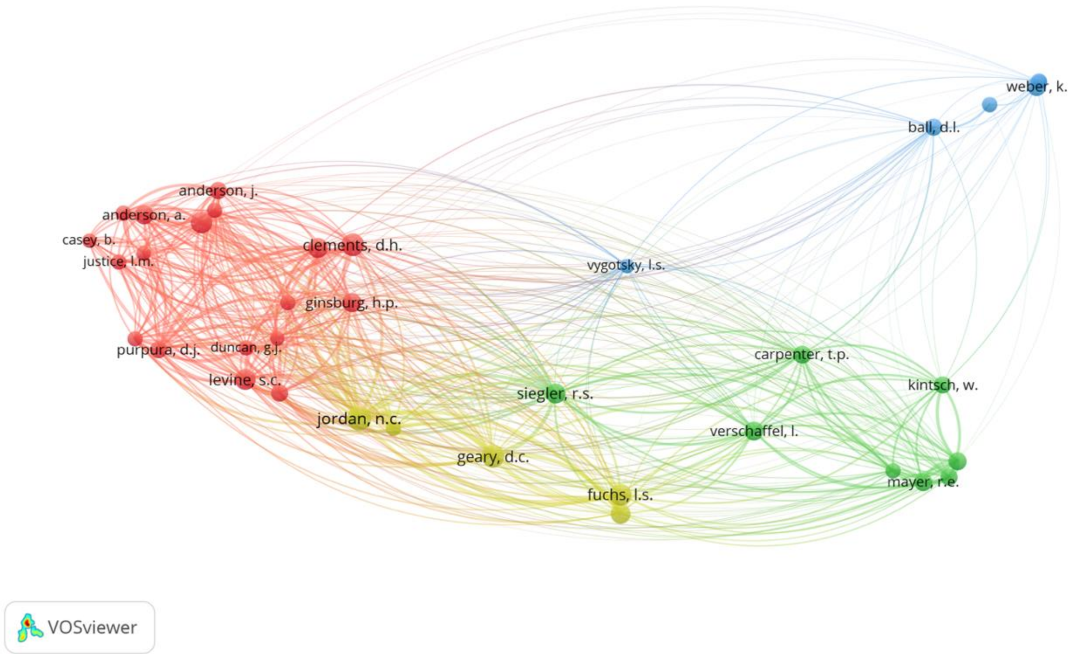

Figure 8. *Co-citation authors network*

When the cut-off point for at least 40 citations was determined among the authors working on this subject, the number of authors decreased to 37. When the co-citation network of 37 authors was examined, 4 clusters emerged. The first cluster, the red one, includes names such as Van den Heuvel Panhuizen, M., Elia, I., Ginsburg, H.P. and Casey, B. The studies in this cluster are about the use of children's literary products in mathematics teaching, children's picture books and early childhood mathematics education. Therefore, it is possible to infer that the works of the authors in this cluster are mostly cited from the focus of children's picture books. It is seen that names such as Alibali, M.W. and Carpenter, T.P. in the second cluster (green) work on story problems. The third cluster (blue) is further away from the other three clusters and includes names such as Vygotsky, L.S. Since the use of literary elements in mathematics teaching brings in-class discussions and sharing, some studies on the subject were referred to Vygotsky's social constructivism theory (Nurnberger et al., 2020a). In the fourth and last cluster (yellow), names such as Geary, D.C., Fuchs, D., and Fuchs, L.S. stand out. Such a cluster may have emerged because these researchers work on learning disabilities focused on both language skills and mathematics in the intervention programs they developed and applied to children's books to support both areas. When the co-citation network on the use of literary elements in mathematics teaching is evaluated in general, this subject finds its answer in different subjects such as problem solving, children's books and intervention programs, and it is also cited from fields such as psychology, which is related to educational sciences, together with different fields of educational sciences.

In studies on the use of literary elements in mathematics teaching, co-word analysis was performed to reveal the frequency of keywords used by the authors and the relationship between them (Figure 9).

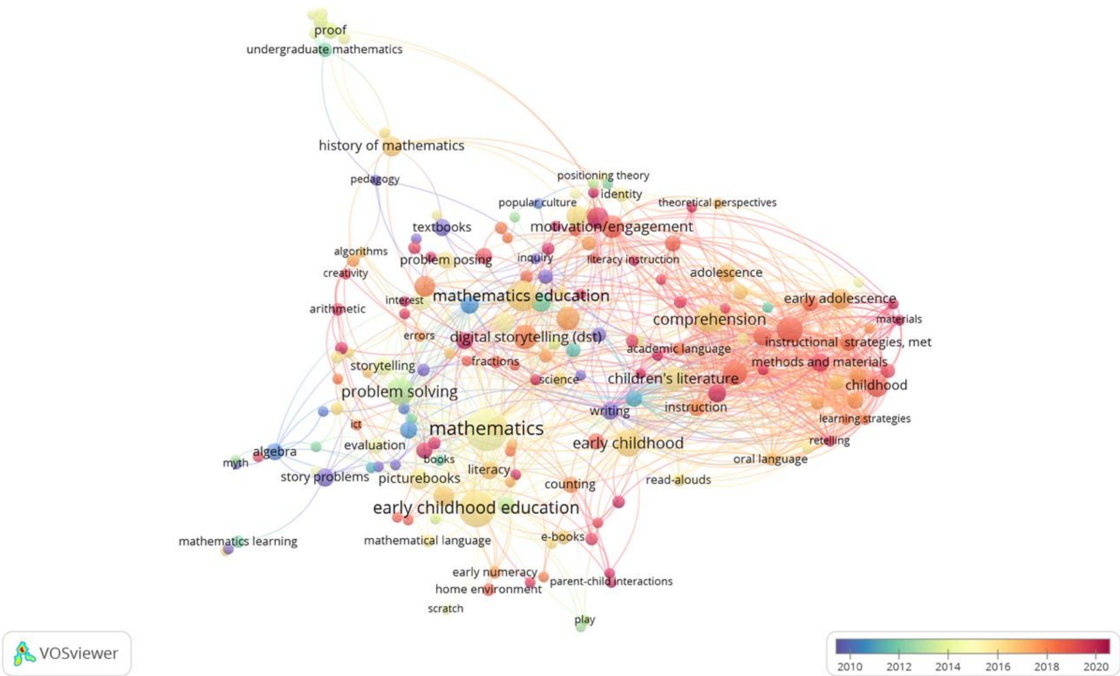

Figure 9. *The co-word analysis*

As a result of the co-word analysis, it is seen that a total of 13 but 2 main clusters emerged. These clusters are shaped around words close to the keywords "content (area) literacy and disciplinary literacy" and "elementary mathematics education (pre-school and primary school)". When the changes in the keywords used by the authors in their studies are analyzed on a yearly basis, the following picture emerges: in 2010-2012, textbooks, pedagogy, writing and constructivism; in 2012-2014 literature, reading, content area reading and problem solving; in 2014-2016, mathematics, storytelling, word problems and elementary education; in 2016-2018 early childhood, picture books, comprehension, digital storytelling, disciplinary literacy and reading strategy, and finally in 2018-2020, shared reading, parent-child interactions, preservice teachers, children's books, content literacy, and professional development keywords are used.

In addition to this, the prominent words are mathematics (n=51), early childhood education (n=32), mathematics education (n=22), (reading) comprehension (n=18), early childhood (n=17), problem solving (n=17), content (area) literacy (n=16), children's literature (n=15), instructional tools (strategy, method, technique, and material) and digital storytelling (n=13). When the connections between the keywords are examined, it is seen that the mathematics education and mathematics keywords have a connection with children's literature; there is a connection between content (area) literacy and children's literature, but there is no connection between content (area) literacy, mathematics education and mathematics. This situation can be considered as an indication that the limitations of the keywords chosen by the authors are left aside, that the studies linking these three areas are limited. Therefore, this table, which emerged because of the common word analysis, offers some perspectives on the conceptual structure of the use of literary elements in mathematics education (Öztürk & Gökhan, 2021).

DISCUSSION, CONCLUSION, LIMITATIONS, AND RECOMMENDATIONS

A search was conducted on the Scopus database for the years 1951-21 September 2021 as part of this study, which examined bibliometric and descriptive analysis of the papers on the use of literary elements (children's picture books, stories, and reading etc.) in mathematics instruction. The inclusion criteria led to access to a total of 484 studies. First, a descriptive analysis was performed on the data. As a result, it was discovered that the first study on the issue was conducted in 1951 and that the studies revealed an erratic upward tendency. The most research on the integration of literary elements into mathematics instruction was done in 2020. Although not regularly, the number of studies generally tends to increase after 2010. In this case, the importance of various literacy such as mathematical literacy due to international exams such as "Programme for International Student Assessment (PISA)" may have played a key role. This finding of the study coincides with the results of Wu (2018). Because he also found that the change of studies on children's picture books according to years tend to increase, albeit irregularly.

Three of the researchers who have the most publications on the use of literary elements in mathematics education are Weber, K., Yang, K.L., and Powell, S.R. Weber, K. conducts studies on the reading of mathematical texts and proof as a dimension of mathematical reading. Yang K.L. has a similar ground that conducted studies on reading mathematical content and focused on reading comprehension. Powell, S. R., on the other hand, conducted studies on mathematical vocabulary, learning disabilities, and children's picture books. Powell, S. R. is followed by Cooper, S., Elia, I., Herbst, P., Purpura, D.J., and Van den Heuvel-Panhuizen, M. It is seen that the related authors also carry out studies on children's picture books, problem solving, mathematical language and stories. However, if we consider the author keywords used, it is difficult to claim that there is a high level of cooperation among researchers working on the subject. Accordingly, the studies of the authors who published the most in terms of selected keywords were carried out in a way to include different dimensions of mathematical reading and literary elements. This associates with the contribution of the context that stories and various mathematical texts provide for learning mathematics (Golden, 2012; Trakulphadetkrai et al., 2019). When the journals that include studies on this subject are examined, it is seen that the authors mostly publish in journals that focus on topics such as mathematics education, early childhood education, reading, literacy and educational psychology. This may be related to the multidimensional nature of the subject and the importance given to reading for learning.

Considering the distribution of studies on the use of literary elements in mathematics education according to institutions and countries, it is seen that there are six institutions that share the first place with eight publications each. As in the distribution of the top ten universities, the most publications on the subject originated in the USA. This may have arisen because only in English publications were included in this study. A similar view emerges when the funds received by the related publications are examined. The National Science Foundation gave the researchers the most support on this issue. The number of funds given by the institutions following the National Science Foundation are close to each other.

When the most cited publications on the subject are examined, it is seen that "Teaching disciplinary literacy to adolescents: Rethinking content-area literacy" by Shanahan T., and Shanahan, C. "What is disciplinary literacy and why does it matter?" by the same authors. Also, these publications are among the ten most cited publications. The fact that each of the articles in the top ten were published in different journals can be considered as an indicator of the multidisciplinary nature of the subject. In addition, the prominence of discipline-specific literacy such as mathematical literacy due to international exams such as PISA may be one of the reasons for this finding.

Finally, co-word analysis was performed in the study. Thus, the current research on the use of literary elements in mathematics education and the conceptual structure of the relevant subject have been revealed. Especially after 2012, the prominence of keywords such as content literacy, disciplinary literacy, storytelling, digital storytelling, pre-service teachers, picture books/children's books and professional development suggests that the professional development and storytelling processes of pre-service and in-service teachers gain importance. Research on the subject is carried out using digital media or picture books (e.g., Kıldan & İncikabı, 2015). However, the trend of research is moving towards teacher education (e.g., Farrugia & Trakulpdetkrai, 2020; Prendergast et al., 2019).

When the frequencies of the keywords are examined, it is noticed that the studies on the subject still focus on the early childhood period and children's books. This is in line with the findings of Edelman et al. (2019), Gökçe and Güner (2021), and Zhang et al. (2023). Gökçe and Güner (2021) stated that as a result of their comprehensive bibliometric review on the field of mathematics education, one of the most repeated terms is early childhood. This situation draws attention to the need for studies at advanced grade levels and different fields not only for children's literary elements and mathematics teaching but also for all mathematics education subjects in the literature. So, research examining the use of literary elements in mathematics education, especially at different educational levels in middle school school and beyond, still points to an important research gap on the subject (Zhang et al., 2023). Because, in the literature, it is noted that very few of the studies on the subject are conducted experimentally, while the studies are mostly carried out at the early childhood level (Clarissa et al., 2021; Edelman et al., 2019). The lack of an emphasis on integrating mathematics and children's literature in the curricula of many countries may be one of the reasons of this finding has emerged (Prendergast et al., 2019; Wikholm & Aerila, 2017). Another reason may be that studies based on parent-child interaction are also being conducted in this field. But, even in preschool classrooms where literary elements are often used, teachers may not consider classroom libraries to be a suitable place to do mathematics. This brings with it missed opportunities of teaching mathematics (Stites et al., 2020). The fact that the studies are mostly carried out in this age range may cause pre-service and in-service teachers to hold negative beliefs about the use of literary elements in mathematics education. Because there is still not enough evidence about how books and other literary elements other than children's books can contribute to mathematics teaching, too (Jett, 2014; Nurnberger-Haag et al., 2020a, 2020b). Also, there is some evidence about that the teachers' attitude towards using children's books for mathematics teaching is the most important factor of the mathematics and literature integration (Hsiao & Chang, 2016). Their attitudes may affect from their beliefs, awareness levels about the integration process (Can & Durmaz, 2023). Some studies show that most of the in-service teachers never use or rarely use literary elements in their classrooms (Livy et al., 2021). In line with this study, Op't Eynde et al. (2022a) call for the researchers to do much more reseach about teacher characteristics. In contrast to this call, in their mathematics education focused review Gökçe and Güner (2021) warn the researchers to focus on students rather than teachers because there are a lot of keywords such as professional development, teacher knowledge and beliefs etc in the mathematics education literature. However, in-service and pre-service teachers still need extra support for the use of literary elements in mathematics teaching (Edelman, 2017; Livy et al., 2021; Rogers et al., 2015), and when support is provided, they may develop their integration abilities (Durmaz, 2022; Wheeler & Mallam, 2020). So, this call made throughout mathematics education may not be fully responded to for a while in this field. Because professional development and teacher training are still important to develop teachers' pedagogical knowledge, experience and self-consciousnes about integration (Livy et al., 2021). But, based on the keywords that emerged in the context of this bibliometric analysis, it is thought that it is important to conduct research that reveals on which mathematics subjects, for which grade level, under what conditions, with what kind of literary elements, and on which variables the integration of literary elements into mathematics teaching is effective (McGuire et al., 2020; Op't Eynde et al., 2022b; Russo et al., 2021).

There are some limitations of this study, in which bibliometric and descriptive analyzes of articles about the use of literary elements in mathematics education are applied. First, the data of the study were obtained only from the Scopus database. The studies obtained from WOS were also accessed, but since VOSviewer, the tool used in the analysis, could not process the data obtained from these two different databases together, the study was conducted with the Scopus database, which gave much more documents because of the literature search. In the future, more inclusive studies can be carried out by using other analysis tools with data from more than one database. Search techniques and documents are also limitations of present study. Before literature search, the keywords frequently used in studies on the subject were examined and a search code was created accordingly. Since the selected keywords were searched in the title, abstract and keywords section, a large body of research were reached in the first search. The reason for this situation is that, as seen in the findings of the research, the studies on the subject have spread to many different fields and to many different journals. The author benefited from such a search strategy because she wanted to include all studies that may be relevant to the subject. Then, to eliminate irrelevant studies, a data cleaning process was carried out and the abstracts of the studies were examined. Thus, a literature review was conducted that is both comprehensive enough to reach all the studies on the subject and limited enough to exclude irrelevant studies. In the future, research can be carried out by choosing more specific keywords. But the aim of this study is to draw a framework as inclusive as possible for researchers interested in this subject. Finally, the last access date of the data obtained through Scopus is 09.21.2021. Since new studies are included in the databases every day, it is possible to reach more comprehensive results in the future. Despite its limitations, it is thought that the framework and landscape that figured out because of this study may support researchers, practitioners and stakeholders who are interested in this subject to take the necessary precautions for the future.

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Being a Female Academic During the Pandemic: Lecturer, Teacher, Mother, Scholar and More

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ABSTRACT

The main objective of this research was to explore the experiences of women in academia who have children, specifically focusing on their encounters with distance learning and working from home during the pandemic. The study aimed to investigate the challenges they faced, the benefits they gained, and their perspectives on how the gender influenced their overall experiences in this context. To this end, the study adopted the qualitative research method of phenomenological design. Interviews wereconducted with 11 participants, including children working at the same university offering courses by means of distance learning during the pandemic. The data wereexamined through content analysis. The participants expressed that they encountered a variety of problems, particularly due to being women. They stated that they assumed many different roles at the same time and place and struggled to carry out the responsibilities. Almost all participants indicated a significant decline in the volume of academic studies, considering the excessive number of responsibilities assumed by women and the lack of a shared workload at home. The present study is expected to help female academics realize that these problems are not unique to them, providing them with a source of motivation.

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INTRODUCTION

Entering Entering public discourse in late 2019 and turning into an intercontinental issue in 2020, COVID-19 has become a factor altering life in a variety of ways. This virus regarding the nature, effects, and treatment of which we do not have adequate knowledge has reshaped our lives and evoked anxiety and disturbances due to its uncertainties (Erdoğdu et al., 2020; Yıldırım, 2020). Countries have been forced to adopt a plethora of measures in many aspects of life, such as education, business, and travel, in order to defend themselves against the contagion. Many countries have imposed nationwide quarantines and curfews. In 2020, distance learning and remote working became the new way of life for many people.

This way of living has transformed homes from solely being spaces of cohabitation into schools and offices at the same time. Components of educational and professional life such as class sessions, meetings, job interviews, and exams have been moved to living spaces. This has affected everyone living together in a house, resulting in a significant adjustment period. Naturally, the adjustment period has brought about many problems. This process has affected women the most (de Paz et al., 2020; Ham, 2021; Yıldırım & Eslen-Ziya, 2020). Professional obligations have been added on top of their existing domestic responsibilities. The domestic workload of women has been significantly increased with many additional tasks such as paying more attention to hygiene inside and outside the home, taking care of the elderly, disabled family members, patients, and/or children for a longer time, and dealing with the learning of children who are continuing with distance education in this period (Yıldırım-Şahin, 2021). Due to complicated and extended working hours, female academics have been considerably affected by the entire process. The sudden emergence of distance learning resulted in issues such as the reorganization of the whole educational process, grading, and being away from research sources (Malisch et al., 2020). Having both teaching and research responsibilities, academics have been forced to adapt their studies to work from home (Cui et al., 2020). Even though both male and female academics have reported significant increases in their childcare and domestic chores during the pandemic, the experience of female academics was found to be more apparent in this respect (Deryugina et al., 2021). This has aggravated the challenges already experienced by female academics in the male-dominated working environment. Studies examining the gender distribution within the publications made during the pandemic support this claim. Many journal editors indicated that there has been an increase of around 20 to 30 percent in article submissions, with most of the submitters being male academics (Beck, 2020 cited in Cui et al., 2020; Kitchener, 2020; Minello et al., 2020; Oleschuk, 2020; Pinho-Gomes et al., 2020) and this situation was found to be prevalent in all fields of study (Andersen et al., 2020; Kitchener, 2020; Minello et al., 2020; Oleschuk, 2020; Pinho-Gomes et al., 2020; Quak et al., 2021). The productivity and scientific output of female academics were disproportionately affected by the global combat against COVID-19 (Gabster et al., 2020).

The primary reason behind this decrease in productivity has been considered to be the role conflict experienced by women due to the pandemic (Couch et al. 2020; Cui et al. 2020). In addition to their research, women have seen an increase in their childcare-related responsibilities, with schools being shut down and curfews being implemented. They also assumed the responsibility of monitoring the performance of their children at school in addition to taking care of them (Petts et al., 2021). Furthermore, the responsibility for fulfilling the emotional and social needs of children has also been borne by mothers. The domestic responsibilities of female academics have surged, while the decrease in support due to the quarantine period has resulted in shifts between the roles of being mothers, spouses, and teachers within the same day. The combination of social roles, familial duties, and professional obligations has made the conditions significantly challenging (Couch et al., 2020). The sense of inadequacy among female academics, compromises over their professional roles, and fulfilling their maternal roles by different and challenging means occurred during this process. Work continuity and anticipatory anxiety regarding their professional careers have accompanied these problems. In particular, mothers with younger children were found to be affected more by this situation (Minello et al., 2020).

Having started to work from home along with the domestic responsibilities traditionally borne by women, female academics have begun teaching remotely through distance learning. Being a new means of education for many academics, distance education has brought about novel habits, skills, and problems. Academics have faced a wider range of novel responsibilities, such as adjusting to this method of lecturing either synchronously or asynchronously, arranging the house accordingly, and learning the methods, techniques, and means suitable for online or distance education.

During the pandemic, certain studies handled the challenges faced by female academics in many countries such as the United States, Australia, France, Germany, Italy, Norway, Sweden, the United Kingdom, and Turkey in distant education (Guy & Arthur, 2020; Minello et al., 2020; Nash & Churchill, 2020; Yıldırım, 2020; Yıldırım & Eslen-Ziya, 2020). The studies included participants from different countries and branches under varying working and living conditions. The present study aimed to conduct research on the experiences of female academics in Turkey specializing in education during lectures and remote working, as well as their opinions on the role of being a woman in these experiences. Turkey adopted distance education in March 2020, with the transition affecting all grades and levels. During the transition, universities implemented varying practices, with some holding courses synchronously and others asynchronously. The university at which the present study is conducted started with online courses following a one-week break. Therefore, the study included female academics encountering two novel situations: transitioning to remote working and online education at the same time. In this respect, the research objective was to identify the experiences of participants going through similar processes. It attempted to define the way they experienced the process as women, academics, and teachers, as well as the impact of being a woman on these life experiences.

For this purpose, this study aimed to answer the following research questions:

(1) What are the experiences of female academics during distance education?
(2) What are the problems of female academics during distance education?
(3) What do female academics think about the impact of being a woman on their own troubles?

METHOD

Research Design

The present study was designed as a phenomenological model one of the qualitative research methods. The purpose of phenomenological design is to understand human experience. In other words, phenomenology aims to present in-depth and detailed knowledge about a subject and to reveal experiences and meanings (Yıldırım & Şimsek, 2005; van Manen, 2007). Interviews provide the fundamental data collection tool in phenomenological research (Creswell, 2003). The phenomenon of this research is being a female academician during pandemic.

Sample and Data Collection

The study group was determined by means of criterion sampling. The study included female academics working at the faculty of education at a public university located in the Marmara Region in Turkey. The reason for choosing this university in the Marmara region is that it is easily accessible by researchers, as well as being one of the first universities to start distance education during the pandemic period. In addition, the study was conducted with female academics working in the faculty of education, who have similar working conditions in the same faculty. The faculty employs 115 academics, of whom 47 are female. A decision was taken to interview those with children among the female academics for the purposes of this study. The purpose behind this decision was to interview academics with similar working and living conditions. In this respect, 11 volunteer academics among the 25 with children of primary or secondary school age participated in the interviews [Alphanumeric symbols were used to identify participants. To that end, a denomination system including the participant number, the initial letter for "participant" (p), and the number of children was used. For instance, if the third participant had two children, the name assigned to the participant was 3P2] as seen on Table 1.

All participants in the study have completed their doctoral studies and are giving lectures. The following section provides an account of the situation in Turkey regarding academic progression and distance education during the pandemic.

Academic progression in Turkey: Academic progression in Turkey (Assistant Professorship, Associate Professorship, Full Professorship) takes place based on the scoring system indicated by the Council of Higher Education (CoHE). The applications prepared in line with the scoring system are assessed by a council, and the academic title is granted if an application is deemed satisfactory. Each university has its own set of criteria for employing academics under the professorship title concerned. These criteria must also be met. To maintain the continuity of assistant professor positions, academic staff are also required to make publications within certain periods in line with the criteria set by the university.

Distance education in Turkey: The first official COVID-19 case in Turkey was announced on March 11, 2020. Following the announcement of the first case, all educational activities were suspended for all levels on March 13. Primary, secondary, and high schools had a 3-week break before starting again with distance learning. As for universities, distance learning was adopted as the means of education starting on March 23, 2020. As of this date, university education is provided exclusively online. The process differed depending on the infrastructure and preparedness of the universities. The university at which the present study was conducted only had a one-week break before swiftly resuming educational activities with live course sessions. The semester course schedule was published on the education platform to be used by students and instructors. All educational practices, such as examinations and assignments, were conducted on this platform. Online courses are also recorded, allowing students to access the recording and listen to the lecture again whenever they want.

Table 1. *Female academics included in the study*

Code	Academic Position	Age	Year of Seniority	Number of Children	Ages of Children
1P2	Lecturer (PhD)	33	11	2	2, 7
2P1	Associate Professor	44	22	1	12
3P2	Assistant Professor	40	14	2	4, 9
4P1	Assistant Professor	37	14	1	5
5P2	Associate Professor	41	17	2	5, 7
6P2	Lecturer (PhD)	35	10	1	5
7P3	Assistant Professor	47	13	3	13, 13, 17
8P2	Lecturer (PhD)	39	3	2	4, 7
9P1	Assistant Professor	35	11	1	4
10P2	Associate Professor	40	16	2	6,12
11P1	Associate Professor	35	12	1	8

Data Collection

Semi-structured interviews were used to collect the research data used in the study. Similar studies were first examined to identify the questions to be used during the interviews (for example, Boncori, 2020; Couch et al., 2020; Manzo & Minello, 2020; Minello et al., 2020; Oleschuk, 2020; Yıldırım & Eslen Ziya, 2020). A pool of questions was created in line with the research purpose and the literature review. Among the questions that served the research purpose, the best ones were selected from the pool of questions and presented to two experts conducting studies on qualitative research methods and a member of the academic staff specializing in women's studies working at the department of sociology. The questions were reviewed and finalized for the pilot study in line with expert recommendations. Then, a pilot study was conducted to identify the comprehensibility and fitness of the questions for research purposes. Furthermore, the opinions of individuals participating in the pilot study were also sought to make the necessary adjustments to improve the clarity and understandability of the questions. The semi-structured interviews involved asking questions of the participants regarding their experiences of distance education, their gains, their problems, and the role of their womanhood in these problems.

Since the lockdown process continued at the time, the interviews were conducted via telephone according to the preferences of the participants, and voice recordings were taken with their permission. The shortest interview duration was 13 minutes, while the longest was 32 minutes.

Data Analysis

The data analysis process consisted of two stages: preparing the data for analysis and conducting the actual analysis. The voice records of the semi-structured interviews were transcribed to prepare the data for the analysis. The consistency of the interview transcriptions and voice recordings was checked.

In this study, the content analysis method was used in data analysis. For data analysis, two researchers first shared the data between themselves to conduct the analysis and kept separate coding notebooks. Then, three researchers held a meeting to compare the codes obtained and exchange views regarding the codes to be included in the re-analysis process as well as the themes to be formulated with these codes. Two researchers then re-examined all the data in line with the decisions taken during this meeting. The researchers convened again after the completion of the analysis to make another comparison. They discussed differing codes and reached a consensus.

Validity and Reliability

Certain practices were adopted before and after the interviews to ensure the reliability of the study. The researchers both made use of the existing literature and sought expert opinion while formulating the questions. The features and working conditions of the participants, as well as the selection criteria for the study, were explained clearly. The participants were given detailed information regarding the purpose of the research, which was to foster an environment of trust. During and following the interviews, participant approval was sought regarding the accurate comprehension of the terms mentioned in conversations. All researchers attended the discussions while analyzing the data in order to avoid researcher bias. Following the analyses, the data were re-examined collectively, with the findings in line with the themes and codes; sample statements were presented verbatim without any modification. Alphanumerical symbols were assigned to participants while they presented the statements.

FINDINGS / RESULTS

The data collected regarding the participant experiences of education during the pandemic and the impact of being a woman on these experiences are presented in line with sub problems.

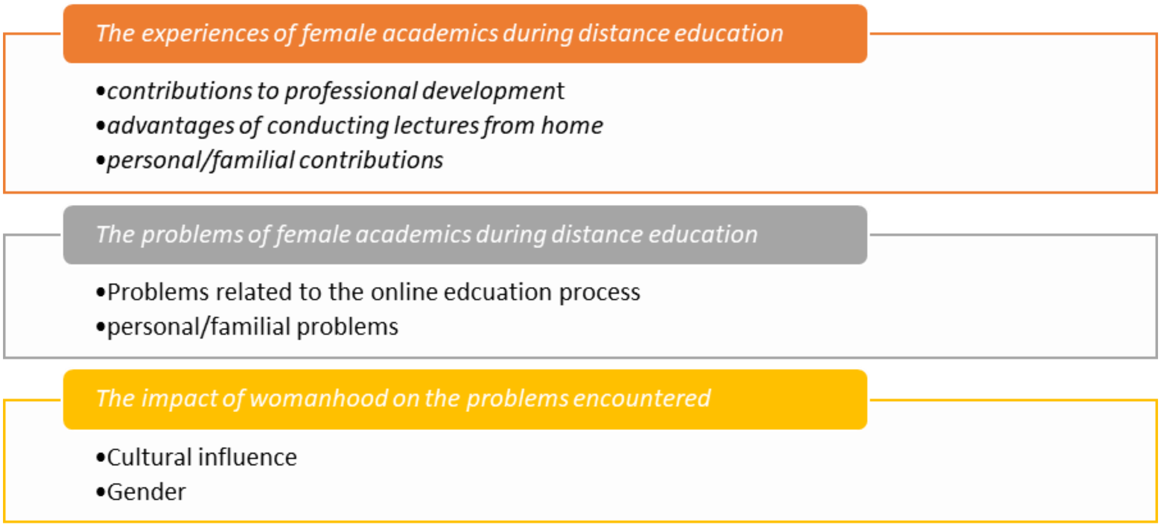

Figure 1. *Themes about subproblems*

The experiences of female academics during distance education

The pandemic has resulted in a sudden transition to distance education. As the university had a suitable infrastructure for distance education, the lectures were resumed following a one-week break. Even though the university offered virtual classrooms before the pandemic, the academics rarely used them. This transition has had the academics using these virtual classrooms to conduct their lectures. Additionally, the academics have also used many different online applications. When the question was asked about the experiences gained during the distance education process, the answers were gathered under there themes. "*contributions to professional development*", "*advantages of conducting lectures from home"* and "*personal/familial contributions".*

Under the theme of *contribution to professional development*, there are codes for "being aware of/using technological applications", "gaining distance education experience", and "contribution to the field of expertise". The experience of distance education during the pandemic was considered as a benefit in its own right. Besides this, the most frequently mentioned benefit concerned "being aware of/using technological applications" or using these applications more often. 1P2 express the following about this code: "*I found about online programs and, for instance, many platforms that may be used in our profession, in social sciences. I really want to use all of them at once, sometimes I prepare specific schedules. This is a great benefit for me. I think I have more self-confidence...*". Similarly, 4P1 also express the following statements: *"I had deemed myself inadequate regarding the use of technology. Now, I think [the present circumstances] have allowed me to improve myself. This because I had to learn inevitably how to use different technological tools to, for example, make better presentations or conduct more effective.*".

Participant named 8P2 said the following about "gaining distance education experience" and "contribution to the field of expertise:

> *One of my courses concerns effective distance education, so I started studying this issue in more detail, applying it to my practices. I believe I have gained considerable experience in distance education, vis-à-vis technological means that may be used for fostering an interactive distance learning environment.*

In addition, the participants stated that they will continue to use their knowledge and experience about digital applications that they gain after the pandemic, and that this is a long-term contribution for them. About the potential reflections of their new knowledge, skills, and habits from online teaching in the post-pandemic period, the participants stated that they will continue to use web 2.0 tools and make online meetings. Regarding this, 3P2 expressed:

> *I will continue giving online assignments. I will not use traditional ways of giving assignments, let students upload them online. It is incredible, quite advantageous. As you said, it saves a great deal of paper and helps you avoid a substantial amount of work.*

5P2 stated:

> *I realized virtual classes as an option to hold lectures even after things go back to normal. In fact, I think it might make things easier for me... Secondly, when it comes to exams, distance education may be a great solution for shorter examinations...*

Also, 2P1 mentioned:

> *I can make active use of Google Classroom after this for all my courses. I think I may collect assignments from there (Google Classroom). This makes it easier to archive them, prevents them from piling up while also saving paper... For example, for graduate thesis dissertations, even if their topic is closely related, the academic did not want to come if they were working in Erzurum [at a university located quite far from the university at which the present study is conducted] ... Now, I believe experts can easily participate in thesis defenses.*

Further, same participant also stated the following about online meetings, *“Another thing is that as seminars and meetings are held online as webinars, the participation rate has increased. Before this, it was difficult to arrange our schedules. Personally, I would like these to continue...”*

The participants also evaluated the “*advantages of conducting lectures from home”.* For instance, 11P1 said “*We have a tight course load, so, we do not have to go to a physical classroom, remain standing during lectures, and be present at classrooms at different hours, which are tiring.* 1P2 expressed “*We had to spend the time, I normally would have spent outside or for commuting, at home.*” Regarding theme of *personal/familial contributions*, the codes *"development of problem-solving skills"*, *"spending time with family members"* and *"spending time to work"* have been determined. Although the problems of being at home and working at home are frequently mentioned during the pandemic process, mothers also stated that they have the chance to spend time with their children and/or spouses. There were some who stated that they were pleased with the positive reflections of this process. For example, *about "development of problem-solving skills",* 6P1 said *“I participated in a meeting with my colleagues while stirring the soup on the stove.”,* 1P2 expressed *“I do not think that the pandemic slowed things down; on the contrary, it sped things up, I complete more tasks.”.* During the pandemic, female academics have simultaneously faced different roles as professionals, mothers, and spouses as well as the responsibilities brought about by these roles. Being able to address the requirements of all these roles have resulted in female academics becoming better problem solvers. They have frequently followed multiple tasks at the same time during the pandemic. Being able to address the requirements of all these roles have resulted in female academics becoming better problem solvers. They have frequently followed multiple tasks at the same time during the pandemic.

Although the problems arising from staying at home and working remotely are frequently discussed, the mothers also mentioned the opportunity to "*spend more time with their children and/or spouses"*. Some participants expressed their contentment with the positive outcomes of the process. Example quotations of this code are mentioned below:

> *For example, my younger child used to talk much less when we left the house, and their grandmother took care of him during the day. Now we are also at home, so is their sister. They started to form complete, interesting sentences; the way they talk, and their attitude has changed. This is, of course, great for our familial relationships. We can spend more time with one another. (3P2)*
>
> *I think it is good also for children to have their parents with them, communicate more with them, and interact more with them. It is good for us as well. Because they will never be children again. (5P2)*
>
> *Now, we are always together during the day, and I am able to closely monitor my child's learning process. I could only have some coffee with my spouse at the weekend; now, we can get some coffee during break times or have dinner a bit earlier.* (*6P1)*

The problems of female academics during distance education

The answers about the problems they experienced during the pandemic process were gathered under two themes: Problems related to the *online education process* and *personal/familial problems.*

The participants stated that even though the online education process has brought about certain benefits, it has also resulted in a variety of problems. The codes under the theme of "Problems encountered in online education during the pandemic" are as follows: "*lack of experience"*, "*lack of interaction", "live lesson process/technical problems"*, "*evaluation process"* and "*increase in the workload in the lessons".* The participants indicated that the *lack of online teaching experience* was initially a problematic source of anxiety. Some problems confronted during this process include the reduced active participation of interaction of the students during lectures and the sporadic problems with the technical infrastructure. These problems reduce both job satisfaction and motivation. About *lack of online teaching experience,* 5P2 mentioned:

> *If we were to assess the distance education process, [the main problems are] not being able to interact with or see the student. Of course, you can have them turn on their cameras and microphones, but our technical infrastructure does not support this as if in an integrated classroom.*

One of the most disturbing issues of the participants in the online education process is the little or no *interaction with the students*. Regarding this, 10 P2 participants stated the following:

> *It has been challenging for me not being able to engage in interactions and communication with students in distance education as I used to during regular lectures. Still, even though we are more used to distance education now, I feel as if I am talking to myself during lectures. This hurts my motivation...*

Similarly, 7P2 also noted:

> *I do not quite enjoy lecturing without any students in front of me, looking at an empty screen, my slides, notes. It feels challenging, that is why I always turn on my camera. I see myself on the screen. At least it is a human face.*

In addition to the lack of interaction with the students, 2P1 expressed the difficulties caused by *live lesson* *process/technical problems:*

> *Holding a lecture for over the determined period in distance education is exhausting. It is not like a mutually interactive course session held face to face. Both controlling the process and attaining and teaching the course objectives at the same time is really exhausting.*

The university at which the present study is conducted requires four different assessments within the semester and a final examination at the end of the year within the scope of the assessment and evaluation system. This system was maintained for online lectures as well. Preparing assignments suitable for the online system, collecting, and archiving these assignments, checking assignment submission, and grading the submissions has entailed additional workload on top of lecture preparation and organization. Adjusting these for the online education process requires a certain amount of time and consideration. Statements about this are included under the code of *evaluation process* and *increase in the workload in the lessons*. For example:

> *We are constantly evaluating papers. My computer is struggling to keep up with the load of the files. I always download submissions; I try to read them without downloading them [at first]. This takes time; for instance, I once spent an entire day cleaning up my computer. I had downloaded every submission by students. Reports, assignments, exams... (1P2)*

In addition to giving online lectures, remote working seems to have also brought about a plethora of problems. The problems the theme of personal/familial problems are grouped under the following codes: "Role confusion/redundancy", "loss/disruption of support", "inability to take time for herself", "decreasing academic studies", "not sharing the workload", "workspace/office need", "multiple people having classes/being at home at the same time", "inability to socialize (self/child)", "the incapability of taking care of their children", "arranging their daily lives around class hours".

The woman is considered to be both a spouse and a mother in addition to the responsibility of maintaining order at a home within the domestic context. Assuming their professional role at home in addition to all these pre-existing roles, women have seen both the number of their responsibilities and issues surge considerably. Although academic women have always had the roles of women, professionals, mothers, and spouses, they had to perform these roles simultaneously and in the same place during the pandemic period. The most common problem expressed by the participants is that they have more than one role, and they have to perform these roles in the same place and time period. Regarding this, 2P1 stated the following:

> *We are now experiencing a process in which many roles overlap, clash and conflict in the domestic setting. We have simultaneous roles. Of course, I have the role of a mother; separately I have the role of the lady of the house. When all these roles pile up, it is possible to see that all becomes increasingly difficult.*

The same participant expressed that he was experiencing role confusion as follows:

> *I mean, regardless of my efforts to make my lectures effective and be a good and professional lecturer, this struggle affects my other roles. My other roles also influence me as a lecturer, which brings us to the matter of priorities.*

11P1 expressed this situation as follows*:* "*This may cause a negative effect such as role confusion. For example, [my child tells me that] the door is ringing while I am lecturing. I can say that I experience role confusion. This is a negative aspect.*" 5P2 indicated:

One of the most difficult points for me during the pandemic was the overlap of all roles and times. I mean, we are mothers and spouses at the same time, so we have had to integrate these responsibilities into our professional obligations and as these different roles and times are all together, there were and are certain problems.

The participants soliciting support for household chores or childcare before the pandemic indicated the inability to procure this professional help during the pandemic as a challenging and tiring factor. Regarding the "loss/disruption of support" code, 6P1 stated:

I used to hire a housekeeper, but now I cannot do that due to the pandemic. I have to do all the household chores now. I mean, I only had to cook, wash the dishes, and do the laundry. The housekeeper did the rest, but now I have to do everything.

Similarly, 3P2 stated the following:

You have extra chores now that you no longer can hire a housekeeper. Then, you have to give up something, push something away. For example, when it comes to academics, one of the points overlooked by female academics is academic studies and research.

With their increasing responsibilities during the pandemic, the participants complained about not being able to *make time for themselves* or to *spare the time for their academic studie*s. Furthermore, they also stated that not being able to find their own *working space and time* has made the process even more difficult. Regarding to the code "inability to take time for herself" 1P2 indicated,

When the pandemic is over, I want to take long strolls with my car. I missed doing that a lot... Right now, I have no personal space. No space to listen to myself...I cannot find the motivation when I am at home even if I have nothing to do. I need to change places, go to the office to get in the mood. I have found myself in a cycle; for example, I empty the dishwasher at home if there is nothing else to do.

Similarly, 10P2 stated, "*I cannot perform the working process, because I like working on my own, individually. So that I can be silent, focus, and pay attention. I cannot do that at home, particularly due to having children around.",* and 3P2 also expressed:

For example, it was effective in terms of planning my time. I mean, not being able to make time for oneself. Because I go to class, have the child eat something, go to another class, put the child to sleep, go to another class, leave class and then at night it is. ... I mean, I could not even get my hair dyed because there is no time... You think you should do other things instead of that. Choose to do something else. You get crushed under so much responsibility, you cannot keep up with yourself, I mean with the things about yourself, about your work.

About the code workspace/office need 7P2 mentioned:

I have never worked at home. And I do not work at night. So, I need to get out of the domestic environment. I used to go to the library when I was a student. Now I can only work at my office.

Due to temporal concerns and increased responsibilities, the participants indicated that they could find neither the time nor the motivation to conduct academic (decreasing academic studies) studies or that they had to work at night, sacrificing their sleep. Regarding to this, 8P2 stated:

I am working at night now because it was initially challenging to set up the system with children being around during the day. We are always together with the children, and one of them being quite *young, you cannot leave them alone for a long time.*

4P1 expressed:

> *Some university-related work can be done somehow, as I said before, by sacrificing some sleep but this is not good, I mean individually; I cannot make time for my academic research, maybe it is about me. I do not know, but I was not able to conduct any studies during this period. This was the most negative aspect for me.*

6P1 put into words such as:

> *Of course, there is also the question of academic work. In other words, the studies under our responsibility concerning the subjects about which we are curious. We cannot overlook this. Most of the time, I do not sleep at night. I stay awake. My sleeping cycle has been considerably disrupted.*

About reduced the volume of their academic studies, 4P2 stated, "*For example, I am an academic, but my academic studies declined, I cannot work. Because I do not have the time for my studies. I already have 30 hours of lectures. I take care of my children during breaks."*

4P1 pointed out that, "*This year, for instance, I was not able to conduct any good academic studies. The studies I initiated remain incomplete, I could not complete them... Days go by, and I cannot do anything."* and 8P2 expressed "*Being at home is restrictive particularly for female academics regarding their academic research. Even if they delegate some of the work like childcare, cooking and household chores, the time remaining is still limited.*"

Only one participant among all stated that they were able to make time for her academic research. The examination of her case revealed that her daughter is relatively older and that she is not with her mother most of the time due to her own classes during the day. About this, 11P1 expressed:

> *I had a lot of collected data. I had many studies planned. I was able to find time to [arrange] the data entered and waiting to be analyzed or cited. This was one of the good sides of the whole process. At home, I first tried to act as if I was at work. It was challenging for us with the child. I told her to think as if I was not home that day...*

These responsibilities and the issues they bring about vary depending on the number of children the participants have as well as the age(s) of the child/children. The participants with more than one child and/or whose children are younger expressed more difficulties. For example, 5P2 stated:

> *The roles of the parents are different. I mean, they are different according to children or, I do not know, due to their positions. For example, children are more likely to wish to be greeted by their mother. While fathers can also do these, children prefer their mothers. At this point, the needs of children are also crucial. My children are quite young. I believe that may be problematic.*

8P2 mentioned as follows:

> *I believe when you become a mother, you have more control over younger ages, younger children need their mother more. That is why they may want to spend more time with you.*

The participants also indicated that the situations of female academics may vary depending on the conditions. For example, 3P2 stated "*The job of their spouse, whether they are married or have children, the number of children... These are all important. Also, the age(s) of the child or children is/are also significant."* Additionally, the participants complained about "multiple people having classes/being at home at the same time", the "inability to socialize", "the incapability of taking care of their children", "arranging their daily lives around class hours".

Many people having class at the same time (as both students and teachers) put a strain on the mother and other members of the household. About the code *"multiple people having classes/being at home at the same time",* 2P1 mentioned:

As my spouse is also a teacher, he continues teaching at home. At this point, we divided the house among the three of us. Everyone has their own school where they complete their school-related tasks. Two people as teachers and one person as a student. Naturally, our voices may overlap inevitably.

Similarly, 1P2 stated:

All three of us have remote courses. Me, my spouse, and my daughter. So yes, we had the most difficulty in terms of class hours. At first, during the first days of the pandemic, we had overlapping classes. I also have a younger daughter. So, there are actually four of us. There were problems at home when three of us had courses at the same time. Who is going to have their class and where? In addition to these, about the code *"incapability of taking care of their children*".

10P2 expressed:

My spouse is also a teacher. He also has courses. So, my children see their parents constantly on the computer. We had difficulties in terms of computers because we had classes with conflicting hours… My 5-year-old daughter was also challenging. She used to wait for us by the door and cry. Because she could hear us in the room giving lectures, crying because her mother could not pay attention to her.

About *the "inability to socialize",* 4P1 expressed "*I feel guilty because I want to spend time with my child, but they want to be with me at all times. In normal circumstances, my child needs to socialize at their age.*" About "arranging their daily lives around class hours", 2P1 indicated:

We look at the schedule and see that there are many classes that day, trying to make specific plans for that day. For example, I tell my spouse that nobody should disturb me as I have a lot of classes. I tell them that I cannot cook. Or to take care of the child … Yet the real problem begins at this point. We are at home at all times. Since we cannot go out due to our workloads and being in a continuous cycle, naturally our tolerance may start to decrease. Even if we make plans, delegate tasks and responsibilities, some conflicts occur after a while.

Similarly, 3P2 stated*:*

We do not have a clear-cut organization. I try to come up with an order or organize things around class hours... While I teach online, my children are with me at home. Feeding them, taking care of them, and giving lectures. Putting them to sleep and giving them food during breaks. For example, you arrange the times for meals based on the class hours of the child.

The principal factor exacerbating these problems might be the fact that the workload borne by women is not shared (code of *"not sharing the workload")*. Most of the female academics participating in the study complained about having to assume responsibility for domestic chores and the lack of task sharing. In fact, they stated that the house has become a comfort zone for men. Example quotations of this code are mentioned below:

(Regarding their spouse) He has always been busy. He is always busy. He is always busy; it seems as if I have nothing to do. That is why I feel more tired. (1P2)

I mean, I have had a lot of chores around the house with my husband also being at home. Sometimes, he came up to the kitchen when I started cooking and asked if there was something he could do. But overall, her husband was able to work quite comfortably. He confined himself in the living room for the entire day, conducting his online interviews easily. He had his coffee and tea. He did not have any problems. So, I took up the task of cleaning the house even though there were others at home. (7P3)

The impact of womanhood on the problems encountered

The participants indicated that being a woman is the primary reason behind these problems upon being asked about the impact of their womanhood on their issues. They argued that culturally, being a woman resulted in assuming all domestic responsibilities, that their professional role has been disregarded during the pandemic as they had to stay at home, and that they had to assume all responsibilities. When asked about the relationship between the problems experienced during the pandemic period and being women, it was seen that the answers were gathered under two themes: “Cultural influence” and “Gender”.

They stated that the “culture” has contributed to their problems, claiming that Turkish culture delegates many household responsibilities to women and that there is a common belief that household chores are not supposed to be done by men. Example quotations of this code are mentioned below:

When you leave home for the university to work and when you are not home, others at home have no expectations about your other roles. But when you bring work to your home, when you work from home, others at home now start having expectations about your other roles related to them. (2P1)

I think we were raised that way. Personally, I believe I was raised that way. I have three brothers. I grew up in a house with a lot of men. That is why my mother and I were constantly responsible for household chores... I think women are gravely affected by this process. I am really curious about the home-office working situation of women in Turkey, percentage-wise. Because I am not in a marriage allowing me to work from home. Actually, I have heard about a study on this topic, claiming that the productivity of male academics has increased while that of female academics has decreased. (1P2)

Regarding to code “gender”, 3P2 said:

This is the truth: as women, you have more work to do, more responsibilities in a patriarchal society than men. As a manager, I came to work and saw that the faculty members who had not been present a lot came to the school, even male colleagues. This is because of the responsibilities at home. The child who is normally at school stays at home, everyone is at home, there are a lot of things to do at home and he might have a lot to do at home, so he decides to come to the school. But as a woman, you do not have this chance to leave. You have no alternatives.”

6P1 expressed “*Gender. I believe this is directly related to gender.”* A striking point came to the fore among the findings. During the pandemic, many female academics complained about the lack of task sharing at home. On the other hand, some academics indicated that they have not experienced such an issue. They stated that they delegate tasks at home, not seeing their workload increase substantially. *2P1 expressed,* “*As we share domestic tasks effectively, I have not had many problems. Besides, my husband is really understanding. I mean,* *he has always been understanding, even before the pandemic regarding my professional obligations".*

> *At this point, I must say that I have had an advantage. We shared that burden together, my husband and I... Be it taking care of children or cooking, we supported each other to the best of our ability whenever we were available. Plus, we helped each other out. (10P2)*

What is worthy of attention in these statements is that task sharing also occurred before the pandemic. These families seem to have always shared their chores among themselves. If the tasks and chores are not shared before the pandemic, it does not develop during the lockdown due to the pandemic. In other words, even though every member of the family is at home, domestic chores are not delegated among the family members if there have not been any task-sharing habits. 7P3 expressed*:*

> *Now, for example, my husband is also at home. His pace does not change when he is home. I did not see him being willing to assume some of the domestic duties, cooking, for example, as a man... If I stay home, I prepare dinner... He does not assume the same responsibilities. His concerns, stress are the same...*

When the interviews with the participants were evaluated in general, it is seen that the pandemic process is quite challenging for female academics, and having to perform multiple roles in the same place makes them tired in many ways. However, it has been determined that this process has advantages such as spending time with their families and being aware of many digital applications.

DISCUSSION

The present study aimed to identify the experiences of female academics who work at the same university with children regarding distance learning and working from home during the pandemic, their problems, gains, and opinions about the impacts of being a woman on their experiences within this process. The participants stated that the pandemic and the process of distance education have had both positive and negative aspects during the interviews.

They indicated that they have gained remote teaching experience while starting to make active use of a wide range of technological applications during the process of remote education in the context of the pandemic. They underlined the importance of these experiences, regardless of the difficulties brought about by distance education. Many studies have obtained similar findings (Basilaia & Kvavadze, 2020; Bergdahl & Nouri, 2020; Sindiani et al., 2020; Marek et al., 2021).

However, even though the classes have been held online within the scope of distance education, the lack of eye contact and communication with students was an apparent deficiency, according to the participants. In fact, they stated that this was exceptionally challenging. The educational system in place allows students to turn on their cameras and microphones; however, separately admitting each student was found to both take time and disrupt the flow of the course. Issues related to the technical infrastructure were also indicated to be troublesome as far as the overall process is concerned. Studies dealing with distance education during the pandemic have also observed similar problems (Hebebci et al., 2020; İnce et al., 2020; Kurnaz & Serçemeli, 2020; Sindiani et al., 2020; Yıldırım-Şahin, 2021).

The participants stated that the assessment system at the university was significantly tiring during this process and took considerable time. The assessment system, which was maintained during distance education as well, involves four separate examinations within the year and a final exam at the end of the year. The participants were thus required to collect documents from emails or various applications while scoring and archiving these documents. This has increased the workload of the participants. On the other hand, the participants stated that they would continue collecting documents through online applications and conducting shorter examinations even after the pandemic is over, deeming these opportunities as gains that they have realized owing to distance education. Furthermore, they argued that the webinars and live chat sessions organized during the pandemic may be maintained in the post-contagion period, along with the chance of arranging thesis dissertations over online platforms (Zoom, Meet, etc.).

The difficulty of being a woman in academia and the fact that gender is at the forefront even in the scientific world have been discussed in many studies (Altınoluk, 2018; Bircan ve Erdoğmuş, 2020; Halifeoğlu, 2020). This was felt even more in the process of working from home during the pandemic. As far as staying at home during the lockdown is concerned, the participants complained about a wide range of issues stemming particularly from their femininity. They argued that being a woman required them to be a mother and a spouse at the same time, with all responsibilities, and that they had assumed multiple roles and struggled to fulfill the obligations entailed by these roles. However, they also claimed that their role as female professionals was sometimes forgotten or neglected. They indicated that they had to sacrifice their sleep to perform their duties as female professionals or minimize their mandatory academic workload. Not sleeping and trying to conclude the day without sleeping much were often expressed by many women (Mavin & Yusupova, 2020). Additionally, some participants also stated that not being able to find a space of their own to work at home was considerably challenging. The inability to find a working space (Crabtree et al., 2020) is considered a problem by many female academics. The participants also voiced their complaints about men working at the same house with them not facing most of these issues or not being forced to cope with them.

Almost all participants stated that their academic studies had come to a halt. With domestic and childcare-related responsibilities being added on top of the tight course schedule of academics working from home, they were rendered unable to make time for their own studies. At this point, female academics had to use the time normally devoted to themselves and their academic studies to fulfill other responsibilities. Many studies in this regard have stated that the limited time female academics have is spent responding to e-mails, reading, and grading assignments, and recording class sessions, with no time for reading and writing articles (Mavin & Yusupova, 2020). Mavin and Yusupova (2020) described the situation as follows: "Considering the centrality of research productivity in recruitment and promotion, COVID-19 has become yet another motherhood penalty". The studies published during the pandemic have revealed that men made a greater number of publications when compared to their female colleagues (Crabtree et al., 2020; Çelebi, 2020; Gabster et al., 2020; Godlee, 2020; Krukowski et al., 2020).

The participants included in the present study did not face the risk of losing their job because they work at a public university. However, they stated that they had to postpone the studies required for their academic progression. Many other studies have found that women face the risk and anxiety of job loss (de Paz et al., 2020; Petts et al., 2020; Ham, 2021).

Research has found that despite their employment status, women have mainly assumed childcare-related responsibilities during the COVID-19 pandemic (Andrew et al., 2020; Crabtree et al., 2020; Krukowski et al., 2020; Lester & Lacey 2020). The challenges faced by female academics, particularly those with children, were widely discussed in many studies (Collins et al., 2020; Yıldırım & Eslen-Ziya, 2020). The problems female academics encounter vary depending on the number and age of their children (Lutter & Schröder 2020). The younger the children, the more problems female academics face (Minello et al., 2020). However, the extent of these challenges and problems may also increase based on the dominant culture. Turkish culture allocates almost all responsibilities when it comes to housekeeping, cooking, and childcare to women. Due to these cultural norms, once the woman arrives at her home, expectations mount regardless of her employment status (Çelebi, 2020). This was addressed by most of the participants, who argued that cultural norms remarkably influenced their problems. Similarly, in the study of Yıldırım Şahin (2021) conducted with female university students studying from home during the pandemic, it was determined that female students had to take care of both their housework and their lessons. These norms burden women with all their responsibilities, even though both men and women continue to work from home during the pandemic. While women juggled the responsibilities of household chores and childcare alongside their work, men had the luxury of primarily concentrating on their professional tasks, with occasional involvement in childcare and assisting with cooking (Gans, 2020). In fact, this situation has transformed the house into a comfort zone for men working from home.

Even though the participants underlined the major influence of culture on their problems, studies conducted in other countries have also produced similar results. The study by Minello et al. (2020) involving female academics from Italy and the US, an account by Yıldırım and Eslem-Ziya (2020) from France, Germany, Italy, Norway, Sweden, Turkey, the UK, and the US, and another article by Gangster et al. (2020) argued that women were affected more by the situation. Gallardo (2021) indicated in a study that women showed little progress following the completion of their doctoral degrees, that their career progress seems to be hindered by familial obligations, that motherhood may influence scientific productivity and, consequently, academic promotion, and that it is difficult to balance the academic roles of teaching, researching, management, consulting, etc. with motherhood. It is evident that this problem, already present, has been exacerbated by the pandemic.

Most participants complained about the lack of task sharing at home. In addition to this, they were also deprived of the chance to seek professional help when it came to housekeeping and childcare. As indicated in many studies, this has led to significant problems for women (Crabtree et al., 2020; King & Frederickson, 2021). However, a limited number of participants also indicated that they were able to delegate some responsibilities through task sharing. Yet these participants also stated that their pre-pandemic conditions had also been similar, with an understanding of collective living in their household. On the other hand, they complained about playing the most significant role in the decisions to be made or tasks to be completed. One might infer that existing domestic habits remain the same under extraordinary circumstances. At this point, the persistence of the usual domestic situation despite changing circumstances and the fact that this is to the detriment of women are both interesting and concerning.

The participants expressed their discontent as they were not able to take care of their children to the extent they would like to. Furthermore, they also seemed to feel disheartened due to the lack of socialization for both their children and them. Mavin and Yusupova (2020) found it unfortunate that their daughter was deprived of many rituals marking her transition into adulthood, such as graduation, balls, vacations, times spent with friends, etc. The study by Crabtree et al. (2020) recorded a statement by a participant considering herself "a bad mother and a bad academic" as she was not able to take care of her children and conduct her academic studies. This statement is an explicit reflection of the extent to which female academics face increased workload, stress, and anxiety levels.

The participants indicated that they plan their daily activities around their online class sessions, which is quite tiring. Multiple people at home having online classes at the same time and the necessary measures to be taken in order to cope with this problem are another issue encountered during the pandemic. Constantly having online class sessions at home, multiple family members being obliged to participate in online classes simultaneously while using the same Internet source, and sharing a working space with other people were all indicated as challenging factors during the overall process (Crabtree et al., 2020).

Despite these problems, the participants expressed their contentment with the positive effects of staying at home in terms of their domestic life and the chance of spending more time with their spouses and children. Regardless of all the negative consequences, many studies also include statements celebrating this positive aspect of the pandemic process (Crabtree et al., 2020; Mavin & Yusupova, 2020). Furthermore, even though merely a handful of participants mentioned the issue, the fact that the hours normally spent commuting are now being spent at home and that conducting classes at home reduces physical fatigue were welcome developments for some academics (Crabtree et al. 2020).

CONCLUSION

The pandemic has been a worrisome, exhausting, and problematic process for all. Already in a disadvantageous position within the academic world, female academics have seen their problems worsen. The roles intermingled with domestic responsibilities during the pandemic have exhausted women both physically and mentally. Their academic productivity has been hindered as they were unable to make time for their scientific work. The findings obtained from the present study show similarities with the outcomes of other studies concerning the experiences of female academics around the globe. One might thus argue that the challenges faced by female academics are not culture-specific and that the feelings experienced and felt are similar despite the differences in cultural settings. Even though distance education is considered a remarkable gain, the technical difficulties faced during the process and the lack of interactivity were found to be demotivating factors.

SUGGESTIONS

The participants included in the study work at the same faculty. Furthermore, the university they work at was able to make a smooth transition to remote teaching as they already had the infrastructure for distance education before the pandemic. Class sessions were held online. Similar studies may be conducted with female academics working at different universities with varying opportunities. Research may be conducted on the experiences of single female academics or those without children. Additionally, the perspective of male academics, spouses, and children may be considered in terms of the process faced by female academics. The number of participants in the present study is limited because the data were collected through interviews. Based on the outcomes of this study and other studies, a survey may be formulated to reach a wider audience.

Policies and practices compensating for the difficulties particularly experienced by female academics may be created based on similar research studies.

Acknowledgements

We saw in the sources we used for the present study that we were not alone. We conducted this study under similar conditions with our participants, who have personally experienced the challenges. We sincerely hope that in addition to contributing to similar studies in the future, this study may help our colleagues who are mothers so that they are not alone, being a source of motivation for them.

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Examination of Water Literacy Levels Secondary School Students in Terms of Different Variables

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ABSTRACT

The aim of this research is to examine the water literacy levels of secondary school students in Turkey in terms of different factories. The research is designed within the survey model. The sampling of the research consists of 408 secondary school students enrolled in schools in Turkish cities of Istanbul, Ankara, Trabzon, Kutahya, and Yozgat. Data is collected via 3 sub-dimensional water literacy scale developed by Sözcü and Türker, (2020a) as well as personal information sheet developed to determine water literacy levels of secondary school students. As a result of the research, when the scores of the secondary school students from the sub-dimensions of the water literacy scale were evaluated, it was found that the gender variable did not make a significant difference on the water literacy, but there was a significant difference in terms of the class level variable, advantaging class 5 and 6. There was a significant difference in the parent education variable, disadvantaging illiterate parents. Likewise, the significant difference was in favour of those with lower family income in the family income variable; in advantage of internet users in internet usage variable; in advantage of city dweller students for the sub-dimension of water conservation in the variable of the settlement they live in; in advantage of villager students for the sub-dimension of water sensitivity; in advantage of those who had less time to be in nature for the sub-dimension of water sensitivity in the variable of being in the natural environment. Water literacy can be added to environmental issues in order to make students gain water literacy in the primary education program.

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INTRODUCTION

People have both been affected by, and have affected, the environment from the past to the present, and this interaction will continue in the future because the environment has always been, and will always be, important for people. However, the main issue that needs to be taken into consideration here is what impact humans have on the environment. The answer to this question is not very pleasant for us because most of the environmental problems seem to be caused by human beings. However, it should be borne in mind that it is again human beings, who will prevent environmental problems, and in this sense, it is necessary for them to be responsible towards the environment.

As human beings began to shape the natural environment with their own will since they have been on Earth, the natural balance in the ecosystem has begun to deteriorate more rapidly (Güçlü, 2021, p.103). As a result of this situation, environmental problems caused by the deterioration of the balance of nature and the impact of people affect not only a region but the whole world in an increasing pace. Minimising environmental problems for a sustainable world will undoubtedly be possible with the efforts of people.

The rapid growing in population, increase in urbanisation rate, economic activities, diversification of consumption habits have increased and continue to raise the pressure on the environment and natural resources. In a world where demand and consumption intensify, environmental and natural resources management become a progressively significant and challenging issue. Global environmental issues such as environmental pollution, climate change, desertification, land degradation, deforestation, loss of biodiversity, and drought, whilst retaining their significance, continue to affect human life more clearly every single day. Fast economic improvement, population growth, and changing climate leads to the expansion of issues connected to resource scarcity. Soil, water, and energy are among the most critical resources for human beings. These resources also have a structure that affects each other (Ministry of Development, 2018, p.2). Water is one of the major natural resources that lean towards depletion, and as a result, both the amount of water to be used per person today decreases and the distribution of water on earth varies. In addition to all these, water is rapidly polluted/contaminated (Ergin, Akpınar, Küçükcankurtaran & Çoban, 2009, p.9; Özdemir, 2017, p.26). The consequences of this affect people negatively.

97.5% of water that accommodates two-thirds of water in the entire world is consisted of the salty water in the oceans. The remaining 2.5% is fresh water, most of which is found as groundwater in glaciers and very deep geological layers at the poles (i.e., Antarctica, Greenland). Accessible clean water resources are found in lakes, reservoirs, rivers, and streams. The amount of water in these sources constitutes 0.10% of the total fresh water amount in the world (https://mgm.gov.tr/genel/hidrometeoroloji.aspx?s=3). When these rates are evaluated, the importance of conscious use of especially fresh water resources becomesbecomes clearer.

Water is one of the most basic substances of human life and has a vital importance for humans because water plays an important role in sustaining human life in a healthy way. From the simplest living organism to the most advanced living being, it is water that sustains all biological life and all human activities (Çankaya, 2014, p.17; Güçlü, 2021, p.80). Today, there are serious concerns about the sustainability of water in the ecosystem. Sustainability of water resources is at the core of many issues, from food safety and energy security to economic growth, combating climate change and preventing biodiversity loss. Therefore, limited or excessive use of water resources concerns all humanity (https://www.wwf.org.tr/calismalarimiz/tatli_su/). Today, 80 countries with 40% of the world's population suffer from water shortages and the need for water is increasing day by day due to the rapid increase in population vis-a-vis stable water resources (Cansaran & Yıldırım, 2021, p.118). Among the reasons why there are limited water resources and water pollution are global climate change, drought, deforestation, increase in the use of fossil fuel, change in consumption habits, economic growth, increase in global population and urbanisation rate, tourism activities in coastal areas, erosion, pollution, lack of awareness of personal water use, water management policies that are inappropriate for resources and developed within political agendas (Güçlü, 2021, p.81; Şahin, 2016, p.2). Considering these situations that cause water pollution, it can be stated that water pollution is more common especially in places where industrialisation and urbanisation are more dense.

Water as a humane, industrial, and ecological resource is a key component to build a sustainable future (McCarroll & Hamann, 2020). Water literacy has become a fundamental part of the contemporary society as the protection, conservation, and management of water is the key to ensuring human survival (Moreno-Guerrero, Romero-Rodríguez, López-Belmonte and Alonso-García, 2020). It covers basic information about water literacy, water resources, and other related factors. One indicator of understanding the importance and role of water literacy is to have a basic understanding of how to use or manage the world's water in a sustainable way (Febriani, 2017). Water literacy is an educational need as water has effects in many areas from health to energy, from culture to economy (Sherchan, Pasha, Weinman, Nelson, Sharma, Therkelsen, & Drexler, 2016), and water-conscious individuals should be raised in order to ensure the sustainability of water. The most important way to instil water awareness in individuals is education.

Thus, this research is undertaken to determine the water literacy levels of secondary school students in terms of different variables. Alongside, answers to the following questions are sought:

Main Research Problem

What are the water literacy levels of secondary school students?

Sub-problems of the Research

(1) Does water literacy of secondary school students differ significantly by gender?

(2) Does the water literacy of secondary school students differ significantly according to their class levels?

(3) Does the water literacy of secondary school students differ significantly according to their mothers' education level?

(4) Does the water literacy of secondary school students differ significantly according to their fathers' education level?

(5) Does water literacy of secondary school students differ significantly according to family income?

(6) Does the water literacy of secondary school students differ significantly according to the time of their internet use?

(7) Does the water literacy of secondary school students differ significantly according to their residence status?

(8) Does the water literacy of secondary school students differ significantly according to their frequency of being in nature?

The Aim of the Research

The aim of this research is to determine the water literacy levels of secondary school students studying in Turkey and to reveal the effects of different variables on their water literacy levels.

METHOD

Research Design

The study was designed in the survey model to determine the water literacy levels of secondary school students and the difference between those levels based on different variables. Survey model is the most widely used method in social sciences. Survey research is research that examines the characteristics, attitudes and opinions of people who are included in the whole universe or a group of samples taken from the universe in order to reach a general opinion about the universe consisting of many people (Karasar, 2014, p.79). The purpose of survey research is generally to make a description by taking the picture of the current situation related to the research subject (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz & Demirel, 2012, p.177).

Research Sample

The sampling group of the research consists of 408 secondary school students studying in Istanbul, Ankara, Trabzon, Kutahya, and Yozgat provinces of Turkey in the 2021-2022 academic year. Convenience sampling method was used in the research. It completely relies on such items that are available and quick and easy to access. In this method, the researcher determines a sufficient number of items from the existing ones as a sample (Baltacı, 2018).

Data Collection Tools

In this research, a personal information sheet and a 5-point likert-type water literacy scale developed by Sözcü and Türker (2020a) were used to identify the water literacy levels of secondary school students. As a result of the exploratory factor analysis carried out by the researchers, it is found that the water literacy scale consists of 30 items and 3 sub-dimensions, and the analyses performed to test the validity and reliability of the scale are as follows: Kaiser-Meyer-Olkin sample adequacy measurement value was found to be significant as .901 and the Barlett test of sphericity as .000. The total variance clarified by the scale was determined as 48.361%. When the load values of the items forming the scale were examined, it was determined that they had values between 0.565 and 0.784. The Cronbach alpha internal consistency coefficient values of the water literacy scale were found to be .89 in the “water conservation” sub-dimension, .88 in the “water awareness” sub-dimension, and .69 in the “water sensitivity” sub-dimension. In general, the Cronbach alpha internal consistency coefficient value was determined as .90. These values show that the scale is highly valid and reliable.

Data Collection Process

The questionnaire form created to collect research data was collected from secondary school students studying in Istanbul, Ankara, Trabzon, Kutahya, and Yozgat in Turkey through Google forms in the spring semester of 2021-2022 academic year.

Data Analysis

The analysis of the data collected for the research was made through the SPSS 22.0 package statistics programme. In the study, in addition to descriptive statistics, the non-parametric Mann-Whitney U test and Kruskal Wallis H test were used for variables where the data did not display normal distribution.

Ethic

This research was discussed at the Gazi University Ethics Commission's meeting dated 10.11.2020 and numbered 11 and was found ethically appropriate with the 2021-54 Research Code Number.

FINDINGS

Within the content of the research findings, the water literacy levels of the participants; Statistical analyzes regarding whether it differs according to gender, class level, settlement area, mother and father education level, frequency of being in the natural environment, social studies course grades, daily internet usage times and monthly family income levels are included.

Table 1.*Findings and comments on the water literacy levels of the participants*

	N	X	S
Water Conservation	408	4.29	.038
Water Awareness	408	3.74	.042
Water Sensitivity	408	2.52	.056
Overall Average	408	3.78	.032

Table 1 demonstrates that the average scores of secondary school students in the water conservation sub-dimension of the water literacy scale were determined as (x=4.29), the average of the scores in the sub-dimension of water awareness as (x=3.74), and the average of the scores in the sub-dimension of water sensitivity as (x=2.52) and the average of the scores in the general water literacy scale as (x=3.78).

Table 2.*U-Test results of the participants' water literacy levels by gender variable*

	Gender	N	MeanRank	RowSum	z	p
Water Conservation	Woman	230	213.70	49151.50	-1.799	.072
	Man	178	192.61	34284.50		
	Total	408				
Water Awareness	Woman	230	204.47	47027.50	-.006	.995
	Man	178	204.54	36408.50		
	Total	408				
Water Sensitivity	Woman	230	200.91	46208.50	-.702	.483
	Man	178	209.14	37227.50		
	Total	408				

Table 2 presents the results of the Mann-Whitney U-test regarding the effect of secondary school students' gender on their water literacy levels.

When the table is examined, the U test results of group-based scores of secondary school students for the water literacy scale are found. According to these results, the water literacy scores of secondary school students do not show a significant difference in the "water conservation" sub-dimension in relation to the gender variable [U=-1.799; p>.05]. While the mean rank of women was 213.70, the mean rank of men was 192.61.

There is no significant difference in the "water awareness" sub-dimension of the water literacy scale in relation to the gender variable [U=-.006; p>.05]. While the mean rank of women was 204.47, the mean rank of men was 204.54.

In the "water sensitivity" sub-dimension of the water literacy scale, there is no significant difference in relation to the gender variable [U=-.702; p>.05] either. While the mean rank of women was 200.91, the mean rank of men was 209.14.

These findings can be interpreted as the gender variable does not make a significant difference on water literacy.

Table 3. *Kruskal-Wallis H test results of participants' water literacy levels by class level variable*

	Class Level	N	MeanRank	x^2	p	Different U
Water Conservation	5	107	215.94	2.741	.433	
	6	96	211.11			
	7	114	192.15			
	8	91	199.54			
	Total	408				
Water Awareness	5	107	225.57	13.857	.003	5-7
	6	96	226.83			5-8
	7	114	186.20			6-7
	8	91	179.09			6-8
	Total	408				
Water Sensitivity	5	107	181.08	12.349	.006	5-6
	6	96	236.58			6-7
	7	114	194.95			
	8	91	210.16			
	Total	408				

Table 3 shows the results of the analysis of the Kruskal Wallis H test regarding the effect of secondary school students' class levels on their water literacy levels.

According to the results of the analysis, no significant difference was found in the water literacy levels of secondary school students at different class levels in the "water conservation" sub-dimension of the scale [x^2(df=3; n=408) =2.741; p>,05].

According to the results of the analysis, a significant difference was found in the "water awareness" sub-dimension of the scale in the water literacy levels of secondary school students at different class levels [x^2(df=3; n=408) =13.857; p<,05]. This finding shows that the water literacy levels of the participants in different class level groups are different. Considering the mean rank of the class levels, a significant difference was found between class 5 students (mean rank=225.57), class 7 (mean rank=186.20) and class 8 students (mean rank=179.09) in favour of class 5 students. Similarly, in the same sub-dimension, a significant difference was found between class 6 students (mean rank=226.83) and class 7 (mean rank=186.20) and class 8 students (mean rank=179.09) in favour of class 6 students. This finding can be interpreted as secondary school students' water literacy levels in the water awareness sub-dimension of the scale are higher among class 5 and 6 students than that of class 7 and class 8 students.

According to the results of the analysis, a significant difference was found in the "water sensitivity" sub-dimension of the scale in the water literacy levels of secondary school students at different class levels [x^2(df=3; n=408) =12.349; p< ,05]. Considering the mean rank of the class levels, a significant difference was found between class 6 students (mean rank=236.58) and class 5 (mean rank=181.08) and class 7 students (mean rank=194.95) in favour of class 6 students. This finding can be interpreted as secondary school students' water sensitivity levels in the "water sensitivity" sub-dimension of the water literacy scale are higher among class 6 students than that of class 5 and class 7 students.

Table 4.*Kruskal-Wallis H test results of participants' water literacy levels by mother education variable*

	Mothers' educationalstatus	N	MeanRank	x^2	p	Difference U
Water Conservation	Illiterate	34	124.44	17.682	.001	2-1
	Primary&Lower-SecondaryEducation	246	211.45			3-1 4-1
	Upper-SecondaryEducation	73	206.38			
	University	55	220.43			
	Total	408				
Water Awareness	Illiterate	34	160.56	8.841	.031	2-1
	Primary&Lower-SecondaryEducation	246	216.16			
	Upper-SecondaryEducation	73	186.53			
	University	55	203.37			
	Total	408				
Water Sensitivity	Illiterate	34	208.93	1.709	.635	
	Primary&Lower-SecondaryEducation	246	209.02			
	Upper-SecondaryEducation	73	188.95			
	University	55	202.17			
	Total	408				

Table 4 demonstrates the results of the analysis of the Kruskal Wallis H test regarding the effect of secondary school students' whose mothers have different education levels on their water literacy levels.

According to the results of the analysis, a significant difference was found in the water literacy levels of the secondary school students with different maternal education levels in the "water conservation" sub-dimension of the scale [x^2(df=3; n=408) =17.682; p<,05]. Considering the mean rank of the participants' maternal education levels, those with illiterate maternal education (mean rank=124.44) and those with maternal education level at primary and lower-secondary school (mean rank=211.45), upper-secondary school (mean rank=206.38), and university (mean rank=220.43) were found to be significantly different from those with maternal education level as illiterate, and this significance is not in favour of the latter. This finding can be interpreted in the way that the level and awareness of "water conservation" increases as much as the education level of maternals increases.

According to the results of the analysis, a significant difference was found in the water literacy levels of the secondary school students with different maternal education levels in the "water awareness" sub-dimension of the scale [x^2(df=3; n=408) =8.841; p< ,05]. Considering the mean rank of the participants' maternal education levels, a significant difference was found between those whose mothers' education level was illiterate (mean rank=160.56) and those whose mothers' education level was primary school (mean rank=216.16) in favour of those whose mothers' education level was primary school. This finding is important in terms of showing the effect of maternal education level on "water awareness".

According to the results of the analysis, no significant difference was found in the water literacy levels of the secondary school students with different maternal education levels in the "water sensitivity" sub-dimension of the scale [x^2(df=3; n=408) =1.709; p>,05].

Table 5. *Kruskal-Wallis H test results of the participants' water literacy levels by father education variable*

	Fathers' educationalstatus	N	MeanRank	x^2	p	Different U
Water Conservation	Illiterate	10	51.40	20.532	.000	2-1
	Primary&Lower-SecondaryEducation	228	203.48			3-1 4-1
	Upper-SecondaryEducation	102	203.97			
	University	68	231.25			
	Total	408				
Water Awareness	Illiterate	10	117.85	6.558	.087	
	Primary&Lower-SecondaryEducation	228	205.95			
	Upper-SecondaryEducation	102	215.00			
	University	68	196.63			
	Total	408				
Water Sensitivity	Illiterate	10	175.50	1.035	.793	
	Primary&Lower-SecondaryEducation	228	207.94			
	Upper-SecondaryEducation	102	204.23			
	University	68	197.64			
	Total	408				

Table 5 demonstrates the results of the analysis of the Kruskal Wallis H test regarding the effect of secondaryschoolstudents' havingdifferentfathereducationlevels on theirwaterliteracylevels.

According to the results of the analysis, a significant difference was found in the water literacy levels of secondary school students with different father education levels in the "water conservation" sub-dimension of the scale [x^2(df=3; n=408) =20.532; p<,05]. Considering the mean rank of the participants' paternal education levels, those with illiterate paternal education (mean=51.40) and those with paternal education level at primary and lower-secondary school (meanrank=203.48), upper-secondary school (meanrank=203.97), and university (meanrankrank=231.25) were found to be significantly different from those with paternal education level as illiterate, and this significance is not in favour of the latter. This finding can be interpreted as thelevel of water literacy in the "water conservation" sub-dimension of the scale increases as much as the education level of father increases.

According to the results of the analysis, no significant difference was found in the "water awareness" sub-dimension of the scale in the water literacy levels of secondary school students with different paternal education levels [x^2(df=3; n=408) =6.558; p> ,05].

According to the results of the analysis, no significant difference was found in the water literacy levels of the secondary school students with different paternal education levels in the "water sensitivity" sub-dimension of the scale [x^2(df=3; n=408) =1.035; p> ,05].

Table 6. *Kruskal-Wallis H test results of the participants' water literacy levels by monthly family income level variable*

	Monthlyincome	N	MeanRank	x^2	p	Different U
Water Conservation	Lower	168	212.79	4.127	.127	
	Middle	188	205.25			
	Upper	52	174.99			
	Total	408				
Water Awareness	Lower	168	225.34	9.006	.011	1-2
	Middle	188	190.99			1-3
	Upper	52	186.03			
	Total	408				
Water Sensitivity	Lower	168	216.38	9.262	.010	1-2
	Middle	188	186.13			3-2
	Upper	52	232.55			
	Total	408				

Table 6 shows the results of the analysis of the Kruskal Wallis H test regarding the effect of secondary school students having different family income levels on their water literacy levels.

According to the results of the analysis, no significant difference was found in the water literacy levels of the secondary school students with different family income levels in the "water conservation" sub-dimension of the scale [x^2(df=2; n=408) =4.127; p>,05].

According to the results of the analysis, a significant difference was found in the "water awareness" sub-dimension of the scale in the water literacy levels of secondary school students with different family income levels [x^2(df=2; n=408) =9.006; p<,05]. Considering the mean rank of the participants' family income levels, a significant difference between secondary school students with lower family income (mean rank=225.34) and those with middle (mean rank=190.99) and high (mean rank=186.03) income levels was found in favour of students with lower family income status.

According to the results of the analysis, a significant difference was found in the water literacy levels of secondary school students with different family income levels in the "water sensitivity" sub-dimension of the scale [x^2(df=2; n=408) =9.262; p<,05]. Considering the mean rank of the participants' family income levels, a significant difference was found between the secondary school students with middle family income level (mean rank=186.13) and those with lower (mean rank=216.38) and high (mean rank=232.55) income levels were found, which was against students with middle income levels.

Table 7. *Kruskal-Wallis H test results of the participants' water literacy levels by daily internet usage level variable*

	Daily Internet Usage	N	MeanRank	x^2	p	Different U
Water Conservation	None	29	124.14	14.888	.005	2-1
	Lessthan1hour	77	212.16			3-1

	1-3hours	155	213.49			4-1
	4-6hours	83	208.09			5-1
	6+hours	64	205.27			
	Total	408				
Water Awareness	None	29	168.97	7.812	.099	
	Lessthan1hour	77	233.28			
	1-3hours	155	203.55			
	4-6hours	83	199.15			
	6+hours	64	195.21			
	Total	408				
Water Sensitivity	None	29	255.72	8.892	.064	
	Lessthan1hour	77	212.38			
	1-3hours	155	188.82			
	4-6hours	83	210.91			
	6+hours	64	201.47			
	Total	408				

Table 7 demonstrates the results of Kruskal Wallis H test regarding the effect of daily internet use of secondary school students on their water literacy levels.

According to the results of the analysis, a significant difference was found in the water conservation sub-dimension of the scale in the water literacy levels of secondary school students with different internet usage levels [x^2(df=4; n=408) =14.888; p<,05]. Considering the mean rank of the participants regarding their daily internet use, a significant difference was found between secondary students those who never used the internet (mean=124.14) and lessthan 1 hour a day (mean=212.16), 1-3 hours (meanrank=213.49), 4-6 hours (mean=208.09), and 6+ hours (mean=205.27), which was against those who did not use the internet. This finding can be interpreted as the use of the internet has a positive effect on raising awareness on water conservation.

According to the results of the analysis, no significant difference was found between the water literacy levels of secondary school students with different daily internet usage times in the “water awareness” sub-dimension of the scale [x^2(df=4; n=408) =7.812; p>,05].

According to the results of the analysis, no significant difference was found between the water literacy levels of secondary school students with different daily internet usage times in the “water sensitivity” sub-dimension of the scale [x^2(df=4; n=408) =8.892; p>,05].

Table 8. *Kruskal-Wallis H test results of theparticipants’ water literacy levels by residential area variable*

	ResidentialArea	N	MeanRank	RankSum	U	p
Water Conservation	Village	178	168.80	30047.00	14116.000	.000
	City	230	232.13	53389.00		
	Total	408				
Water Awareness	Village	178	195.53	34803.50	18872.500	.176
	City	230	211.45	48632.50		
	Total	408				
Water sensitivity	Village	178	222.27	39564.50	17306.500	.007
	City	230	190.75	43871.50		
	Total	408				

Table 8 presents the results of the analysis of the Kruskal Wallis H test regarding the effect of the areas, where the secondary school students reside, on their water literacy levels.

When the table is examined, the results of the U test regarding the “water conservation” sub-dimension of the water literacy scale scores of the secondary school students in relation to the residential units group variable are found. According to these results, secondary school students’ water literacy scores show a significant difference in the “water conservation” sub-dimension, in relation to the variable of residential areas [U=-5.400; p<.05]. While the mean rank of the people living in the village was 168.80, the mean rank of the people living in the city was 232.13. According to these findings, it can be said that the water conservation awareness level of secondary school students living in the city is higher than those living in the village.

There is no significant difference in the “water awareness” sub-dimension of the water literacy scale scores of secondary school students in relation to the variable of residential areas [U=-1.354; p>.05]. While the mean rank of those living in the village was 195.53, the mean rank of those living in the city was 211.45.

In relation to the residential units group variable of secondary school students’ water literacy scale scores, the U test results related to the “water sensitivity” sub-dimension are seen here. According to these results, the water literacy scores of secondary school students show a significant difference in the sub-dimension of water sensitivity in relation to the variable of residential areas [U=-2.685; p<.05]. While the mean rank of the people living in the village was 222.27, the mean rank of the people living in the city was 190.75. These findings suggest that the water sensitivity level of secondary school students living in the city is higher than those living in the village.

Table 9. *Kruskal-Wallis H test results of the participants’ water literacy levels by being in the natural environment variable*

	Being in thenaturalenvironment	**N**	**MeanRank**	**x^2**	**p**	**Different U**
Water Conservation	Rarely	96	194.22	2.570	.277	
	Sometimes	184	200.63			
	Often	128	217.78			
	Total	408				
Water Awareness	Rarely	96	206.29	1.753	.416	
	Sometimes	184	196.64			
	Often	128	214.45			
	Total	408				
Water Sensitivity	Rarely	96	232.14	7.018	.030	1-2
	Sometimes	184	197.63			1-3
	Often	128	193.65			
	Total	408				

Table 9 shows the results of the analysis of the Kruskal Wallis H test regarding the effect of secondary school students’ presence in the natural environment on their water literacy levels.

According to the results of the analysis, there was no significant difference in the water literacy levels of secondary school students in the “water conservation” sub-dimension of the scale [x^2(df=2; n=408) =2.570; p>,05].

According to the results of the analysis, no significant difference was found in the water literacy levels of secondary school students in the “water awareness” sub-dimension of the natural environment

[x^2(df=2; n=408) =1.753; p>,05].

The results of the analysis suggest that a significant difference was found in the "water sensitivity" sub-dimension of the scale in the water literacy levels of the secondary school students being in the natural environment [x^2(df=2; n=408) =7.018; p<,05]. Mann-Whitney U test was conducted to determine between which groups there were significant differences, and according to the results of its analysis, a significant difference was found between those who were rarely in the natural environment (mean rank=232.14) and those who were sometimes in the natural environment (mean rank=197.63), and those who were often in the natural environment (mean rank=193.65), in favour of those were rarely in the natural environment.

CONCLUSION AND DISCUSSION

The importance of protecting and using water maintains its importance in the past and present because water is one of the most vital elements necessary for life. Therefore, people's attitudes on this subject and the level of their knowledge are always on the agenda and will continue to be on the agenda. In this study, water literacy levels of secondary school students were examined in relation to the variables of gender, class level, parental education status, daily internet use, residential area and frequency of being in the natural environment.

In the study, it was firstly examined whether the mean scores of secondary school students for the sub-dimensions of the water literacy scale differed significantly within the gender variable. As a result of the study, it was finalized that the mean scores of the students for the "water awareness", "water conservation", and "water sensitivity" dimensions in the water literacy scale did not differ within the gender variable. In parallel with this result, Wang, Chang and Liou (2019) and Tian, Wang and Wang (2021) also found in their multiple regression analysis that gender did not have a significant effect on water literacy. Küçük (2022), on the other hand, found in his study that the water literacy levels of lower- and upper-secondary students differed significantly in favour of girls in the "water conservation" dimension of the scale, but did not create a significant difference in other dimensions. Sözcü and Türker (2020b), Yentür, Sözcü and Aydınözü (2022), and Ekinci, Acıelma, Küçükseymen, Öztürk, Kubilay, Yelseli, and Toprak (2022) maintained different results from this study. In those studies, in which the water literacy levels of upper-secondary students were determined, they found a significant difference in all sub-dimensions of the scale according to the gender of the students and stated that this difference was in favour of female students. In the study, the researchers interpreted this difference as the fact that female students were more sensitive and conscious about water due to their personal characteristics brought about by gender difference. Febriani, (2017), on the other hand, found that women's water literacy levels were lower than men's. Given the result of this study, it can be stated that because water is one of the most important vital resources, this issue has reached a level that will affect people of all ages, all genders, and all segments of society, as is the case with many other issues today.

As a result of the research, while there was no significant difference in the water literacy levels of secondary school students at different class levels in the "water conservation" sub-dimension of the scale, a significant difference was found in the "water awareness" and "water sensitivity" sub-dimensions. While the mean scores of class 5 and 6 were higher in the "water awareness" dimension, it was concluded that class 6 students' water sensitivity was higher in the "water sensitivity" sub-dimension. Yentür et al. (2022), in their study in which they determined the water literacy levels of upper-secondary students, defined differently from this study that there was a significant difference in the "water conservation" sub-dimension for the students in relation to the class level while a significant difference was not found among the students in the "water sensitivity" sub-dimension in relation to the class level. In the "water awareness" sub-dimension, a similar result was reached with this study, and the mean scores of students differed significantly based on the class level. Ekinci et al. (2022), in their studies with upper-secondary students, a significant difference was determined in all sub-dimensions of the water literacy scale in relation to the class level, and this difference was determined as a difference in favour of class 9 students. As in many subjects at each level of education, trainings on the importance of water use, water conservation, etc., which are either dependent or independent to environmental issues, are important in terms of raising awareness and generating consciousness on this issue. In this way, social awareness will also be ensured. When the results of the research are evaluated, it is seen that the average scores/levels of students in terms of water awareness and sensitivity are lower as the class level increases. This situation can be interpreted that the education provided in this regard remains insufficient once the level of education increases. Therefore, it can be stated that it is a necessity to include subjects related to water literacy in education programmes and textbooks to continue the development.

Among the other variables discussed in the study, there is the variable of parental education status, which may affect the water literacy levels of secondary school students. As a result of the research, it was concluded that as the mothers' education level increased, the "water conservation" level and awareness of the participants increased. In the "water awareness" sub-dimension of the water literacy level of those students in relation to maternal education status, a significant difference was found between those with maternal education status as illiterate and those with maternal education status as primary education, which was in favour of those with maternal primary education level. In the "water sensitivity" sub-dimension of the scale, there was no significant difference according to the education level of the mother. In parallel with this study, Yentür et al. (2022) found a significant difference in the "water awareness" dimension of the scale related to the educational status of the mother. However, unlike this study, they determined that there was no significant difference among students in the "water conservation" sub-dimension. Also, in the "water sensitivity" sub-dimension, there was a significant difference among them. Ekinci et al. (2022), on the other hand, showed a significant difference in the "water conservation" sub-dimension in their study, while no significant difference was found in the "water awareness" and "water sensitivity" dimensions in relation to the maternal education level. Sözcü and Türker (2020b), on the other hand, found a significant difference in all sub-dimensions of the scale between those whose mothers' education level is categorised as illiterate and whose mothers' education level is categorised as university.

According to the paternal education level of students, in the "water conservation" sub-dimension of the scale, a significant difference was found between those whose paternal education level was categorised as illiterate and those as primary and lower secondary school, upper-secondary school, and university. The significant difference is against the former category of paternal education level. Based on this finding, it can be stated that the level of water literacy in the "water conservation" sub-dimension of the scale increases as the education level of the father increases. There was no significant difference in the water literacy levels of students in the "water awareness" and "water sensitivity" sub-dimensions of the scale, based on the paternal educational status though. In the studies of Yentür et al. (2022), unlike this study, it was observed that there was a significant difference in the "water awareness" and "water sensitivity" dimensions of the water literacy scale, while there was no significant difference in the "water conservation" sub-dimension. In the study of Ekinci et al. (2022), in parallel with this study, they determined a significant difference related to students' paternal education level in the "water conservation" dimension, but they did not find a significant difference related to students' paternal education level in the "water sensitivity" sub-dimension. Unlike this study, they determined in their study that there was a significant difference in the dimension of "water awareness" and concluded that the water sensitivity of students increased as much as the paternal education level increased. Sözcü and Türker (2020) found significant differences in all sub-dimensions of the water literacy scale in their study. Significant difference was found in the "water conservation" and "water awareness" sub-dimensions of the scale, between those with paternal education level as primary school and those as university. In the "water sensitivity" sub-dimension, there were significant differences between those with paternal education level as primary school and those with paternal education level as upper-secondary school and university.

Considering the family income level variable, as a result of the research, there was a significant difference in the “water awareness” sub-dimension of the scale. However, there was no significant difference in the “water conservation” sub-dimension of the water literacy scale. Considering the mean rank of the participants’ family income levels, there is a significant difference between secondary school students with lower family income and those with middle- and upper-income levels, which is in favour of students with lower family income. On the other hand, the significant difference determined in the “water sensitivity” sub-dimension of the scale is against those with middle family income compared to those with lower- and upper-income levels. In their study that is parallel with this study, Yentür et al. (2022) concluded that family income status was not effective in the “water conservation” dimension of the water literacy scale, while it was concluded in both studies that the family income status was effective in the “water awareness” sub-dimension. In the sub-dimension of “water awareness” determined in both studies, it is remarkable that students with low family income are more conscious about water. Yentür et al. (2022) explained this situation in their study as the students living in low-income families were more interested in water-related research and they regarded the result of their research as an important data when the items forming water awareness were examined. Ekinci et al. (2022), on the other hand, concluded that students with lower- and upper-family income levels were more conscious about water conservation and water sensitivity than students with middle-income level, while water awareness is higher in students with middle-income level. Tian et al. (2021), in their multiple regression analysis, found that income had an effect on water literacy. Küçük (2022), on the other hand, found that family income had no effect on water literacy of lower-secondary and upper-secondary students.

In proportion to the results of the research, a significant difference was found in the “water conservation” sub-dimension of the water literacy levels of secondary school students with different internet usage times, which is in favour of students with more internet usage time. This result can be interpreted as the use of the internet has a positive effect on raising awareness on water conservation. There was no significant difference in the “water awareness” and “water sensitivity” sub-dimensions of the scale according to the internet usage time of students.

The water literacy scale scores of secondary school students showed significant differences in the sub-dimensions of “water conservation” and “water sensitivity” with regards to the residential area variable. As a result of the research, it was determined that secondary school students living in the city had higher awareness levels of water conservation and water sensitivities than those living in villages. It can be said that this situation stems from the fact that the problems related to water in cities are more than in villages. In the "water awareness" sub-dimension of the scale, it was determined that the residential area did not cause any difference among students.

In regard to the results of the research, a significant difference was found in favour of students living in the cities, for the “water conservation” dimension of the water literacy scale in relation to the residential area variable. This finding is in similar with the study of Küçük (2022) on lower- and upper-secondary students. In the “water awareness” dimension of the water literacy scale, there was no significant difference in favour of those living in any residential units. This finding is also in similar with the study of Küçük (2022). In the “water sensitivity” dimension of the water literacy scale, a significant difference was found in favour of students living in the villages. This finding differs with the study of Küçük (2022). Küçük (2022), in his study, concluded that the water literacy status of lower- and upper-secondary students in the “water awareness” sub-dimension of the water literacy scale did not differ in accordance with the residential area. Tian et al. (2021), as a result of the multiple regression analysis, conducted in their study that the residential area had an effect on water literacy. Sözcü and Türker (2020b) also tested whether the water literacy levels of upper-secondary students differed based on the region they live in. The results showed that water literacy levels in all sub-dimensions of the scale differed based on the geographical region in which upper-secondary students lived. This finding can be interpreted as the development or education level of the region where students live affects the water literacy levels of them.

The last variable discussed in the study was the situation of secondary school students being in the natural environment. No significant difference was found in the "water conservation" and "water awareness" sub-dimensions of the scale, related to students' presence in the natural environment. Yet, in the "water sensitivity" sub-dimension, a significant difference was found in favour of those who were rarely in the natural environment in comparison to those who sometimes were in the natural environment and those who were often in the natural environment.

Water literacy can be added to environmental issues in order to make students gain water literacy in the primary education program.

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Examination of Projects Prepared by Prospective Secondary School Mathematics Teachers Using Scratch

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ABSTRACT

The aim of this study is to examine the projects prepared by prospective secondary school mathematics teachers using Scratch for the learning outcomes in the Mathematics Course Curriculum (Secondary School 5^{th}, 6^{th}, $7^{th,}$ and 8^{th} grades) in terms of the proficiency level of programming concepts and computational thinking concepts. 73 prospective secondary school mathematics teachers participated in this research in which the case study design was used. Prospective teachers prepared Scratch projects related to the 5^{th}, 6^{th}, $7^{th.}$ and 8^{th}-grade level learning outcomes of the Mathematics Course Curriculum. A total of 292 Scratch projects were examined within the scope of the research. Scratch projects were evaluated through the "Scratch Projects Assessment Rubric" and the "Dr. Scratch Assessment Tool". The result of the research showed that most of the criteria in the "Scratch Projects Assessment Rubric" were provided in more projects than at the beginning as new projects were developed by the prospective teachers at different grade levels every week. Nevertheless, it was evident from the Dr. Scratch evaluation that as the prospective instructors utilized the Scratch program, the level of proficiency of the projects they created is improved. It is recognized that this beneficial development has occurred because of the rise in the number of potential instructors who have experience with the Scratch program.

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INTRODUCTION

In today's world where information technology is developing very rapidly, the computer shows its effect as an indispensable tool in all areas of life increasingly. Programming, which is an indispensable component of computers, is also progressing by diversifying in parallel with this visible and developing effect of computers (Erümit & Berigel, 2018). In line with these developments, a wide range of computer programs that will be beneficial for the students is developed and used in education, such as ensuring the active participation of the students in the course, keeping their interest in the course alive, and increasing their motivation (Öztürk, 2021). Integration of technology into education is to make technology an indispensable element of education processes in accordance with learning objectives as well as incorporating technology into education (Atun & Usta, 2019).

Overcoming rapid changes and making sense of the world requires not only understanding how technology is advancing but also acquiring and developing skills that will help adapt to these changes (Erdoğan & Şimşek, 2018). In this sense, programming is accepted as one of the 21st century skills that everyone should have (Yükseltürk & Üçgül, 2018). Programming refers to all activities from the design of a solution to its implementation in the process of solving a problem (Karal et al., 2018). Another concept that is not considered separately from this concept and affects each other is the computational thinking skill when it comes to programming (Üzümcü & Bay, 2018). Computational Thinking refers to problem-solving, designing systems, and understanding human behavior by making use of the basic concepts of computer science. Computational thinking is a fundamental skill that should be known not only by computer scientists but also by different segments of the population concerned (Wing, 2006).

In the world evolving into the information age, new technologies that are inevitably bound to be widely used, lead to updates in the education-teaching process by providing new opportunities (Ersoy, 1997; Oluk & Çakır, 2021). While these new tools enable to restructure of the processes of learning and teaching mathematics, they also guide the expectations from mathematics and the way they use mathematics (MONE, 2018). In the literature, it is seen that the contribution of technological tools to mathematics education is widely included: Software that draws graphs, computer algebra systems, software with a programming language, and graphing calculators are some of them. In addition, it is becoming easier for students to visualize mathematical concepts and to have access to multiple representations of concepts quickly and effectively (Akkoç, 2013). In recent years, many countries have realized the importance of programming and started to teach programming either as an independent course or by integrating it into different subjects such as mathematics and physics (Apriola & Tedre, 2012, as cited in Şimşek, 2018). In particular, there is a remarkable relationship between mathematics and programming. In the context of this relationship, it is possible to associate the programming curriculum with the mathematics course outcomes and enrich the content of the courses (Lewis & Shah, 2012). In addition, it is possible to teach some abstract and difficult-to-comprehend content in mathematics programs more easily through programming (Akpınar & Altun, 2014).

Many students struggle with learning programming (Gomez & Mendes, 2007). Traditional programming languages such as C, C++ are difficult for students to learn (Genç & Karakuş, 2011). Traditional programming languages are structurally difficult, and complex, can cause some difficulties. Recently, open-source platforms such as Scratch, Google Blockly, and Code.org, which make programming easier, user-friendly, and supported by many visual features, have been developed to guide and encourage candidates who are just starting to learn programming (Aytekin et al., 2018). Among these platforms, Scratch is a block-based visual programming environment that allows the creation of interactive and communication-rich projects. In fact, Scratch was initially used in informal learning environments, then it is increasingly used as an educational teaching material in schools (Maloney et al., 2010). The fact that Scratch is suitable for easy and fast learning, as well as being easy-accessible and allowing those who want to learn to improve their programming skills, increases the frequency of its application in the field of education (Iskrenovic-Momcilovic, 2020). The Scratch program provides students with an environment where they can enjoy programming and exploration and creativity, while also supporting them to improve their understanding of embedded programming and mathematical concepts (Calder, 2018). Scratch can be used as a tool to support students' learning while simultaneously facilitating teachers' teaching efforts (Mo et al., 2021).

The development of these easier-to-use programming languages provides educators with significant opportunities how to use these programs to teach math more easily and with fun (Germia & Panorkou, 2020). In this sense, while discussing the importance of programming in the educational process, it should not be ignored that teachers and prospective teachers are at the center of this process (Güleryüz et al., 2020); because one of the most important functions of education is to raise individuals equipped with the skills required by their era (Doğan, 2014). The development of prospective teachers skills in using technology can be considered a critical variable that improves the quality of the education system (Usta & Korkmaz, 2010). In this sense, it is important and necessary to train prospective teachers who are equipped with the skills required by the information age due to their critical roles in the education process and the mission they have (Güleryüz et al., 2020). In the literature, there are studies evaluating Scratch projects. It is seen that Scratch projects are evaluated in terms of pedagogical aspects (Öztürk, 2021), in terms of design elements and educational aspects (Yıldız Durak and Karaoğlan Yılmaz, 2019), in terms of programming concepts (Yıldız Durak et al.,2018; Gabriele et al., 2019; Öztürk, 2021) or in terms of computational thinking concepts (Gabriele et al., 2019) in these studies. Considering the studies that evaluate the projects in terms of programming concepts or proficiency level of computational thinking concepts; it is seen that study groups include primary teacher education prospective teachers (Gabriele et al., 2019), students of psychological counseling and guidance and social studies teaching department (Yıldız Durak et al., 2018), mathematics teachers (Öztürk, 2021), prospective kindergarten teachers (Papadakis and Kalogiannakis). In this sense, it is understood that the studies conducted with prospective secondary school mathematics teachers are incomplete. Due to its explained importance and determined deficiency, in this study, it is aimed to examine the projects prepared by prospective secondary school mathematics teachers, using Scratch for the learning outcomes in the Mathematics Course Curriculum (Secondary School 5th, 6th, 7th, and 8th grades) in terms of programming concepts and competency level of computational thinking concepts. In line with this purpose, the following questions were tried to be answered:

1. Which programming concepts do prospective secondary school mathematics teachers include in the projects they prepare by using Scratch for the learning outcomes in the Mathematics Course Curriculum (Secondary School 5th, 6th, 7th, and 8th Grades)?

2. What is the Proficiency Level of Computational Thinking Concepts in the projects prepared by prospective secondary school mathematics teachers using Scratch for the learning outcomes in the Mathematics Course Curriculum (Secondary School 5th, 6th, 7th, and 8th Grades)?

METHOD

Research Design

Case study design was used in the study. The purpose of case studies is to reveal the results related to a particular situation. In this study, the holistic single case design, one of the case study designs, was used. In holistic single case studies, there is only one analysis unit, and it is aimed to interpret a situation holistically in its natural environment (Yıldırım & Şimşek, 2006).

Research Study Group

73 prospective teachers who took the Algorithm and Programming course in the 2^{nd} grade of the secondary school mathematics teacher education undergraduate program of a state university participated in the study. Since the pre-service teachers took Algorithm and Programming course in the 2^{nd} grade, the study was carried out with 2^{nd} grade students. Purposive sampling, one of the non-probability-based sampling methods, was used in the study.

Table 1. *Distribution of the study group by gender*

GENDER	f	%
Female	55	75.3
Male	18	24.7
Total	73	100

Examining Table 1, it can be seen that 75.3% of the prospective teachers participating in the study are female and 24.7% are male students.

Research Instruments and Processes

The study was carried out within the scope of the "Algorithm and Programming" course taken by prospective secondary school mathematics teachers for one semester. Due to the COVID-19 outbreak, the study was carried out synchronously through the distance education system of the university. Moreover, in addition to the live sessions, video footage was made by the researcher in which the Scratch program was narrated, and those videos were uploaded to the researcher's personal YouTube channel. The links to the uploaded videos were sent to the prospective teachers through the distance education system. The deficiencies of the Scratch program were eliminated during the live class hours by asking the researcher about the issues that the prospective teachers did not understand in the video recordings they watched. Prospective teachers started to prepare Scratch projects, starting from the 5^{th}-grade level, at the 6^{th}, 7^{th}, and 8^{th}-grade levels respectively, in accordance with the learning outcomes of the 2018 Mathematics Course Curriculum (Secondary School 5^{th}, 6^{th}, 7^{th} and 8^{th} Grades), after the completion of the Scratch program courses. The projects at the 5^{th}, 6^{th}, 7^{th}, and 8^{th}-grade levels, which were prepared by each prospective teacher, were uploaded on both the distance education system and to the Scratch studios opened by the researcher on the Scratch website. The prospective teachers uploaded Scratch projects to the created studios, which were selected based on various learning outcomes. This allowed them to observe, assess, and provide feedback on projects that were designed with different learning objectives. Moreover, they were able to generate new ideas and concepts for the projects they would create for the subsequent grade level. Each of the 73 pre-service teachers prepared 4 Scratch projects, one for each grade level (5^{th}, 6^{th}, 7^{th}, and 8^{th} grade). Thus a total of 292 Scratch projects were prepared by prospective teachers at the end of the study. The projects prepared by the prospective teachers regarding the learning outcomes in the Mathematics Course Curriculum (Secondary School 5^{th}, 6^{th}, 7^{th}, and 8^{th} Grades) were analyzed with the "Scratch Projects Assessment Rubric" and "Dr. Scratch Assessment Tool".

Scratch Projects Assessment Rubric

A coding schema has been developed by Denner et al. (2012) that is thought to correspond to computer science programming concepts and that will be used to determine the extent to which these concepts are used in the content when content is created. The coding scheme consists of 3 main categories and 24 subcategories. Gabriele et al. (2019) adapted this coding scheme according to Scratch and organized it into 3 main and 17 subcategories. The first main category, "Programming Concepts", consists of 9 subcategories, the second main category, "Code Organization", 3 subcategories, and the third main category, "Designing for Usability", consists of 5 subcategories. In the developed project, 1 or 0 points are given according to whether each item is present or not, and the project is evaluated. This assessment rubric also reveals which computational thinking concepts are learned by users (Gabriele et al., 2019). Denner et al. (2012) refer to the categories of "Programming Concepts", "Code Organization" and "Designing for Usability" in this coding scheme as 3 competencies that they determine to engage individuals with computational thinking, and these competencies are evaluated with this coding scheme.

Dr. Scratch Assessment Tool

Dr. Scratch is a free open-source web application that allows you to easily analyze Scratch projects as well as obtain feedback that can be used to improve programming skills and computational thinking. To analyze a project with Dr. Scratch, simply copying the project's Uniform Resource Loader (URL) is sufficient. Analyzing a Scratch project using Dr. Scratch, it shows the user the computational thinking score. Dr. Scratch assesses proficiency in seven concepts. These are flow control, data presentation, abstraction and parsing, user interaction, synchronization, parallelism, and logic. A project is evaluated on a scale of 0-21 and each competency is evaluated on a scale of 0-3 (Moreno Leon et al., 2015). Projects are accepted at the "Basic" level between 0-7 points, "Developing" level between 8-14 points, and "Proficiency" level between 15-21 points according to the score they receive (Moreno Leon & Robles, 2015). The application also reveals situations such as bad programming habits, code repetitions, and codes that never work (Demir & Seferoğlu, 2017). Dr. Scratch also provides users with a link to download project certificates that show the score they received from their project (Setyawan, 2020).

Data Analysis

The projects prepared by the prospective teachers according to the 5th, 6th, 7th, and 8th-grade curriculum learning outcomes were analyzed with Dr. Scratch Assessment Tool and Scratch Projects Assessment Rubric, and descriptive statistics (percentage, frequency, average) were included. The evaluation of the projects was conducted using the Scratch Projects Evaluation Rubric, with the researcher, a field expert, and a computer engineer expert analyzing the projects. To ensure the reliability of the data analysis, a formula [Consensus / (Consensus + Disagreement) x 100] was utilized (Miles & Huberman, 1994). As a result of this independent verification, 96% inter-rater reliability was achieved. In cases where there are different encodings, the coders are united on a common opinion and codified. Sample Project Evaluation with Scratch Projects Assessment Rubric is given below.

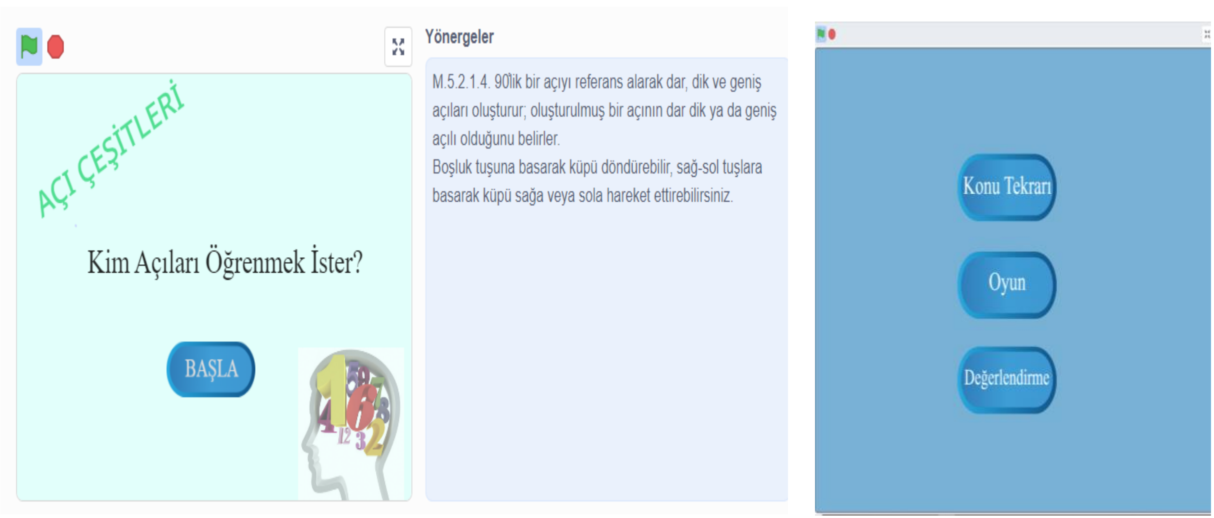

Figure 1. *Example of a scratch project prepared by a prospective teacher*

The project, which was prepared by choosing the learning outcome of M.5.2.1.4 from the 5th grade geometry and measurement learning field, was prepared in three parts as subject repetition, game, and evaluation. It is seen that the sequence, user interaction, iteration/loop, variables, conditional states, coordination and synchronization, random numbers and boolean logic criteria are included in the

Programming Concepts main category when the project is examined according to the Scratch projects assessment rubric. Looking at the Code Organization main category, it is seen that there is no extraneous block used in the project. In the game part of the project, a variable was created and named "*score*" in accordance with its purpose, but the names of most sprite used in the project were left as they were in the program's library. Assessing the criteria within the Design for Usability main category, it is seen that the program has been meticulously developed to align with its intended purpose, as determined by the selected learning outcome. The program operates seamlessly, meeting the functionality criterion. Furthermore, the project encompasses user customization of sprites and stage, with a clear and concise explanation of its operations, and it stands out as an original creation. Accordingly, the scoring of the project is given Table 2.

Table 2. *Scoring of the project*

PROGRAMMING CONCEPTS	***f***
1. Sequence	1
2. User interaction	1
3. Iteration / Loop	1
4. Variables	1
5. Conditional statements	1
6. Lists (arrays)	0
7. Coordination and synchronization	1
8. Random numbers	1
9. Boolean logic	1
CODE ORGANIZATION	
10. Extraneous Blocks	0
11. Sprite names	0
12. Variable names	1
DESIGNING FOR USABILITY	
13. Functionality	1
14. Sprite customization	1
15. Stage customization	1
16. Clear instructions	1
17. App originality	1

Ethic

For the research, the ethics committee approval was obtained from Necmettin Erbakan University, Social Sciences, and Humanities Scientific Research Ethics Committee with the decision dated 19.02.2021 and numbered 2021/83.

RESULTS

The Scratch Projects Assessment Rubric adapted by Gabriele et al. (2019) was used to analyze the programming concepts used by prospective teachers in their Scratch projects related to, respectively, 5^{th}, 6^{th}, 7^{th}, and 8^{th}-grade learning outcomes using the Scratch 3.0 program. A total of 292 Scratch projects were analyzed within the scope of the study. The frequency and corresponding percentage values of the criteria in the Scratch Projects Assessment Rubric showing how many of the projects were prepared according to the learning outcomes in the mathematics program at each secondary school grade level by 73 prospective teachers within the scope of the study are presented in Table 3.

Table 3. *Scratch projects assessment rubric results*

	5th grade		**6th grade**		**7th grade**		**8th grade**	
PROGRAMMING CONCEPTS	***f***	**%**	***f***	**%**	***f***	**%**	***f***	**%**
1. Sequence	67	91.8	67	91.8	70	95.5	71	97.3
2. User interaction	66	90.4	65	89.0	70	95.5	69	94.5
3. Iteration / Loop	44	60.3	51	69.9	54	74.0	65	89.0
4. Variables	36	49.3	32	43.8	39	53.4	48	65.8
5. Conditional statements	62	84.9	61	83.6	66	90.4	65	89.0
6. Lists (arrays)	2	2.7	3	4.1	4	5.5	4	5.5
7. Coordination and	40	54.8	41	56.2	55	75.3	56	76.7

synchronization								
8. Random numbers	19	26.0	12	16.4	13	17.8	11	15.1
9. Boolean logic	9	12.3	15	20.5	12	16.4	11	15.1
CODE ORGANIZATION								
10. Extraneous Blocks	20	27.4	16	21.9	8	11.0	6	8.2
11. Sprite names	7	9.6	8	11.0	10	13.7	12	16.4
12. Variable names	36	49.3	32	43.8	39	53.4	48	65.8
DESIGNING FOR USABILITY								
13. Functionality	49	67.1	57	78.1	63	86.3	65	89.0
14. Sprite customization	13	17.8	15	20.5	15	20.5	15	20.5
15. Stage customization	13	17.8	15	20.5	21	28.8	22	30.1
16. Clear instructions	61	83.6	62	84.9	63	86.3	65	89.0
17. App originality	21	28.8	32	43.8	30	41.1	40	54.8

According to table 3, when the Scratch projects prepared by the prospective secondary school mathematics teachers based on the learning outcomes in the mathematics program at each secondary school grade level are examined in terms of grade level, it is seen that *sequence*, *user interaction*, and *conditional statements* criteria in the Programming Concepts main category, the *extraneous blocks* criterion in the Code Organization main category and the *functionality* and *clear instructions* criteria in the Designing for Usability main category are provided in more projects at secondary school grade levels. The *lists*, *random numbers*, and *Boolean logic* criteria in the Programming Concepts main category, the *sprite names* criterion in the Code Organization main category, and the *sprite customization* and *stage customization* criteria in the Designing for Usability main category appear to be provided in fewer projects at all grade levels.

It is seen that many of the "Scratch Projects Evaluation Rubric" criteria of the projects prepared by prospective teachers for the 5th, 6th, 7th, and 8th-grade levels of secondary school have increased at the 8th-grade level compared to the 5th grade in case of usage. That is, the criteria are included in more of the last 8th-grade level projects compared to the 5th-grade level projects prepared at the beginning.

Accordingly, while the *iteration/loop, variables, coordination, and synchronization* criteria in the main category of Programming Concepts are used by the prospective teachers in more projects than at the beginning and the usage increase is higher, the usage case of the *random numbers* criterion is in fewer projects than at the beginning and the use of *boolean logic* and *lists (arrays)* criteria is not sufficient and its use appears to be low even though it is in a few more projects than the beginning.

Examining the main category of code organization, it is seen that the use of *extraneous blocks* in projects created by prospective teachers gradually decreases as more projects are created. As prospective teachers create more projects, it is seen that *variables* are used in more projects and this situation is also provided in the criterion of *giving meaningful names to the variables*. It is seen that the criterion of *sprite names* in the code organization category wasn't used adequately by prospective teachers, that is, they create their projects with the names in Scratch's own library for the sprites they use while creating their projects.

Examining the main category of designing for usability, it is seen that the *functionality* and *application originality* criteria are provided by the prospective teachers in more projects than at the beginning as more projects are created and the usage increase is higher, while the use of *sprite customization* and *stage customization* criteria is not sufficient even though they are provided in slightly more projects than the beginning.

Dr. Scratch Assessment Tool was used to analyze the proficiency level of Scratch projects related to 5th, 6th, 7th, and 8th-grade curriculum learning outcomes in terms of computational thinking concepts prepared by prospective teachers using the Scratch 3.0 program, and 292 Scratch projects were analyzed. The distribution of the obtained data is presented in Table 4.

Table 4. *Distribution of analysis results according to dr. scratch assessment tool*

	Basic		Developing		Proficiency		Total	
Grade Level	***f***	**%**	***f***	**%**	***f***	**%**	***f***	**%**
5th grade	6	8.2	42	57.5	25	34.2	73	100
6th grade	5	6.8	34	46.6	34	46.6	73	100
7th grade	3	4.1	35	47.9	35	47.9	73	100
8th grade	1	1.4	30	41.1	42	57.5	73	100

It is observed that 6 (8.2%) of the Scratch projects prepared by prospective teachers related to 5th-grade learning outcomes are at the basic level, 42 (57.5%) are at the developing level and 25 (34.2%) are at the proficiency level, 5 of the Scratch projects (6.8%) prepared for the 6th-grade learning outcomes are at the basic level, 34 of them (46.6%) are at the developing level and 34 (46.6%) are at the proficiency level, 3 of the Scratch projects prepared for the 7th-grade learning outcomes (4.1%) are at the basic level, 35 (47.9%) are at the developing level, 35 (47.9%) are at the proficiency level, 1 (1.4%) of the Scratch projects prepared for 8th-grade learning outcomes are at the basic level, 30 (41.1%) are at the developing level and 42 (57.5%) are at the proficiency level when Table 4 is examined. Accordingly, as the use of the Scratch program increases, it is seen that the adequacy level of the prepared projects is also increased.

The distribution of the average scores of the 7 computational thinking concepts in the Dr. Scratch assessment tool of the Scratch projects prepared by the prospective teachers according to each grade level is given in Table 5.

Table 5. *Score averages results of computational thinking concepts in dr. scratch assessment tool of projects prepared at grade level*

	Concepts of Computational Thinking						
Grade levels of prepared Scratch projects	Flow Control	Data Representation	Abstraction	User Interactivity	Synchronization	Parallelism	Logical Thinking
	$\overline{X}$	$\overline{X}$	$\overline{X}$	$\overline{X}$	$\overline{X}$	$\overline{X}$	$\overline{X}$
5th grade	2.03	1.53	1.12	1.95	2.34	2.10	1.75
6th grade	2.18	1.52	1.30	1.93	2.41	2.49	1.90
7th grade	2.29	1.60	1.11	1.97	2.53	2.53	1.92
8th grade	2.33	1.73	1.21	1.95	2.71	2.77	1.97

According to Table 5, when the average scores of the computational thinking concepts used by the prospective teachers in the Scratch projects they prepared for the 5th, 6th, 7th, and 8th-grade learning outcomes, respectively, are examined, the fact that the most common computational thinking concepts determined in the projects are flow control, synchronization, and parallelism, while the least is the abstraction is seen. In addition, the fact that the average scores of the computational thinking concepts used in the recent (related to the 8th-grade learning outcomes) projects of the prospective teachers are higher than the first projects they have done (related to the 5th-grade learning outcomes) is observed.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

After the explanation and applications related to the Scratch program were completed in the scope of the research, the prospective teachers developed projects starting from the 5th-grade level related to the learning outcomes in the Mathematics Course Curriculum (Middle School 5th, 6th, 7th, and 8th Grades). A total of 292 projects, 73 at each grade level, were examined and evaluated. Accordingly, it was seen that most of the criteria in the "Scratch Projects Evaluation Rubric" were provided in more projects than at the beginning as new projects were developed by prospective teachers at different grade levels every week. It can be said that Scratch (Yoon et al., 2016), which is a good programming tool to teach programming concepts to new learners of programming, has a positive effect on the increase in prospective teachers' use of Scratch. Moreover, it helps to develop new projects (from 5th-grade level to 8th-grade level), to discover programming concepts and to reflect them in the projects.

Examining the projects made at each grade level, it is seen that the *sequence*, *user interaction,* and *conditional statements* criteria in the "Programming Concepts" main category of the Scratch Projects Assessment Rubric are met in most of the projects. Sequential execution (algorithmic order) is one of the basic concepts that a Scratch user encounters when starting to create a project (Maloney et al., 2008). In this sense, it is thought that most prospective teachers understand this basic programming concept from the moment they start creating Scratch projects. In the study conducted by Gabriele et al. (2019) with prospective teachers, it was seen that all projects prepared by prospective teachers provided *sequence* criteria. Similarly, in a study conducted by Öztürk (2021) with mathematics teachers, when the games designed by the teachers with the Scratch program were examined, it was seen that the *sequence* criterion was complied with in all the games.

Since the projects, demonstrate the use of *user interaction* are the majority at each grade level, indicated that the prospective teachers prefer to design projects in a way that requires the active use of the students and that the majority of their projects have been game-based. In addition, it is noted that most Scratch projects have the requirement of *user interaction* in the research examined in the projects in the literature (Gabriele et al., 2019, Maloney et al., 2008; Wilson et al., 2012).

In the main category of Programming Concepts, it has been seen that the criteria of *iteration/loops, variables, coordination, and synchronization* are included in more projects than at the beginning as more projects are created by prospective teachers and this situation is increasing. On the other hand, both at the beginning and as more projects are created, it becomes clear that programming concepts such as *random numbers*, *boolean logic*, and *lists(arrays)* are used in much fewer projects. The reason why these concepts are used in far fewer projects is that these programming concepts are difficult to learn (Gabriele et al., 2019) and not easily explored (Maloney et al., 2008).

Looking at the main category of Code Organization included in the rubric, the *extraneous blocks* usage errors that do not affect the functioning of the program (Gabriele et al., 2019) were seen less as the number of projects developed by prospective teachers increased. It is indicated that if prospective teachers are given the opportunity to develop projects more frequently, it may have a positive effect on the fact that such errors are less common. Similarly, studies examining Scratch projects in the literature have revealed that only a tiny percentage of students used excess blocks (Funke et al., 2017; Gabriele et al., 2019; Wilson, 2012).

Usability is when a tool can be used effectively for a specific purpose (Denner et al., 2012). It has been observed that as prospective teachers create more projects, they give more space to the *functionality* and *application originality* criteria in the main category of Designing for Usability. Therefore, as the experiences of prospective teachers increase, it can be said that the projects developed meet these criteria with an increasing trend. This positive change is considered to have created or will cause an increase in original projects. The projects developed by the prospective teachers were evaluated for the *Functionality* criterion, both in terms of suitability for the selected learning outcomes (suitable for the purpose) and the fact that the project was working without error. The *functionality* criterion also shows a positive course in the process. In direct proportion to the experiences of the prospective teachers, it is believed that there is a rise in the number of error-free projects appropriate for the chosen acquisition.

It was observed that the *Sprite names* in the Code Organization category and the *Sprite customization* and *Stage customization* criteria in the Designing for Usability category were included in very few of the projects developed and that there was not a sufficient increase in the use cases of the criteria in this category as the number of projects increased. In the study in which Funke et al. (2017) examined 127 Scratch projects made by university 4th-grade students, it was found that none of the sprites used in the developed projects had name editing, and most of the projects did not have sprite customization (85%) and stage customization (88%).

A total of 292 projects developed by 73 prospective teachers were evaluated by the Dr. Scratch assessment tool, an automated assessment tool. In the first stage, 6 of the projects prepared by the prospective teachers with 5th-grade learning outcomes were at the basic level and 25 of them were at the proficiency level, while 1 of the projects prepared with 8th-grade learning outcomes was at the basic level and 42 of them were at the proficiency level. It is seen that the average scores of the computational thinking concepts are higher in the last (8th grade) projects compared to the projects they first did for the 5th-grade level when the average scores of the projects according to the seven computational thinking concepts in the Dr. Scratch assessment tool are examined. The increased experience of prospective teachers using the Scratch software is assumed to be the cause of this positive change.

It was seen that as the prospective teachers gained experience when the programming concepts used in similarly developed projects were analyzed with the Scratch Projects Assessment Rubric, there was an increase in the number of projects in which many criteria in the rubric were used together. Therefore, it is true that developing more projects and gaining experience is effective in discovering both programming and computational thinking concepts.

The lowest average score was recorded in the concept of *abstraction*. In the study where the education process was evaluated by Papadakis and Kalogiannakis (2019) within the scope of Introduction to Programming with Scratch with prospective kindergarten teachers, 93 projects developed by prospective teachers at the end of the 13-week course were analyzed with Dr. Scratch assessment tool and it was seen that the lowest average score was in the concept of *abstraction*. Similarly, Hoover et al. (2016) evaluated computational thinking in students' game designs within the scope of the research given to 5 secondary school girls after the training was analyzed with the Dr. Scratch assessment tool and it was seen that the lowest score in the projects was generally for the concept of *abstraction*. Gabriele et al. (2019) also found that when they evaluated 40 Scratch projects made by prospective teachers with the Dr. Scratch evaluation tool, the concept of *abstraction* was used in the projects least. Troiano et al. (2020) used the Dr. Scratch assessment tool in their study to investigate how game types affect the development of computational thinking in Scratch games developed by 8th-grade students. As a result of the research, it was found that the concept of *abstraction* in most game types has low scores. In the literature, it is stated that it is difficult to teach *abstraction* to inexperienced novice users (Armoni, 2013). In this sense, although prospective teachers have developed projects at more than one different grade level in the process, it is thought that this is not enough for the development of the concept of *abstraction*.

The incorporation of technology into mathematics education helps to learn mathematical concepts in a meaningful way (İnce Muslu & Erduran, 2020). In this sense, programming can also be integrated into lessons, and teaching other topics through programming becomes more interesting, and it will be easier and faster for students to learn new concepts (Iskrenovic-Momcilovic, 2020). Depending on the results of this research, it is recommended for mathematics teachers and prospective mathematics teachers, to learn different block-based programs in order to integrate programming into their courses and to develop themselves in terms of programming concepts and computational thinking concepts in order to use the programs effectively. Apart from Scratch, it is recommended to conduct research with other block-based programming tools.

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Opinions on Awareness Activities Regarding Inclusive Community Life: Experiences of Pre-Service Teachers

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ABSTRACT

The aim of this study is to examine the opinions of the Special Education teacher candidates about the awareness activities organized in terms of the rights of children with special needs, their social participation, accessibility and contributing to the social inclusion climate. 56 pre-service teachers studying in the 2nd year of the Special Education Department of the Faculty of Education were included in this study. The data of the research carried out in a phenomenological designwas collected through the analysis of the forms containing the written opinions of pre-service teachers in the fall term of 2022-2023. By analyzing the data with document analysis technique, it was gathered under five main themes: *"Classification of Organized Awareness Activities, Description of Activities Serving Purpose, Importance of Awareness Activities, Activities That Pre-service Teachers Want to Organize and Suggestions for Activities".* In awareness activities, it is noteworthy that the pre-service teachers, who draw attention to social, legal, and physical regulations, emphasize the importance of content that reflects a rights-based view and the fundamental rights of individuals for this purpose. It was also seen that pre-service teachers emphasized the importance of including permanent and continuous awareness activities rather than containing a certain time interval and diversifying them in terms of being aimed at different disability groups. Based on the results of the research, it can be suggested that family and peer participation in awareness activities in inclusive environments, up-to-date and continuity of activities, and information sharing about individuals with special needs can be recommended.

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INTRODUCTION

Awareness skills play a pivotal role in the inclusive community living of individuals with special needs, starting from early childhood and continuing throughout their developmental stages (İlhan & Esentürk, 2015). These skills encompass the ability to perceive, comprehend, and attentively engage with the surrounding world, enabling individuals to make sense of their environment. The cultivation of such skills is instrumental in fostering positive attitudes towards individuals with special needs, facilitating an understanding of various disabilities, and embracing individual differences (Lindsay & McPherson, 2012). However, individuals with disabilities encounter challenges in attaining equal participation in society and exercising their rights, much like their non-disabled counterparts (Carroll, Witten, Calder-Dawe, Smith, Kearns, Asiasiga, Lin, Kayes & Mavoa, 2018). To address these issues, numerous studies have integrated awareness activities aimed at promoting the rights and inclusion of individuals with disabilities (O'Connor, 2016; Hurst, Corning & Ferrante, 2012; Wardany, Hidayatullah & Wagimin, 2018). These activities can be organized in various ways to effectively cater to the diverse needs of individuals with special needs (O'Connor, 2016; Artman-Meeker, Grant & Yang, 2016).

According to the United Nations Convention on the Rights of the Child (1989), it is seen that the right of all children to participate fully and actively in society, to have self-confidence and to receive education under appropriate conditions is emphasized. Therefore, children with special needs, like their peers, have the legal right to support friendship relations, to be accepted, and to have a sense of belonging. Practices related to awareness activities have an important place in children's academic, social and emotional development in order to create social acceptance and cooperative learning opportunities (Columna et al., 2009). Inclusive educational environments are of critical importance for children with special needs, and although students with special needs spend most of their time in school environments, their acceptance by their peers is not at the level expected to be valued, and it is supported by studies that these children feel lonely and insecure (McDougall et al., 2004; Tavares, 2011). Attitudes of children with normal development towards children with special needs are directly related to the acquisition of knowledge about children in their social environment. Among the reasons for the negative attitudes of normally developing children towards their peers with special needs and their exclusion from social activities is due to their lack of knowledge about these children. Awareness activities organized for children with special needs play a major role in changing the negative attitudes of their peers (Hunt & Hunt; 2004; Nowicki, 2006). The number and type of awareness activities differ in terms of knowledge acquisition. It is suggested that awareness raising activities, in which different activities are used together, are more effective on children and should be used in a way that supports each other as much as possible (Flower et al., 2007; Hutzler et al., 2007).In order to gain knowledge in terms of increasing the awareness of children with special needs, many activities such as video screening, drama activities, puppet shows, discussions, use of stories, simulations, group work are used (Flower et al., 2007; Godeau et al., 2010; Pivik et al., 2002).

Awareness activities in the studies;

a) activities for social communication/interaction
b) simulation activities
c) curriculum- based activities and activities involving the use of all components together appear to take place in shapes (Flower et al., 2007).

The awareness activities organized in inclusive environments are briefly given below.

a) Social Interaction

Researchers focusing on increasing the awareness of children with special needs focus on working with normally developing children with special needs peers by drawing attention to social relations. In this way, they express that they will increase the acceptance of their peers with special needs and develop positive attitudes (Favazza & Odom, 1997). In some of these studies, it is seen that activities such as "*friend circle" and* "*peer network"* are included by highlighting interaction-based activities that include facilitating friendship relations and harmony in inclusive environments (Carter et al., 2013; O'Connor, 2016). Thanks to the activities that are based on peer interaction and focus on group work, the awareness of children with special needs can be raised by their peers and it is seen that their social acceptance increases. These activities carried out to increase interaction and acceptance among students include different activities for peers (Carter et al., 2013; O'Connor, 2016). Lindsay and McPherson (2012), working with children with Cerebral Palsy, emphasized the importance of peer support for developing awareness and social interaction skills of children with special needs, and included fun activity practices Game-based "Game intervention," which is one of the awareness activities concerning social interaction in children with special needs, is incorporated into the game-based activities. It is possible to realize the social-emotional development and interaction of children, especially with dramatic play activities used from early childhood. Games enable all students to interact and communicate in the classroom (O'Neill, 2013). In this way, it is possible to work together with children with special needs and their peers. In addition to game activities, sports activities encompass another domain utilized for awareness objectives and fostering interaction among children with special needs and their peers.Particularly with adaptive sports activities, children with special needs can participate in these activities and their positive features such as sharing with their peers, developing friendships and cooperation can be supported. Children who learn social behaviors with positive features can adapt to the society they live in more quickly and easily (Özkalp, 2007). Sports activities also support children in terms of better planning and effective use of time, and distract them from aimless activities (Öztürk, 2002).

b) Simulation Activities

When the awareness activities were examined, it became evident that different experiences were incorporated, including simulation, for knowledge acquisition.Pivik et al. (2002) used virtual environments related to simulation, based on a computer program, enabling children with normal development to experience wheelchair use and supported them in gaining knowledge. At the end of his work, he stated that there were positive developments in knowledge acquisition and awareness. In a similar activity, Seidler (2011) focused on increasing students' awareness by developing positive attitudes about inadequacies in his study. In gaining awareness activities of role playing/simulation activities; it is used to reveal the current situation, to gain knowledge about children with special needs and to develop positive attitudes (Hurst et al., 2012). In role-playing/simulation activities, children with normal development take on the roles of different types of disabilities in small groups, revealing the situations they encounter in daily life. It is aimed to gain awareness by making discussions about how to behave in positive and problem situations (Hurst et al., 2012).

c) Curriculum-Based Activities

When we look at the curriculum-based activities in awareness activities, it is seen that they focus on gaining knowledge about different types of disability. Reading activities, puppet shows, videos, class-based activities, exercises and games are used for this (Hutzler et al., 2007; Triliva et al., 2009). Reading activities can be done together with special needs children and their peers on the basis of interaction, as well as individually for the purpose of gaining knowledge. In the reading activities carried out for the purpose of gaining knowledge, information on many characteristics such as the individual characteristics of children with special needs and their strengths can be included. In reading activities, students can also read aloud in order to include group discussion and sharing, and then discussions can be included (Sigmon et al., 2016; Wilkins et al., 2016). Apart from activities based on reading and group activities, awareness-raising activities are also organized in different ways (Moore & Nettlebeck, 2013; Nowicki & Brown, 2013; Ranson & Byrne, 2014). Another study on awareness activities is a puppet show with normally developing children, and these activities can be used to develop knowledge and attitudes towards children with special needs (Dunst, 2014). Awareness is raised by making puppets talk about the characteristics of individuals with special needs, their strengths, the situations they encounter in communication and social skills. Dunst (2014) used the puppet show in order to improve the knowledge and attitudes of primary school students about their peers with special needs. By personalizing the puppets, he touched on important information about his peers with special needs. At the end of the research, it was stated that the puppet show made significant contributions to awareness skills and that associating it with real life increased awareness. On the other hand, Moore and Nettelbeck (2013) chose a documentary that included the speeches of the athletes about the Olympics and their activities, and in this documentary, they gave general information about different disability groups and conveyed their success stories (Moore & Nettelbeck, 2013). Aiming to raise awareness of children with special needs through comic book drawings, Seidler (2011) asked sixth grade students with normal development on this subject to create a comic about children with special needs. Before this drawing, teachers and students discussed and exchanged information about the inadequacies and judgments of the society. Awareness activities can be used independently or together. Multi-component applications, which include the use of many awareness activities such as curriculum-based activities, social interaction/communication, use of technological and virtual environments, are mostly preferred by researchers in terms of knowledge acquisition and attitude development in children (Seidler, 2011).

As a result, knowledge acquisition in the awareness of children with special needs is of great importance in the development of positive attitudes, and for this, activities that include social interaction, curriculum-based, simulation or all of them together should be used (Ali et al., 2001).When we look at the studies on the awareness of children with special needs in inclusive education environments, it has been seen that while it was observed that positive attitudes developed in environments that provide information about their peers with special needs, group discussion and storytelling, it was stated that children with special needs had difficulties in participating in group activities and adapting to the classroom environment in environments where awareness activities were not included (Öztürk & Yıkmış, 2013; Tuş & Çifci-Tekinarslan, 2013). In studies that draw attention to peer awareness, it is stated that the acceptance of children with special needs, who have difficulties in academic and social skills and behavioral problems, by their peers decreases, and it is stated that positive attitudes of children with special needs develop along with their characteristics, positive aspects and knowledge acquisition for awareness purposes (Çolak et al., 2013).

In awareness activities organized for children in need of special education, it is important how they are planned and put into practice as well as what kind of content is used. In the study of Atmaca (2023), it was determined that if no other instruction was given to pre-service teachers, cognitive goals were mostly included in the lesson plans or activity plans for the purpose of raising awareness, and psychomotor and affective goals were either little or not mentioned at all. Atmaca (2023) emphasizes that even in extra-curricular activities aimed at raising awareness, independent of the formal curriculum, more importance is given to teaching cognitive information and allocating time, while the learning of the affective and psychomotor domains is revealed to be ignored.. In awareness activities organized for children in need of special education, it is important how they are planned and put into practice as well as what kind of content is used. It is understood from this that teachers need professional support in order to effectively plan both formalcurriculum and extra-curriculum awareness activities.

Awareness activities play a crucial role in the integration and adaptation of children with special needs into society. However, it is essential for teachers to possess professional knowledge and skills in utilizing these activities effectively. Existing literature indicates a limited number of studies on awareness activities for children with special needs within school environments. Starting from an early age, teachers should implement supportive programs that facilitate communication skills development between children with special needs and their peers throughout primary, secondary, and high school levels. This study aims to contribute to the development of awareness and positive attitudes among pre-service teachers, enabling them to create an inclusive world that upholds the rights and awareness of children with special needs as they embark on their professional careers. Moreover, uncovering the perspectives of pre-service teachers on activities related to the awareness of children with special needs is of significant importance. It is believed that pre-service teachers hold a pivotal role in cultivating awareness and fostering a comprehensive understanding of crucial aspects such as the unique characteristics of children with special needs, adequate training for their educational requirements, and the acceptance of these children within their peer groups and broader environment. In light of these objectives, this research endeavors to explore the opinions and experiences of pre-service teachers regarding the awareness activities involving peers, families, and society concerning children with special needs.

METHOD

Research Model

This study, which aims to reveal the opinions of special education pre-service teachers about the awareness activities organized in terms of contributing to the rights of children with special needs, their social participation, accessibility, and social inclusion climate, was designed with the phenomenological research method, one of the qualitative research methods. According to Creswell (2017), it is defined as a pattern that takes its source from philosophy and psychology, in which the researcher describes the lived experiences of individuals related to a phenomenon as defined by the participants. In this study, awareness activities related to inclusive social life were handled as a phenomenon and how the pre-service teachers experienced this phenomenon, their comments about their experiences and their suggestions, if any, were questioned with semi-structured forms. While special education teacher candidates continue their undergraduate education in order to increase their professional knowledge and skills based on education, it is believed that they should bolster social awareness through engagement in social activities and awareness-building initiatives.The significance of fostering a culture of coexistence and promoting societal attitudes towards individual differences is deemed comparable to the importance of inclusive education environments in establishing an inclusive mindset. In this way, individuals with special needs, who are members of the society, will be able to come together with other individuals with an inclusive understanding in all areas of life. Therefore, in this study, an answer was sought to the question of what the opinions of special education teacher candidates about awareness activities in developing inclusive attitudes towards individuals with special needs are.

Phenomenological research is generally focused on individual experiences, structured or semi-structured forms are the most common data collection techniques (Yıldırım & Şimşek, 2018).Therefore, pre-service teachers reflected their experiences of awareness activities of inclusive community life on these forms. The collected written texts are linked by the researcher and turned into a narrative (Yıldırım & Şimşek, 2018). In this study, a semi-structured form consisting of five questions was given to special education pre-service teachers and their written comments on these questions were analyzed by descriptive analysis by dividing them into codes, themes, and categories. As a result of the analysis, five themes were obtained. In the findings section, the themes and sub-themes are given in detail.

Participants

In this research 56 pre-service teachers attending the Special Education Department of a state university in the Black Sea Region of Turkey were included. The criteria used in determining the participants were:

a) Continuing education in the Special Education Teaching Undergraduate Program in Higher Education
b) Volunteering to participate in the study.

Easily accessible case sampling, one of the purposeful sampling methods, was applied to determine the study group in the research. Easily accessible case sampling adds speed and practicality to research (Patton, 1987). Second year students were included in the sample selection of the researcher in terms of ease and accessibility. In addition to this, in the selection of the study group, especially from the second grade teacher candidates instead of other classes, it was considered important to examine their experiences and their views on awareness activities in addition to the fact that they had taken special education lessons and related field courses in the first year because they had not yet attended the observation lesson in special education institutions during the data collection process. Before starting the study, the participants were informed about the purpose and importance of the research and their voluntary participation status was determined. After obtaining the consent of the pre-service teachers regarding their voluntary participation, information about the work schedule was given. In order to keep their identities confidential, each of the prospective teachers was given specific codes (for example, PT1, PT2, PT3 ……. .PT56). Information about the participants is given in Table 1.

Table 1.*Demographic information of participants*

Participants	**Female**	**Male**	**Age range**	**Grade**	**Department**
PT1, PT2, PT3……. PT56	33	23	2 1-28	2. Grade	Special Education Teaching

A semi-structured form including four demographic and five open-ended questions was used to collect data in semi-structured documents from prospective teachers at the end of the 2022-2023 fall semester. To ensure face and content validity, the opinions of three experts were taken into consideration. The pre-service teachers actively observed various activities in their environment that were related to awareness activities in inclusive settings. Their focus was on assessing the effectiveness of these organized activities in developing awareness and shaping attitudes. Additionally, the pre-service teachers shared their valuable insights and recommendations on how to effectively raise awareness among children with special needs in inclusive education environments. They were asked to reflect on how they experienced this phenomenon by writing their opinions and thoughts on the questionnaire.

Research Instruments and Processes

The data were collected by document analysis technique by writing down their opinions and thoughts on the forms presented to the pre-service teachers for document analysis between 07.11.2022 and 05.12.2022. Document analysis, which is defined as obtaining data by examining existing records and documents (Karasar, 2005), includes a number of processes in order to evaluate and examine materials through printed and electronic means (Bowen, 2009).

Pre-service teachers were given forms and one hour to write. During this period, pre-service teachers were asked to express their ideas in writing between 750-1000 words to open-ended questions. Since the pre-service teachers were given a certain amount of time in their written statements, the average word range was limited to 750-1000 words during this period. The researcher examined the written documents provided by the pre-service teachers and determined the relevant codes for the descriptive transcripts.Yıldırım and Şimşek (2018) state that the similarities and differences of th e codes that emerge for thematic coding should be determined, and accordingly, the themes that can be combined with the codes that are related to each other should be recognized. In the study, the main themes and sub-themes were reached by taking into account the similarities and differentiation between the codes in the characterization of the codes, and the themes were given their final shape.It has been seen that the pre-service teachers expressed more than one opinion regarding the theme and sub-themes. For example, while the pre-service teachers expressed their opinions about "Social Support" in the sub-themes related to "Awareness Activities" in the first theme, it is seen that the same pre-service teacher also expressed an opinion in the "Informational Support" category. Therefore, the total frequencies in the themes include all the different views of the pre-service teachers, not the numbers.

In the document analysis, special education pre-service teachers were asked to answer open-ended questions in writing about awareness activities organized for children with special needs in inclusive environments. These questions are;

1) What is being done in your environment about awareness activities organized in inclusive environments with children with special needs?
2) What extent do you think awareness activities organized in inclusive environments with children with special needs serve their purpose?
3) Why do you think awareness activities organized in inclusive environments with children with special needs are important?
4) What would you do as awareness activities in inclusive environments for children with special needs?
5) What would you recommend for organizing awareness activities in inclusive education environments for children with special needs?

Data Analysis

Based on the written transcripts of the pre-service teachers, the researcher created appropriate themes and sub-themes. Written transcripts taken from pre-service teachers were made without any intervention, taking into account the inter- coder reliability of three experts, including the researcher. Necessary arrangements were made by talking about the themes and sub-themes "consensus" and situations where there was disagreement, which were created with the data obtained by the experts. Experts used the reliability formula of Miles and Huberman (1994) in the analysis of the written document and in the decision-making process of the theme and sub-themes (Reliability=Agreement/ (Agreement + Disagreement). As a result of the calculations, the reliability of the research was found to be 92. This ratio was accepted as reliable for the research.

Ethic

The necessary ethics committee permissions for the research were obtained from the Social Sciences Ethics Committee of Bülent Ecevit University with the decision dated 07.11.2022 and numbered 233108.

RESULTS

As a result of the document analysis on the phenomenon of awareness activities, they were summarized in five categories as below:

1. *Classification of Organized Awareness Activities*
2. *Identification of Activities that Serve Purpose*
3. *The Importance of Awareness Activities*
4. *Activities that Pre-Service Teachers Want to Organize*
5. *Suggestions for Activities.*

Below are the main themes obtained from the written transcripts of the phenomenon of awareness activities related to inclusive social life and the frequencies of these themes.

1. Theme: Classification of Organized Awareness Activities

The first main theme is for the classification of activities and consists of three sub-themes. In Table 2, these activities of the pre-service teachers were classified under three headings as "*Social Support Activities", "Information Gaining Activities for Awareness Purposes" and "Support Activities Related to Legal Rights and Processes"*.

Table 2.*Classification of the organized awareness activities of the pre-service teachers*

2.1. Social Support Activities	
Sports Activities-Games-Competition-Fun	16
Artistic Activities (Theatre, Dance, Music)	14
Simulation/ Putting Oneself in the Place of a Special Needs Person	10

Painting-Painting Activities with Peers (Wall-Face-School)	6
Watching Video/Film/Documentary with Peers	6
Reading Poetry	6
Walking Activities	5
Peer/Family Participation	4
Family's Participation in Activities	3
Food, Picnic Organizations	3
Total	**73**
2.2. InformationGaining Activities for Awareness Purposes	
Magazine-Board-Slide	22
TV Shows-Press	20
Panel -Seminar -Symposium	16
Activities (such as Meeting with Famous People/Celebrities)	14
The Importance of Early Diagnosis	13
Transfer of Knowledge on Various Subjects	11
Public Advertisement-Social Media	9
Sharing the Difficulties of Individuals with Special Needs	8
Positive Attitude	5
Association Studies for Individuals with Special Needs	4
Theater-Cinema Activities	3
Focusing on Later Emerging Inadequacies	3
Family Awareness	3
Organizations in Official/Government Institutions	2
Total	**133**
2.3. *Support Activities Related to Legal Rights and Processes*	
Expressing the Problems Experienced	4
Choice of Words	3
Employment	3
Utilizing Educational Services	2
Total	**12**

In the first theme, which is seen to be related to the classification of the activities, it is seen that the pre-service teachers categorize the activities carried out in their environment related to the awareness of children with special needs in inclusive environments in order to support them socially, to gain knowledge, and to the extent that awareness activities about the legal rights and legal processes of these children are included. In the sub-theme "*Social Support Activities*" within the scope of the classification style theme, pre-service teachers describe how they experienced this phenomenon by giving examples of artistic activities, meal/picnic organizations, competitions, games, video/film screenings, simulations, and family participation in activities. It is seen that they give examples of social support activities as follows:

PT15 "…. .organizing running races, wearing colorful socks, organizing dance performances…"

PT 32 " …. An effort is made to raise awareness among students about individuals with special needs along with voice competitions, water sports, stage plays, archery, performing arts, kite festival, Autism, Down Syndrome, Hearing-Visual Impaired, etc. for disabled children."

PT45 " …. E-Library project's books, magazines and other materials are supported by the human voice and presented to visually impaired children."

PT4 " ……. Choirs and theater plays consisting of children with special needs are staged …"

PT5 " ……Various activities are usually held in schools around us to raise this awareness. Carrying out these activities in schools is especially effective in helping children develop empathy and having a good awareness when they are younger. Children with special needs also accept themselves thanks to these awareness activities, and their social relations are progressing in a positive direction."

Although many studies have been carried out in our country on the participation of children with special needs in educational services in inclusive environments, there are still deficiencies (Bakkaloğlu et al., 2019; Koçyiğit, 2015). Especially socially, it is apparent that these children face challenges in gaining acceptance from their peers, , they are excluded and they feel lonely. It is seen that they experience similar situations and emotions not only in the school environment, but also in their immediate surroundings. In the examples given by the pre-service teachers in our research, they draw attention to the fact that, evident from their observations, awareness activities are given as social support through games, competitions, artistic aspects, and different group works. In addition, they drew attention to inclusive environments outside the school and included examples such as picnic organizations, walking activities, collaborative painting activities.

Observations reveal that pre-service teachers also highlight the importance of information dissemination during awareness activities conducted within their inclusive education settings for children with special needs. The second of the sub-themes within the scope of the main theme of the classification style was determined as " *Knowledge Acquisition for Awareness"* . Examples of banner-poster-magazine-board, TV programs, the importance of early diagnosis, social media accounts, association studies, family/peer awareness and education are as follows:

PT28 "…. .first of all, some information activities are carried out in public areas, educational institutions."

PT33 "……XXXX Municipality organizes seminars every year in order to raise awareness about individuals with special needs . In these seminars, this municipality tells thousands of students every year the difficulties experienced by individuals with special needs."

PT27 "……radio, TV programs about disability groups, programs that produce solutions to the problems of the disabled are broadcast. Theater shows on this subject are organized in schools, films and slide shows are watched…"

PT42 "… ……. . With sign language, songs, marches, theater plays, news are presented, the importance of differences is explained…."

PT54 "…. It aims to provide the society with the necessary information and awareness in order to facilitate a better understanding of individuals with special needs, to ensure their socialization, and to ensure their acceptance.

PT 50 "……. Schools, non-governmental organizations, various associations, municipalities, national education directorates organize activities in coordination with children with special needs. Various seminars, programs, walks, demonstrations are held…."

Knowledge acquisition constitutes an important area used for awareness activities in inclusive environments. Pre-service teachers draw attention to the use of various information sources in raising awareness. It is stated that information and explanation meetings, discussions, videos, TV programs, books and magazines are used in awareness studies conducted in the international arena (Dycheset al., 2001; Ostrosky et al., 2015). As a result of this research, it has been noted that the pre-service teachers referenced the studies conducted for information purposes, and they mostly stated that they included activities such as books/magazines and discussions, similar to the literature.

Regarding "Legal Rights and Processes", which is the last sub-theme of the " *Classification Style"* theme, the pre-service teachers pointed out the negative effects of the expressions used in society for children with disabilities and drew attention to the choice of words used. In addition, they emphasized that it is important for families and children with disabilities to share their difficulties in awareness activities and that these children should be supported in order to be able to work in a future job by expressing their written opinions about employment in the future. For example;

PT 48 "…Generally, corporate public institutions and NGOs organize activities..."

PT 35 "…. First of all, the concept of disability constitutes the approach perception of the society, not the individual. Disability actually consists of conscious or unconscious judgments and attitudes created by people who do not have any disease or disability. The way to make these individuals unhindered can be solved by making people's mistakes, attitudes and thoughts positive."

PT 26 "They also have jobs to do and we should help them get a job. Our laws require that two out of a hundred workers working in the workplaces must be disabled workers."

As evident in the theme of classification style, it becomes apparent that special education pre-service teachers categorize the activities based on social support, knowledge acquisition, and legal rights regarding awareness activities in inclusive environments. As social support, they highlighted that the games, sports activities and competitions played by children with special needs and their peers would increase their awareness by their peers with normal development and would support their participation in group work. The expressed opinions of the pre-service teachers highlight the utilization of diverse approaches for information sharing, emphasizing the existence of more extensive research on *"Information Sharing"* compared to the field of *"Social Support"* within the context of promoting awareness in inclusive education settings. By drawing attention to the importance of the wrong definitions made about awareness in the circles of the pre-service teachers about *"Legal Rights and Legal Processes ",* the wrong expressions in the choice of words, the wrong pictures used, both for the child with special needs and for his family. They articulated that such approaches and comparable ones were encountered in society.

2. Theme: Identification of Activities That Serve Purpose

The views of pre-service teachers on whether the awareness activities organized for children with special needs in inclusive environments for full participation in social life have achieved their goal are discussed in the second theme, and their perspectives converge within three sub-themes.These are listed in Table 3 as the Pre-service Teachers' Opinions on How Much Awareness Activities Organized Serve the Purpose.

Table 3. *Identification of activities that serve purpose* by pre-service teachers

3.1. Awareness Activities Serve the Purpose Successfully	f
Social Awareness/positive attitude	14
Successful Disclosure	5
Empathy, Feeling Good/Happy	4
Successful Artistic Activities	3
Legal Rights and Responsibilities	3
Successful in Social Sharing	3

Successful for Inclusive Education	2
Successful in Focusing on Problems	2
Total	**36**
3.2. Awareness Activities Serve the Purpose at a Medium Level	
Awareness Studies	7
Preventive Measures, Studies	4
Feeling Good/Happy	3
Putting Himself in the Place of a Special Needs Person	2
Ensuring Continuity in Activities	2
Total	**18**
3.3. Failure of Awareness Activities	**f**
Failure to Ensuring Continuity (Performing activities only in a certain time interval)	25
Negative Waste of Labor and Non-Purpose	18
Limitation in Diversification/Number of Activities	10
Family Education, Social Relations, Limitation of Information	10
Limited to Only One Type of Disability	8
Limited to Widespread Impact (not all children participating)	8
Limited Involvement of the Environment in the Activity	8
Adaptation of Activities to All Age Levels cannot be made	6
Negative Emotions (Misunderstandings/Misunderstandings, Intensity of Pity)	6
Difficulty in Positive Attitude	6
Insufficient Knowledge Gain on Legal Rights	4
Limited in Providing Equal Opportunity	3
Total	**112**

In the theme of Activities Serving Purpose, three sub-themes as successful, medium and insufficient were created about how well the pre-service teachers serve their purpose about the awareness activities organized. The pre-service teachers who recognized that awareness activities fulfilled their objectives and fostered the cultivation of a positive attitude were predominantly in agreement within the sub-theme of Social Awareness/positive attitude. They provide an illustration of *"Awareness Activities Serving the Purpose Successfully":*

PT 29 "...I think these studies or these activities achieve their purpose in a positive way. Because families and their children participate in such activities and activities, they both make them socialize with the environment and enable them to establish closer relationships with people…"

PT 52 "…… Thanks to such activities, we are more empathetic towards children with special needs in our society. a more conscious communication style has begun to emerge. Thanks to these efforts, the society has started to act more sensitively in terms of not turning the inadequate situations experienced by children with special needs into an obstacle."

PT 19 "... Although the activities carried out through social media have a great impact on a wide scale, these activities are not limited to a certain group of people, but reach many people, in this way many people are informed, and such activities reach their goal…."

Awareness activities in inclusive environments constitute an important factor for both the child and the family. Woodgate et al. (2019) stated in their study that children and families feel lonely and excluded by the society, they do not have a social world outside home, and they experience discrimination and exclusion. Therefore, it is thought that the social lives of families and children will also improve significantly, thanks to the effect of awareness in their social environment in school environments. In the data of this study, Several pre-service teachers mentioned that awareness activities fulfilled their intended purpose in terms of promoting social awareness. In the sub-theme of *"Awareness Activities Serve the Purpose at a Medium Level"*, some pre-service teachers stated that awareness activities were moderately successful in terms of preventive measures, positive attitude acquisition, and continuity in activities. In addition, they expressed that the activities conducted had a positive impact on raising awareness but were not effectively implemented. . For example;

PT32 "... Although the information activities, festivals and sports competitions are beneficial to the society, the missing aspect is the problem of turning the information into action…"

PT 47 "... If we say that we can say that we provide service completely, the answer to this question would be no, or let's ask, how long can we make individuals with special needs happy thanks to these studies we have done?"

PT 11 "... While some of the studies for individuals with special needs are very effective, I believe that some of them are done just for the sake of being done, go beyond their purpose, do not create any awareness and do not have an effect that makes the lives of these individuals easier."

They stated that the success of the awareness activities, which the pre-service teachers described as successful, was insufficient due to some features, the lack of continuity of awareness, awareness cannot be achieved in the whole of social life and can only be done in a certain area. In addition, they indicated in their statements that the suitability of the awareness activities for the type of disability was not satisfactory. In the sub-theme of *"Failure of Awareness Activities"*, it was observed that the pre-service teachers mostly drew attention to the "failure to ensure continuity" and pointed out that awareness activities in inclusive environments were unsuccessful.They stated that there were problems especially in terms of time and workforce, it was limited to a certain time. In addition, it was evident from their written statements that they highlighted the insufficiency of the variety and quantity of awareness activities conducted in inclusive services. For example;

PT 50 "... But I think that the fact that these awarenesses are only for that day does not have much impact on society and children. Studies that are thought to create awareness should have a long-term effect."

.PT 38 "… The number of activities is not enough. The number of various activities should increase. Students with special needs in villages can be ignored. Our state needs to increase its financial support a little more in this respect…."

PT 20 "…. .For example; If a seminar were to be given, it might not arouse curiosity and a desire to learn in primary school children. It can be boring to them. Therefore, the activities should appeal to all ages and every disability should be the focus for a certain period of time. We do not need only special days to create awareness. Something can always be done. In addition, larger activities can be organized on special occasions."

PT 11 "…. Although there is not much activity around me, most of these studies are insufficient and cannot reach many people. Activity adaptation should be made for each age group."

PT29 "……. As it is understood, the diversity and number of the studies do not attract the attention of the society enough, and they do not create awareness at the desired level."

As per the insights shared by the pre-service teachers, it is noteworthy that awareness activities exhibit continuity within inclusive educational settings, considering factors such as the quantity, variety, and target population of these activities. It is important to highlight that these activities may not encompass all children with special needs. In the literature, similar study results have been reached on this subject, and it is seen that they focus on the diversification of activities, especially for knowledge acquisition. It is also stated that different activities can increase awareness by supporting each other and be more effective on children (Hutzler et al., 2007; Flower&Burns, 2007). In addition, it is seen that they express their opinions about the importance of peer and family participation in awareness activities in inclusive educational environments for social interaction. Although there are many studies on inclusive education environments for children with special needs, the problems faced by families, teacher,s and children still draw attention (Kahriman-Pamuk & Mazhar, 2019). It is seen that children experience feelings of not being accepted by their friends, negative attitudes and not feeling valuable in inclusive environments. The findings of this study also support the field regarding the participation of the family in awareness activities.

3. Theme: The Importance of Awareness Activities

The opinions of the pre-service teachers on the third main theme are about why awareness activities organized for children with special needs in inclusive environments are important, and Table 4 contains information on the theme and sub-themes.

Table 4.*The importance of organized awareness activities*

4.1. Important Reasons to See	**f**
The Prevalence Effect of Insufficiency	18
Raising Awareness	17
Providing Knowledge Gain	12
Ensuring Full Participation in Community Life	11
Revealing Your Difficulties	9
Supporting Social/Emotional Engagement	6
Developing Communication Skills	4
Positive Attitude Development	3
Opportunity Equality	3
Early diagnosis	2
Raising Family Awareness	2
Reason for Incompetence in Relative	2
Total	**89**

In the theme highlighting the significance of awareness activities, the majority of the pre-service teachers emphasized the influential role of these activities in addressing various aspects related to children with special needs. These aspects encompassed raising awareness, facilitating early diagnosis, promoting family awareness, fostering full participation in social life, enabling knowledge acquisition, cultivating positive attitudes, and supporting social and emotional engagement. The findings pertaining to this theme are presented below: *PT22 "…With these activities, children with visual impairments are brought into society and inclusive education environments. Courage must be instilled. Streets and avenues should not be places that these children are afraid of, but places where they can have fun and have a walk."*

PT38 "…If the social and emotional needs of children with autism are met, children with autism will adapt to society more quickly. A lot of hearsay information pollution about autism is circulating in society. I wanted to address the issue of autism in order to minimize this information pollution as much as possible."

PT49 "……Because as far as I can see, they are marginalized by many people. Since there is a visible inadequacy, most people exclude these individuals even with their looks. Cerebral Palsy is a condition in which a child has difficulty using certain muscles as a result of damage to the brain. But like everyone else, they are individuals, and they have a place in society at least as much as we do."

When we look at the information obtained from the forms of pre-service teachers about the importance of awareness activities, it is notable that there are factors such as the prevalence of inadequacy, supporting social emotional participation, and gaining knowledge. It is seen that many factors such as knowledge gain, social participation, attitudes, beliefs, equality of opportunity, cooperation, family participation are together in the success of inclusive education (Siagian & Kurniawati, 2019). Therefore, the findings obtained on the importance of awareness activities seem to give us information about the important components of inclusive environments.

4. Theme: Activities That Pre-Service Teachers Want to Organize

" *Activities That Pre-service Teachers Want to Organize"* consists of four sub-themes. Below (Table 5) are the opinions of the pre-service teachers about what kind of activities they want to do within the scope of awareness activities.

Table 5. *Activities that pre-service teachers want to organize*

5.1. Activities Related to Information and Attitude	**F**
Information activities	14
Poster/brochure preparation	10
Movie/Animation/Documentary	9
Audition/Concert	8
Conference	5
Theater Show	5
Sightseeing/City Tour, Walking	5
Races/Games/Sports Activities	5
Success Stories	4
Physical Arrangements for Disability	3
Bus Painting/Decoration Event	2
Event Communities/Tables	2
Photography Exhibitions	2
Total	**74**
5.2. Social Interaction Based Activities	F
Simulation Activities	23
Organizing Family Participation Activities (such as picnics, walks)	16
Folk Dances/Dance/Game Activities/Sports Races	13
Peer Group Work	7
Psychological support	7
Successful Examples of People with Disabilities	6
Physical Environmental Regulations	5
Visiting	4
Interview Prepared by Special Education Teachers	4
Audio Story Activities	4
Social Contact (hugs, hugs, etc.)	3
Dancing/Singing	2
Lecture on Sign Language	2
Transferring Experienced Difficulties	2
Activities for Schools	2
Digital Applications, Public Service	2
Total	**102**
5.3. Financial support	
Raffle, Giveaway, Meal	6

Festival, Kermes	4
Donation Campaign	3
Handicrafts Exhibition	3
Total	**16**
5.4. Legal Rights and Responsibilities	
Creating Public Opinion, Meeting with Statesmen	2
Job Employment	2
Total	4

"Activities That Pre-service teachers Want to Organize" theme consists of *"Activities Related to Information and Attitude", "Activities Based on Social Interaction", "Financial Support" and "Legal Rights and Responsibilities"*sub-themes.

In the sub-theme of "*Activities Related to Information and Attitude*", pre-service teachers suggest that students with disabilities and their peers perform together in theater performances , share the success stories of individuals with disabilities in awareness activities, and activities based on developing positive attitudes. In addition, they emphasize the importance of activities such as playing basketball, planting saplings, organizing photography exhibitions, and listening to music. For example:

PT15 "………In these activity tables, there were activities such as finger painting, face painting, dancing, jumping rope, playing ball, dough playing, drawing, singing."

PT24 "First of all, I would prepare brochures or posters to inform the environment about autism, and these posters and brochures would be in the form of information about autism. For example, I would prepare posters or brochures such as 'I don't like physical contact because I'm autistic' or 'I can't make eye contact because I'm autistic' or 'I don't react when my name is called because I have autism'.

PT32 "…Sports is a sportive activity in order to enable them to mingle with people actively and to keep them away from a sedentary life."

PT51 "…For example, for children with Down Syndrome with special needs, slogans containing short articles on this subject or drawing attention to awareness can be written with colored paints in certain parts of the school."

It is seen that especially curriculum-based reading, brochures and posters are used in the sub-theme of "*ActivitiesRelatedto Information and Attitude".* It is apperent that reading and other activities can be done interactively as group work in the classroom environment, as well as individually organized activities. This scenario is considered a notable illustration of the diverse utilization of awareness activities, encompassing not only knowledge acquisition but also fostering social assistance, interaction, and support. Existing literature underscores the positive impacts of engaging in various multidimensional activities that facilitate the development of awareness. (Seidler, 2011).

Most of the pre-service teachers emphasize the importance of social interaction for individuals with disabilities, emphasizing simulation activities, especially in order for the society to develop a positive attitude. Furthermore, it is observed that they articulate their viewpoints regarding visits aimed at fostering social interaction, interviews with accomplished individuals with disabilities, social engagement, collaborative group work, and communal activities within educational institutions. For example;

PT19 "…Children with autism will be able to achieve the feeling of being hugged in these areas. In line with the Blue Hugging Area project, it will be an important step towards the integration of children with autism into society."

PT31 In the activity titled "Can you replace me for a day?", a healthy individual who does not have a physical disability will be asked to spend one day in a wheelchair……"

PT29 "…. Seminars titled "Information about special children…"

PT36 "……The students played blindfolded in the football match. In volleyball, the students played *sitting on the floor. Thus, the students experienced the difficulties they experienced and how important and valuable sports are for the disabled. These awareness activities carried out by the students one-on-one enabled the activity to reach its goal, and it also developed empathy in individuals."*

PT44 "…. . A theater or short film can be shot and broadcast on all social media, based on the troubles, problems, situations that they like or dislike, how they deal with them when they have trouble, or how they can't cope with them." They provide an illustration of this.

Simulation activities are among the most frequently used awareness activities in the literature, and it is seen that digital animations are made for this. In simulations in digital environments, the characteristics of individuals with disabilities and the situations they encounter in society are tried to be considered (Hurst et al., 2012). The pre-service teachers who participated in the research also mentioned the importance of doing simulations in the digital environment, similar to physical animation, imagining or studies in the field, in awareness activities.

The pre-service teachers highlighted that individuals with disabilities are provided support in terms of their financial needs in awareness activities, and underscored the potential of these activities to make both social and financial contributions. Thus, they stated that sharing the handicrafts of children with disabilities with other people will not only provide interaction with the festivals / bazaar activities to be organized, but also support them financially. They also mentioned that raffles, food organizations and gift giving are activities that can be organized in the context of both social cohesion and financial support. For example;

PT 36 " …… I used to make an exhibition of handicrafts made by disabled people, present them to people, and then sell them by auction. At the end of the day, I would donate the income to the disabled people's foundation so that disabled children will see how valuable what they do is." It is seen that they give an example.

Within the sub-theme of "Legal Rights and Responsibilities," pre-service teachers emphasize the criticality of promoting the employment opportunities for individuals with disabilities. They highlight the necessity of integrating these considerations into awareness activities.Furthermore, it is evident that both the private sector and the government bear significant responsibilities in this regard. For example;

PT18 *"…… there are almost no individuals with autism who can work in cafes, markets, shopping malls.* It is seen that *suitable jobs can be arranged for individuals with autism who are able to work by communicating with employers, providing information about autism* .

Pre-service teachers recognize the significance of awareness activities for fostering the professional development of individuals within inclusive society practices, both during their school years and in their post-school lives. They emphasize the need for integrating awareness activities throughout the educational journey, encompassing aspects such as school selection and career choices. By incorporating awareness activities into these transitional periods, pre-service teachers believe that children with special needs can achieve full participation in social life and develop positive attitudes towards their abilities and potential.

5. Theme: Suggestions for Activities

According to the written transcripts of the pre-service teachers, the last theme of the study was determined as " *Suggestions for Activities* ". Awareness activities; the sub-themes were the opinions that it should show features such as positive discrimination, equal opportunity in education, family support, full participation in social life, empathy, support through the press, and information sharing. Pre-service teachers, who attach importance to early diagnosis and family education, mentioned that information studies should be carried out on this issue. In addition, they emphasized that in order to ensure the continuity of the awareness activities organized, it is important that the activities are not limited to certain days, but should be carried out in every aspect of life. Below, the suggestions of the pre-service teachers are given in Table 6 under the themes and sub-themes.

Table 6:*Suggestions for organized awareness activities*

6.1. Suggestions for Activities	f
Family Support/Training/Counselling	12
Media/Press Support	8
Full Participation in Social Life, Legal Rights and Responsibilities	8
Continuity of Activities	8
Positive Discrimination, Priority in All Fields	6
Community Information Activities	6
The Importance of Positive Attitude Should Be Emphasized	6
Participation of All Individuals in the Activities	5
Equal Opportunity in Education	4
Making Physical/Environmental Arrangements	4
Employment/Health Support	4
Financial Support to Private Education Institutions	4
Benefiting from IEP Trainings	3
Activities of Non-Governmental Organizations	3
Total	**81**

Within the theme of *"Suggestions for Activities"*, a notable trend among the majority of pre-service teachers was their emphasis on specific sub-themes such as *"family support/education and counseling", "legal rights and responsibilities", "full participation in social life" and "continuity of activities".* These sub-themes received more attention compared to others. To provide an illustrative overview, some exemplar suggestions provided by the pre-service teachers in the table are presented below:

PT1 "…. In my opinion, the first things to be done urgently for children with special needs are positive discrimination, priority in every field, sufficient free education, considering individuals with special needs in all actions for social life, and special legal regulations and legal support for the legal problems they face."

PT52 "…. As long as there are posts about individuals with special needs on social media, it will create great interest and awareness. In this way, many people will be informed about autism and awareness of autism will be created."

PT11 "…. In order for these activities to be more effective, I think it would be better to involve more people in these activities and to organize more comprehensive and more lasting activities that can last throughout the day, in certain months, in certain weeks, in certain months, in certain weeks, with more frequent intervals."

PT 17 "…. For this reason, university students should contribute to the approach of non-governmental organizations to the concept of disability, their participation in non-governmental organizations and volunteering activities, and their contribution to the purpose of these studies."

PT9 "…. When a healthy communication with families and the necessary education are given, any children with special needs can be equal to their peers."

The findings indicate that a significant number of pre-service teachers highlight the importance of family support, counseling, and education as key "recommendations for activities." They emphasize that by implementing these strategies, children with special needs can have equal opportunities for development alongside their typically developing peers. Moreover, pre-service teachers emphasize the value of integrating early diagnosis and early educational services with family education, emphasizing the necessity for continuous implementation of such activities throughout society.

DISCUSSION

The findings of this research, which tries to reveal how special education pre-service teachers experience the phenomenon of Awareness Activities Related to Inclusive Community Life, have five main themes: *"Classification of Organized Awareness Activities, Description of Activities that Serve Purpose, Importance of Awareness Activities, Activities that Pre-service Teachers Want to Organize and Suggestions for Activities"* appear to gather around it.

"Awareness Activities Organized", which is the first theme of the research, pre-service teachers especially; stated that they were made about social support, knowledge acquisition, legal rights, and processes. It is in the written records that their awareness has increased as well as many gains such as providing peer sharing, development of social interaction, communication with activities such as organized sports activities, walking/trips, artistic activities and reading books. Similarly, this situation is in parallel with the findings of studies in the literature that include activities to ensure students' awareness, harmony, and peer acceptance. For example, Tindall (2013), that sports activities are important in raising awareness for children with special needs in inclusive environments, facilitating their acceptance by their peers and increasing interaction, that they adapt the volleyball activity in groups to children with special needs and enable them to play with their peers. Tindall (2013) draws attention to the importance of artistic and sports activities in social development in these sports activities, which have effects such as participation in the group, initiating and maintaining communication, and developing positive attitudes. In addition, pre-service teachers drew attention to the knowledge gains related to awareness in inclusive environments and stated that they mostly expressed their opinions on the use of activities such as participation in seminars, posters, interviews, reading books and magazines. It is stated in the literature that the importance of knowledge acquisition for the awareness of children with special needs is emphasized and activities such as videos, discussions and seminars are included for this purpose (Flower et al., 2007). The results of the research show that social activities such as artistic activities and games are mostly held in inclusive environments, and in terms of information awareness, they write their opinions about activities such as posters, interviews, and seminars. In addition, it is seen that they mentioned the importance of the family's participation in activities and supporting them in terms of information.

When the transcripts were analyzed within the scope of the theme of *"Defining the Activities That Serve Purpose"*, it was seen that the pre-service teachers wrote their opinions stating that the awareness activities served successfully, did not serve enough and were unsuccessful. Most of the pre-service teachers, who stated that the activities serve the purpose in providing social awareness, mention the importance of information activities for awareness. It has been seen that the pre-service teachers who described the activities as unsuccessful mostly express their opinions on issues such as the activity being carried out in a certain period of time and the lack of continuity, the limited effect in providing widespread effect, the difficulty in diversifying, and the inclusion of the family in education and activities. The participants, who stated that the activities partially affect the purpose and provide awareness, stated that this effect is in the context of feeling good/happy, awareness activities in the context of preventive measures. In the literature, there are studies that draw attention to curriculum-based activities in terms of knowledge acquisition in awareness activities in inclusive environments. In these studies, it is seen that many activities such as classroom-based activities, book reading, puppet shows are presented on the basis of the curriculum (Sigmon et al., 2016; Wilkins et al., 2016). In this way, children's relations with their peers and awareness within education and training services provide continuity. In our study, there are many pre-service teachers who stated that they are insufficient in ensuring continuity in awareness activities. Therefore, based on this information, it can be said that awareness of children with special needs will be increased by supporting children with special needs in different lessons with curriculum-based activities.

Within the scope of the "*Importance of Awareness Activities*" theme, pre-service teachers stated that different activities covering all disability groups should be organized in different ways throughout the year in inclusive environments. It is thought that factors such as lack of information and ambiguous expressions, less coverage in the media, and the prevalence of disability in the society play a role in addressing all groups with special needs within the scope of the subject. In the international literature, it is stated that in order to be successful in awareness activities for children with special needs, it is first necessary to clarify why it is important and what our purpose is. For successful intervention, it is necessary to increase diversity and eliminate knowledge acquisition deficiencies (Lindsay& McPherson, 2012). In addition, it is stated in studies that many factors such as awareness activities in inclusive environments, developing attitudes for children with special needs, equal opportunities, benefiting from early intervention services, and ensuring full participation in community life are important (Tavares, 2011). In this study, it is seen that pre-service teachers draw attention to similar points and provide information on equal opportunities for children, full participation in education services and supporting social participation.

Awareness activities related to fulfilling legal rights and responsibilities, activities related to information and attitudes, activities to provide social interaction, and financially are included in the theme of "Activities That Pre-Service Teachers *Want to Organize "* regarding what kind of activities the pre-service teachers will plan for the awareness of children with special needs. Especially in the awareness activities to be organized, it is seen that the majority of pre-service teachers suggest simulations and activities related to putting themselves in the place of the individual with disabilities for equal access to social rights. This situation is similarly supported in the literature, and it is stated that awareness is provided through activities such as reviving the difficulties experienced with students with different disabilities and acting by putting themselves in their shoes (Hurst et al., 2012). Similarly, peer group studies are among the most preferred activities in awareness activities. Including the family in awareness activities and informing activities are among the preferred activities. In the literature, Dukes and Berlingo (2020) stated in their study that quality interaction could not be achieved between students with special needs attending the same school and their peers, and this situation negatively affected their emotional characteristics and behavior patterns. It is also stated in the same study that the in-class activities organized in schools in order to ensure peer interaction, in the form of cooperation within a certain plan, will contribute to both the acceptance of children with special needs and their awareness.

The theme of "*Suggestions for Activities*" to be organized by pre-service teachers about individuals with special needs constitutes the last theme of the research and it is seen that most suggestions are made about family support/education and counseling within the scope of this theme. Considering that the family is the beginning of education, it is thought that it is inevitable that the family is the basis of awareness activities. In addition, it is seen that individuals with special needs also intensely touch on the issues of full participation in social life, awareness of their legal rights and responsibilities, and positive discrimination. These findings also show parallelism with the pre-service teachers' theme of "not serving the purpose sufficiently" in awareness activities. It is seen that the pre-service teachers expressed the deficiencies that they observed in the suggestions section and made additions.

Communication, social and emotional development of children constitute important dimensions for psychosocial development. Awareness activities include many social activities such as cooperation between students, taking part in group work, working within a plan/program, showing democratic attitudes and behaviors, respecting fundamental rights, raising awareness towards activities, situations and people, and ensuring the development of positive interactions and attitudes with their environment. Enables the development of the skill (Awbrey et al., 2008). Thanks to these activities, students exhibit skills such as meeting students with different individual characteristics and different cultures, grasping their strengths, and gaining knowledge. In addition, it strengthens their social networks and enables them to establish positive relationships with these individuals in their daily lives (Awbrey et al., 2008). Thanks to these activities, the acquisition of skills such as belonging to a group, providing motivation to be successful, maintaining teamwork in a goal-oriented manner, and cooperating are provided. In the development of children with special needs and their typically developing peers, awareness activities contribute to increasing social acceptance, developing empathy skills, acting together as a group, and developing positive attitudes.

CONCLUSION, SUGGESTIONS

As a result, it is seen that the pre-service teachers who have experienced the phenomenon of Awareness Activities for Inclusive Community Life offered for individuals with special needs have different experiences based on their opinions in the written transcripts. It is seen that pre-service teachers have different experiences based on their opinions in the written transcripts. According to the opinions of the pre-service teachers, these activities can be done in different types in order to support children with special needs socially. It is considered important in awareness activities in terms of developing positive attitudes that children with special needs share with children with typical development through activities such as food organizations, excursions, walks, meetings with well-known people, drama, music concerts, folk dance competitions. Pre-service teachers, who also drew attention to peer unity and family participation in these activities, mentioned that information activities, curriculum-based activities, and other activities to understand the difficulties should be included. Another important issue regarding awareness activities is that there are inadequacies in ensuring the permanence and continuity of the activities. The pre-service teachers, who expressed negative opinions about the activities being limited to certain days and not serving the purpose, suggested that awareness studies be carried out that address all inadequacy groups. It is recommended by pre-service teachers that informative awareness studies on early diagnosis and early intervention should be carried out in order to support full participation in community life.

Based on the research findings, it can be suggested that these studies should be carried out in different departments of Education faculties for advanced research, and the studies should be compared with different departments. In addition, studies should be based on practice. Cooperation with different institutions and organizations in activities for the full participation of children with disabilities in community life, and work on family awareness in the early period is suggested.

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Pre-service English Language Teachers' 21st Century Skills: A Mixed-Methods Study on Digital Literacy*

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ABSTRACT

Despite an increasing number of studies on pre-service teachers' digital literacy, there are few studies on pre-service English as a second/foreign language teachers. In the existing studies, there are issues especially regarding sample size, methodology, and analyzing different variables. Hence, this study recruits more participants from different institutions and investigates the effects of five variables, which are gender, grade, daily amount of time spent on digital platforms, the most used device, and year of digital platform use. The participants were 186 pre-service teachers from Türkiye. The quantitative data were collected via the Digital Literacy Scale and analyzed by Statistical Package for the Social Sciences (SPSS) 25.0 via independent samples t-test and one-way variance analysis. The qualitative data were collected via semi-structured interviews and analyzed by Descriptive Analysis. The findings showed that the participants had a medium to high level of digital literacy, while they reported higher levels in the interviews. The analysis of the survey indicated that the most used device and year of digital platform use had a significant effect on the participants' digital literacy levels. The interview results combined with the survey implied that the vital point in digital literacy training is to ensure "learning how to exploit digital skills" rather than gaining knowledge on all the available tools, applications, and resources.

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INTRODUCTION

Today, information and communication technologies are developing rapidly, and they affect each aspect of our lives. These effects occur thanks to the increase in the information we have. However, together with this massive increase in information, there is also an emerging problem of information pollution (McDougall et al., 2019). In today's world, there is access to information almost everywhere; however, checking the reliability of information and accessing the desired and relevant one requires a significant skill (Shenton, 2009). Hence, one of the significant 21st century skills is digital literacy (hereafter, DL). DL is a critical skill for pre-service teachers (hereafter, PTs). As for the definition of DL in this study, the definitions of DL as a set of decontextualized general digital skills are contested. Instead, the reconceptualization of DL from the perspective of the New Literacy Studies movement (Gee, 1990; Street, 1984) as a literacy practice located within a particular discourse with certain characteristics is followed (Campbell & Kapp, 2020).

The review of the literature suggests that there are few studies undertaken on pre-service English language teachers' (hereafter, P-ELTs) DL competence in the world (Alfarisyi, 2020; Anggeraini et al., 2019; Eryansyah et al., 2020; Liza & Andriyanti, 2020), and these studies were undertaken with a limited number of participants (Some are case studies, and even when it is a survey, the number of participants are around 50). This limits the generalizability of their results. In addition, none of the existing studies in the literature considered the effect of some potential variables and factors, nor did they utilize a mixed-methods approach except for Liza and Andriyanti (2020). What is more, there are few more studies that studied P-ELTs indirectly together with other PTs (Boyacı, 2019; Çam & Kıyıcı, 2017; Özoğlu & Kaya, 2020); however, as P-ELTs were only one group of the PTs in these studies, little specific information was provided about them. Moreover, the findings of the previous studies were partly contradictory. To summarize the issues in the literature, the studies in the literature have some limitations especially regarding sample size, methodology, and including different variables. Considering the significant gap in the literature in terms of the number of studies and the limitations in the methodology of the existing few studies, this study aims to fill in this gap by investigating P-ELTs' DL levels via a mixed-methods approach.

In a relevant study, Gilster (1997) stated that DL is a particular thinking style related to having perspectives beyond only pressing buttons. In addition, Gilster (1997) and Pool (1997) identified DL as the ability to understand and use the information presented by computers from different resources in various ways. DL, which is considered a measure while evaluating the quality of learning activities in digital environments, also supports a user-friendly approach (Eshet-Alkalai, 2004). The indication of having DL is an adaptation to new or developing technologies (Ng, 2012). Accordingly, DL not only includes an individual's learning of information and communication technologies efficiently, but it also underlines the use of these technologies in a secure, legal, and moral way to help an individual pursue personal development, solve problems in any context, and support social participation and production (Özerbaş&Kuralbayeva, 2018). DL consists of complex cognitive, sociological, and emotional skills that users need to work in digital environments efficiently. Reading the instructions on a graphic screen, creating meaningful materials in this environment, and assessing the quality and validity of the information on digital platforms are among the instances of DL (Karabacak & Sezgin, 2019). DL does not only enable users to find items or issues on digital platforms. At the same time, the users need to be able to use this information in their lives, transfer them to other areas of their lives and critically evaluate the obtained knowledge (Martin, 2008). In a nutshell, DL comprises the ability to use the platforms offered by today's information and technology age appropriately, detect the reliability of the information presented on these platforms, and also use digital technologies efficiently.

So, why is DL exactly necessary for PTs? Teacher training programmes face the difficulty of training PTs to use digital media critically. Recruiting informed and reflective PTs depends on pre-service teacher training (Santisteban et al., 2020). From the perspective of students, according to Prensky (2001), natives, born after the 90s, identify themselves as immersed in technology and the digital world since birth. However, this does not ensure that they will readily use digital tools and technology in the classroom (Cortina-Pérez et al., 2014). PTs themselves should be able to use them first and whether they will use them in the future is variable (Fluck& Dowden, 2013). Considering that students from all grades use digital technologies frequently and the swift integration of the internet into our lives, education should systematically benefit from technology to increase efficiency via utilizing DL skills for pedagogic purposes. These kinds of technologies and platforms provide educational settings, and as a consequence, they let the users socialize and exchange information (Baker, 2000; Barile & Durso, 2002). They also let students learn better, and they can provide various implications for English language teaching (Paker & Doğan, 2021; Solmaz, 2020). Also, Karakoyun and Lindberg (2021) studied PTs from different fields in Türkiye and Finland, and they focused on 21st century skills. The study suggested that the PTs acknowledged the significance of DL skills for their future career and students. Considering the literature review above, it has been seen that there is a gap in the precise understanding of DL for pedagogical purposes. This is essential as using digital platforms for pedagogic purposes requires specialization.

Literature Review

In line with the recent changes, 21st century skills have been an essential part of our lives, and the role of teachers and PTs has also changed "from being an instructor to becoming a constructor, facilitator, coach, and creator of learning environments" (Amin, 2016, p. 41). To perform their novel roles per the current requirements, they must have DL (Eryansyah et al., 2020). When they themselves are digitally literate, it is only then they can lead and teach their students accordingly. This means that when PTs as future teachers have DL, they can teach more effectively and set an example for students regarding the utilization of 21st century skills.

Although some studies showed that PTs and especially P-ELTs have a moderate to high level of DL competence (Alfarisyi, 2020; Anggeraini et al., 2019; Boyacı, 2019; Çam & Kıyıcı, 2017; Eryansyah et al., 2020; Liza & Andriyanti, 2020; Özoğlu & Kaya, 2020), there are still studies which suggest that improving DL is essential for PTs (Akayoğlu et al., 2020; Campbell & Kapp, 2020). Hence, specific courses aiming to equip PTs with the necessary knowledge and skills regarding computer use, and thus digital literacy in general, should be reconsidered (Zehir-Topkaya, 2010). In the same vein, Liza and Andriyanti (2020) suggested that most English teachers and PTs were not prepared for integrating digital technologies into their lessons. In another study, Campbell (2016) found that PTs conflated DL with Internet Literacy. It was suggested that even if teachers had a medium or high level of DL, this was usually limited to technical skills and using digital tools (Dashtestani, 2014; Fitriah, 2017; Hedayati& Marandi, 2014; Liza & Andriyanti, 2020). They indeed had a superficial level of knowledge when it came to using digital technologies properly for pedagogical purposes.

As for the studies specifically undertaken on P-ELTs' DL competence, the literature review shows that there are very few studies throughout the world, and they are quite limited in terms of methodology (Alfarisyi, 2020; Anggeraini et al., 2019; Eryansyah et al., 2020; Liza & Andriyanti, 2020). Alfarisyi (2020) studied DL via a survey on 66 participants at a single university. So, it is a quantitative study, and it is slightly limited in terms of the number of participants and institutions (i.e., implemented in one single university). The results showed that the P-ELTs had a medium to high level of DL. Anggeraini et al. (2019) studied P-ELTs' views on DL and their DL level. They utilized a questionnaire, and this study also recruited a few participants from a single institution. Their findings suggested that P-ELTs had a medium level of DL. Eryansyah et al. (2020) investigated P-ELTs' DL level and factors in its development. The participants were the 4th graders at a single university, and thus there was no cross-sectional analysis. The data were collected via a survey. The results suggested that their level was above medium level. The final study is Liza and Andriyanti (2020), a mixed-methods study recruiting 54 participants. They found that the participants had a high level of DL.

To sum up the justification of this study considering the literature review, there are few studies undertaken on P-ELTs' DL competence (Alfarisyi, 2020; Anggeraini et al., 2019; Eryansyah et al., 2020; Liza &Andriyanti, 2020). As suggested above, the studies in the literature were undertaken with a limited number of participants (some are case studies, and even when it is a survey, the numbers are around 50-60), and they studied only one institution. This limits the generalizability of the results. Moreover, none of these studies considered the effect of some potential variables and factors, nor did they utilize a mixed-methods approach except for Liza and Andriyanti (2020). There are few more studies that studied P-ELTs' indirectly together with other PTs (Boyacı, 2019; Çam & Kıyıcı, 2017; Özoğlu & Kaya, 2020); however, as P-ELTs were only one group of the PTs in these studies, little specific information was provided about them. What is more, the findings of the previous studies were partly contradictory. While some claimed that P-ELTs had a medium level of DL (Anggeraini et al., 2019; Boyacı, 2019; Çam & Kıyıcı, 2017; Özoğlu & Kaya, 2020), other researchers suggested that they had a high level (Liza & Andriyanti, 2020). On the other hand, Alfarisyi (2020) and Eryansyah et al. (2020) found that it was medium to high. Accordingly, considering these gaps, this study was designed as a mixed-methods study specifically on P-ELTs, and 186 students from 3 different universities were recruited as participants to provide a more reliable and valid account of their views and DL level. Accordingly, considering the significance of 21st century skills, specifically DL, and the gap in literature, the following research questions were formed:

1. What is pre-service English language teachers' digital literacy level?
2. Does pre-service English language teachers' level change according to the variables gender, grade, mostly used devices, daily amount of time spent on digital platforms, and year of digital platform use?
3. How do pre-service English teachers view their digital literacy level and competence?

METHODOLOGY

Research Design

This study has a mixed-methods research design. The Digital Literacy Scale (Üstündağ et al., 2017) and a semi-structured interview were used to collect the data. The survey model can be used to investigate the variance between two or more variables or the level of variance, and the interview is a good way to obtain qualitative data (Karasar, 2005). The design of the study is summarized below.

Table 1.*The Methodology*

Research Questions	Data Collection Tools	Data Analysis
1) What is pre-service English language teachers' DL level?	The Digital Literacy Scale (Üstündağ et al., 2017)	The quantitative analysis of the DL scale via SPSS
2) Does their level change according to the variables gender, grade, mostly used devices, daily amount of time spent on digital platforms, and year of digital platform use?	The data collected via the personal information form and The Digital Literacy Scale (Üstündağ et al., 2017)	The analysis of the DL scale by SPSS with regard to the demographic variables through independent samples t-test and one-way variance analysis
3) How do the pre-service English teachers view their DL level and competence?	Semi-structured interviews	Qualitative analysis via Descriptive Analysis

The Context and Participants

The participants were P-ELTs 2019-2020 academic year. They were recruited via convenience sampling. The researchers sent the surveys to three universities with which they had a contact. 186 of them filled in the scale. Then, some participants were invited for interviews on a voluntary basis via e-mail. In total, 26 volunteers were interviewed and audio-recorded. 13 of them were males, and 13 of them were females. The information about the 186 participants is presented below.

Table 2. *The Participants*

Variables		f	%
Gender	Female	123	66,1
	Male	63	33,9
Grade	1st grade	19	10,2
	2nd grade	68	36,6
	3rd grade	15	8,1
	4th grade	84	45,2
Mostly used digital platforms	Computers	41	22,0
	Smartphones	145	78,0
Daily amount of time spent on digital platforms	0-3 hours	44	23,7
	4-6 hours	81	43,5
	More than 6 hours	61	32,8
Year of digital platform use	Less than 6 years	21	11,3
	More than 6 years	165	88,7
Total		186	100

Data Collection Tool

To collect the quantitative data, a personal information form and the Digital Literacy Scale that was developed by Ng (2012) and adapted to Turkish by Üstündağ et al. (2017) were used. The scale consists of 10 items and a single factor. It utilizes a 5-point Likert type scale. So, the lowest point from this scale is 10, while the highest is 50. The Cronbach's Alpha internal consistency coefficient was calculated as 0.86 for the scale. The internal consistency was calculated as 0.824 after the implementation in this current study.

The qualitative data collection was undertaken via the semi-structured interview protocol that the researchers developed. There are six questions, which were developed after a thorough literature review. Then, they were sent for expert opinion. The experts approved them with minor changes such as adding a follow up clarification question. The questions were also checked for linguistic aspects by a language specialist to ensure validity and avoid any ambiguities. Finally, the analysis of the interviews were shared with two participants chosen on a convenience base (i.e., the ones from the researchers' university) to check whether the results were in line with their ideas. They confirmed that the analysis reflected their opinions.

The interview questions are below:

1) How do you assess your level considering current technologies you use?

2) When you encounter a problem with the technological platforms you use, can you solve the problems yourself? Could you provide some details?

3) Can you learn current technologies easily? Could you please explain how and why?

4) What do you think about your competence level in new technological learning environments such as presentation, digital stories or blogs? Could you please explain?

5) What are the methods and tools that you specifically use in the internet? Do you consider yourself competent in this aspect?

6) Can you find solutions to the problems (other than hardware issues) that you face while roaming? Could you please provide some details?

Data Analysis

SPSS 25.0 was used for analyzing the survey data. The significance level was set as 0.05, and whether the Digital Literacy Scale showed normal distribution was checked. Hence, the Kolmogorov-Smirnov test was applied, and the results confirmed that the data showed normal distribution at p>0,05. When p is smaller than 0.05, the data can be interpreted by checking skewness-kurtosis coefficients (Büyüköztürk, 2007; Büyüköztürk et al., 2019). Accordingly, the Digital Literacy Scale points were checked for skewness and kurtosis via the Kolmogorov – Smirnov test. The results were presented in below.

Table 3.*Kurtosis and Skewness Values*

	K-S	p	Skewness	Kurtosis
Digital Literacy Levels	,073	,017	-.181	.248

When the Kurtosis and Skewness values are between -1.5 and +1.5, it is considered normal distribution (Tabachinick & Fidell, 2013). Therefore, the data of this study showed normal distribution. The variances according to the Levene's test results were ($F = 1.267$, $p > .05$) for participants' gender, ($F = .616$, $p > .05$) for grade, ($F = .873$, $p > .05$) for mostly used digital platforms, ($F = .659$, $p > .05$) for daily amount of time spent on digital platforms, and ($F = 4.848$, $p < .05$) for year of digital platform use. These results prove that the groups show equal variances. Hence, further SPSS analysis on the data is reliable. Accordingly, when the variables with two subgroups (i.e., gender, mostly used digital platforms, and year of digital platform use) were analyzed, independent samples t-test was applied, and with the variables that had more than two subgroups (i.e., grade and daily amount of time spent on digital platforms), one-way variance analysis was utilized.

The interview data were collected from 26 participants that were invited via e-mail and volunteered to take part in the study. The data were analyzed by Descriptive Analysis. Each of the six questions in the interview was analyzed one by one. In Descriptive Analysis, the data is analyzed according to some pre-defined themes (i.e., digital literacy), and the results are presented according to the research questions. Direct quotations from the participants are also used while presenting the findings. In this way, the findings are provided in a systematic way with direct evidence from the data (Yıldırım & Şimşek, 2008).

Ethics

This study has ethical approval from Sakarya University under the protocol number 61923333/050.99/ on 09/11/2020.

FINDINGS

The analysis of the scale

Considering the research questions, the analysis of P-ELTs' DL level and its investigation according to the variables were presented below. These answered the initial two research questions. After the scale results, the analysis of semi-structured interviews was presented, which answered the third research question. The results of P-ELTs' digital literacy level are presented below.

Table 4. The Descriptive Results of Digital Literacy Levels

	$\overline{X}$	sd
Digital Literacy	3.77	.55

The analysis showed that P-ELTs had an average of 3.77 from the DL scale. This result suggests that their level is above the medium level. In other words, the P-ELTs in this study may be considered qualified at a medium to high level in terms of their DL level and abilities.

The results of independent samples t-test analysis that was undertaken to check whether the first variable, gender, affected the participants' DL level are presented below.

Table 5. *Participants' Digital Literacy Levels according to Gender*

	Groups	n	$\bar{X}$	Sd	df	t	p
Digital Literacy	Female	123	3,73	,57	184	-1,394	.164
	Male	63	3,85	,52			

According to Table 5, while the males had an average of 3,85, the females had 3,73. There was a slight quantitative difference in favor of males; however, the results did not show any significant difference considering gender [t(184) = -1.394, p>.05]. So, it can be stated that gender as a variable did not significantly affect the participants' DL level.

The results of the one-way Anova test that were obtained from the analysis of the participants' DL level concerning grade are presented below in Table 6.

Table 6. *Participants' Digital Literacy Levels according to grade*

	Groups	N	X	Sd	df	F	p	Significant difference
Digital Literacy	1st grade	19	3,63	,48	3	,947	,419	No
	2nd grade	68	3,73	,56	182			
	3rd grade	15	3,83	,50	185			
	4th grade	84	3,83	,58				

The analysis showed a slight increase from the 1st grade (3,63) to the 4th grade (3,83) cross-sectionally. However, this was not a significant difference (p<,419). This means that grade did not have a significant effect on the participants' DL levels [F(3-182) =.947, p>.05]. In other words, although participants' average was higher in the following grades (e.g., 3,63 in the 1st grade while 3,83 in the 4th grade), this difference was not found to have significance.

The following variable was the digital platforms the participants used the most. The results of the independent samples t-test undertaken to investigate whether the platform used by the participants affected their DL level are presented in Table 7 below.

Table 7. *Participants' Digital Literacy Levels according to the mostly used devices*

	Groups	n	$\bar{X}$	Sd	df	t	p
Digital Literacy	Computers	41	4,02	,56	184	3,342	.001
	Smartphones	145	3,70	,53			

According to Table 7, there was a significant relationship [t(184) = 3.342, p<.05] between the device P-ELTs used and their DL levels. The results suggested that the participants using computers had a higher DL (= 4,02) than those using smartphones (= 3,70), and more importantly, this was a significant difference. Consequently, it may be suggested here that the mostly used devices had a significant effect on participants' DL levels in favor of computers.

The results of the Anova one-way variance analysis undertaken to investigate whether PELTs' DL significantly differs according to the daily amount of time spent on digital platforms were presented in Table 8 below.

Table 8. *Participants' Digital Literacy Levels according tothe daily amount of time spent on digital platforms*

	Groups	N	X	Sd	df	F	p	Significant difference
Digital Literacy	0-3 hours	44	3,72	,54	2	1,930	,148	No
	4-6 hours	81	3,72	,57	183			
	More than 6 hours	61	3,89	,54	185			

The results showed that there was not a significant difference [F(3-182) =1.930, p>.05] in P-ELTs' DL levels with regard to the daily amount of time spent on digital platforms. This means that the daily amount of exposure to digital platforms does not have a significant effect on the participants' DL levels.

Although a slight increase was observed as the time spent on digital platforms increased (e.g., 3,72 in 0-3 hours while 3,89 in more than 6 hours), the analysis did not suggest any statistically significant differences among groups.

The results of the analysis that was undertaken to check whether year of digital platform use affected the participants' DL level are presented below.

Table 9. *Participants' Digital Literacy Levels according to year of digital platform use*

	Groups	n	Median	Rank Sum	U	p
Digital Literacy	Less than 6 years	21	59,07	1240,50	1009,500	.002
	More than 6 years	165	97,88	16150,50		

According to Table 9, P-ELTs' DL was significantly [t(184) = -3.965, p<.05] affected by year of digital platform use. Those using digital platforms for more than 6 years had an average of (= 3,83), while those who used them less than 6 years had (= 3,34).When the medians are considered, it is also observed that the participants that used digital platforms more than 6 years had higher digital literacy levels than those that used them for less than 6 years. Then, the analysis demonstrated that P-ELTs who used digital platforms more had higher DL levels.

The Analysis of the interviews

As for the results of the semi-structured interviews, the results will be provided one by one for each question in the interview.

The first question was, "How do you assess your level considering current technologies you use?" The analysis of the responses showed that most of the participants thought that they could solve the problems they encountered on technological and digital platforms. Six of the participants said they were very good, and 13 said they were good at current technologies. On the other hand, 5 of them said they had a medium level of skills while 2 said they were bad at solving problems about technologies.

The second question was, "When you encounter a problem with the technological platforms you use, can you solve the problems yourself? Could you provide some details?" The analysis showed that they mostly said "yes". To exemplify, P24 said: "Yes. I use search engines and specialist websites". Only 1 person said "sometimes", and 2 of them said they had difficulties. This showed that most of the participants thought they could solve the problems they had on technological platforms. Those who said "yes" explained that they solved the problems mostly by the internet via search engines, videos, and forums. Most of them also suggested that experts, friends, and acquaintances also helped them. Sometimes, they also used technical support and checked instructions, and they benefitted from English. Those who said no also reported similar solutions such as forums, videos, and acquaintances /experts. However, in the failure cases, the problem stemmed from the cases where it was too technical or mathematical and when they were afraid to break it down.

The third question was, "Can you learn current technologies easily? Could you please explain how and why?". This question focuses on the learning of new technologies, which is essential as this indicates their life-long learning and self-updating skills. Twenty-two of them said that they could learn them easily while 4 said no or at medium level. This suggests that most P-ELTs thought that they could learn new technologies easily. The most common ways were long exposure to technology (e.g., being born into technology) mentioned by 8 and interest mentioned by 6 participants. A few of them mentioned trial and error (3 people), the use of technology by family members as well (2 people), and forums (e.g., expert websites and tech websites mentioned by 2).

As for those who said no, they mentioned interest as one factor. They said they were not interested in technology. P22 said: "It is not interesting for me. I only learn the necessary ones". A few P-ELTs complained that new technologies kept emerging, and each device had its own programs and rules. They also suggested that they were exposed to it late, afraid to break it down, and they did not have much time and interest.

The fourth question was, "What do you think about your competence level in new technological learning environments such as presentation, digital stories, or blogs? Could you please explain?". Most participants said that they could use these kinds of environments. As an explanation, P12 stated, "We have been educated regarding this, and we always use them." On the other hand, 3 participants said they had a medium level in these environments. None of the participants reported having serious problems considering the use of learning environments. Some of the ones who said they had a medium level mentioned that they sometimes had problems when there were environments that required special knowledge, such as some features of Microsoft Excel or creating a blog.

The fifth question was, "What are the methods and tools that you specifically use in the internet? Do you consider yourself competent in this aspect?". In response to this question, almost all the participants said they felt competent in this aspect. As for the methods and tools, search engines (almost always Google) were mentioned the most frequently (24 participants), and specialist/popular web pages (often Google scholar, databases, forums, and specialist websites) were mentioned by 11 as they were considered reliable. 2 participants stated that they cross-checked other web sites instead of single sources. 3 mentioned online libraries, another 3 mentioned social media, and 1 mentioned expert people. To exemplify a typical response, P12 said: “Yes. I use search engines and specialist web pages such as ScienceDirect.”

The final question was, "Can you find solutions to the problems (other than hardware issues) that you face while roaming? Could you please provide some details?". Again, almost all the participants stated that they could solve these kinds of problems. Only 1 person said it was at a medium level, and another participant stated there were problems. Hence, 3 participants mentioned having some problems regarding this point. They explained this by referring to the fact that they were born before or in the middle of the technology age. Hence, they believed that they needed to equip themselves more as future teachers. On the other hand, P25 argued that although he was not born into the digital age, he could use digital technologies.

DISCUSSION

In line with the research questions, the analysis of the data was summarized in Table 10:

Table 10: *Overall results of the analysis concerning the research questions*

Research Questions	Results
1) What is P-ELTs’ DL level?	P-ELTs have a DL of a medium to high level.
2) Does their level change according to the variables gender, grade, mostly used devices, daily amount of time spent on digital platforms, and year of digital platform use?	Two variables, the mostly used devices and year of digital platform use, have a significant effect on P-ELTs' DL level. On the other hand, gender, grade, and the daily amount of time spent on digital platforms do not have any significant effects.
3) How do the pre-service English teachers view their DL level and competence?	Most P-ELTs think that they have a high digital competence. They mostly considered themselves competent at solving digital problems, benefitting from technology for pedagogical purposes, and learning new technologies. These indicate that they consider themselves competent in digital skills.

The findings then showed that the participants had a medium to high level of DL, and the mostly used devices (i.e., in favor of computers compared to smartphones) and year of digital platform use (i.e., in favor of more than 6 years in contrast to less than 6 years) had a significant effect. The interview results also supported the findings from the scale regarding the 1st research question. When the survey and interview results were compared, it may be suggested that they were in line with each other in that the P-ELTs were found to have a medium or higher DL level (in questionnaire results), and they also expressed this in the interview. This is in line with similar studies that focus on other aspects such as technological pedagogical content knowledge (e.g., Sarıçoban et al., 2019), and it has implications for PT training (Santisteban et al., 2020).

On the other hand, in the interviews, it was seen that the participants reported a higher level of DL, as obvious from the fact that they thought they could use technology and digital devices for daily issues as well as pedagogical issues. What is more, they suggested that they could solve the problems they faced on the internet via various tools and methods. When a comparison with the literature is made, the findings regarding P-ELTs' DL levels are in line with most of the literature, which found that P-ELTs had a medium to high level (Alfarisyi, 2020; Eryansyah et al., 2020; Liza &Andriyanti, 2020). On the other hand, some studies argued that they had a medium level (Anggeraini et al., 2019; Boyacı 2019; Çam & Kıyıcı, 2017; Özoğlu & Kaya, 2020, p. 415). These results do not seem to contradict each other in that they agreed that P-ELTs had at least a medium level. One thing to note is that the studies which found a medium level of DL are slightly older than the ones that found a medium to high level, including our study. This slight year gap may explain this difference as newer generations of P-ELTs possibly become more and more digital natives as the years pass (Prensky, 2001).

The five variables analyzed in this study suggested that only the mostly used device (i.e., computers) and year of digital platform use (i.e., 6 or more years) had a positive effect on P-ELTs' DL levels. This finding is precious as the previous studies did not investigate the effects of variables much. The digital platform seems to contribute to DL levels positively; however, it is difficult to detect whether it is the cause or the effect. As they included more properties and features, having computers may enable the participants to do more things on digital platforms in comparison to mobile devices, and this may lead to a higher DL level. On the other hand, the participants with a high level of awareness of DL may prefer to choose computers as they believe that they may do more thanks to them, which makes using computers an effect rather than a cause. As for year of digital platform use, it may be suggested that this is an expected finding in that more exposure to digital platforms will probably lead to more competence. A comparison with the literature cannot be made as there are no studies focusing on the effects of factors on DL, as mentioned in the justification of our study. Still, it can be suggested here that information and communication technologies offer contributions into pre-service teacher training. As the current study has shown, the participants already have a medium to high level of competence. Hence, teacher training programs may focus on improving further skills and developing ways to benefit from information and communication technologies more for pedagogic purposes (Cortina-Pérez, 2014).

As for more detailed issues, the second interview question specifically focused on problem-solving on technological platforms, which is an essential part of DL. The findings showed that most of the participants thought that they could solve these problems. As the responses showed, this was probably thanks to the help of experts and acquaintances. Although most participants said that they asked for help frequently, it may still be argued that they knew how to solve or find a way to solve digital problems. So, they could solve digital problems ultimately. The few participants who said they could not solve the problems suggested that they had difficulties when the problems were too technical or mathematical and when they were afraid to break it down. This is quite understandable and, in fact, normal as laypeople cannot be expected to be good at mathematical or too technical issues. This was also mentioned in the next question, in which the results showed that no participants reported having significant troubles in learning environments except for the cases which required technical information and knowledge. Thus, the analysis of the answers to this question also suggested that the participants overall had a medium to high level of DL.

The fourth interview question investigated the use of learning environments, which is essential for the P-ELTs as future teachers in the digital era. The findings demonstrated that none of them reported any severe problems considering the use of learning environments. They explained that they had been trained on using them and used them all the time. This means that the participants seemed to be quite confident in the pedagogical use of technology. This is an essential finding in that P-ELTs felt comfortable with using technology for teaching purposes. Eryanshah et al. (2020) also had a similar observation regarding this. They suggested that there was a negative link between lack of training on DL skills and DL level. So, this showed that training the digital natives is essential, and it is in line with Ng's (2012) findings. The other question analyzed the methods and tools used on the internet. Search engines were mentioned as the most frequent one, Google hugely dominating the others. This is in line with some other studies (e.g., Atar & Bağcı, 2020). Also, they stated that they referred to specialist and expert web pages such as forums and Google scholar, and they sometimes cross-checked the information from different web pages. This is related to the information searching aspect of DL as they paid attention to reliability (Atar & Bağcı, 2020).

One interesting finding is that although most of the P-ELTs thought they were good at technology, they sometimes reported solving their problems with the help of specialist web pages, search engines, and experts. Hence, they occasionally asked for help from others, as in the case of experts or maybe forums. This may indicate that knowing how to solve digital issues is also significant in addition to being knowledgeable in digital technologies. It may be argued here that knowing how to access data and tools may be more important than having the information in your mind as our minds are limited. However, the internet and technology provide immense opportunities as digital skills enable people to function successfully without having to learn and understand many technical issues. So, it may be suggested that the focus of education should be on teaching students how to access and use reliable sources via DL, and maybe we may argue that the vital point is ensuring learning how to exploit digital skills, rather than learning and knowing all the tools, applications and resources.

A theme raised several times by the interviewees was digital nativeness (Prensky, 2001). This was observed in the interview data occasionally, especially in the 3rd and 6th questions. The analysis of the interview supported the existence and conceptualization of this idea among the participants. When they tried to explain why they considered themselves competent in DL, they referred to their being born into technology. According to the analysis, this was possible via long exposure to technology and the familiarity of the family with digital platforms as well. This finding confirms the suggestions in the literature regarding the characteristics of digital natives. The participants believed that they were born into technology, and this was simply how they could use and learn technology at ease. Hence, the analysis showed that most P-ELTs thought that they could acquire new skills easily as supported by the results of the 3rd interview question as well. This is significant as this indicates their life-long learning and self-updating skills, too. Still, intervention studies that focus on improving teachers' and pre-service teachers' digital skills may be more benefical (Fluck& Dowden, 2013), and this area indeed needs further studies. As Karakoyun and Lindberg (2021) suggested, defining pre-service teachers' DL level is significant to further improve their skills.

Conclusion

This study set out to fill a gap in the literature regarding P-ELTs' DL levels and their views. The previous studies in the literature were restricted in terms of generalizability as they tended to focus on few participants and usually one institution. Also, the previous studies reported conflicting results considering P-ELTs' DL levels, and they usually depended upon either a quantitative or qualitative design without taking variables into account. Accordingly, this study analyzed P-ELTs' DL levels and their views regarding their competence via a mixed-methods study that analyzed data from 186 participants from 3 institutions. The analysis also investigated the effects of some potential variables. The findings suggested that P-ELTs had a medium to high level of DL. As for the interview results, it was found that most P-ELTs thought they had a high DL level. They mostly considered themselves competent at solving digital problems, benefitting from technology for pedagogical purposes, and learning new technologies. This indicated that they considered themselves competent in digital skills. Two variables, the mostly used devices and year of digital platform use, were observed to have a significant effect on P-ELTs' DL level.

On the other hand, gender, grade, and the daily amount of time spent on digital platforms did not have any statistically significant effects.

This study also showed that the participants were aware of their digital native status explicitly, although it was not asked to them. In this sense, from a social identity perspective, they considered themselves as digitally literate individuals that can function easily in the new digital world. On the other hand, a few of the participants who said they had some problems solving internet problems suggested that this was so because they were born before or in the middle of the digital world. Then, it may be argued here that the concept of digital natives manifests itself firmly in the discourse they used to assess and position their DL. So, building upon their confidence in digital literacies, the goal of PT education programs should be aligned with teaching PTs how to exploit digital resources rather than teaching them digital tools. Finally, as this study showed that learning how to exploit digital skills is more important than the level of competence itself, more systematic interventions were suggested for future studies. To exemplify, boosting self-regulated learning strategies may enable individuals to improve their DL in a sustainable way.

Despite its contribution to a significant gap in the literature, this study naturally has some limitations. Although this study included more participants and different institutions in its sample compared to the previous studies, still the sample is restricted to a single country. Hence, studies including participants from different countries can sketch P-ELTs' DL levels around the globe. Another significant point is that this study demonstrated that, in general, P-ELTs felt secure about their DL levels and competence. Accordingly, future studies might identify P-ELTs' specific needs and focus on improving them directly as they seem to have an established competence already. The output of Digital Competence Framework for Educators (DigCompEdu) may be utilized for this goal, and intervention studies that aim to improve PTs' DL skills are needed. To exemplify, Pérez-Escoda et al. (2019) is an extensive study on the development of DL. Finally, this study utilized a cross-sectional design; however, future studies may be designed as a longitudinal one and track the same individuals' progress over time.

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Misconceptions in 5-6 Year Old Children: Formation of a Cloud

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ABSTRACT

Many phenomena and events in which children are included are suitable to be researched and discovered by children within the scope of science education. Children ask many questions while researching the scientific facts and phenomena they are curious about and learn new concepts. In this process, it is essential to teach the concepts children will learn and the new education to be formed. Therefore, this study aimed to examine the concept of cloud, which mainly attracts children's attention, and the current conceptual knowledge and misconceptions about cloud formation. For this purpose, the phenomenology pattern was used in the research. The study group consisted of 5-6 year-old children studying in an independent kindergarten affiliated with the Ministry of National Education in Antalya. A total of 12 children and one teacher were included in the study. The research used the 'Personal Information Form', 'Children's Scientific Concepts Evaluation Form' and 'Teacher Interview Form for Science Education' as data collection tools for children and their teachers. The data were analyzed by the descriptive analysis method. Findings obtained from children were presented in the form of themes by coding. As a result of the research, it was determined that children had concept deficiencies and misconceptions about the formation of the cloud and that there were errors in the formation of meaning. In addition, suggestions were made to teachers for practices to assess and change children's misconceptions.

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INTRODUCTION

Preschool is a period in which the foundations of human life and development are based. This period includes a process in which brain development and synaptic connection speed are highest, and children experience extreme cognitive, social-emotional, language, and motor development changes. Furthermore, while children grow and mature rapidly in the first years of life, the brain is highly open to external stimuli during this period (Nicolic, 2010). For this reason, teachers and families need to form a planned and qualified environment to support children's mental development most effectively. For this, first of all, supporting the competencies of teachers and families and, accordingly, environmental planning organized with a multi-sensory and scientific understanding in the early years should be given priority.

Recent developments in learning suggest that children need science to develop new understandings in the early years (Guo et al., 2015; Lind, 1998). However, past research conducted within the scope of science education shows that many educators do not pay much attention to the ability of early childhood children to learn the concepts of science (Ayers, 1999; Tanık-Önal & Sönmez-Eryaşar, 2022). This idea is wrong in terms of children's development and learning. Because teachers with this idea often fail to "… take advantage of children's innate interest and enthusiasm for science" (Watters et al., 2001, p. 2). Concept-oriented studies have replaced these thoughts, a prerequisite for scientific thinking (Fleer, 2009; Saçkes et al., 2010). The important names that form the basis of this idea in his works are undoubtedly Vygotsky and Piaget. Vygotsky and Piaget, who focused on the development of language and thought in children during their early studies, increased the interest in children's mental structures and concept learning required for scientific thinking (Bodrova & Leong, 2017; Hedegaard & Chaiklin, 2005; Sözbilir, 2003). Especially in Vygotsky's explanations on conceptual development, there has been a great interest in his views on the differences between everyday and scientific concepts due to everyday and scientific thinking (Bodrova & Leong, 2017). Vygotsky (1987) argued that these everyday concepts form the basis of learning scientific concepts. In this context, he stated that forming everyday concepts and forming scientific concepts are strongly linked. Therefore, everyday concepts based on the daily life experiences of children and adults form the potential for developing scientific concepts in the context of school experiences (Fleer, 2009). Concerning this, Hedegaard and Chaiklin (2005) explained that the most powerful learning contexts are that teachers take the contexts of 'everyday concepts' and 'scientific concepts' into consideration when planning to learn.

Concepts are mental tools that enable the individual to think by classifying what is learned and organizing information (Senemoğlu, 2001). However, much research has revealed that children acquire inaccurate information and the right ones from their environment before starting school and that they form a unique world of meaning with what they see in their environment. Accordingly, they point out that children come to school with concepts that are generally inconsistent with the concepts, skills, and phenomena they have in the early years (Abell & Lederman, 2007; Smolleck & Hershberger, 2011). This inconsistent information that children have is called misconception (Akbaş, 2002).

The misconception describes "a situation in which children's ideas about a concept differ from those of scientists" (Blosser, 1987 as cited in Smolleck & Hershberger, 2011). Accordingly, the concepts and misconceptions of young children are based on their daily experiences. Logical but scientific misconceptions often guide children's ways of characterizing and explaining the world. In many cases, children develop partially correct ideas that can be used as a basis for further learning (Committee on Undergraduate Science Education, 1997). Children also make inferences and build basic concepts while constructing these ideas (Civelek & Özyılmaz-Akamca, 2018). However, studies have revealed that these ideas are mainly contrary to scientific explanations (Dove, 1998; Vosniadou & Brewer, 1992).

In the related literature, it is stated that children's misconceptions are caused by their daily observations and experiences, learning, religious or cultural teachings acquired before starting school, and science practices that do not adequately question children's misconceptions (Abell & Lederman, 2007; Alawiyah et al., 2018; Chavan & Patankar, 2016; Committee on Undergraduate Science Education, 1997; Thompson, 2006). There are many contexts in children's lives where they encounter information that encourages misconceptions. Therefore, it is possible for children to draw more than one conclusion for a particular phenomenon, depending on the context they are in (Smolleck & Hershberger, 2011). As children draw conclusions in the learning process, they build their new learning by combining it with their previous learning. Therefore, it is seen that they continue their misconceptions as a result of an error/mistake or inadequate inferences in their previous learning (Kirbulut & Geban, 2014; Rowell et al., 1990). However, the inability to pay attention, excessive attention, incorrect learning, and some physical inadequacies can also lead to misconceptions (Newton, 2000).

On the other hand, Piaget stated that misconceptions are a structure and are added on top of each other. He also revealed that teaching activities without evaluating the learners' prior knowledge and misconceptions would increase the children's misconceptions (Aydın & Özkara, 2011). At the same time, studies have revealed that eliminating misconceptions is not easy and is an essential obstacle to meaningful learning. It has been stated in many studies that children have difficulty in changing the wrong ideas they have acquired and tend to stick to these ideas (Büyükkasap et al., 2001; Duncan, 1999).

When the formation of misconceptions is examined, it is stated that it starts as a gap of lack of knowledge. This gap is explained as the random filling of children with their existing knowledge and experiences due to the lack of unqualified or concept-oriented education. Although the information obtained by the child through random gap-filling is somewhat successful, this situation emerges as a misconception at some point. These misconceptions are seen as developers in terms of teaching, provided that they are corrected over time (Rowell et al., 1990). However, although many teachers think of children as a primary mental writing board and assume the role of filling it, the main problem is that the boards are not empty but contain some preliminary knowledge and intuition. Teaching activities to be carried out without identifying children's prior knowledge and intuition and determining to what extent they are consistent in scientific thinking will cause difficulties in achieving the desired conceptual change (Tytler, 1998).

Teachers are responsible for identifying, explaining, and correcting misconceptions (Barke et al., 2008; Izzati & Rochmah, 2020). Children's misconceptions are only possible with the knowledge of how their cognitive structures work and develop. Therefore, evaluation is critical in determining children's misconceptions. Furthermore, evaluations that will make children's existing concepts and understandings visible are crucial in accurately representing their misconceptions based on the misinformation they produce (Izzati & Rochmah, 2020). Strategies such as concept maps, word association, concept cartoons, student drawings, card sorting, clinical interviews, mind/thinking maps, role-playing, and model/scientific apparatus are proposed for the detection and correction of misconceptions (Chavan & Patankar, 2016). In this regard, Ünal and Akman (2006) drew attention to the importance of the teaching techniques used by teachers to establish a solid scientific basis in children because teachers' competence in doing effective science with children may vary depending on their scientific concept knowledge, attitudes toward science, and scientific understanding.

Effective science education studies to be presented to children should be organized in a motivating way against scientific phenomena and events that children can experience with all their senses, encouraging their effective participation (Macpherson, 2011). Because the concrete experiences gained during this period support brain development in children and provide permanent information (Oktay, 2007). However, children's dispositions towards scientific phenomena and events are known to be highly influential on their learning (Perkins et al., 1993). Because children develop an understanding of the world as they research and discover in line with their dispositions. These understandings and concepts developed in the early years form the basis for future periods and deeper understandings. Therefore, early learning can prevent or support future learning (Smolleck & Hershberger, 2011). For this reason, it is vital for teachers to develop their competencies for effective science practices and to build the concepts children need to correctly make sense of the world through scientific facts and events.

When the studies described above and the related literature were examined, although there are many studies on the misconceptions of children in the preschool years in foreign literature, few studies investigate the scientific misconceptions of children and the effectiveness of the developed educational program in Turkey. Therefore, this study aims to examine the current misconceptions and changes in the cloud concept and its formation that attract children's attention. For this purpose, the conceptual knowledge of children aged 5-6 years about the formation of clouds and clouds was evaluated in the study. Furthermore, with the training program prepared by the researchers about cloud and the formation of cloud, the extent to which the concept knowledge and misconceptions have changed was examined. Therefore, this study is necessary to be an example and guide for future studies with the educational program applied to determining the misconceptions of preschool children and correcting these misconceptions.

Aim of the Study

The main purpose of this study was to examine the concept of cloud, which attracted the most attention of aged 5-6 year children in the study group in line with the results obtained from the preliminary interview, and their current conceptual knowledge and misconceptions about cloud formation.

In line with this purpose, answers to the following questions were sought:

1.What kind of concept knowledge do the children in the study group have about the cloud and the formation of the cloud?

2.What are the misconceptions of the children in the study group about the cloud and the formation of the cloud?

3.Is the education program applied to the children in the study group influential in children's concept development?

METHOD

Research Design

The research was planned as a phenomenology pattern. Phenomenological studies focus on the common characteristics of several people in their experiences associated with a phenomenon or concept. Phenomenological studies usually emphasize a concept or idea (Creswell, 2013). The phenomenon accepted within the scope of this study is the misconceptions of preschool children about clouds and the formation of clouds. Revealing children's misconceptions constitutes the scope of the research.

Study Group

The study group of this research consists of 5-6 years old children attending an independent kindergarten affiliated with the Ministry of National Education (MoNE) in the central district of Antalya in the 2022-2023 academic year. The convenience sample method was used to recruit 12 preschool children and their teacher for this study. No personal information explaining the identity of the children involved in the study was included. The study group consisted of 12 children aged 5-6 years, with more girls (n=8) than boys (n=4) and the teacher was female and had a degree in preschool education with 20 years of experience.

Data Collection Tools

In the study, the "Personal Information Form," "Children's Scientific Concepts Evaluation Form," and "Teacher Interview Form for Science Education" prepared by the researchers were used as data collection tools. Information on data collection tools is presented below.

Personal Information Form

It was prepared by the researchers to determine the characteristics of children, such as age, gender, and developmental status.

Children's Scientific Concepts Evaluation Form

The children's Scientific Concepts Evaluation Form was developed by the researchers to determine the current concept knowledge and misconceptions. Considering the developmental periods of the children, it was given importance to formulate the questions in the form of clear and straightforward language. Accordingly, questions that can reveal children's thoughts about scientific facts or events have been determined. 'Children's Scientific Concepts Evaluation Form' consists of three questions. The questions in the form were studied in two stages with the children.

Teacher Interview Form for Science Education

It was prepared by the researchers to determine the teachers' opinions of the children included in the study about science education in the preschool years. There are a total of six questions in the form. These questions were prepared to obtain the teacher's personal information, the scope of science education, the methods, and techniques used in science education, the frequency of doing science activities, and the information about the materials preferred within the scope of science education.

Educational Program

In the development of the educational program developed by the researchers, the relevant literature was first reviewed. In light of views of the relevant theorists (Vygotsky, Piaget, Chomsky, Lenneberg), approaches (socio-cultural, constructivist) and the categories of scientific concepts described by the National Research Council [NRC] (1996), while forming the framework of the educational program, the idea of the need to support the concepts and development processes that children will need in their scientific thinking processes effectively has been the focus of our program. In this context, various scientific fields in the literature of preschool science education, physical sciences, life sciences, Earth and space sciences, and scientific concepts related to these fields were examined (CUSE, 1997; MoNE, 2013; NRC, 1996). Afterward, children were interviewed to clarify the scientific phenomenon/event to be determined within the scope of the research. Before the concept of cloud formation was defined, the children were asked about the things they were most curious about during the interviews. Accordingly, it was noted that children focused on themes such as rain, cloud, lightning, etc. Therefore, the program's theme is determined as the cloud and the formation of the cloud. In this context, the children's teachers were asked about their studies. In the next stage, the educational program's content, methods, duration, and materials were determined, and the program was finalized. The program was designed to be implemented three times a week for 2 weeks as activities lasting 30-40 minutes. Information about the program is presented during the implementation phase.

Data Collection Process

Necessary permissions were obtained from the institution where the application will be made before starting the study. The teacher of the children to be studied in the institution was informed about the purpose, content, duration of the study, and the data collection tools to be used. data were collected using a semi-structured interview technique. Afterward, preliminary interviews were held with the children to determine the children's concept knowledge and misconceptions about the cloud and the formation of the cloud. The data obtained from the interviews with the children were transferred as raw data. In order to change the existing misconceptions, an educational program developed by the researchers and expert opinion was applied to the children. After the implementation phase, a final interview was held with the children to evaluate how much they had changed their existing misconceptions and the scientific concepts they had just learned. After the last interview, an individual interview was held with the teacher. The study was conducted between February and March 2023.

Implementation Phase

Pre-interview stage; before the implementation of the education program, individual interviews lasting about 10 minutes were held with every child to identify the children's misconceptions and concept knowledge about the cloud and its formation. In the individual interviews, the researcher first introduced himself to each child and explained the purpose of the study. A short conversation was held so the child could feel comfortable and express his/her feelings and thoughts comfortably. In the next stage, the child was asked to examine the sky and clouds by showing an image. The researcher pointed to the clouds and asked, “What do you think these might be?" If the child does not have any conceptual knowledge about "cloud", the child points to the visual and explains that it is a cloud. Then “What do you know about the cloud?” question is asked. To the answer given by the child, "So where did you learn this/these?" question is asked, and data are collected about the children's information source. Then the child is asked, "How do clouds” form? In line with the answers given by the children, the "So where did you learn this/these?" question is asked again, all answers are recorded, and the interview is finished.

Implementation of the educational program; After the children's existing conceptual knowledge and misconceptions about clouds and cloud formation were identified, an educational program was implemented to expand their conceptual knowledge and change their existing misconceptions. The program includes methods and techniques such as science education, drama, brainstorming, concept maps, experimentation, analogy, and drawing.

The final interview phase; After the implementation of the educational program, individual interviews were conducted with the children to determine to what extent the children's misconceptions about the cloud and its formation have changed. The image used in the pre-interview and expressing the sky is shown to the children again. The clouds are pointed out, and questions are repeated. After the children's responses are recorded, the interview is finished.

Interview stage with the teacher; An individual interview was conducted with the teacher in order to find out what kind of activities the teacher included within the scope of science activities, how he/she decided on the theme selection, what kind of materials he/she used within the scope of science education, and how often he/she did science work. Answers were recorded after the interview, which lasted about 20 minutes.

Data Analysis

In this study, Furthermore, the descriptive analysis technique was used to analyze the data obtained from the interview. In the descriptive analysis technique, the data can be formed by considering both the themes revealed by the research questions and the questions in the interview.

Validity and Reliability

In order to increase the validity of the research, the opinion of two field experts, one in the field of preschool education and one in the field of curriculum development, was consulted during the development of the interview forms. In addition, raw data are described with direct quotations and detailed descriptions. The researchers conducted preliminary interviews with three children to test the comprehensibility of the questions. After the interview, some changes were made to the questions, and the form was ready for implementation. In order to evaluate the validity of the program within the scope of the educational program, three field experts, one preschool education researcher, one program development researcher, and one preschool teacher, were consulted. With the feedback from the field experts, the educational program was finalized and made ready for implementation.

Some measures have been taken to ensure the reliability of the research. It is vital to collect data from different sources to collect data in research. Within the scope of this study, data were collected from preschool children and their teachers. The themes formed after the analysis was subjected to expert opinion and verified also called peer inquiry (Türnüklü, 2000). Accordingly, the researchers consulted the themes formed by other researchers who have experience and knowledge about the research subject. Therefore, children were coded as C1, C2, C3….

Ethic

The ethics committee approval of the study was obtained by Burdur Mehmet Akif Ersoy University Ethics Commitee (Approval Nr. GO 2023/84) in 01 February 2023.

FINDINGS

This section presents the findings obtained in line with the research data below.

Table 3. *Children's views about the concept of cloud*

N	Pre-interview Explanations	Pre-interview Theme	Final Interview Explanations	Final Interview Theme
C1	"It consists of water. It consists of vapors coming out of the water. It rains from the sky".	Water, steam, weather events	"The cloud is a vapor. Water is made up of droplets."	Steam, water droplets
C2	"The cloud was actually a water droplet, and because the water droplets came together, they turned into a cloud."	Water droplet	"They evaporate from the sea, the droplets accumulate, the cloud cannot carry them, and it rains on certain days."	Water droplets
C3	"I am forgetting. There is a cartoon of Maysa, his brother."	Other	"I have forgotten."	Other
C4	"I see the ones going slowly. Sometimes I see them turn into animals. Sometimes they are straight. And then I see these little clouds."	Other	"I see people going like a straight train. If the clouds go up, we cannot reach them; they are far away."	Other
C5	"Rain, wind, storm, hurricane."	Weather events	"Water is made up of droplets."	Water droplets
C6	"I see it in the air. I see it in the distance. The cloud has grown; it has grown big. I see it above."	Other	"It is raining, and a rainbow appears. Lightning cloud. I learned about rain."	Weather events
C7	"The rain. I don't know anything else, that is all."	Weather events	"The clouds formed the rain."	Weather events
C8	"I know that the clouds are above; they are high, so high."	Other	"First, the water droplets evaporated from the sea, and then the water droplets turned into clouds."	Water droplets
C9	"They can make lightning; I do not know anything else."	Weather events	"The water droplets formed a cloud."	Water droplets
C10	"White is blue because of the color of the air. When the wind blows, they start to turn blue. This is because they are blowing in the wind. When it rains in the clouds, we open the umbrella when we go to school."	Weather events	"When the water droplets rise, they turn into clouds."	Water droplets
C11	"Earth. The disappearance of clouds. That the clouds came out in the morning and disappeared at night."	Other	"Steam, water droplets."	Steam, water droplets
C12	"The rain. I don't know anymore."	Weather events	"The rain. Water"	Weather events

When Table 3 is examined, it was seen that there was a difference between the pre-interview and the last interview in the answers given to the question "What do you know about the cloud?" and the answers of all the children (n=12) differed in the last interview.

When Table 3 is examined, it is seen that there is a difference between the pre-interview and post-interview in the answers given by the children to the question "What do you know about the cloud?" and that the answers of the most of the children (n=10) differed in the post-interview. It was determined that 10 children's knowledge about the cloud changed within the scope of the purpose of the study, while two children did not have any change in their existing knowledge.

Table 4. *Expressions of children about the formation of the cloud*

N	Pre-interview		Final Interview	
	Explanations	Theme	Explanations	Theme
C1	"Clouds are formed by coming vapors from the sea and going to the sky."	Steam	"The sun was warming the sea, evaporating, and the water droplets were rising and turning into clouds."	Water loop
C2	"They evaporate from the sea, and then the droplets accumulate."	Steam, droplets	"The sun warms the sea, and the water evaporates into the sky. Water droplets were becoming clouds in the sky."	Water loop
C3	"From the rain"	Weather events	"The sun heated the sea, and then the droplets went up and merged to form a cloud."	Water loop
C4	"I don't know"	Other	"The sun was heating the pool. After that, steam comes out of the sea into the air. After that, we can see them together."	Water loop
C5	"They go when it is dark and not when it is sunny. God leads them from this side to that side."	Other	"Water droplets. The sun warmed the sea. The steam went up. The water droplets made the cloud."	Water loop
C6	"It is in mother's belly, and it is me."	Other	"The sea was vaporizing; little droplets were going up and merging."	Water loop
C7	"From the rain"	Weather events	"The sun evaporates the water; then the droplets go up and turn into clouds."	Water loop
C8	"Form cotton"	Other	"The sun was warming the sea. It was evaporating. Then the water droplets went up, and the cloud formed."	Water loop
C9	"I don't know"	Other	"The sun was shining towards the sea, and then the sea was warming. The water droplets were meeting above and making clouds."	Water loop
C10	"The clouds come together, and then the sky thunders."	Weather events	"The sun was warming the sea. The sea was evaporating. Then the water rose and turned to clouds."	Water loop
C11	"With smoke"	Other	"The sun warmed the sea, and then steam came out of the sea. When the water droplets went up, there was a cloud."	Water loop
C12	"The clouds go into the sea, evaporating from there and becoming rain."	Weather events	"The sun was warming the sea. The water droplets are going up. Then there are wind and cold, and clouds."	Water loop

When Table 4 is examined, it is seen that there is a difference between the pre-interview and the final interview in the answers given by the children to the question "How does a cloud form?" and in the last interview, it was observed that the answers of all children (n=12) differed. At the end of the study, it was determined that all children made sense of the water cycle for the formation of clouds, used scientific concepts and created meaning.

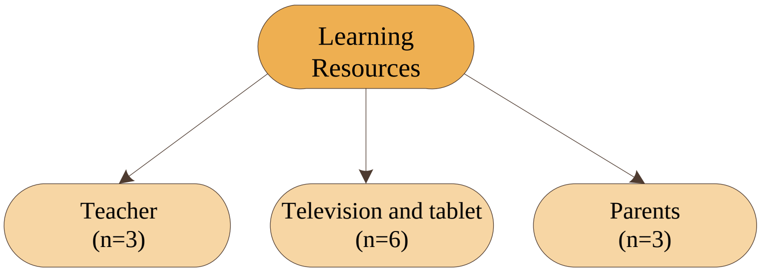

Figure 1. *Children's responses to learning resources about the concept of cloud*

When Figure 2 is examined, the majority of children's responses to the sources of learning the concept of cloud are that they learned it from television and tablets. In the last stage of the study, children were asked to draw a picture to evaluate their thoughts about the formation of the cloud. According to examples from the children's answers; C1 stated "*I learned while watching cartoons*..", C7 stated "*My teacher told me..*".

Examples of children's drawings are presented below.

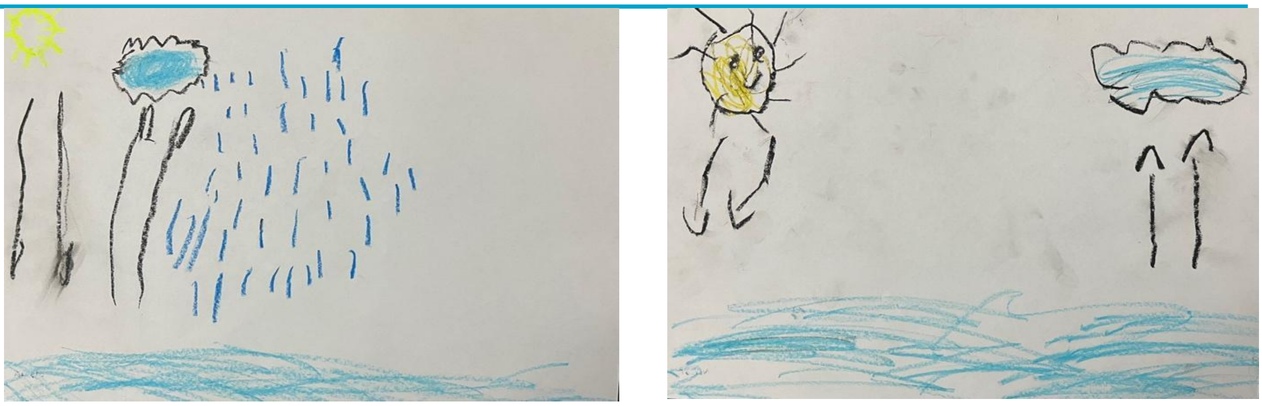

Figure 2. *Examples of children's drawings*

Tablo 6. *Opinions of primary school teachers on science education*

Interview Questions	Teacher's Statements
What kind of activities do you plan within the scope of science activities?	Observation, Trip Activities, Experiments, Experiment Days with Family Participation, Examination of Scientists Contributing to the Experiment
How do you decide on theme selection in science events?	According to Acquisition and Indicators
What kind of materials do you use in science education?	Easily Accessible Materials and Ingredients in Nature
How often do you study science?	Two Days a Week, Sometimes Three Days

When Table 6 is examined, it is seen that the teacher said, "*We definitely organize observation and scientific excursion activities. We are not only dependent on the classroom. Experiments are already a must for us. For example, each child planned an experiment with his/her family and we had experiment days*." In addition, in the scientific theme choices, she answered, "*I plan according to the monthly achievements and indicators, not according to the subject...*". Regarding the materials, she used, she stated, *"...We usually try to use easily accessible materials that everyone can have or have in their hands... Natural materials in nature such as tree branches, stones, shells, soil, etc...*".

DISCUSSION, CONCLUSION, RECOMMENDATIONS

This study aimed to examine the effect of the educational program applied to the conceptual knowledge and misconceptions of children about the concept of cloud and cloud formation in early childhood. Because from the moment they are born, children face many events and phenomena related to the research subject and try to make sense of them. In the research findings, children's explanations about clouds and their formation give an idea of their current perceptions or interpretations. It also shows how these ideas can be influenced by effective science teaching. The effects of these findings on concept teaching are discussed in this study.

When the findings obtained from the preliminary interview with the children for the first question of the study were examined in terms of themes, it was seen that in the answers to the question "What do you know about clouds?" (Table 3.), half of the children answered (n=6) in the ‘other’ category, some (n=4) answered in the ‘weather events’ category, and two children answered in the ‘steam/water droplets’ category. In the research findings, it was seen that there were no misconceptions, only in the prior knowledge of C2 about the cloud, but there was a lack of scientific knowledge. Other children included in the study (n=11) were found to have various misconceptions about clouds in general. For example, it was seen that C3 answered the question "What do you know about the clouds?" as "I forget, there is a cartoon Maysa, her brother" to the question, "I forget, there is a cartoon in Maysa", C4 answered "I see that they turn into animals, they become flat sometimes", C7 answered "Rain. I do not know anything else, that is all". The statements of C1, "It consists of water..." and "It makes it rain," indicate a lack of scientific knowledge and misconceptions about the cloud. As a result of the research, it was seen that the children's preliminary knowledge of the cloud includes information such as rain, the name of a living thing, disappearing at night, being above, and having different shapes.

It is noteworthy that, especially in international studies, children's views and misconceptions about natural cycles (water cycle, states of matter, etc.) have been investigated since a long time ago (Piaget, 1972; Stavy, 1990; Osborne & Cosgrove, 1983). Children are very familiar with water, rain, ice, and steam because these phenomena have been a part of their lives since the first years of their lives (Osborne & Cosgrove, 1983). However, it is seen in the research results that children may have misconceptions about these phenomena in their daily life experiences. These misconceptions will likely affect the scientific concepts, skills, and phenomena children will develop in the future (Smolleck & Hershberger, 2011). Therefore, by investigating and understanding children's concepts and misconceptions, teachers can better shape their education, thus providing opportunities for children to correct their misunderstandings and develop a deeper scientific understanding.

It was determined in the examination of the answers of the children to the question “What do you know about clouds?” in the last interview after the implementation of the educational program (Table 3.) that there was a positive change in the existing concept knowledge and misconceptions of all children except C3, C4, and C12. It was noted that C2 increased his/her scientific knowledge. For example, it was seen that C1's statement 'It consists of water. It consists of vapors from water. It makes it rain from the sky” changed to "Cloud is vapor. It consists of water droplets." It was seen that C6's statements about the cloud during the pre-interview, "I see it in the air, I see it far, I see it above...", his/her prior learning changed and expanded by using expressions about rain and lightning after the program. When the preliminary information and the last information of C3, C4, and C12 were compared, it was noted that there was no change in their conceptual knowledge and understanding.

In previous studies on the subject of the research, it was reported by Henriques (2000) that children had misconceptions such as "clouds are mostly smoke, they are made of cotton or wool". According to Henriques (2000), the idea that clouds are made of cotton or other materials may be a prior knowledge formed by how we define clouds or by the fact that clouds are made of cotton in art activities. Similarly, Platten (1995) stated in his study that children expressed that clouds resemble cotton, cotton candy, and soft feathers. Piaget's (1972) book 'The Child's Conception of the World' revealed that many questions children ask spontaneously relate to natural events. For example, they stated that children ask questions like ‘Why is it raining? Where does it come from? What is fog? Who made it? and in their explanations about this, children perceive clouds as the source and cause of rain and a sign that it will rain soon (Miner, 1992; Piaget, 1972). In this study we conducted, it has been determined that children make references to their belief that clouds are made or moved by a force or someone (for example, 'God.../It is formed in the womb of the mother...). Piaget associated this situation with children's religious explanations of their thinking characteristics, namely egocentrism (Erdener, 2009). These findings and the literature show similar characteristics to our research findings. When the second question of the research, "How does a cloud form?", is examined within the scope of the themes consisting of the answers given by the children in the preliminary interview (Table 4.), it was observed that half of the children (n=6) are in the 'other' category, some of the children (n=4) are in the 'weather events' category, and two children are in the 'steam'/droplets' category. The research findings noted that ten children lacked scientific knowledge about the formation of the cloud, misconceptions, and mistakes in forming meaning. However, in the last interview made after the implementation of the educational program, it was seen that all children's answers (n=12) were gathered under the 'water cycle' category. In the research findings, it has been noted that the use of scientific concepts has increased, there has been a change in misconceptions, and there has been an improvement in the interpretation they have formed about the formation of the cloud. For example, it was seen that C4's statement "I do not know" in the pre-interview was changed to "The sun was heating the pool. After that, steam was coming out of the sea into the air. After that, we can see them together"' after the application. In the pre-interview, it was determined that C8's statement "from cotton" was changed to "The sun was warming the sea. It was evaporating. Then the water droplets were going up, and a cloud was forming." As a result of the research, it was determined that the children's views on the formation of the cloud were explained incompletely and incorrectly in the first application, mostly with daily concepts related to their life experiences. However, after the program, they made explanations combining prior experiences and scientific concepts. Since misconceptions point to wrong or incomplete ideas of children (Kambouri, 2011), concerning this, Fleer (2009), in a study examining children's daily concepts and scientific concept use in early childhood centers, concluded that a well-programmed and scientific context to be presented to children significantly increases their use of scientific concepts. Because misconceptions point to wrong or incomplete ideas of children (Kambouri, 2011). Fleer (2009), in a study examining children's daily concepts and scientific concept use in early childhood centers, concluded that a well-programmed and scientific context to be presented to children significantly increases their use of scientific concepts. In such a case, children will decide which information to keep by engaging in reasonable discussions with themselves and their environment (Rowell, Dawson, & Harry, 1990). Considering the findings obtained from the research and the literature, the teachers need to carry out the practices to be carried out systematically and continuously in order to form a complete understanding of certain concepts in the minds of the children in terms of the correct and permanent acquisition of the concepts.

As a result of the interview with the teacher of the study group in the research, it was seen that the teacher included science activities at least two and at most three times a week, considering the activities he/she applied, the materials he/she used and the frequency of science activities. In addition, it has been determined that the methods and techniques used in science practice are limited to travel and observation, experiments, and family participation studies. Also, although the materials provided for the activities in the classroom are insufficient, it has been determined that he/she prefers natural and easily accessible materials.

There are many possible sources for the development of misconceptions. Some of these are parents, materials, media, and teachers. The main issue is that the above sources are considered 'reliable' and that children readily accept what is taught due to their developmental limitations (Thompson & Logue, 2006). For this reason, teachers' knowledge of children's concept learning and their competence in concept teaching, which is the focal point of science education, is very important. In their study, Kıldan and Pektaş (2008) found that the teaching methods and techniques most used by teachers regarding science and nature teaching are trips, observations, and examinations. Regarding the inclusion of science in the curriculum, some teachers are willing to take steps to include science more in their educational programs. However, these teachers explained that they were unsure of what to do (Conezio & French, 2002). Kambouri (2011) emphasized in his study with children that teachers often do not accept the existence of these misconceptions and that this situation may prevent children from learning.

Children develop scientific concepts due to their interaction with adults, materials in the environment, or their experiences when faced with a new activity or event (Charlesworth & Lind, 2013; Fleer, 2009). As Vygotsky (1987) put forward, while underlining that actual concept formation and daily and scientific concepts should be taught with entertaining events, he primarily focused on the "teacher as mediator". However, he argued that the dynamics of concept formation, how it develops, how it begins, and what it looks like in the end are often not studied (Fleer, 2009). In addition, a list that can be further expanded can be mentioned among the characteristics that effective teachers should have in science teaching and learning, such as scientific concepts and process skills, effective teaching methods, evaluation of science activities and children, and preparing scientific environments (Kostelnik et al., 2019; Akanca et al., 2017; Akman et al., 2017; Bredekamp, 2015; Saçkes et al., 2012; Erdiller & McMullen, 2003). For this reason, teachers need to develop themselves in the above competencies to carry out effective science education and concept teaching with children. Because the erroneous and incomplete concept knowledge that teachers and parents have is transferred to children and similarly emerges in the concept constructed in children. In addition, teachers are required to allow sufficient time for children to explore, to offer experiences organized with themes that support their curiosity, and to include scientific knowledge and concepts appropriate for the age and developmental level of children in these learning experiences.

In addition to the research findings, children were asked to draw pictures to make their mental representations of cloud formation visible. When the pictures drawn by the children were examined, it was seen that the children consistently drew the cloud formation cycle in line with their learning process for cloud formation. It is seen in the research results that the use of methods such as analogy, concept map, and drama, which are included in the study, supports children in making sense of and concretizing the formation of the cloud. Using different active teaching methods in the preschool years affects children's conceptual understanding and academic success. Many studies show that experiments, concept maps, and analogy successfully eliminate certain misconceptions about children (Akay et al., 2012; Chiou et al., 2012; Esiobu & Soyibo, 1995; Güven & Gürdal, 2002; Öztuna, 2002).

As a result, when the findings of the research and the literature are evaluated together, it is seen that children's natural curiosity toward the world around them and the questions they ask are generally related to scientific facts and events. In the past, it was thought that children had too concrete thoughts to reason with scientific means and to understand the concepts of science, but in recent years, there have been changes in this understanding towards children. Because children are full of some preliminary information, prejudices, and intuitions (Baldwin et al., 2009). At this point, teachers and families can be aware of children's misconceptions and that it is possible to achieve conceptual change in children with science-based educational programs and development-appropriate planning to eliminate these misconceptions. One of the most critical issues to consider is that the prerequisite for meaningful learning is that children can form a scientifically consistent and logical link between their previous knowledge and their new knowledge. In line with the results obtained from the research, the following recommendations were developed.

- The limited number of studies conducted in Turkey related to the research subject limits our comparison of the results we obtained. For this reason, conducting studies on educational programs that can be developed to detect and eliminate misconceptions in children will be helpful.
- By expanding the working group of the studies to be carried out, studies with working groups with different characteristics can be planned.
- In the study, no data were collected from the parents to evaluate the children's preliminary knowledge as a result of their daily experiences. Therefore, future studies may also be recommended to collect parents' data to evaluate children's prior knowledge.
- This study discussed children's misconceptions about the cloud and its formation. In similar studies, children's misconceptions about different concepts can be addressed.
- Within the scope of preschool education, the scientific content information, the methods they use, and the existing misconceptions can be shared with the teachers to set an example for the applications to be made. In addition, a scientific concept list can be prepared for teachers under scientific themes that children may be interested in.

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High School Students' Evaluations on the Reflections of Geographical Information on Daily Life[1]

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ABSTRACT

Geography is a critical tool for understanding the physical, social, economic, and political characteristics of places around the world and is important for grasping the various factors that shape people's lives and decisions. Knowledge of geography directly or indirectly affects people's daily lives by determining the characteristics of settlements, natural resources, climatic conditions, economic activities, natural disasters, or cultures and societies around the world. This research was carried out with 10th grade students who tried to gain geographical knowledge systematically through a geography course. The aim of the research is to reveal how the students' geography knowledge is reflected in their daily lives. A semi-structured interview form created by the researchers was used to collect data in the study that employed phenomenology design, one of the qualitative research methods. The obtained data were analyzed using the descriptive analysis approach, and results were gathered with regard to the students' level of interest in the geography course, the factors affecting this level of interest, the definition of geography knowledge and the future contribution of geographic knowledge, and the use of this knowledge in daily life. The main conclusion of the study is that one-third of students don't use geography in their daily lives. In light of this circumstance, it could be advised to design geography topics based on activities, using real-world examples in a practical way.

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INTRODUCTION

The contribution of geography science to the acquisition of basic information for recognizing, understanding, planning, and organizing the planet we live on is undeniable. By fusing remnants from the past with geographic knowledge acquired through formal and informal learning processes, the science of geography, which examines the relationship between the natural and human environment and its impact on daily life, helps people live in the present and create the future. Akınoğlu (2006) emphasizes that geography, which he defines as social science, allows individuals to learn about their environment and become more aware of it. He claims that geographical knowledge enables us to form a relationship between the past and the present, analyse and assess the events and phenomena we encounter on a daily basis, and assist our future objectives. Doğanay (2012) defines knowing the science of geography or having knowledge of geography, both of which have political power, as "seeing the world". We can better fulfill our responsibility to protect nature and benefit from it in a controlled manner with the help of the knowledge of geography. Individuals or societies that fail to refrain from engaging in activities that go against nature, due to their inability to internalize geographical information, are bound to suffer harm from nature.

It is obvious that geography is the course we need most in order to prevent the environmental problems that have increased in recent years. Some of the problems caused by the increasing world population and the losses caused by the increase in the number of disasters experienced. Geography education in Türkiye starts at the preschool level with basic ground direction and spatial perception studies in formal education institutions (MoNE, 2013). At the 1st, 2nd, and 3rd grades in primary school, some topics such as the structure and movements of our planet, sketches and maps, management units, and direction finding are included in the social studies courses starting with the immediate environment we live in (MoNE, 2018a). In order to acquire elements connected to a number of geographical abilities, such as map use at the secondary school level, strategies to prevent disasters, human and economic activities, topics were included in the social studies course up to the seventh 7^{th} grade (MoNE, 2018b). Geography course is taught as a compulsory subject in the ninth and tenth grades, and as an elective in the eleventh and twelfth grades (MoNE, 2018c).

Geography, which includes all social and human sciences, plays an important role in developing a comprehensive approach to the world's growing environmental problems. As a result, geography education is a tool that assists people of all ages in achieving sustainable development goals and making sense of the future (Meadows, 2020). According to Kubiatko, Janko and Mrazkova (2012), geography knowledge is undervalued in comparison to other disciplines because it is perceived as being able to tell the location of countries on a map and knowing the capitals of the countries. The most important reason for this situation is the geography curriculum. At the secondary education level in Türkiye, constructivist approach has been involved in geography curricula since 2005. The curriculum, and textbooks, as well as the teaching methods, are of great importance for geography knowledge to contribute to the acquisition of analysis and evaluation abilities. According to Dikmenli (2015), having geographical knowledge is not enough; one must also be able to analyze and synthesize this information in order to become geography literate. Geographic literacy is defined as the ability to transform information into a skill after reaching a level of understanding and comprehension of geographical information. Indeed, in order to increase the number of people who can apply their geographical knowledge and turn it into a skill, all components such as the curriculum, textbooks, teacher training, and central placement exams must be improved and developed. Gökçe (2009) also emphasizes that the cornerstones of geography education—curricula, textbooks, the learning-teaching process, and pre-service teacher education—should be reviewed first in order to qualify geography education and increase the geographical knowledge and awareness levels of individuals who receive geography education.

Beneker and Schee (2015) emphasize that geography education has the potential to facilitate the future, given the field of study and the subjects it covers. Geography, which is at the intersection of natural sciences and social sciences, generates information that can be used to help society solve its social, economic, and technical problems (Akınoğlu & Akarsu Bakır, 2003, cited from Doğanay, 1989). Geographic science, which has an interdisciplinary position, should be taught by giving the necessary importance at all levels of education and gaining geographical skills. Otherwise, it will be impossible to reduce the number of people who do not use their knowledge, do not know how to use it, or are unable to apply their knowledge in real life. Butt and Lambert (2014) emphasize the necessity of teaching geography to young people in order to increase their knowledge and competitiveness in the global knowledge economy in the future. Geographical knowledge is needed to gain a critical perspective on the world and to achieve freedom of enquiry (Winter, 2013). People often use geographical information while verbally expressing their experiences in their relations with nature or telling their life stories (Balcı, 2018).

Every student who attends a school brings their knowledge and understanding of the world with them, whether they gained it directly or indirectly. They improve their geographical knowledge and awareness by combining their personal spaces and geographical environments with the information they have learned in school (Matthews, 1992; Catling, 2005; Spencer & Blades, 2006). In addition to the differences such as the natural environment of the regions in which they live, food culture, climate, and plant characteristics, their personal geographies develop as they grow older, thanks to the information they learn from stories, toys, information and communication tools, and the people around them (Roberts, 2014). One of the biggest tasks of geography teachers is to be able to integrate the different personal geography experiences of their students into the lesson and geography subjects. Because the path to developing individuals with good geography knowledge and the ability to apply geography knowledge at the analysis-evaluation level passes here. Şahin & İnce (2020) emphasize that geography subjects taught in primary education are important for people to perceive and benefit from the environment they live in correctly. According to Beneker and Schee (2015), geography should be a compulsory subject as it provides more knowledge and skills about how the world works. The reason for selecting 10th grade students for this study is that the 10th grade represents the final year where geography is mandatory within secondary education. It was discovered that several studies on this subject had been carried out when the literature was searched (Yiğit, 2003; Akınoğlu, 2006; Tomal, 2009; Keçeci, 2010; Kenger, 2010; Kocalar & Demirkaya, 2014; Dikmenli, 2015; Şahin & İnce, 2020; Dere & Aktaşlı, 2022). However, no qualitative research was found that directly examined geographic information in daily life.

The problem for our research has been determined in this context: "How is the use of geography knowledge by high school students in daily life? The following sub-problems were investigated considering this problem statement:

- What is the level of interest in geography lessons among high school students?
- What factors influence high school students' interest in geography lessons?
- How do high school students define geography knowledge?
- How do high school students think the geography knowledge will contribute them in the future?
- How do high school students apply their geographic knowledge (physical geography and human geography) in everyday situations?

METHOD

This part contains information about research design, the data collection process and analysis.

Research Design

Phenomenology design, a qualitative research technique, was used for this research. In the phenomenology design, it is tried to reveal the common meanings of the experiences of the participants about a phenomenon. In order to do this, information is gathered from individuals having experience with the determined phenomena, and a holistic description is made to highlight the essence of these individuals' perceptions of the phenomenon (Creswell, 2015). The phenomena, studied in this study is "students' use of geography knowledge".

Thanks to the information obtained from factual studies, in addition to making definitions related to the phenomenon that the research centers on, various meanings are revealed based on the participants' experiences and feelings related to this phenomenon. These meanings also enable us to bring very useful and rich information to the field's literature while creating theories (Özmen & Karamustafaoğlu, 2019).

Study Group

It should be studied with a working group that has an experince related to the phenomenon being studied and can reflect the data related to this exprerience (Creswell, 2015). Therefore, the research's study group is made up of 153 students in the 10th grade who are studying geography in Kastamonu. The main reason for choosing tenth-grade students is that it is their final year of taking the geography course as a mandatory subject, both under the name of the geography course and within other lessons at primary and secondary school.

The study group consisted of 56.86% (87 students) of females and 43.13% (66 students) of males. "Convenience sampling," one of the non-random sampling methods, was used to form the study group. The study group is chosen from easily accessible units using this method (Yıldırım & Şimşek, 2018).

Research Instruments and Processes

An interview form was used in this research as a tool for collecting data. First, draft questions for the interview form were developed by looking through local and foreign literature and taking into account the problem situation and related sub-problems. These questions were written concisely and simply as possible, while avoiding being overly generic or abstract. The fact that the questions were open-ended prevented the participants' responses from being limited to "yes" or "no". Following the development of the draft interview form, it was assessed by two experts with experience in qualitative research and a language expert to evaluate the questions in terms of grammar, and necessary adjustments were made in response to the feedback received. At the final stage, the interview form was administered to 12 people who matched the characteristics of the group to which the main application would be made, and the final version of the interview form was formed based on the information gathered. There are questions on the interview form about the participants' gender status, their interest in the geography lesson and its subjects, the definition of geography knowledge, the contribution of geography knowledge to people, and its use in daily life.

The research data was gathered by the researchers in the final week of the 2021–2022 academic year by providing necessary explanations to 10th-grade students studying in the project schools in Kastamonu province.

Data Analysis

Descriptive analysis method was used in this study. The descriptive analysis approach categorizes and interprets the available data based on predetermined themes. These themes can be determined based on the research questions or by considering the data collection questions. The primary purpose of this approach is for the reader to see the findings obtained in an organized and interpreted way. Following the systematic and clear description of the data obtained, these descriptions are explained, comments are made, and the results are reached by providing the cause-effect relationship (Yıldırım & Şimşek, 2018, pp. 239–240).

Analyzing the data, a framework was created by using interview questions first. Accordingly, five categories have been created as “Geography lesson and the level of interest towards its subjects”, “Factors affecting the level of interest in geography”, “What comes to mind when it comes to geography knowledge”, “The state of contribution of geography knowledge in the future” and “The state of using geography knowledge in daily life”.

The second stage involved reading all of the study data and matching it with the relevant ones in the designated categories. At the third stage, the relevant data matching these designated categories was supported with direct quotes, ensuring that the readers could easily understand and define the findings. Making a direct quotation, students were identified by their gender and their placement in the ranking. The results presented to the reader in a methodical manner were then explained, a connection between them was created, and a comparison with other studies in the field of literature was made.

To ensure the research's reliability, two geography educators who are field experts were asked which of the five predetermined categories should correspond to the data obtained. The experts' matches were compared with the authors' matches. As a result of this comparison, the cases of consensus and disagreement were examined one by one, and the research's reliability was calculated using Miles and Huberman's (1994) formula (Reliability = Consensus / Consensus + Disagreement). As a result, the research's reliability rate was determined to be 92%, indicating that the research is reliable.

FINDINGS

The findings related to the research's problem statements were provided in this section.

What is the level of interest in geography lessons and its subjects?

Table 1 displays their responses to questions regarding their interest in high school geography and the geography they were most interested in.

Table 1. *Level of Interest in geography and area of interest*

State of interest	f	%
Low	24	15.7
Medium	96	62.7
High	33	21.6

The interest levels of the high school students shown in Table 1 towards the geography course and subjects: 24% of the students stated that they had low interest, while 62.7% showed moderate interest. 21.6% of the students stated that they had a high level of interest in geography lesson and its subjects. These findings indicate that students have a moderate interest in geography lesson and its subjects in general.

What are the factors affecting high school students' level of interest in Geography?

The factors affecting high school students' level of interest in geography were presented in Table 2.

Table 2. *Factors affecting the level of interest in geography*

Factors affecting interest	f	%
Style of narration	2	1.2
Topics	29	17.6
Exam grade	4	2.4
The teaching style	12	7.3
Course content	11	6.7
Associating with daily life	20	12.1
Liking the lesson	6	3.6
Curiosity about the environment	9	5.4
Term redundancy	5	3
Memorization	10	6
Teacher's personality	6	3.6
Density of topics	3	1.8
Future benefit	3	1.8

Factors affecting interest	f	%
Course material	4	2.4
My interests	11	6.7
Enjoying travelling	2	1.2
The difficulty of the lesson	4	2.4
Curiosity	2	1.2
Other (Textbook, my choice of field, family factors, political events, the effect of other courses, social media, exploring nature, getting to know my country, psychological state, exams, Google Earth)	11	6.7
No comment	11	6.7
Total	165	100

Examining Table 2, it was seen that geography subjects had the highest percentage (17.6%) among the factors affecting students' interest. Following, which is also related to the subjects, was the status of associating with daily life (12.1%). The most often discussed subjects included the course's content (6.7%), the teaching style (7.3%), and the interest level (6.7%). 6.7% of students in high school did not provide a factor influencing their interest in geography. Factors such as the intensity of the subjects, course material, curiosity, liking to travel, future usefulness also affected the students' interest status at least slightly.

The explanations made by the high school students were evaluated in three groups and quoted as example sentences.

Sample sentences in which high school students expressed their high interest in geography:

M12: This lecture is engaging and fascinating.

F15: Asking random questions in the lesson prevents me from sleeping and increases my interest in the lesson.

F67: I learn better and am more interested when there are visual components involved.

M45: The subjects are enjoyable and interpretive.

F23: Geography subjects intrigue my interest; I'm curious to travel to the places we've learned about in class.

F55: Learning about the many geographical features of the places I live and learning about the physical and human geographical features both in terms of Türkiye and the world are the most important factors that positively affect my interest in geography.

M56: I guess because I am in touch with nature in the village and these subjects are easy for me.

F21: Map skills are fun for me, geographic information is fun for me; it is like a riddle.

M39: The fact that geography knowledge can be used in daily life and that what is learned can be easily observed increases my interest in geography lesson.

F59: I have a curiosity about the beginning of life. When I do research in line with this curiosity, we intersect with geography.

Q59: I have a curiosity about the beginning of life. When I do research in line with this curiosity, we intersect with geography. My interest in geography is confirmed by my curiosity about how early humans lived and how these habitats have changed.

F28: My curiosity is what influences my interest in geography. I want to know where I am geographically and what progress has been made.

Examples of sentences in which high school students express that their interest in geography is variable are given below:

F33: My interest in the lesson is influenced by the way our teacher lectures.

M51: It changes depending on the memorization or interpretation level of the subject.

M43: It affects which subject we deal with. The emotions I felt that day also affected my interest in the lesson.

F78: Getting low or high scores in the exams held to measure success in the course.

F70: When there are subjects that will help me in real life and make my life easier, my interest in the course increases if practical information is given with certain causalities rather than memorization.

Examples of sentences in which high school students express a low level of interest in geography are given below:

M46: I am not interested in geography in general, or it is not very productive for me in terms of teaching it as a course.

F60: Too many terms in geography make me less interested in the course.

F57: I am not particularly interested. Only certain subjects interest me.

F34: There is a great deal of conceptual density and detail.

F27: The fact that the subjects are very detailed and complicated made me lose interest.

M2: Geographical topics have not intrigued me since middle school.

F23: The dominance of other courses…

F55: I have trouble memorizing things.

F61: The course is boring because I'm in the science-maths field.

F82: Learning geography is boring.

M58: The geography course has too much unfamiliar vocabulary, which makes it challenging for me. I'm compelled, so I can't. It sounds monotonous as a result.

M60: I have no broad interest in geography. It is also beneficial that this is only taught to us in schools with a knowledge-based emphasis.

What comes to mind when it comes to geography knowledge?

Information on how high school students defined their knowledge of geography was presented in Table 3.

Table 3. *The status of defining geography knowledge*

Geography Knowledge	***f***	**%**
Map Skills	55	23.2
Geographic Environment	9	3.8
Landforms	38	16
Disaster	5	2.1

Geography Knowledge	f	%
Seas	3	1.3
Streams	4	1.7
Soil	8	3.4
The Structure of the Earth	2	0.8
Flora	11	4.6
Learning About the Earth	17	7.2
Stones	2	0.8
Geological Features	9	3.8
Environmental Knowledge	2	0.8
General knowledge	8	3.4
Location	8	3.4
Country	12	5
Climate	18	7.5
Population	4	1.7
Society	2	0.8
Human and Environmental Interactions	6	2.5
Waters	2	0.8
Other (tourism, country forces, physical characteristics, economic activities, nature, seasons, the biology of the world, living life, lakes, cities, transportation, culture)	12	5
Total	237	100

According to Table 3, when geography knowledge was mentioned, 23.2% of the students understood map knowledge. 16% of high school students answered "landforms" after mentioning map skills. 7.5% of high school students connected geography to climate, 7.2% to knowing the world, and 4.6% to flora. The fewest associations were made with the words "tourism, country forces, physical characteristics, economic activities, nature, seasons, the biology of the world, living life, lakes, cities, transportation, and culture. Some examples of geography knowledge given by students were given below:

F72: I see it as an important tool for getting to know the world. There is a geographical explanation for almost every event that occurs around the world, which is extremely valuable.

M65: Recognizing the locations of countries, continents, and seas in the world, the geography of these places, and their characteristics such as climate and landforms. Maybe the ability to interpret the landform of a rock we see, maybe even the ability to interpret that beyond knowledge.

F83: What I've learned is what I see when I look around, and that is general knowledge for me.

M67: Understanding what is going on around us, being prepared, and acting accordingly.

F5: Knowing the places in the world, that is, consciously examining them.

F11: Everything about the world we live in.

M6: The first thing that comes to mind is countries, their potential, their position in the world, their power, water resources, natural beauties, national parks, and touristic places. I also love learning the scientific facts behind natural phenomena and getting to know explorers.

F86: It is a branch of science that tries to comprehend the workings of the earth and investigates the earth.

F19: It is information that contains various information in various areas of life and teaches its correct use.

M3: For me, geography knowledge means the environment we live in. When I think of geography, everything I see when I go out comes to mind.

How will geography knowledge contribute to you in the future?

High School Students' Views on the Contribution of Geography Knowledge to the Future

The opinions on how high school students would contribute to their geography knowledge in later years were presented in Table 4.

Table 4. *Opinions on the future contribution of geography knowledge*

Contribution of geography knowledge to the future	*f*	%
In disaster-emergency situations	11	6.2
As general knowledge	66	37
Places you want to visit	10	5.6
Getting to know where you live	11	6.2
Recognizing plants	5	2.8
On the way to work	2	1.1
In my chosen profession	10	5.6
In finding location	6	3.4
Curiosity	3	1.7
Patriotism	2	1.1
Preparing for exams	7	3.9
Being conscious	10	5.6
In map usage	6	3.4
In friend chats	3	3.4
In the things that happen to us	4	2.2
I don't know	4	2.2
No comments	6	3.4
It's of no use to me	3	1.7
Other (in nature, scientific thinking, recognizing cultures, understanding natural beauties, traveling, projects, academic knowledge, choosing clothes, in all areas of life)	9	5
Total	178	100

The fact that high school students thought that geography knowledge would contribute to them mostly as general knowledge (37%) in the future is examined in Table 4. The rate of high school students who thought that they would contribute to disasters and emergencies by getting to know the place they live was 6.2%. Following that, 5.6% of high school students stated that they would contribute to their knowledge of places they wanted to visit, the profession they would pursue, and being conscious. The rate of students who said they had no knowledge of the subject was 2.2%, the rate of students who said they did not assume the course would contribute was 3.4%, and the rate of students who said it would not work for them was 1.7%. The views of high school students on whether geography would contribute to the future were cited by dividing them into two groups.

The example sentences in which high school students stated that geography would contribute to them are given below:

M22: It contributes in every way because it helps us throughout our lives and develops us culturally.

F24: It will help us become more competent and prepared.

M31: I believe that while exploring and traveling, my knowledge of geography will be useful.

M64: It can help if I want to study in a geography-related department at the university.

F73: I believe that my knowledge of geography will elevate me to a higher level than others.

F83: Not understanding my surroundings better and failing to take appropriate precautions in the face of danger.

M59: My knowledge of geography is important to me. Because it's general knowledge. This is something I need to understand and learn thoroughly. Knowing my country's geographical location allows me to better understand the threats it will face in this geography and the policies it will implement.

F51: Knowledge of geography helps us in almost every aspect and stage of our lives.

M49: We may require geography knowledge regardless of our area of employment. I will continue to live my life as a person of high general knowledge.

F26: It's nice to know something while chatting, watching the news, or traveling.

F40: It is a field that is not relevant to the profession I want to pursue, but it can provide me with information about places I want to visit and see.

M20: We visit various cities in Türkiye. These trips allow me to better explore my surroundings. It also helps me learn about the climate of my city.

F28: I'll also respond with an example from the lesson. 'Little Tinny' foresaw the tsunami and purposefully saved people's lives.

F50: Knowing where the countries are helps me both as general knowledge and in establishing the cause-and-effect relationship between the events that occurred.

F24: When we travel in the future, we will have a better understanding of the region.

F42: Knowing a little about some regions will help me understand the circumstances in which people from those regions will grow up in the future. This will help me improve my communication with those individuals.

F9: I believe it will be beneficial to general knowledge. I learned a lot of things that will help me in my daily life.

M7: I am curious about the world, especially Canada, Poland, and Finland. I'd like to visit Africa. I believe the knowledge I gained will be useful to me if I ever have the opportunity to visit. I believe that these courses on cultures and countries provided me with preliminary information and a cornerstone for myself.

F5: If someone stops me and shows me the soil in our area, I can tell them what type it is.

F77: Knowing geography makes us conscious. For example, it is critical that we have advanced knowledge of natural disasters. It allows us to save the lives of many, including our own.

F63: Even if knowing the geographical features I live in does not directly contribute to me, it will be easy enough for me to have an idea about most situations and to determine my plans or the places and periods I will go.

Below are examples of sentences in which high school students stated that geography would not contribute or that the contribution would be low:

F52: I don't think it will contribute except for the exams.

M32: If I do not forget what I have learned—and I will probably forget—it will have accumulated knowledge.

M35: The limited map skills I acquired and my understanding of this location's climate may have an effect on my general knowledge in the future.

F55: I don't think it will provide much benefit other than exams and academic success.

M38: Just knowing what I see in the places I go will make me happy, that's all.

F59: As a normal citizen, I don't consider it to be a significant issue.

F78: I don't think it will make much of a difference, but it will help us become more cultured. Aside from that, what should I do with knowing the types of scrub, etc?

M66: "I don't believe so." My profession will most likely have nothing to do with geography.

What are the examples of the use of geography information in daily life?

The examples given by high school students for using their knowledge of climate, plants and soil, which are physical geography subjects, in daily life were analyzed and shown in Table 5.

Table 5: *Examples of the use of physical geography knowledge (climate-plant-soil) in daily life*

Use of Climate-Plant-Soil Information	***f***	**%**
Weather	3	1.8
Recognizing soil types	14	8.2
Choosing places to go	4	2.3
When visiting new locations	7	4.1
Selecting weather-appropriate clothing	9	5.3
Inspecting the region	4	2.3
In plant cultivation	18	10.6
In the selection of the place of settlement	5	2.9
In agricultural production	23	13.5
In recognizing plants	10	5.9
In informing people	2	1.2
In recognizing the climate	17	10
Creating a travel itinerary	5	2.9
In friend conversations	4	2.3
I don’t use it	42	24.7
Other (In solving puzzles, dispersal of waters, animal husbandry)	3	1.8
Total	170	100

According to Table 5, it was seen that 24.7% of high school students did not use the information about climate, vegetation, and soil, which are physical geography subjects in their daily lives. The area that high school students used most in daily life or expressed that they would use was agricultural production with 13.5%. Agricultural production was followed by plant cultivation with 10.6%, climate recognition with 10%, and soil type recognition with 8.2%. The subject that they said they used least in daily life was informing people with 1.2%.

Some examples of high school students' use of physical geography knowledge in daily life were given below:

M62: When moving from a place, the climate of the place is taken into consideration.

M84: We cultivate the plant according to the fertility level of the soil in the environment.

M7: It led me to learn about where and how plants grow. For instance, the hazelnuts we grow in the interior of Trabzon are smaller than those my aunt grows on the shore.

M64: I can learn more about the environment when we take a walk in the outdoors.

M86: When my father and I disagree on certain matters, I sometimes utilize it.

M4: When I go to the fields, I comment that this soil is fertile or unproductive.

M8: It helps with the care of flowers and so on. For example, I can determine what kind of soil a plant I will put in a pot needs and the frequency of watering.

M12: Going to a picnic according to the weather.

M53: Cultivation of plants according to the soil type of the regions.

M14: I'm commenting while looking at the forests. Coniferous trees increase as altitude increases, etc.

M39: Determining the climate of a place and knowing the characteristics of these climate types are very important in the future development and planning of that region. It is important to determine which of the agricultural, industrial and similar activities to be carried out in this region are suitable or not, and how the settlement will be made in this region.

F7: If I go on vacation to a place I have never been to before, I will have information about the climate and vegetation of that place and go prepared accordingly.

M9: I look at the trees and examine how they are.

M33: Even when talking to my family and acquaintances, I can comment on a tree or landform that I see around me. I can also understand the types of mines. I think these are very important things. I find it a bit strange that these are measured by exams and memorized just for the exam. The important thing was to acquire that skill.

M48: To be able to know whether the crop to be grown in agriculture is suitable there or not.

F17: I can tell more or less what type of soil the soils I see are.

F16: For example, when we go to Canada, we know what kind of clothes to bring because we know the cold climate there.

F56: I love growing flowers and I know how the soil should be thanks to geography.

M1: When I go somewhere, I buy clothes according to the climate. I give information about the soil to those who do agriculture in the villages.

M49: I know how the flowers I have can grow in which soil, in which season, and how they can be more productive.

F2: I went to a village recently. The soil is close to orange red. According to what we learned this year, I made the statement that the iron oxide rate is high.

F82: I can use my knowledge about soil. Since my family is engaged in farming, I sometimes talk to them about it.

The examples given by high school students for their daily use of their knowledge of internal forces, external forces and rocks, which are physical geography subjects, were analyzed and shown in Table 6.

Table 6. *Examples of the use of physical geography knowledge (internal-external forces, rocks) in daily life*

Internal-external forces and use of rock information	***f***	**%**
As general culture	8	5.2
Use of stones	12	7.8
Learning volcanic terrains	2	1.3
Learning rock structure	4	2.6
Ground analysis in house construction	2	1.3
Understanding landforms	19	12.4
Tectonic awareness	8	5.2
Understanding geological features	3	2
Determining the settlement	3	2
I don't know	17	11.2
I don't use it	68	44.5
Other (Soil structure, importance of the river, construction, formation of the world, nature walks, coastal formations, conversation)	7	4.6
Total	153	100

Table 6 shows that 44.5% of high school students never used their knowledge of internal-external forces and rocks in their daily lives. Similarly, 11.2% of high school students stated that they did not know how to use these subjects in their daily lives. The rate of students who stated that they use internal and external forces and rocks in their daily lives to understand landforms was 12.4%. Following this, 7.8% of high school students stated that they used their knowledge of the use of stones; 5.2% of them used it to create tectonic awareness and a general culture about internal-external forces and rocks.

Some examples of high school students' use of physical geography knowledge in daily life were given below:

F2: I evaluate my knowledge of the properties of mountains and rocks when traveling by car.

M12: Prediction of earth movements according to regression-transgression situations.

F67: Recognize the rocks used in industry and for making goods.

M54: I benefit from the natural stone collection I made from my knowledge of rocks. Again, I benefit from my knowledge of internal and external forces in recognizing the places I have seen and visited.

F15: I love stones, and it helps me research them.

F42: Thanks to the rocks, we learn the structure of the soil and whether it is fertile or not. We learn about how our world was formed and volcanic places.

F46: For example, when we learn that the stream creates fertile soil, we pay more attention not to pollute it.

M6: It allows us to have information about the ground in that area when building a house.

F10: It can enable us to have more information about the formations in the places we visit and see.

F36: It helped me to better understand the rocks and the shapes formed in the places I visited and the geography I lived in.

M10: To know how the world is formed in general and to understand how it is formed when we encounter these events.

F83: Since I know which rock is where when I go to a place, I can easily know things such as the soil structure of the place.

M64: With this information, I can know how the natural structures (such as travertine) were formed and how these lands were in previous years.

F70: I have information about natural stones and have researched which stones treat what.

M16: Actually, I don't use it in many areas, but my knowledge on these subjects allows me to examine the environment more carefully when traveling in a car.

M45: I love and am interested in natural stones. I have an idea about the source of these.

The examples given by high school students regarding the use of their knowledge on disasters, environment, population, and migration, which are among the subjects of environment and society, in daily life were analyzed and shown in Table 7.

Table 7. *Examples of the use of environment-society issues (disasters, environment, population and migration) in daily life*

Use of disasters, environment, population and migration information	***f***	**%**
Disaster attitude	2	1.1
Environmental awareness	12	6.5
Preparedness for disaster	67	36.4
Country interpretation in population structure	12	6.5
Disasters	11	6
Migration	14	7.6
Selection of settling to live	4	2.2
Geographical analysis	10	5.4
Awareness of current issues	6	3.3
Information about countries	2	1.1
Family-friends chat	4	2.2
I don’t use.	38	20.6
Other (Conscious citizen, country problems)	2	1.1
Total	184	100

Examining the use of environmental-society knowledge in daily life, 36.4% of high school students stated that they used this information for disaster preparedness, 1.1% for disaster attitude, and 6% for disasters in general. In addition, 7.6% of the students stated that they used migration, 6.5% environmental awareness, and 5.4% geographical analysis in their daily lives. High school students stated that they did not use environmental and social issues in their daily lives at a rate of 20.6%.

Some of the appropriate examples given by high school students regarding the use of environmental and social information in daily life were given below:

M57: It allows me to reflect on the country's problems.

F74: I don't know where it is used for myself in daily life, but we have had a lot of conversation with the knowledge of my dear grandfather.

F77: Making development, production, and consumption plans based on population information.

M55. Taking precautions against natural disasters in accordance with the information obtained.

M18: I think that this information will create a big problem in the future, if not today. I think people's lack of knowledge will bring us to an end.

M26: Taking precautions against disasters that may happen to us in our daily lives can be useful for us, and at the same time, population and migration can be good conversation topics. Other than that, I don't think there is any benefit.

F30: I feel more secure after getting information about disasters.

M62: We can calculate whether the place we live is risky in terms of disasters and take precautions.

M39: Knowing why Syrians are here.

F5: By looking at the population structure of different countries, I can make comments on behalf of that country.

F38: It helps me to be informed about events such as earthquakes and helps me to take precautions.

F66: It helps to take precautions as it raises awareness of the environment.

M25: We can decide on the development of a place according to the disaster situation, population, and migration status and determine the place we will go accordingly.

M47: I have learned what I can do in disaster situations; even if I have not used it so far, I think it will be useful for me in the future. I say that everyone should learn this information.

F74: It taught me to plan my life and to take precautions against dangers. I learned what to do when I'm in trouble. I became more conscious about world powers.

F84: I can learn about the development of any city or country by looking at the population.

M37: I can interpret why migrations happen and what kind of policy we should follow.

F37: We can choose the city we will live in according to disasters and population distribution.

F81: Since this issue is especially important for our country, it will be beneficial to get information about all kinds of disasters that we may encounter and to learn the precautions.

M44: We can know whether the place we will go will be crowded, what the living conditions are like, and whether it is risky or not.

F29: I can understand the reasons for the political and social events that are on the world agenda.

F54: It enables us to have accurate information about migrations and population changes in our country.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

This study was conducted to determine the use of geography information in the daily lives of 153 high school students studying in the 10th grade in schools that accept students by exam in Kastamonu, the city center of Türkiye. According to the problem statements of the research, the following results emerged:

While 15,7% of high school students stated that they had a low interest in geography courses and subjects, 62.7% stated that they had an intermediate level of interest, and 21.6% stated that they had a high level of interest. These results indicate that the students' level of interest in geography is average. The most important conclusions that emerged from the opinions of students with low interest levels are that the subjects are boring, they are educated in different fields, and there are too many terms and concepts. The low interest of the students can generally be evaluated as the lesson becoming boring as a result of the term- and concept-oriented teaching in the course and directing them to the memorization method. In the research conducted by Kocalar and Demirkaya (2014), it was determined that 70% of science high school students and 65% of anatolian high school students liked geography, and 63% of social sciences high school students did not like geography. It was observed that among the students at the Social Sciences High School, those who emphasized that the geography lesson was boring were in majority. Gökçe (2009) stated that in order to increase the interest of high school students in geography lessons and to develop a positive attitude, the learning environments should be arranged by the teachers according to the interests, levels, and expectations of the students.

The factors that caused variability in the interest status of the students were expressed as the teacher's course operating style, the level of interest in the subject covered, the status of the exam grades, and the usefulness of the information. These conditions point to the importance of student-teacher interaction. The use of materials in the course, its openness to interpretation, curiosity about the world, and settlement expressions stood out when the main reasons why students were interested in geography lessons were examined. Most of these statements were seen as student-induced factors. In this context, it was seen that planning would be useful by considering the issues within the framework of the principle of student relativity. According to Akınoğlu (2006), the perspective of individuals who have experienced active learning in geography teaching changes with social events. Geographical information, which enables us to realize the potential of the country, gives us the ability to question domestic and inter-country issues. In this way, geography education contributes to the education of individuals who understand the world.

High school students first defined geography knowledge as map knowledge. Considering the importance that geography attaches to space and distribution, this result can be seen as pleasing. In addition to the map, the widespread expression of landforms, climate, country, and vegetation also pointed to the main parts of the geography. However, it was seen that the definitions emphasizing human-environment interaction, which refer to the holistic definition of geography, were not enough. This situation also contributes to the perception that geography has a density of terms and concepts. However, geography brings a holistic view of the world far beyond terms and concepts.

Students who state that the most important contribution of geography in the future will be general culture have a significant proportion. This result coincides with the opinions of science high school students who participated in the research conducted by Kocalar and Demirkaya (2014). However, it contradicts the results of the study conducted with secondary school students by Akınoğlu and Akarsu Bakır (2003). While 62% of secondary school students stated that they do not use geographical information in their daily lives, only 10% emphasized that learning geography subjects is necessary for daily life. It could be said that geography has a side that contributes to the general culture of people with its social science aspect and enables the use of information in conversations. However, evaluating geography only within the general knowledge of culture will not be an approach in accordance with the philosophy of geography. Apart from this, students who express that geography will contribute to disasters and emergencies, to be conscious, to know the place where they live, and to research the places they want to visit and see, have an important rate. This information to be used constitutes the desired responses in the application phase of geographical information.

The fact that there are very few students who thought that geography knowledge would not contribute to the future shows that the objectives in the curriculum were achieved in general. Those who thought that geography knowledge would not contribute explained the reason why they would not choose a profession related to geography stating that they would forget the information they learned. These explanations can also be analyzed using individual approaches. Students who stated that geography would make an important contribution to their lives explained this situation by pointing out that geography existed in all areas of life and contributed directly to their lives. They stated that they could benefit in many areas, from holiday plans to disaster preparedness and curiosity about the formation of the world. These expressions can be considered expressions in accordance with the essence of geography, which we can express as a guide to understanding and using the world.

Cloke, Crang and Goodwin (2005) advise undergraduate students studying geography to relate their academic knowledge to their daily lives. The ability to establish the integration of geographical information with daily life will increase the retention of information. According to Beck (2013), he emphasizes the importance of the connection with everyday experiences in the learning of academic geography.

The knowledge students will gain from the geography lessons they take in secondary school will be greatly influenced by the geography infrastructure at the primary education level. The geography infrastructure at the primary education level has a great impact on the knowledge to be gained from geography courses to be taken in secondary education. According to Şahin and İnce (2020), the active participation of the students is important in the teaching of geography subjects at the primary school level, with the student-centered teaching adopted away from memorization. On the other hand, Dere and Aktaşlı (2022) underline the necessity of emphasizing concept teaching in order to fulfill geography-related objectives within the context of a social studies course. In order to teach geography at the high school level in line with the objectives of the curriculum, the foundation of geography knowledge constructed at the primary level is also essential.

It was questioned whether high school students used the information they learned in their daily lives based on the subject they studied in line with the curriculum in the 9th and 10th grades. It was concluded that the information they learned about climate-plant-soil issues in physical geography can be used in agricultural production in daily life. Again, there are students who expressed that they used it in plant cultivation and in recognizing climate and soil types. They stated that they learned the growing conditions of plants grown in small-scale gardens such as hobby gardens, which have become widespread today, and that they grew plants suitable for this. These statements are examples of the practical use of geographic knowledge. The fact that they are used to discover new places, chat with friends, and make vacation plans can also be considered in the same category. However, 25% of high school students stated that they never used their knowledge of climate, plant, and soil issues in their daily lives. In the research conducted by Kenger (2010), it was found that students used subjects related to the movements of the place, local time calculations, and maps more in their daily lives and did not use topics such as vegetation, pressure, and wind in their daily lives. This ratio indicates that there are problems associating geographical information with daily life. It is a truth that using this knowledge can significantly improve daily living on a personal and a societal level, particularly in the current world where global climate change, drought, and associated water issues are encountered.

Internal and external forces and rocks were among the physical geography subjects that high school students used the least in daily life. It was concluded that these issues are most useful in understanding landforms in daily life. In addition, recognizing stones, collecting by knowing their properties, developing tectonic awareness, and, more importantly, researching the rock structure in the selection of settlements attracted attention. These are positive examples of the acquisition of geographical consciousness. However, more than half of high school students either did not use or did not know the subjects of internal and external forces and rock in their daily lives. It is very important for the science of geography to comprehend the internal and external forces that form the basis of the evolution of the world and are the main field of struggle. The assimilation of this information and its adaptation to daily life are two of the basic conditions for geography. At this point, it would be appropriate to say that the deficiency is excessive.

In the research conducted by İbret, Aydın and Turgut (2018) with geography teachers, it is emphasized that geography is life itself and that geography knowledge and education are important in order to make sense of their countries and the universe they live in. It is also stated by Keçeci (2010) that the geography course is effective in raising environmental awareness.

It was concluded that high school students used their knowledge of environmental and social issues in their daily lives, mostly for disaster preparedness. In Türkiye, which is an earthquake country, it is seen as an important result that students used the information, they learned for disaster preparedness. This result supports Yiğit (2003)'s view that with geography education, individuals will realize the possible negativities they will experience if they do not take into account the characteristics of the environment they live in. It is important that they expressed in detail in their explanations what they did and would do at the point of disaster preparedness. In addition, the fact that they stated that they made geographical analyses on population and migration and their behavior towards environmental awareness were also remarkable results. However, it is also a problem that 1/5 of high school students do not use their knowledge of these subjects in their daily lives.

In light of the results obtained, the most striking point is that approximately 1/3 of the students do not use their geographical information in their daily lives. As a result of the research conducted by Aydın (2012) with social sciences high school students, it was determined that 55% of the participants did not use the geography information they learned in the courses in their daily lives. It was suggested that geography teachers can use more examples from daily life to solve this situation. Tomal (2009) also determined that students are partially competent in applying the knowledge they have gained in geography courses in their daily lives. When the students' interest levels were examined, this result is expected to be lower. Again, when the results of the students' explanations of their interest situations were analyzed, it was seen that they emphasized that geographical issues should be related to life and should not be drowned in terms and definitions. Combining all these points, it is clear that geography issues should be planned in an effective-based, daily-life example-based, and practical way. These plans can be made throughout the country, taking into account local conditions. Geography has much more meaning than the number of questions in the exams held throughout the country and the score obtained from the exams held in school. This meaning should be taken into consideration by all education stakeholders. As highlighted by Prajapati, Sharma and Sharma (2017), individuals can survive with the daily living skills they possess. At this point, the science that can offer the greatest contribution to geography should be carried to the point where it deserves to be.

Akınoğlu (2006) highlights the importance of effectively imparting geographical knowledge and shaping individuals' perspectives on the world. To achieve this, geography teaching should prioritize the principle of relevance to everyday life, and the curriculum should be designed to raise awareness of our country's geopolitical and geostrategic position and significance. In the research conducted by Balcı (2018), it was determined that information on most sub-branches of geography was used in life stories. In order to realize a geography education that will provide the opportunity to make sense of and structure the planet we live on, an improvement is needed that includes all components such as curriculum, textbooks, and teacher training. Geography educators play a significant role in the application of geographical knowledge in everyday life and transforming it into a practical skill. In this process, it is more important to make changes and updates to the training program for geography teachers. In addition to teacher education, it is suggested that geography knowledge should be designed to enhance the life skills of individuals, and necessary adjustments should be made to deliver this knowledge in educational environment.

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Development of Postgraduate Education Attitude Scale: (PEAS) Validity and Reliability Study

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ABSTRACT

The aim of this research is to develop "Postgraduate Education Attitude Scale (PEAS)" to be used for determining attitudes of master's and doctoral students toward graduate education. The data were collected from 441 participants via an online survey tool. For content validity, opinions of four experts were elicited while exploratory factor analysis (EFA) was performed for construct validity of the scale. As a result of the analysis, a 21-item scale consisting of three factors named "valuing graduate education, prioritizing graduate education, resistance to graduate education" was obtained. The total variance explained by the three-factor structure is 61.209%. Cronbach's alpha reliability coefficient was estimated for reliability analysis. The Cronbach's alpha reliability coefficient for the entire scale was found to be .94, and the reliability coefficients for the sub-dimensions were .91, .87, and .86, respectively. Item-total correlations and comparisons between upper and lower groups indicated that all items in the scale were discriminative. The correlation coefficients between the total scale score and the sub-dimensions ranged from 0.58 to 0.92, and a medium to high level positive relationship was found at α=0.01 significance level. Based on the obtained data, a valid and reliable measuring tool was developed to determine the attitudes of postgraduate students towards postgraduate education.

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INTRODUCTION

Due to the development of technology and rapid information flow, scientific competence is now being completed through postgraduate education, which is seen as a step to specialize in a certain field after undergraduate education and is considered an important function of higher education institutions (TDK, 2022). Varis (1972) defines postgraduate education as educational activities that aim to raise scientists and academics who have the qualifications needed by science and society and enable the acquisition of postgraduate degrees. In other words, the aim of postgraduate education is to provide human resources who produce knowledge, use this knowledge where necessary, and can think critically. In this regard, postgraduate education is seen as an important factor in training scientists and conducting scientific processes (Alhas, 2006). Considering the requirements of the 21st century, postgraduate education also provides opportunities for individuals to develop themselves, in addition to contributing to scientific advancement (Ardahan and Özsoy, 2015).

Postgraduate education, which is carried out through programs prepared at the master's and doctoral levels in higher education institutions, plays an important role in training scientists who will contribute to the development of countries (Dilci and Gürol, 2012). In Turkey, postgraduate education consists of programs for master's degrees, specialization in medicine, proficiency in art, and doctoral degrees. Students who want to specialize after undergraduate education continue their education through the relevant institutes at universities, in accordance with the postgraduate education and training regulation determined by the Higher Education Council (HEC) (Yağan and Çubukçu, 2019). According to statistics published by the Higher Education Council, as of 2022, there are 358,271 master's and 109,540 doctoral students in our universities. When the number of postgraduates for the 2020-2021 academic year is examined, it is seen that 54,165 students graduated from master's programs and 7,865 students graduated from doctoral programs (YÖK, 2022). Although the number of students has increased significantly since 2009, the difference between the number of students and graduates is remarkable. In addition to informing undergraduate graduates about postgraduate education and encouraging them to pursue it, constructing a positive attitude towards postgraduate education is important in increasing the number of students and graduates.

The quality of universities, which are one of the institutions that make society qualified, is closely related to the quality of postgraduate education. Postgraduate education has functions parallel to the roles of universities, producing and disseminating science/art, accurately perceiving social problems, and developing solutions, and contributing to the training of high-level human resources (Bakırcı and Karaman, 2010). The quality of graduate education also includes components such as graduate student proficiency, management and administrative staff quality, academic staff and counseling quality, physical condition quality, and evaluation process quality (Aksarı and Karakaya, 2022).

Attitude, defined as "manner/a way of thinking" according to Turkish Language Association (2022), is "an emotional readiness or tendency observed as the acceptance or rejection of a certain person, group, institution, or idea" (Özgüven, 2012, p. 353). Allport (1935) defines attitude as a mental or neural readiness state that has a direct or dynamic directing effect on the object and situations that individuals are associated with and that develops through experiences. Krech and Crutchfield (1948) define attitude as a continuous formation/organization of motivational, emotional, perceptual, and cognitive processes related to a direction in the individual's world. Pickens (2005) defines attitude as the tendency or mindset that directs the individual to act in a certain direction according to their experiences and nature. Eagly and Chaiken (1993) define attitude as a psychological tendency that includes the individual's evaluation of their degree of liking/disliking. According to the definitions, it is possible to say that attitudes are a sum of cognitive, emotional, and psychomotor processes affected by the experiences and life events of individuals and can be defined as a tendency and direction that can positively/negatively direct the individual to the relevant object/situation. Determining the attitudes of candidates and individuals who are already postgraduate students towards postgraduate education is important in terms of understanding their tendencies and positive/negative emotions and their interest and value for postgraduate education. Indeed, according to Çetin (2006), the attitude shown to the relevant object or subject is shaped by the interest and value shown to it. When the literature is examined, research focusing on attitudes towards graduate education and expectations from education have been conducted, especially with teachers. Concepts such as contributing to professional development and competence, providing knowledge and skills in a professional sense, and thus helping career development, supporting the development of critical skills, material, and moral support, and increasing confidence level in decision-making have been associated with attitude. The expectations include organizing programs suitable for working life, fair treatment in interviews and increasing quotas, conducting online education, and increasing the reputation and quality of universities offering graduate programs.

There are scales that have been developed and/or adapted to measure attitudes towards graduate education (Bezen et al., 2016; İlter, 2019; Ünal and İlter, 2010). The Graduate Education Attitude Scale (GEAS), developed by Ünal and İlter (2010), measures undergraduate students' attitudes towards graduate education. The GEAS is a five-point Likert scale consisting of 15 items and has two sub-dimensions: "the function of graduate education" and "desire for graduate education.The Scale for Attitude Towards Graduate Studies developed by Bezen, Aykutlu, Seçken, and Bayrak (2016) aims to measure the attitudes of undergraduate students in vocational education toward graduate education. This scale is a five-point Likert scale consisting of 27 items and has four dimensions named "interest and importance," "fear and anxiety," "lack of need," and "desire and want." The Scale of Attitude towards Postgraduate Education (SATPGE) adapted by İlter (2019) was developed by Ng, Tuckett, Fox-Young, and Kain (2014). The adaptation analysis resulted in a scale consisting of 13 items and three factors: "facilitator roles," "professional recognition," and "inhibiting factors." It was observed that there is currently no measurement tool for the attitudes of postgraduate students towards postgraduate education, regardless of their field of study, in the literature of our country. Therefore, it is thought that the development of the Postgraduate Education Attitude Scale will contribute to providing data on the attitudes of masters and doctoral students towards graduate education.

METHOD

Research Design

This research is designed using a descriptive survey model. The descriptive survey is a research model that is relatively conducted with larger samples to describe situations such as interests, skills, abilities, and attitudes that have occurred or are currently occurring in the literature (Fraenkel & Wallen, 2006; Karasar, 2007). Furthermore, it aims to collect data to determine certain characteristics of a group and reflect the existing structure as it is (Büyüköztürk et al., 2016).

Study Group

The size of the study group was determined by reviewing the literature for exploratory factor analysis. In the literature, it is stated that a sample of 200 people may be sufficient, but obtaining a larger sample would be beneficial to achieve satisfying results (Kline, 1994). Since Tavşancıl (2014) states that the sample size should be 5-10 times larger than the number of scale items, determining the sample size in this research is based on this recommendation. The scale form was sent via e-mail to all postgraduate students (n=3650) enrolled in the education programs at Gazi University Graduate School of Educational Sciences. The study group of research consists of 441 students who responded to the form. The demographic characteristics of the students are presented in Table 1.

Tablo 1. *The distribution of students according to demographic characteristics*

Variable		Frequency (*f*)	Percentage %
Gender	Female	306	69.38
	Male	135	30.62
Type of graduate education	Master of Science with thesis	231	51.93
	Ph.D.	210	47.62
Total		441	100

Table 1 indicates that 69.38% (n=306) of graduate students are female, while 30.62% (n=135) are male. When the types of graduate education of the participating students are examined, it is found that 52.38% (n=231) of the students are pursuing a thesis-based master's degree, while 47.62% (n=210) are pursuing a doctoral degree.

Steps of Scale Development

It has been stated in the literature that scale development should follow certain stages. In the development of the attitude scale for postgraduate education, following the stages of the descriptive research, the related steps were followed (Büyüköztürk et al., 2016; Cohen and Swerdlik, 2013; DeVellis, 2017; Özgüven, 2012; Tezbaşaran, 1997):

1. Determination of the purpose and scope of the scale; decision on content

The purpose of the scale is to determine the attitudes of graduate and doctoral students towards postgraduate education. The compatibility, scope, and discriminative power of the items in attitude scales are important. On the other hand, it is important for scale items to be based on a theory or to be original. In this scale development study, the originality levels of the items were taken into consideration.

2. Writing items in the determined scope and content direction; item control and creating scale form; determining the scoring method of items

When developing the scale, creating items that reflect the purpose of the scale can be expressed as the starting point. Generation of items is realized by ensuring the items being clear and understandable, asking for the basic idea in a short and concise manner, and being original. Ambiguous and grammatically incorrect expressions were avoided. To ensure internal consistency, many items were included in the item pool. In this context, a 31-item pool was created, considering the literature. It is important for the measurement tool to show variability and correlation with other scales. One way to increase variability is to have many response categories. Therefore, a five-point Likert-type rating, "1: Strongly Disagree, 2: Disagree, 3: Partially Agree, 4: Mostly Agree, 5: Strongly Agree" was used for the items in the scale.

3.Obtaining expert opinions (Ensuring Face and Content Validity)

In content validity, it is questioned whether the items reflect the "attribute" to be measured sufficiently. In this direction, the opinions of 4 experts are acquired. Of four experts participated in this study, two were from Curriculum and Instruction Department, one is from Turkish Education and one is from Measurement and Evaluation in Education Departments. Three items were edited in line with the opinions of the experts. There was no item removed. The final version of the 31-item scale was sent to a researcher in Turkish education for language and spelling control.

4.Creating the pilot form and conducting the pilot study and the actual implementation

Before starting the actual implementation, a pilot study was conducted with 10 participants using the updated items of the scale to determine the comprehensibility and possible problems of the items. The items were revised considering the responses given. The pilot form includes 19 positive and 12 negative items. The items form cognitive, affective, and psychomotor/behavioral components that constitute attitudes (Allport, 1935; Morgan 1961; Oskamp and Schultz, 2005) according to three factors.

5.Conducting validity and reliability analyses based on data obtained from the actual application.

In the actual application, candidate scale items were delivered to participants via "Google Forms" to collect data. There was no missing data as all items in one section had to be marked before proceeding to the next section. In addition, it was checked whether the data was filled in a specific pattern or randomly. Negative items were reverse-coded. Afterwards, Exploratory Factor Analysis (EFA) and reliability analyses were conducted and reported in the table footnotes.

FINDINGS

In this part, validity and reliability analyses regarding the scale are presented.

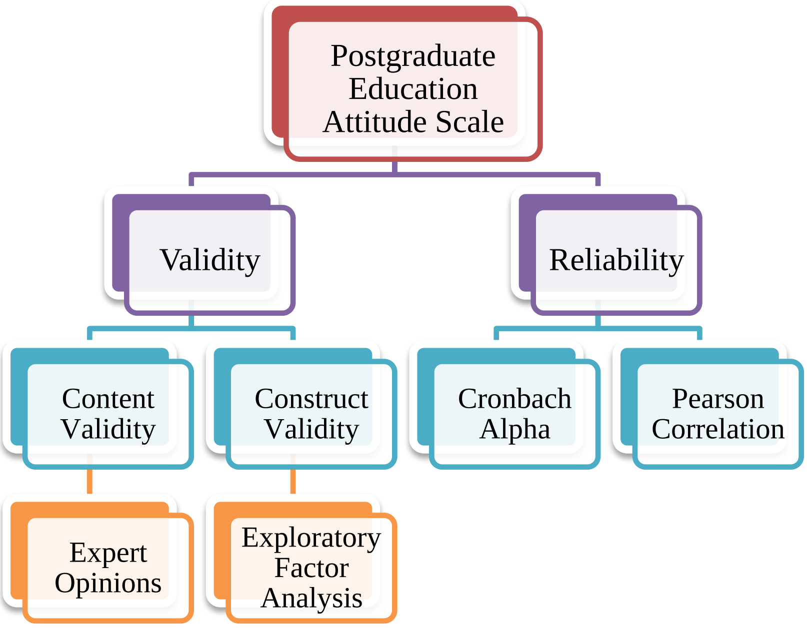

Figure. 1. *The diagram related to Postgraduate Education Attitude Scale*

Findings on the Validity of the Scale

Content Validity

In the form prepared to be sent to expert opinion, three columns titled "appropriate, not appropriate, needs revision" were opened for each item, with an additional column for comments, requesting experts to explain their suggestions if any. Experts were asked to fill out the form according to their opinions. When the opinions of the experts were examined, three items were revised, but the number of items remained the same. Consensus was achieved in the scale items.

Construct Validity

Construct validity is a judgment about the appropriateness of inferences made based on individual test scores for a variable called "construct" (Cohen & Swerdlik, 2013). In other words, researchers prepare observable and/or measurable questions to determine individuals' abilities, performance, attitudes, and other characteristics. The extent to which these questions accurately measure this structure is related to structural validity (Büyüköztürk et al., 2016).

Exploratory Factor Analysis (EFA)

To provide evidence for the construct validity of the scale developed in the study, an EFA was conducted. The KMO coefficient was calculated, and the Barlett Sphericity Test was performed to determine if the scale data set was suitable for factor analysis. The KMO value was found to be .94 and the Barlett Sphericity value was [X2= 5580.857; p<.001]. If the KMO value is greater than 0.5, it is stated that factor analysis can be performed (Kaiser, 1974). In this case, the observed KMO value of .94 was higher than the recommended KMO value, indicating that the scale is suitable for factor analysis (Büyüköztürk, 2018; Field, 2013). To determine the existing factors in the scale, it was rotated with varimax rotation based on a cutoff point of 0.45. As a result of the rotation, three factors were observed with eigenvalues greater than 1. The "Scree Plot" graph based on the eigenvalues of the factors in the scale, is also presented in Figure 2.

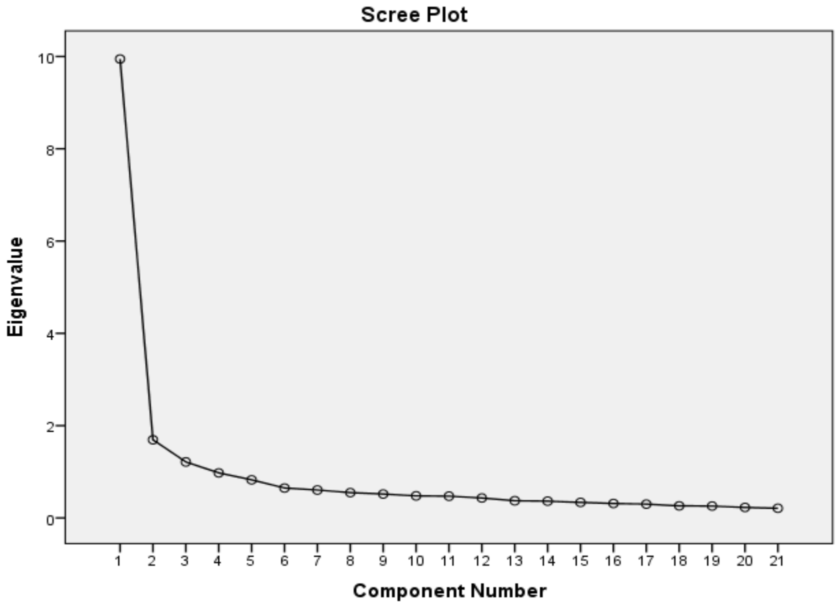

Figure. 2. *Scree Plot Graph*

The values of exploratory factor analysis regarding the scale are presented in the Table 2.

Tablo 2. *EFA results of Postgraduate Education Attitude Scale*

FACTORS	Common factor variance	Varimax Factor loadings	Eigenvalue	% of variance explained
Factor 1: Valuing postgraduate education		9,946		22,186
2. I think that postgraduate education contributes to improving myself.	,521	,523		
8. I value all the knowledge I have gained during postgraduate education process.	,556	,596		
10. I think postgraduate education has provided me with a lot of benefits.	,686	,699		
13. I believe that postgraduate education has made a positive difference in my life.	,669	,686		
16. Doing postgraduate education is increasing my self-confidence.	,612	,662		
17. I think postgraduate education has increased my scientific awareness.	,695	,784		
25. It makes me happy to have friends who are interested in postgraduate education.	,571	,526		
27. I think postgraduate education will create future opportunities for me.	,463	,533		
29. I believe that postgraduate education has provided many gains in terms of research process and discipline.	,649	,774		
Factor 2: Attaching importance to postgraduate education			1,694	19,750

1. I am interested in postgraduate education.	,439	,549		
4. I can make many sacrifices to continue postgraduate education.	,579	,743		
5. I think postgraduate education is an opportunity that should not be missed.	,646	,708		
7. I enjoy doing postgraduate education.	,659	,591		
14. Postgraduate education is a must-have in my life.	,641	,704		
19. I do not give up postgraduate education even if I face difficulties.	,651	,747		
<u>Factor 3:</u> Resistance to postgraduate education			1,214	19, 274
9. Postgraduate education is unnecessary.	,563	,640		
21. Doing postgraduate education is an education that useless people should think about.	,392	,544		
24. I feel sorry for those who are considering doing postgraduate education.	,733	,826		
26. I think beginning postgraduate education is a mistake.	,738	,776		
28. I do not suggest anyone to have graduate education.	,775	,833		
30. I think that graduate education is overvalued.	,615	,653		
Total Variance				61,209

Table 2 indicates that the scale consists of a total of 21 items, including 6 negative and 15 positive items. The scale consists of three factors. Factor 1, consisting of 9 items in line with the theoretical structure and content of the items, is named "Valuing Postgraduate Education", Factor 2 consisting of 6 items is named "Attaching Importance to Postgraduate Education", and Factor 3 consisting of 6 items is named "Resistance to Postgraduate Education". The factor loadings of the items in Factor 1 vary between .784 and .523 and account for 22.186% of the total variance. The factor loadings of the items in Factor 2 range from .747 to .549 and contribute to 19.750% of the total variance. The factor loadings of the items in Factor 3 range from .833 to .544 and contribute to 19.274% of the total variance. The total explained variance of the scale is 61.209%. Factor loadings of 0.45 and above for items under a factor can be interpreted as the items measuring the relevant structure (Büyüköztürk, 2018). Accordingly, it can be said that the items under the factors in the scale measure the relevant structure. It is considered sufficient for each factor to explain a minimum of 5% of the variance ratio and for the total explained variance value to be between 40% and 60% (Hair, Black, Babin, and Anderson, 2009). It is seen that the variance ratios obtained in this study and the total explained variance value are above the accepted levels.

Findings Regarding the Reliability of the Scale

To examine the reliability of the scale developed in the study, Cronbach's alpha reliability coefficient was calculated for the total scale and each subscale. Item-total correlation values for each item of the scale and independent t-tests based on upper 27% and lower 27% groups were conducted. The findings of the reliability analyses are presented in Table 3.

Tablo 3. *Findings related to reliability analysis.*

Factor number	-Item	Item total correlation	27% sub and top groups	Cronbach's alpha reliability coefficient
Factor 1				,91
Item 2		,665	12,166***	
Item 8		,670	13,641***	
Item 10		,742	16,250***	
Item 13		,736	18,314***	
Item 16		,692	17,538***	
Item 17		,663	14,544***	
Item 25		,711	15,397***	
Item 27		,618	14,420***	
Item 29		,592	14,279***	
Factor 2				,87
Item 9		,636	11,220***	
Item 21		,389	9,386***	
Item 24		,594	14,677***	
Item 26		,697	15,183***	
Item 28		,647	13,692***	
Item 30		,675	13,719***	
Factor 3				,86
Item 1		,569	11,737***	
Item 4		,518	12,038***	
Item 5		,674	17,635***	
Item 7		,755	17,402***	
Item 14		,669	19,457***	
Item 19		,607	16,044***	
Total				,94

***P<.001,

The reliability coefficient of the Cronbach's Alpha obtained for the entire scale was found to be .94. The Cronbach's Alpha reliability coefficients for the subscales of the scale were found to be .91 for Factor 1, .87 for Factor 2, and .86 for Factor 3. It is considered sufficient for the Cronbach's Alpha coefficient for reliability to be greater than .70 (Büyüköztürk, 2018). Therefore, the reliability coefficient obtained for the entire scale shows that the reliability is high. When the item-total correlation values of the items in the scale were examined, it was seen that the values varied between 0.38 and 0.75, and the item-total correlation values were significant at the .001 level. The independent sample t-test results for upper and lower group were also found to be significant to reveal the distinctiveness of each item in the table ($p \leq .01$). That is, there is a significant difference between the means of the upper 27% group and the means of the lower group, and this is considered as an indicator of internal consistency (Büyüköztürk, 2018). In addition, the scale was analyzed using the test-retest reliability technique, and the Spearman-Brown internal consistency coefficient was calculated. The Spearman-Brown internal consistency coefficient was found to be "0.90". The high value indicates that the items in the scale measure the same attribute.

The correlation values between the total and subscales of the scale were calculated, and the findings are presented in Table 4.

Table 4. *Correlation coefficients regarding total score and between subscale scores.*

	Total scale	Factor 1	Factor 2	Factor 3
Factor 1	,929**	----------		
Factor 2	,824**	,659**	----------	
Factor 3	,882**	,743**	,580**	----------

**P<.01

It was found that the correlation values between the total scale and the subscales in Table 4 ranged from 0.58 to 0.92, indicating a moderate to high level of positive relationship at the α=0.01 level of significance.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

The aim of this study was to determine the attitudes of postgraduate students towards postgraduate education. Firstly, literature was reviewed and related measurement tools were examined (Bezen, Kutluoğlu, Seçken and Bayrak, 2016; İlter, 2019; Ünal and İlter, 2010). Bezen et al. (2016) developed a scale to evaluate the attitudes of undergraduate students towards postgraduate education. İlter (2019), on the other hand, adapted the scale developed by Ng, Tuckett, Fox-Young, and Kain (2014) to the Şanlıurfa sample to determine the attitudes of individuals who are studying and/or graduated at any level of postgraduate education in higher education. The scale developed in this study differs from the scales in the literature in that it is specifically designed for postgraduate students. Furthermore,literature review indicates that there is not a scale developed in Turkish culture related to attitudes of postgraduate students towards postgraduate education.

The developed measurement tools, factors, and sample items were examined. A 31-item pool was created in line with the scope of the attitude scale to be developed. Then, the opinions of four experts were obtained and a pilot study was conducted after revisions were completed.

After the main implementation of the scale, validity and reliability analyses were performed. As a result of the Exploratory Factor Analysis, 10 items were removed. The final version of the scale consists of 21 items, with 6 negative and 15 positive items. The three factors identified in the scale were named "valuing postgraduate education, importance given to postgraduate education, resistance to postgraduate education". The total variance explained by the scale is 61.209%. According to the reliability analysis, the Cronbach's Alpha reliability coefficient for the overall scale was found to be .94, and the reliability values for each sub-dimension were .91, .87, and .86, respectively.

The highest score that can be obtained on the scale is 105 and the lowest score is 21. The lowest and highest scores that can be obtained in the "valuing postgraduate education" sub-factor are 9 and 45, respectively; in the "attaching importance to postgraduate education" sub-factor, the lowest and highest scores are 6 and 30, respectively; and in the "resistance to postgraduate education" sub-factor, the lowest and highest scores are also 6 and 30, respectively. Negative items are scored as 1-2-3-4-5, while positive items are scored in reverse.

According to the findings, the "Postgraduate Education Attitude Scale" possesses the psychometric properties that it should have according to the development steps and criteria of the measurement tool. During the literature review, no measurement tool was found evaluating the attitudes of graduate students towards graduate education within the scope and context of the developed scale. It is believed that the developed scale will contribute to attitude determination in the literature. The "Postgraduate Education Attitude Scale" tested for validity and reliability in this study can be used on different samples and different variables. Before these studies are conducted, it is recommended to perform confirmatory factor analysis. While determining the attitudes of students towards postgraduate education with this measurement tool, studies supported by qualitative data through interviews can be conducted.

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The Effect of Coding Education Designed with Different Visual Programs On Academic Success and Attitudes and Self-Efficiencies of Secondary School Students

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ABSTRACT

This research was conducted in order to measure students' attitudes towards computer and software course while giving coding education to students, to determine students' self-efficacy perceptions towards computer and software course, to measure students' attitudes towards coding education supported by educational games, and to measure students' academic success. and observing differences in educational outcomes resulting from these measures performed. Quantitative research methods were used in this study, which examines the effects of coding education designed with different visual programs on the academic achievement, attitudes and self-efficacy of secondary school students. The applications were made for 10 weeks in accordance with the lesson plan period in the curriculum. The data obtained as a result of the training, which lasted for 10 weeks in total. According to the findings obtained at the end of the research, it was seen that the application of the Scratch program in coding education made a significant difference on the programming skills of the students and contributed to the coding education. It can be said that academic achievement has a "large" effect size on self-efficacy perceptions in computer-assisted education, attitudes towards computer-assisted education and educational computer-assisted coding education.

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INTRODUCTION

Today is called the age of information and technology, and we live in the age of information and technology. In the period we live in, students are expected to be able to access existing information and solve problems with scientific process skills rather than memorizing information. As a usual return of the age, technology is present in every aspect of our daily life (Geçer ve Funda, 2010; Somyürek, 2014). Technology is used in many fields such as health, engineering, banking, security and as a result, the use of technology in the field of education has become a necessity rather than a privilege (Geçer & Funda, 2010; Somyürek, 2014). Due to such rapid developments in technology, innovations and education follow each other synchronously (Batdal, 2005). Developing and advancing technology in all fields has also been actively used in the education and training process (Baş, 2011; Tsai & Tsai, 2003). The concept of 21st century skills, which has recently entered our lives, prepares our children for the future world, and at the same time, it is studied on which skills individuals should be equipped with (Roy-Singh, 1991). Due to the changes in education, it is expected that they produce information instead of consuming it in the century we live in. The individual desired by the 21st century and our age is not the one who accepts and memorizes the data as it is, waits to be directed and managed; They are individuals who interpret, make sense of and actively participate in the transferred information. (Yildirim & Simsek, 2008). In order for students to be given these skills, these skills must be included in the education systems. In particular, the integration of these skills with technology has revealed the idea of computational thinking and countries have started to integrate the STEM education model within their education systems (Demir & Seferoğlu, 2017). The acronym STEM is formed by combining the initials of the words Science, Technology, Engineering and Mathematics. STEM education ensures that the subjects of science and mathematics lessons can be taught practically with a holistic approach (Kırkıç & Aydın, 2018). STEM education is an education method that provides an integrated connection with daily life and these disciplines (Yıldırım & Selvi, 2017). With the increase in the application of STEM education, other innovative approach models have started to be applied in education. One of the trainings applied as one of the innovative approach methods today is coding training. In our age, developed and developing countries are working on integrating coding education into their existing education systems so that students can gain coding skills. Coding education has become very important for digital literacy skills, which is one of the 21st century skills, in order to raise people with the necessary skills of our time and future. The importance of coding education has increased with the rapid impact of technology on our daily lives and the inclusion of advancing technologies in the educational lives of both students and teachers. As a result, coding education has become widespread in schools. It is gradually included in the curriculum of information technologies and software in secondary schools (Ünsal, 2019). As a result of the researches, it was determined that problem solving skills are among the areas where primary and secondary school students are the most unsuccessful. The difficulty that students face in learning programming is mostly the lack of problem solving skills (Gomes & Mendes, 2007). The purpose of the Scratch program is to improve the use of technology in children and youth. The Scratch program is recommended by experts as the first language for children and young people to learn programming (Atun & Usta, 2019; Malan & Leitner, 2007). In Turkey, the Information Technologies and Software course is taught as a compulsory course at the 5th and 6th grade levels in secondary and imam hatip secondary schools, and as an elective course as two course hours per week at the 7th and 8th grades. The titles of the learning areas announced by the Ministry of National Education and published in the curriculum of the Information Technologies and Software course are determined as follows;

1. IT literacy,
2. Communicating, sharing information and expressing oneself through information technologies,
3. To be able to research, construct knowledge and work collaboratively,
4. Ability to solve problems, do programming and produce original products,

• Can develop a strategy in order to solve a problem and realize the project, use different perspectives and new approaches while producing a solution.

• Recognize what authorship and programming languages are, and use at least one programming language actively.

• It can create models, make simulations and create animations to examine subjects and systems (M.E.B., 2012).

It is thought that it would be appropriate to use the Scratch program and the Tospaa non-computer coding program in the Problem Solving, Programming and Original Product Development unit. The reason why we prefer to use these programs is that the Scratch program in the 6th grade Information Technologies and Software course of the Ministry of National Education is suitable for the age levels of the students and provides simultaneous progress with the curriculum. Again, the preference of the Tospaa program is that it meets the gains that students need to earn and it is an easy coding tool that can be accessed by all classes. Thanks to the Scratch program, students can design their own projects and produce creative solutions to the problems they encounter in real life (Karabak & Güneş, 2013; Lee, 2011).

In this study, the solution of existing problems was carried out by the students using Scratch and Tospaa programs. Since Scratch and Tospaa provided easy, visually interesting environments, students took an active role in the design environment during the problem solving phase.

This research aims to measure the students' attitudes towards the Computer and Software course while giving coding education to the students, to determine the students' self-efficacy perceptions towards the Computer and Software course, to measure the students' attitudes towards coding education, to measure the academic success of the students and to observe the differences in the educational outcomes resulting from these measurements. It is desired to determine in which of the computer-assisted and non-computer-assisted education environments the subjects comprehend the coding education more efficiently.

1. Will the coding education given to the students without using a computer make a significant difference after the pre-test and post-test?

2. Will the coding education that will be given to the students in the Computer Aided Education environment make a significant difference in the students after the pre-test and post-test?

3. What is the readiness level of students for the use of computer programs?

4. What are the students' prior learning about coding?

5. Was the teaching strategy of the course effective in the scores of the students in the academic achievement test?

METHOD

Quantitative research methods were used in this study, which examines the effects of coding education designed with different visual programs on the academic achievement, attitudes and self-efficacy of secondary school students.

In this study, unequal quasi-experimental design with pretest and posttest experimental and control groups was preferred (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2012). The experimental and control groups are selected from the groups by unbiased assignment. It is a method used when random selection is not possible. This method; It is a design that includes an experimental approach in which random distribution is not suitable for selecting subjects. It is a method that is implemented using pre-built classes.

In the study, students are divided into two groups as experimental and control groups (Karasar, 1999). In the control group, the lessons were taught using the Tospaa computer-free coding program (Tospaa, 2020). While the lessons were taught in this way in the control group; In the experimental group, lessons were taught with the support of Scratch software (ScratchAbout, 2020). The applications were made for 10 weeks in accordance with the duration of the lesson plan in the curriculum.

While the lessons were taught in this way in the control group; In the experimental group, lessons were taught with the support of Scratch software. In both groups, measurements are made before and after the experiment in the same way (Büyüköztürk et al., 2012). In the Experimental and Control groups, at the beginning and at the end of the research, the students were given an academic achievement test for coding, the Attitude Scale for Computer-Aided Education (Arslan, 2006b), the Self-Efficacy Perception Scale for Computer-Aided Education (Arslan, 2006a) and the Attitude Scale for Computer Games Assisted Coding Learning (Keçeci, Alan, & Zengin, 2016). Self-efficiency and perception regarding computer aided education scale it is a likert-type scale consisting of 20 items, The attitude to taking computer aided education scale is a 20-item likert-type scale, and The attitude scale for educational computer-assisted coding learning is a likert-type scale consisting of 28 questions. It is important to analyze the data as detailed and directly as possible with the statements of the study group, and it has been examined whether it is effective in learning outcomes based on the data obtained for the theory put forward with quantitative research (Creswell & Clark, 2017; Miles, Huberman, Huberman, & Huberman, 1994; Strauss & Corbin, 1998).

Study Group

The study group of the research consists of 6th grade primary school students studying at Meram Gödene TOKİ Imam Hatip Secondary School in Meram district of Konya in the 2020-2021 academic year. The research was implemented with distance education lasting 10 weeks. In the study, lessons were given by the same teacher in both the experimental and control groups. In the study, an experimental and a control group were formed in order to test how the independent variables affected the dependent variables. The study was carried out on a total of N= 45 students, with N=21 students in the experimental group and N=24 students in the control group.

Table 1. *Demographic data of the study group*

		N	%
Gender	Woman	17	37.7
	Male	28	62.3
Experimental group	Woman	7	29.1
	Male	14	66.9
Control group	Woman	10	41.6
	Male	14	58.4
Total		**45**	**100**

As can be seen from Table 1, 37.7% of the students in the study group of the research are female students and 62.3% are male students. The experimental group consisted of 29.1% female students and 66.9% male students; The control group consists of 41.6% female students and 58.4% male students.

Research Instruments and Processes

In order to measure the success of the students in coding, which was applied to both groups as a pre-test and post-test, the achievement test covering the problem solving and programming achievement in the 6th grade Information Technologies and software curriculum of the Ministry of National Education 2020/2021 was used.

The academic achievements of the students participating in the research were prepared as Scratch Academic Achievement Test and Tospaa Academic Achievement Test by the school informatics teachers who are experts in their field. There are 14 questions in the Scratch academic achievement test and 5 questions in the Tospaa academic achievement test.

The reliability coefficient of a multiple-choice test (academic achievement test) needs to be determined. For this, KR-20 and KR-21 formulas are generally used (Guven, 1990). When using this method, in order to create the data sets in the measurement tool during the application process, "1" points are given if there is an expected feature in the answers taken from the items, and a "0" point is given if there is no expected feature. For the determination of the internal reliability coefficient of the tests, the determined features are taken into account and the formula Kr-20 or Kr-21, whichever is more appropriate, is used (Ercan & Kan, 2004).

Kr-20 formula (Ergin, 1995);

n : number of items in the test

q : rate of those who did not answer an item correctly = (1-p)

P : rate of those who answered an item correctly

∑pq is the sum of the calculated (p x q)'s for each item

S^2 : variance of test total scores,

Kr-20 Formula

$$r_{iç} = \left(\frac{n}{n-1}\right)\left(\frac{S^2 - \Sigma pq}{S^2}\right)$$

The Kr-20 formula is used in cases where those whose items are not answered and those who give wrong answers are not evaluated, and those who give correct answers are evaluated. If the items in the test are to be evaluated with different scores, the Kr-20 formula cannot be used. If the difficulty values of the items in the test are close to each other, the Kr-21 formula can be used (Ergin, 1995).

Kr-21 formula (Ergin, 1995);

n : number of items in the test

Xt: Average of total scores

S^2: variance of test total scores;

Kr-21 Formula

$$r_{iç} = \left(\frac{n}{n-1}\right)\left(1 - \frac{\bar{X}_t(n-\bar{X}_t)}{nS_t^2}\right)$$

Table 2 and Table 3 show the table of specifications for the Scratch Academic Achievement Test and the Tospaa Academic Achievement test used in the study.

An example question from the Scratch academic achievement test is as follows;

Which of the following is the flow chart that starts and ends the algorithm? (10 points)

a) Ellipse

b) parallelogram

c) Rectangle

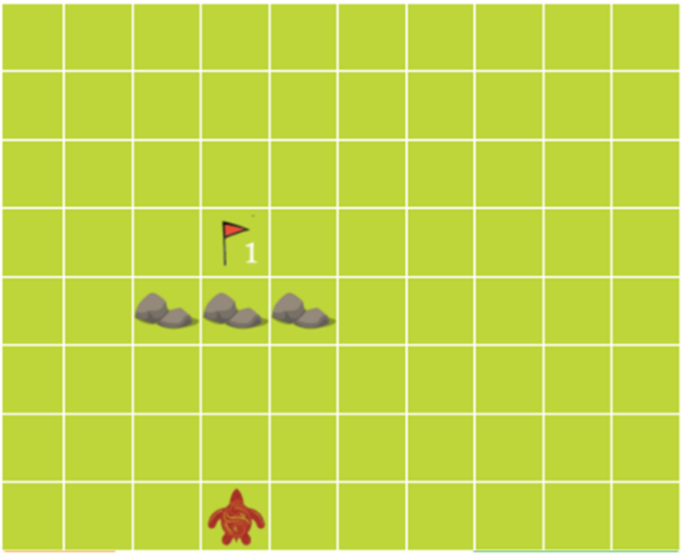
d) rhombus

Table 2 *Table of specifications for the preparation of the Scratch academic achievement test*

Questions	Achievements
1	Explain the concept of algorithm.
2	Explains flowchart components and functions.
3	Develops an algorithm for solving the problem.
4	Edits a faulty algorithm to work correctly
5,6,7,8,9	Recognize the interface and features of the block-based programming tool
10,11,12	Develops and organizes a program presented in a block-based programming tool according to the given criteria.

Our sample question from the Tospaa academic achievement test is as follows;

Deliver the balls to their target points



Tospaayı engellere değmeden hedeflere ulaştırın

Table 3 *Table of specifications for the preparation of the Tospaa academic achievement test*

Questions	Achievements
1	Explain the concept of algorithm.
2	Explains flowchart components and functions.
3	Develops an algorithm for solving the problem.
4	Edits a faulty algorithm to work correctly
5	Develops and organizes a program presented in a block-based programming tool according to the given criteria.

Considering the Kr-21 values for both multiple-choice tests, it was found that the difficulty index of the Scratch Academic Achievement Test = .758 and the difficulty index of the Tospaa Academic Achievement test = .726.

The results of the comparison (independent t-test for unrelated samples) of the results of the self-efficacy perception scale regarding computer assisted education, the attitude scale for computer assisted education and the attitude scale for educational computer games assisted coding learning applied to the experimental and control groups before the application (pre-tests) Table 4, Table 5, Table 6 and Table 7.

Table 4 *Pre-test comparison results of the self-efficacy perception scale for computer-assisted education between groups*

	Groups	N	$\overline{X}$	Ss	Sd	t	p
Pre-test	Experimental group	21	66,95	4,82	43	-,972	.336*
	Control group	24	65,57	4,71			

*p<0.05

After the experimental and control groups were determined before the application, in the pre-tests (experimental group pretest average =66.95; control group pretest mean =65.57) *.05<.336 for p<.05 significance level large and not significant. In other words, the pre-test scores of the participants on the Self-Efficacy Perception Scale for Computer Assisted Education do not show a significant difference.

Table 5 *Pre-test comparison results of the attitude scale for computer-assisted education between groups*

	Groups	N	$\overline{X}$	Ss	Sd	t	p
Pre-test	Experimental group	21	62,20	7,11	43	-1,433	.159*
	Control group	24	59,47	5,41			

*p<0.05

After the experimental and control groups were determined before the application, in the pre-tests (experimental group pre-test average =62.20; control group pre-test average =59.47) *.05<.159 for p<.05 significance level because it is not meaningful. In other words, the participants' Attitude Scale Towards Computer Assisted Education pre-test scores do not show a significant difference.

Table 6 *Pre-test comparison results of the attitude scale towards coding learning supported by educational computer games between groups*

	Groups	N	$\overline{X}$	Ss	Sd	t	p
Pre-test	Experimental group	21	92,20	13,91	43	- 1.003	.321*
	Control group	24	87,71	16,14			

*p<0.05

After the experimental and control groups were determined before the application, in the pre-tests (experimental group pre-test average =92.20; control group pre-test average =87.71) *.05<.321 for p<.05 significance level because it is not meaningful. In other words, the pre-test scores of the participants' Attitude Scale Towards Educational Computer Games Supported Coding Learning do not show a significant difference.

In other words, the study group has approximately similar numbers of experimental and control groups and the comparison of the pre-test results of the statistical tests (self-efficacy perception scale regarding computer-assisted education, attitude scale regarding computer-assisted education, attitude scale towards educational computer-assisted education-assisted coding learning) With these results, it was determined that both groups (experimental and control groups) were equivalent before the research and were suitable for the application of the research.

Data Analysis

The demographic information of the study group students was explained with descriptive statistics such as standard deviation, arithmetic mean, percentage, frequency. In the quantitative aspect of the study, the statistical package program SPSS 22 (Statistical Package for Social Sciences) version program was used for the analysis of the mathematical results obtained as a result of the experimental process.

RESULTS

In this part of the research, the research questions, the results of the statistical analyzes made according to the data collected from the research and the interpretations of the research questions on these results are presented in detail. Reliability Analysis Findings of the Self-Efficacy Perception Scale on Computer Assisted Education. Cronbach's Alpha reliability coefficient, which is the internal reliability coefficient, was found to be .870 in the reliability test performed with the data collected from the study group after the application of the Self-Efficacy Perception Scale on Computer Assisted Education.

Table 7 *Reliability analysis results of the Self-Efficacy Perception Scale Regarding Computer Assisted Education*

Self-Efficacy Perception Scale on Computer Assisted Education	
Cronbach's Alfa	**Number of Items in the Scale**
.870	20

Reliability Analysis Findings of the Attitude Scale towards Computer Assisted Education

Cronbach's Alpha reliability coefficient, which is the internal reliability coefficient, was found to be .81 in the reliability test performed with the data collected from the study group after the application of the Attitude Scale towards Computer Assisted Education.

Table 8 *Reliability analysis results of the attitude scale for computer assisted instruction*

Attitude Scale Towards Computer-Aided Education	
Cronbach's Alfa	**Number of Items in the Scale**
.81	20

Reliability Analysis Findings of the Attitude Scale towards Educational Computer Games Assisted Coding Learning

Cronbach's Alpha reliability coefficient, which is the internal reliability coefficient, was found to be .92 in the reliability test performed with the data collected from the study group after the application of the Attitude Scale towards Educational Computer Games Supported Coding Learning.

Table 9 *Attitude scale towards coding learning supported by educational computer games*

Attitude scale towards coding learning supported by educational computer games	
Cronbach's Alfa	**Number of Items in the Scale**
.92	28

<u>Experimental group Academic Achievement Test Pretest – Posttest comparison (t-test for dependent samples / paired t-test)</u>

As a result of the application, the results of the comparison of the pre-test and post-tests made to determine the status of the experimental group students are given in Table 11.

Table 10 *Experimental group pretest-posttest comparison results for academic achievement test total*

	Test	**N**	$\overline{X}$	**Ss**	**Sd**	**t**	**p**
Experiment group	Pre-test	21	69,58	14,21	23	23,985	.000
	Final test	21	87,08	15,24			

*P<0.05

It was observed that there was a statistically significant difference between the pretest-posttest scores of the experimental group (pretest mean =69.58; posttest mean =87.08) for *p<.05 significance level (p<0.05). It was determined that the experimental group students increased their success in the academic achievement test as a result of the computerized coding application they participated in (Table 10).

<u>Experimental group Self-Efficacy Perception Scale on Computer Assisted Education Pretest – Posttest comparison (t-test for dependent samples / paired t-test)</u>

Comparisons of the pre-test and post-tests were made to determine the status of the experimental group students as a result of the application. The result is given in Table 11.

Table 11 *Experimental group pre-test-post-test comparison results for the self-efficacy perception scale related to computer-assisted education*

	Test	**N**	$\overline{X}$	**Ss**	**Sd**	**t**	**p**
Experiment group	Pre-test	21	66,95	4,82	23	68,016	.000
	Final test	21	73,79	4,13			

*P<0.05

In the application, it was found that there was a statistical difference between the pretest-posttest scores of the experimental group (pretest average =66.95; posttest average =73.79) *p<.05 in terms of significance level (p<0.05). It was determined that the students in the experimental group increased their Self-Efficacy Perceptions Regarding Computer Aided Education as a result of the computerized coding application they participated in (Table 11).

Experimental Group Attitude Scale Towards Computer-Aided Education Pre-Test – Post-Test Comparison (Paired T-Test)

The pre-test and post-tests made to determine the status of the experimental group students as a result of the application were compared. The result of this comparison is given in Table 12.

Table 12 *Experimental group pre-test-post-test comparison results for the attitude scale towards computer-assisted education*

	Test	N	$\overline{X}$	Ss	Sd	t	p
Experiment group	Pre-test	21	62,20	7,11	23	42,840	.000
	Final test	21	74,45	6,92			

*P<0.05

In the application, it was found that there was a statistical difference between the pretest-posttest scores of the experimental group (pretest average =62.20; posttest average =74.45) *p<.05 in terms of significance level (p<0.05). It was determined that the students in the experimental group increased their Attitudes towards Computer-Aided Education as a result of the Scratch application they participated in (Table 12).

Experimental Group Attitude Scale Towards Learning Coding Supported by Educational Computer Games Pre-Test – Post-Test Comparison (Paired T-Test)

he pre-test and post-tests made to determine the status of the experimental group students as a result of the application were compared. The result of this comparison is given in Table 13.

Table 13 *Experimental group pre-test-post-test comparison results for the attitude scale towards educational computer games-assisted coding learning*

	Test	N	$\overline{X}$	Ss	Sd	t	p
Experiment group	Pre-test	21	92,20	13,91	23	32,469	.000
	Final test	21	95,54	9,53			

*P<0.05

In the application, it was found that there was a statistical difference between the pretest-posttest scores of the experimental group (pretest average =92.20; posttest average =95.54) *p<.05 in terms of significance level (p<0.05). It was determined that the students in the experimental group increased their Attitudes towards Learning Coding Supported by Educational Computer Games (Table 13).

Control group Academic Achievement Test (Tospaa) Pretest – Posttest comparison (paired t-test)

In order to reveal the status of the control group students as a result of the application, comparisons of the pre-test and post-test were made. The result is given in Table 14.

Table 14 *Pretest-posttest comparison results for the total academic achievement test control group*

	Test	N	$\overline{X}$	Ss	Sd	t	p
Control Group	Pre-test	24	45,71	23,62	20	8,867	,000
	Final test	24	73,80	27,60			

*p<0.05

In the application, it was found that there was a statistical difference between the pretest-posttest scores of the control group (pretest average =45.71; posttest average =73.80) *p<.05 in terms of significance level (p<0.05). As a result of the teaching conducted with the Tospaa application in which the control group students participated, it was observed that there was a significant difference in their Academic Achievement and they increased their Academic Success (Table 14).

Control Group Self-Efficacy Perception Scale Regarding Computer Assisted Education Pre-Test – Post-Test Comparison (Paired T-Test)

In order to reveal the status of the control group students as a result of the application, comparisons of the pre-test and post-test were made. The result is given in Table 15.

Table 15 *The control group pretest-posttest comparison results for the self-efficacy perception scale related to computer assisted education*

	Test	N	$\overline{X}$	Ss	Sd	t	p
Control Group	Pre-test	24	65,57	4,71	20	63,693	.000
	Final test	24	78,19	4,61			

*p<0.05

In the application, it was found that there was a statistical difference between the pretest-posttest scores of the control group (pretest mean =65.57; posttest mean =78.19) *p<.05 in terms of significance level ($p<0.05$). As a result of the teaching conducted with the Tospaa application in which the control group students participated, it was observed that there was a significant difference in Self-Efficacy Perceptions Regarding Computer Assisted Education (Table 15).

Control group Attitude towards Computer Assisted Education Pretest – Posttest comparison (paired t-test)

In order to reveal the status of the control group students as a result of the application, comparisons of the pre-test and post-test were made. The result is given in Table 16.

Table 16 *The control group pretest-posttest comparison results for the attitude scale towards computer-assisted education*

	Test	N	$\overline{X}$	Ss	Sd	t	p
Control Group	Pre-test	24	59,47	5,418	20	50,299	.000
	Final test	24	65,09	6,015			

*p<0.05

In the application, it was found that there was a statistical difference between the pretest-posttest scores of the control group (pretest average =59.47; posttest average =65.09) *p<.05 in terms of significance level ($p<0.05$). As a result of the teaching conducted with the Tospaa application in which the control group students participated, it was observed that there was a significant difference in their Attitudes towards Computer Assisted Education (Table 16).

Control group Attitude Scale Towards Learning Coding Supported by Educational Computer Games Pre-test – Post-test comparison (paired t-test)

In order to reveal the status of the control group students as a result of the application, comparisons of the pre-test and post-test were made. The result is given in Table 17.

Table 17 *The control group pre-test-post-test comparison results for the attitude scale towards educational computer games-assisted coding learning*

	Test	N	$\overline{X}$	Ss	Sd	t	p
Control Group	Pre-test	24	87,71	16,14	20	24,904	.000
	Final test	24	85,57	14,13			

*p<0.05

In the application, it was found that there was a statistical difference between the pretest-posttest scores of the control group (pretest mean =87.71; posttest mean =85.57) *p<.05 in terms of significance level (p<0.05). As a result of the teaching conducted with the Tospaa application, in which the control group students participated, it was observed that there was a significant difference in their Attitudes towards Educational Computer Games Supported Coding (Table 17).

Comparison of experimental-control group Self-Efficacy Perception Scale for Computer Assisted Education post-tests (independent t-test)

Table 18 shows the result when the "Self-Efficacy Perception Scale Results of Computer Assisted Education" were compared between the students using the Scratch application in Computer Coding (experimental group) and the students using the Tospaa application (control group).

Table 18 *Results of the post-test comparison (t-test) between groups (experimental-control group) for the self-efficacy perception scale related to computer assisted education*

Groups		N	$\overline{X}$	S	Sd	t	p
Final test	Experimental group	21	78,19	4,61	43	3,373	.002*
	Control group	24	73,79	4,13			

*P<0.05

It is significant as it is .00 < .05 for *p<.05 significance level in the post-tests performed after the application to the experimental and control groups. In the post-tests (experimental group post-test average =78.19; control group post-test average =73.79), it was determined that the posttest scores of the experimental group were higher than the posttest scores of the control group (Table 18). The result obtained shows that the application is in favor of the experimental group regarding Self-Efficacy Perceptions Regarding Computer Assisted Education. In addition, eta square value was examined to determine the effect size of the computerized coding environment on the Self-Efficacy Perception Scale of Computer Assisted Education. Effect size values were calculated as $\eta 2 = .133$. In this case, considering the effect size value ($\eta 2 = 0.133$), it can be said that the computerized coding environment has a "large" effect size on Self-Efficacy Perceptions Regarding Computer Assisted Education.

Comparison of experimental-control group Attitude Scale towards Computer Assisted Education post-tests (independent t-test)

Table 19 shows the result when the "Attitude Scale towards Computer Aided Education" scores of the students using the computer-aided coding Scratch application (experimental group) and the students using the Tospaa application (control group) were compared.

Table 19 *Intergroup (experimental - control group) post-test comparison (t - test) results of attitude scale towards computer-assisted education*

Groups		N	$\overline{X}$	S	Sd	t	p
Final test	Experimental group	21	74,45	6,92	43	-4,809	.000*
	Control group	24	65,09	6,01			

*P<0.05

It is significant as it is .00 <.05 for the *p<.05 significance level in the post-tests after the application to the experimental and control groups. In the post-tests (experimental group post-test average =74.45; control group post-test average =65.09), it was determined that the post-test scores of the experimental group were higher than the post-test scores of the control group (Table 19). This result shows that the application is for the benefit of the experimental group. In addition, eta square value was examined to determine the effect size of the computer coding environment on Attitudes towards Computer Assisted Education. Effect size values were calculated as η2= .129. In this case, considering the effect size value (η2 = 0.129), it can be said that the computer coding environment has a “large” effect size on Attitudes towards Computer Assisted Education.

<u>Comparison of the experimental-control group Attitude Scale towards Educational Computer Games Supported Coding Learning post-tests (independent t-test)</u>

When the "Attitudes Towards Educational Computer Games Supported Coding Learning" of the students using the Scratch application in Computer Coding (experimental group) and the students using the Tospaa application (control group) are compared, the result is given in Table 20.

Table 20 *Intergroup (experimental - control group) post-test comparison (t - test) results of attitude scale towards educational computer games assisted coding learning*

Gruplar		**N**	$\overline{X}$	**S**	**Sd**	**t**	**p**
Final test	Experimental group	21	95,54	9,53	43	-2,805	.008*
	Control group	24	85,57	14,13			

*P<0.05

It is significant as it is .00 <.05 for the *p<.05 significance level in the post-tests after the application to the experimental and control groups. In the post-tests (experimental group post-test average =95.54; control group post-test average =85.57), it was determined that the experimental group's posttest scores were higher than the control group's posttest scores (Table 20). This result shows that the application is for the benefit of the experimental group. In addition, eta square value was examined to determine the effect size of the Attitude Scale towards Educational Computer Games Supported Coding Learning on the total. Effect size values were calculated as η2= .134. In this case, considering the effect size value (η2 = 0.134), it can be said that the computer coding environment has a “large” effect size on Attitudes Towards Educational Computer Games Supported Coding Learning.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

Within the scope of the research, demographic information forms, academic achievement test, self-efficacy perception scale related to computer-assisted education, attitude scale to computer-assisted education, attitude scales to coding learning supported by educational computer games, which were applied before the application process of 45 middle school students who made up the study group, were included in the study group. When the answers given were examined, the results were obtained according to the information obtained.

When the demographic information applied to 45 middle school 6th grade students who were considered within the scope of the research was examined, the results were obtained according to the information obtained. From the students in the study group of the research; female students make up N=17, that is 37.7%, and male students make up N= 28, that is, 62.3%. Of the students in the experimental group of the research; female students make up N= 7 ie 29.1%, male students N= 14 ie 69.9%. Of the students in the control group of the study; female students make up N= 10 ie 41.6%, male students N= 14 ie 58.4%.

When the Kr-21 values of the Scratch Academic Achievement Test and Tospaa Academic Achievement test, which are the multiple-choice tests used in the study, are examined, the difficulty index of the Scratch Academic Achievement Test was found to be = .758 and the difficulty index of the Tospaa Academic Achievement test = .726.

Comparison of the results of the academic achievement test, self-efficacy perception scale for computer assisted education, attitude scale for computer assisted education, and attitude scale for coding learning supported by educational computer games applied to the experimental and control groups before the application (pre-tests) (independent t- test) results, no significant difference was observed between the scores of the students. The comparison of the pre-tests and the experimental and control group numbers of the study group and the comparison of the pre-test results of the statistical tests (self-efficacy perception scale for computer-assisted education, attitude scale for computer-assisted education, attitude scale for coding learning supported by educational computer games.), it was concluded that both groups (experimental and control groups) were equivalent before the research and were suitable for the application of the research.

Cronbach's Alpha reliability coefficient, which is the internal reliability coefficient, was found to be .870 in the reliability test performed with the data collected from the study group after the application of the Self-Efficacy Perception Scale on Computer Assisted Education. Cronbach's Alpha reliability coefficient, which is the internal reliability coefficient, was found to be .81 in the reliability test performed with the data collected from the study group after the application of the Attitude Scale towards Computer Assisted Education. Cronbach's Alpha reliability coefficient, which is the internal reliability coefficient, was found to be .92 in the reliability test performed with the data collected from the study group after the application of the Attitude Scale towards Educational Computer Games Supported Coding Learning.

It is significant as it is .00 < .05 for *p<.05 significance level in the post-tests performed after the application to the experimental and control groups. In the post-tests (experimental group post-test average =78.19; control group post-test average =73.79), it was determined that the post-test scores of the experimental group were higher than the post-test scores of the control group. The result obtained shows that the application is in favor of the experimental group regarding Self-Efficacy Perceptions Regarding Computer Assisted Education. In addition, eta square value was examined to determine the effect size of the computerized coding environment on the Self-Efficacy Perception Scale of Computer Assisted Education. Effect size values were calculated as $\eta 2= .133$. In this case, considering the effect size value ($\eta 2 = 0.133$), it can be said that the computerized coding environment has a "large" effect size on Self-Efficacy Perceptions Regarding Computer Assisted Education.

It is significant as it is .00 <.05 for the *p<.05 significance level in the post-tests after the application to the experimental and control groups. In the post-tests (experimental group post-test average =74.45; control group post-test average =65.09), it was determined that the post-test scores of the experimental group were higher than the post-test scores of the control group. This result shows that the application is for the benefit of the experimental group. In addition, eta square value was examined to determine the effect size of the computer coding environment on Attitudes towards Computer Assisted Education. Effect size values were calculated as $\eta 2= .129$. In this case, considering the effect size value ($\eta 2 = 0.129$), it can be said that the computer coding environment has a “large” effect size on Attitudes towards Computer Assisted Education.

It is significant as it is .00 <.05 for the *p<.05 significance level in the post-tests after the application to the experimental and control groups. In the post-tests (experimental group post-test average =95.54; control group post-test average =85.57), it was determined that the posttest scores of the experimental group were higher than the posttest scores of the control group. This result shows that the application is for the benefit of the experimental group. In addition, eta square value was examined to determine the effect size of the Attitude Scale towards Educational Computer Games Supported Coding Learning on the total. Effect size values were calculated as $\eta 2= .134$. In this case, considering the effect size value ($\eta 2 = 0.134$), it can be said that the computer coding environment has a “large” effect size on Attitudes Towards Educational Computer Games Supported Coding Learning.

In the context of all these results, the fact that the Scratch application was made in a computerized environment encouraged students to learn. By using Scratch, one of the block-based coding tools, the students received a computer-applied coding training and the students followed the studies more actively. The researches and the data obtained show that suitable environments such as computer classes in schools should be created for computer coding in information technologies and software courses. On the other hand, we can predict that teachers of Information Technologies and Software courses will improve their cognitive and algorithmic thinking skills if they give computer coding training to their students using different portals. In addition to all these, it is thought that it will be beneficial for the students to increase the information technology course hours in education and to open weekend courses for students in all schools where they are requested.

SUGGESTIONS

This section has been created to assist future studies based on the results obtained as a result of the study.

1. The data obtained in this study were obtained as a result of the application carried out in a limited study group for a limited time of 10 weeks. Conducting such a study with a large study group with a long-term application may make the results more generalizable.
2. The study was carried out in a distance education environment due to the Covid-19 outbreak. After the epidemic process is over, the study can be done in a face-to-face education environment and the results can be examined.
3. The study was conducted on 6th grade students, in a similar study it can be done on students from different grade levels and a different block coding tool.
4. As a result of the findings obtained from this research, it was concluded that the education provided in a computerized environment had a positive effect on students, and activities to encourage students in and out of school can be organized in order to spread computer-aided education. For this reason, students' participation in the coding week (Codeweek) is in the coding activities of the students; Developing analytical thinking and problem solving skills, creating games with web 2.0 tools, increasing their motivation and awareness, and raising awareness about the importance of coding.
5. This study, made with Scratch software, was conducted with 6th grade students in secondary school. The findings have been that teaching coding with Scratch affects academic success. Therefore, it can be said that Scratch, a software that supports and develops creativity for all ages, can be used at all levels from kindergarten to higher education.
6. Coding classes can be established in schools so that coding education can be carried out in accordance with its purpose. Students can also experience learning by doing in these classroom environments.

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An Activity for Design Skill Labs: Activity Planning Processes and Pre-Service Chemistry Teachers' Views [1]

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ABSTRACT

The traditional roles of schools are inadequate to prepare students for the change. Thus, Design Skill Labs (DSLs) have been established in Turkey to provide opportunities for students at all levels of education to discover and develop their talents. Nevertheless, the activities currently available in DSLs are not yet sufficient or diverse enough. The aim of this study is to exemplify the process of developing an activity that can be implemented in DSLs and to obtain the opinions of pre-service teachers about them. Two out of six pre-service chemistry teachers planned the activity, and six pre-service teachers are participated in the study. The participants were senior pre-service chemistry teachers from a state university in Ankara. The data collected from the case study were analyzed using content analysis. According to the research findings, DSLs activities differ from other activities carried out in schools in terms of student and teacher roles, learning environment, research problem, and process. Moreover, DSLs activities contribute to students' skill acquisition, personality development, learning, socialization, and mental development.

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[1] The activity in this study was developed by undergraduate students under the mentorship of the author within the scope of the "Research Project in Field Education" course.

INTRODUCTION

Although there are many different definitions, purposes, and functions of education, one of them is the process of bringing about a desired change in an individual's behavior through his/her own experiences (Ertürk, 1972). Changes in people brought about by education are also reflected in societies, and societies develop and change like people. Education is one of the important elements necessary for a society to progress and develop. Each society has its educational dynamics. As the dynamics of the age change, societies also change (Dinçer, 2003; Parlar, 2012). Thus, education and training activities should focus more on the needs and requirements of the era. The task of the understanding of education is to raise individuals who can respond to the needs of the age and survive. The understanding of education in this era focuses on providing individuals with critical thinking and problem solving, communication and collaboration skills, flexibility and adaptability, initiative and self-direction, social and intercultural skills, leadership and responsibility, information and media literacy and technology skills (Rotherham & Willingham, 2010). There is a need for different approaches and spaces than the current approaches and physical environments in schools to provide such skills and competencies.

These spaces to meet this need are stated as Design Skill Labs (DSLs) in the 2023 Education Vision (MoNE, 2021a). These workshops are defined as workspaces designed for a common purpose at primary, secondary and high school levels, emphasizing the use of the child's hand, and associated with professions (MoNE, 2018). Teachers and students have different roles in design skill labs. Compared to existing approaches, design skill labs emphasize approaches that allow students to learn by doing and experiencing, and that emphasize designing, making, and producing rather than knowing. In this context, the philosophy of design skill labs, like other student-centred approaches, is based on the philosophy of constructivist learning (MoNE, 2021a; MoNE, 2021b). According to the constructivist approach, the role of the teacher is not to present pre-prepared information, but to provide a learning environment where students can do real and physical activities (Piaget, 1976). DSLs are environments where students seek solutions to problems and where learner-content interaction is provided in collaboration with their teachers and peers. From this perspective, project-based learning, problem-based learning, collaborative learning, and design-based learning approaches should be employed in DSLs so that students can produce design-oriented answers to the problems they realize in these environments in cooperation with different disciplines in line with their competencies and skills (MoNE, 2021a).

The laboratory environment provides researchers with more opportunities and benefits (Koskinen, Zimmerman, Binder, Redstrom, & Wensveen, 2011). They can be used to generate alternative explanations, test hypotheses, make more detailed and accurate calculations and observations through the equipment in the laboratory, make more detailed documentation, and to be repeated in other laboratories. In many countries around the world, these design laboratories are structured in different contexts in industrial design schools. This shows that design laboratories will emerge as interdisciplinary research centers of the 21st century (Başkan & Curaoğlu, 2017).

In the 2023 Education Vision, separate design skill labs groups are defined in primary and secondary education to develop different skills and competencies of students. Primary Education Institutions have 10 workshops focused on science, art, sports, culture, and life skills. STEM and Software-Design Labs focus on science; Wood and Metal, Visual Arts and Music Labs focus on art; Drama and Critical Thinking Labs focus on culture; Nature and Animal Care and Life Skills labs focus on life skills; Outdoor and Indoor Sports labs focus on sports (MoNE, 2021b). Having different types of workshops in Primary Education institutions will provide opportunities for students in younger age groups to recognize their skills and interests, combine knowledge and skills from different disciplines, and experience and develop 21st-century skills.

In Secondary Education Institutions, there are labs focused on Science and Culture and Arts. STEM, Robotics, 3D Design, Electrical-Electronics and Software Labs are science-oriented workshops, while

Traditional Handicrafts, Cinema, Music, Painting and Woodworking labs are culture and art-oriented workshops (MoNE, 2021b). These labs take their spaces where students can engage in thinking, designing, and producing activities.

It is observed that some studies aim to determine the opinions of teachers, students, and school principals about DSLs when the literature is examined (Akıllı, Yıldız, Ateş & Ateş, 2020; Aşkar, 2021; Demir, Çaka, Şimşek, Kızıltepe & Özkurt, 2021; Ulutaş & Öztürk, 2021). However, there are a limited number of studies introducing a sample activity and explaining how teachers should prepare an activity that can be applied in DSLs (Orak & Çilek, 2020). In the study conducted by Güleş and Kılınç (2020) with primary schools' teachers, it was determined that teachers played intelligence and mind games and made origami in science labs. Yücel-Toy & Uçar (2022) proposed a model to develop an activity that can be used in DSLs to help teachers. This model consists of 7 stages: getting to know the student, determining the content, determining the objectives, deciding on the labs, planning the activity, implementing the activity and evaluation. There are no studies in which the proposed model of this research is applied and its effectiveness is evaluated. This study aims to prepare an activity that can be applied to DSLs in secondary education schools and to determine the views of pre-service chemistry teachers about DSLs. It was underlined that the activity was interdisciplinary and had been planned by considering the sample activities listed in the MoNE's Guidelines. In this context, a system that can be used in sustainable agriculture practices and irrigate according to the plant's needs will be designed. The lack of activities that can be applied in DSLs draws attention when the literature is examined. The activity will be a source for the needs of teachers and students regarding the use of DSLs. Thus, it is thought that the planned activity will be meaningful and valuable in terms of the related literature.

According to Güleş and Kılınç (2020), one of the problems encountered in DSLs is that teachers are not ready for DSLs, because curriculum updates have not yet been made in teacher training. Therefore, this research can help in the in-service training of teachers who will take part in DSLs and in the planning of pre-service teachers' training by revealing the differences between the activities carried out in traditional learning environments and DSLs.

In line with the above-mentioned purpose, the sub-problems of this research are:

1) What are the opinions of pre-service chemistry teachers about the difference between an activity applied in DSLs and the activities carried out in the laboratory?

2) What are the opinions of pre-service chemistry teachers about the possible contributions of an activity applied in DSLs to students?

METHOD

In this study, case study design, one of the qualitative research methods, was used. A case study is a method used to describe and analyze in detail an event, person, or situation in a natural environment and to interpret it holistically (Yıldırım & Şimşek, 2018). The study aims to examine the views of pre-service chemistry teachers who have experience in planning an activity that can be applied in design skills labs (DSLs) about the possible benefits of DSLs.

Participants

The study was carried out with a total of 6 participants, including 2 pre-service chemistry teachers who planned the activity and 4 pre-service chemistry teachers whose opinions were taken after the activity was presented. The participants were determined by the criterion sampling technique, which is one of the purposeful sampling methods. The preferred criterion in determining the participants is that they have the necessary knowledge to plan an activity that can be applied in DSLs. This study was conducted with pre-service chemistry teachers attending a state university in Ankara. The participants were selected from the senior year (4th year, 8th semester) students who completed the chemistry course in their curriculum and completed the majority of the chemistry education courses. The pre-service teachers received training on design skills labs in two different courses related to field education and examined the "Teacher's Guide" prepared by the Ministry of National Education (MoNE), which includes activities for DSLs.

Data Collection Tools

In the study, data were collected using two methods: (i) interviews and (ii) researcher observation notes.

Individual/Group Interviews

Individual and group interviews were conducted with the participants during the activity planning process and after the activity was presented to the 4 pre-service chemistry teachers. The participants met regularly for at least 40 minutes every week during the activity planning process, and the researcher mentored the participants during these interviews. Open-ended unstructured questions were asked to the participants during the interviews. However, considering the aims of the research, the questions were planned with a certain aim. Participants were asked to explain the difference between an activity implemented in DSLs and activities carried out in the chemistry laboratory and to discuss the possible contributions of an activity implemented in DSLs. The questions were asked directly or indirectly in each interview in a way that allowed the participants to express their opinions clearly. The interviews with the participants who planned the activity were conducted both individually and as a group interview, depending on the research process. All interviews were conducted online and recorded. These records were then analyzed.

Researcher Observation Notes

It was a document in which the researcher records the problems experienced by the pre-service teachers during the activity planning process, how they solved them and the benefits of an activity preparation process for DSLs for pre-service teachers. These notes were recorded by the researcher during weekly meetings with the participants and were subsequently analyzed and compiled for the purposes of the study.

Research Process

The study was conducted in three stages (Figure 1). In the first stage, participants conducted a comprehensive review of the "DSLs Teacher's Guidebook", which is currently the only literature available on activity preparation. The researcher, who is one of the authors of the Guidebook, provided guidance to the participants during the review process, explaining the fundamental principles of activity planning. Specifically, the planning model of the "Science Labs" activities, the titles in the activity plans, and the planning principles of the activity were elaborated upon.

In the second stage, participants planned an activity to be carried out in DSLs. The activities were intended to be interdisciplinary, bringing together students with different abilities through collaborative group work, be suitable for applying student-centered methods such as problem-based teaching and project-based teaching, and have features that enable students to use knowledge in the application process. Participants planned an activity that would address a problem within their own skills and interests. The activity aimed to highlight environmental literacy as a 21st-century theme and information, media, and technology skills to support the development of participants' 21st-century skills.

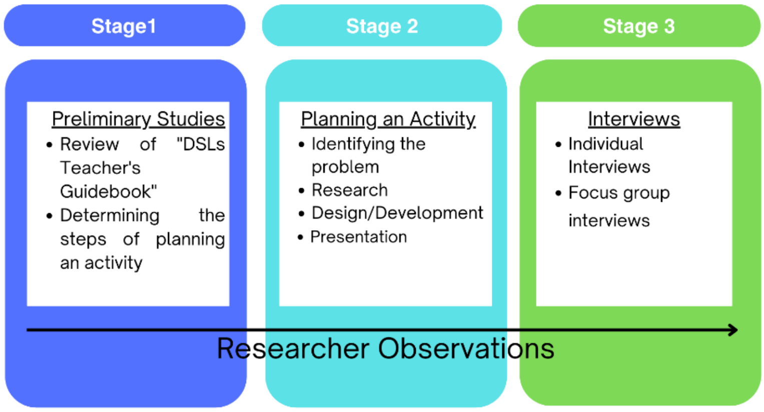

Figure 1. *Research Process*

The activity described in the paper was planned through a 4-step process, as illustrated in Figure 2. The first step involved problem identification, during which participants were instructed to select a problem that would be of interest to high school students, related to 21st-century themes and skills, and suitable for a solution through designing in DSLs conditions. The second step was dedicated to interdisciplinary research, which was necessary to solve the identified problem. Design and development constituted the third step, wherein participants were encouraged to produce a solution-oriented design by conducting design development processes. They were instructed to follow five steps in this stage, namely (i) analysis, (ii) design, (iii) prototype development, (iv) implementation, and (v) development. The last step was the presentation phase, where participants showcased their designs to their peers (i.e., pre-service teachers) and received feedback.

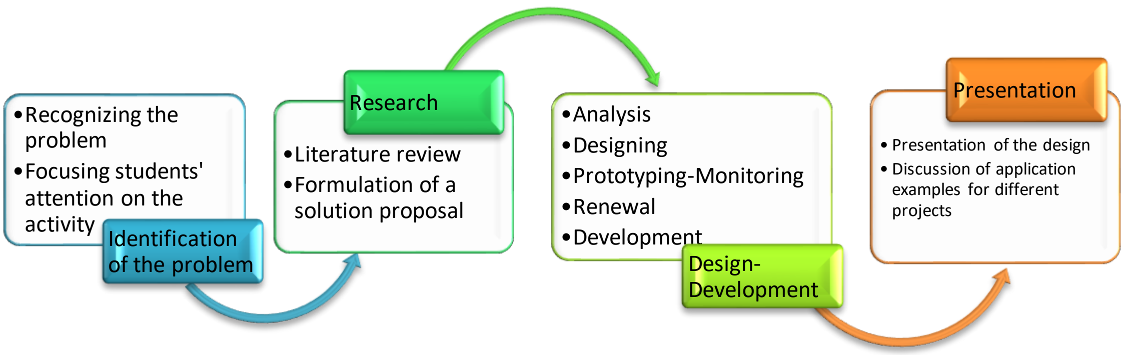

Figure 2. *Process of planning the activity*

The planned activity and its planning stages are described below.

1-Identification of the Problem

The first step was problem identification, with a focus on environmental literacy, one of the key themes of the 21st century. The activity aimed to raise awareness about sustainability, sustainable agricultural practices, recycling, and renewable energy sources. Participants were tasked with identifying a problem related to these themes.

Research problem: The environment we live in faces numerous challenges, including pollution and other ecological problems. By taking a moment to observe our surroundings, we can identify the sources of pollution and consider other environmental issues that may arise. One solution to address such issues is sustainable gardening, which involves using recycled materials and sustainable practices to beautify our surroundings. For instance, we can create a planter or garden using recycled materials such as old pots, cans, or even

pallets.

However, sustainable gardening requires proper planning and care, especially when we are away from home. To address this issue, we need to design a system that can water our plants automatically even when we are not around. This could involve installing a drip irrigation system or using a self-watering planter.

By exploring these topics and designing solutions, we can contribute to a healthier and more sustainable environment.

2-Research

The activities carried out in Design-Based Science Learning (DSL) labs are design-based research activities. At this stage, participants come up with different solution proposals within the framework of the identified problem and conduct research on them. In this activity, participants were expected to conduct research on environmental pollution, recycling, renewable energy sources, and coding. To raise awareness about sustainability and sustainable agricultural practices, recycled materials were used in the planting phase of the project and compost fertilizer was prepared. Thus, participants investigated the preparation stage of compost fertilizer and the differences and benefits of compost fertilizer from other types. This stage can be realized in STEM labs in DSLs, although it would be helpful to specify which specific labs this applies to.

3- Design-Development

In the design-development stage, participants researched the features that a design should have and analyzed design development processes. The specific processes identified were making compost fertilizer from waste garbage, making a flower bed for flower planting in the wood labs, and installing an automatic irrigation system. In the first stage, participants prepared compost fertilizer with materials from household organic waste (Photo 1a). Then, they made a flowerpot using recycled materials by cleaning and painting a waste plastic container and also prepared a bench using wood to hold the flower (Photo 1b). Ultimately, participants designed an irrigation system that activates automatically when the soil moisture declines using a moisture sensor.

Photo 1 a. *Preparing compost fertilizer with organic waste*

Photo 1 a. *Preparing a flowerpot and bench*

During the design phase, they made a drawing in the Tincercard program. They created their drawing as a prototype using Ardunio set (Photo 2). In the first prototype, the irrigation system was connected to electricity. The participants decided that this would be a disadvantage and developed the second prototype by stating that an irrigation system could be designed by adding a solar panel. This stage can be realized in 3D Design and Robotics Workshops in DSLs.

4- Presentation

At this stage, the participants presented the activity to their friends. They shared their experiences in the activity preparation process with their peers and received their opinions.

Photo 2. I*rrigation system with Arduino*

Data Analysis

In this study, data were collected through interviews with participants and researcher notes. Content analysis was used to analyze the interviews and notes, which involved classifying the data into themes to reveal their relationships (Yıldırım & Şimşek, 2018). The researcher analyzed the participants' statements through open and closed coding, content analysis, and constant comparative analysis. Themes and categories were created by using the codes that emerged from the participants' statements during content analysis. Additionally, an expert in science education also analyzed the data. The level of consensus on the coding was calculated using Miles and Huberman's (1994) formula, resulting in a reliability of 87.8%. Finally, the participants confirmed the agreed-upon codes, themes, and categories.

FINDINGS

Research findings 1) The difference between an activity performed in DSLs and activities performed in other teaching environments, 2) The possible contribution of an activity applied in DSLs to students was examined under the headings.

The Difference of DSLs from Other Teaching Environments

Participants were asked to identify the characteristics that an activity that can be implemented in DSLs should have as well as the differences between the activities currently being carried out in schools. The themes and categories that emerged from the analysis of their answers are given in Table 1.

Table 1. *Differences between DSL activities and laboratory activities*

	Student Role	Teacher Role	Learning Environment	Research Problem	Process
Positive aspect	Technology user	Technology user	Working in different spaces (labs)	A problem from everyday life	Interdisciplinary work
	Researcher	Be resourceful	Be fun		
	Entrepreneur	Can motivate			
	Designer	Leader			
	Creative/producer				
	Talented				
Negative aspects			Risky environment (Safety)	Difficulty relating to learning outcome	Long working time
					Violation of the examination system

The differences between an activity implemented in DSLs and an activity carried out in the laboratory were grouped under 5 categories: student and teacher roles, learning environment, problem, and process (Table 1). According to the category of differences in student roles, students in DSLs have the roles of researcher, entrepreneur, technology user, designer, creative and talented. One of the participants described his role in DSLs as follows: "In the laboratory, we plan experiments at most. In the laboratory, the purpose is clear, the materials are clear. Here, we made a design". The same participant emphasized entrepreneurial skills with the statement "I think I can market the product we designed very well".

Differences in teacher roles were grouped under the themes of resourceful, technology user (able to use technology), motivator and leader. The participants emphasized that "the teacher should be able to use different devices (such as Arduino sets) in these activities and should be able to code" and "there is even a 3D printer in DSLs. The teacher should know these and be able to use different programs", emphasizing the role of teachers as a technology user. Similarly, one of the participants stated that "the teacher's job is much more difficult. When the process is long, they need to motivate students well", emphasizing the theme of a motivator. Teachers should also be able to use many tools and devices. One of the participants explained the role of "resourceful" with the statement "The teacher should be resourceful and be able to use different tools".

Another difference between DSLs and laboratories is “learning environment”. Participants stated that DSLs are more fun but risky and consist of many workshops. Both participants stated that "There are different tools in DSLs. Students can cut their hands..." and "Chemistry or physics labs are also dangerous, but DSLs, especially wood workshops, can be risky for students... accidents can happen". Another difference is related to the structure of the research problem. The research problem used in DSLs should be related to daily life. One of the participants stated that "activities should be completely intertwined with life. It is sometimes difficult to relate the experiments conducted in the laboratory to life". Another difference is that it is difficult to relate the research problem to the outcome. One of the participants expressed his opinion as follows: "I don't know if the outcome is important in this activity.... We did not focus on the outcome here. We focused on the product, design, and process". The differences in the teaching process in DSLs are interdisciplinary work, long working time, and contradiction to the exam system. The participants expressed that the process took a long time with "it took a long time to create the product" and "we could do experiments in a short time, the process is long in DSLs". In addition, they also stated that the process was contrary to the exam system by using "it may be difficult to implement in schools. It is because of the exam. Students may not want to study. Instead, they solve tests".

Contribution of DSLs to Students

In the study, participants were asked to indicate the possible contribution of an activity applied in DSLs to students. The themes that emerged from the analysis of the answers are given in Table 2.

Table 2. Possible contributions of DSLs activities to students

Skill Acquisition	Personality Development	Learning	Socialization	Mental Development
Hand skills	Self-recognition	Use tools/devices	Ability to communicate	Analytical thinking
Entrepreneurship skills	Self-confidence	Concept learning	Collaborative work	Critical thinking
Engineering skills	Perseverance	Learning to code		Imagination
Ability to design	Taking responsibility	Problem- solving		Creativity

The possible contributions of the activities carried out in DSLs were grouped under 5 categories: skill acquisition, personality development, learning, socialization, and mental development (Table 2). According to the participants, DSLs provide students with the opportunity to acquire manual skills, entrepreneurship, engineering, and design skills. One of the participants stated that "students are very lucky in DSLs, they design, draw and combine like engineers. This is a chance.... there are many who want to be engineers" and expressed its contribution to engineering skills. The other participant stated that DSLs can contribute to the student's ability to design with the words "they will learn to design, they will become makers". Similarly, one of the participants expressed the idea that DSLs can support entrepreneurial skills with the words "Students can create products with high economic value, maybe they will start their own business".

According to the participants, DSLs can support students' development of self-knowledge, self-confidence, perseverance and taking responsibility behaviors. The participants stated that they can learn to persevere with the expressions " learns to persist in the face of challenges " and "learns not to run away from problems". In addition, the participants expressed their thoughts that DSLs provide students with the opportunity to get to know themselves with the statements "... it allows them to discover their interests..." and "DSLs are a great opportunity to discover their talents, students can get to know themselves...". According to the participants, DSLs provide opportunities for students to learn how to use tools/devices, learn concepts, learn to code, and learn problem-solving. All the participants emphasized that DSLs could support coding learning with the words "no other course allowed me to code... students will learn to code" and "... I learned to use the application. I learned to write code, every student will be able to learn these programs to a greater or lesser extent". One of the participants stated that DSLs will contribute to students learning how to use tools/devices with the words "There will even be a 3D printer in DSLs. They can learn to use it", while the other participant stated that "There are many different tools... especially in the wood workshop... they will be able to use them". Similarly, participants expressed that DSLs activities can support students' concept learning with the words "they can learn chemistry better... because they will apply it" and "they can learn many different subjects better about each other".

Another possible contribution of DSLs activities to students is that they create an environment for students to socialize. According to the participants, students will be able to work collaboratively and communicate effectively in these environments. One of the participants expressed this view as "they can learn to work collaboratively with their groupmates". Finally, DSL activities can support students' analytical and critical thinking, creativity, and imagination. One of the participants emphasized the theme of creativity with the words "You have to be creative to design ... it helps them develop their creativity". The same participant also emphasized the theme of creativity with the words "You use your imagination a lot. Imagination develops" and emphasized the theme of imagination.

DISCUSSION

The purpose of this study is to investigate the differences between the activities carried out in Design Skills Laboratories (DSLs) and other activities conducted in the school environment, particularly in chemistry labs, and to determine their potential contributions to students. Pre-service teachers who are familiar with DSLs were asked to plan and present an interdisciplinary activity to other pre-service teachers to achieve this goal. Based on the results of the study, it was found that the activities conducted in DSLs and traditional laboratories differ in terms of the teacher, student, learning environment, research problem, and process. The participants reported that DSLs promote differentiation in student roles, with students assuming more active roles as researchers, technology users, entrepreneurs, designers, and creators during workshops compared to other activities in schools. Examining these roles, it was found that students are expected to exhibit 21st-century skills in DSLs. These skills, also known as P21, are comprised of three skill groups: (i) learning and innovation skills, (ii) information, media, and technology skills, and (iii) life and career skills (Larson & Miller, 2011; Mishra & Kereluik, 2011; Partnership 21, 2009; Rotherham & Willingham, 2010). Among the differentiated student roles in DSLs, the "researcher" and "technology user" roles support the development of information, media, and technology skills; the "entrepreneur" role supports the development of life and career skills; and the "designer" and "creative/producer" roles support the development of learning and innovation skills. Research has shown that DSLs can contribute to the development of students' 21st-century skills (Aksoy & Saraçoğlu, 2021; Gündoğan & Can, 2020; MoNE, 2018).

Although many internal and external stakeholders such as students, teachers, parents, and school administration have an impact on the use of DSLs, teachers constitute the most important element for the effective use of DSLs (Gülhan, 2022). According to the participants, teachers should be able to use different tools and devices (resourceful), code, use different applications, and motivate and lead students throughout the process. These roles are generally different from the roles of teachers in environments where traditional teaching approaches are used. Gündoğan and Can (2020) emphasized that teacher roles need to change to increase the functionality of DSLs. Similarly, in a study investigating teacher competencies in DSLs, it was determined that teachers should have some instructional, social, and personal competencies (Demirata & Sadik, 2021). According to the study, teachers should be individuals who can use coding, robotics, and 2D and 3D design skills in learning environments. In addition, a teacher should be a model for his/her students, be able to guide them and work collaboratively. These findings are in line with the differentiated teacher roles in DSLs that we identified as a result of our research.

While there are only a limited number of studies on DSLs (Aksoy & Saraçoğlu, 2021; Gülhan, 2021), there are other studies that support the findings of this research. For instance, based on the participants' feedback, DSLs can be risky environments for students due to potential accidents that may occur. Participants' apprehension stems from the use of different tools and devices in the workshops. In a study conducted by Gündoğan and Can (2020), classroom teachers also expressed safety concerns. Similarly, Gülhan (2021) found in a study with school administrators, teachers, and students that the negative aspect of DSLs in all three participant groups is that "accidents may occur if adequate precautions are not taken." In the same study, teachers described DSLs as an environment that provides an opportunity for students to have fun because they are active and can design their own products. These environments may make students happier than traditional classrooms. Another distinguishing feature of DSLs from conventional learning environments is that activities in DSLs are not aligned with the examination system of the education and training process. As teacher-centered education is generally dominant in schools (K.Çoban, Yalçın-Çelik, & Kılıç, 2021), activities in DSLs, where students are active and use their manual skills, may worry parents in terms of academic success (Gündoğan & Can, 2020).

Another objective of this study was to determine the contribution of DSL activities to students. According to the participants, students who engage in activities in DSLs develop new skills, and their personality and mental development are supported. They also socialize and learn new things. The themes of communication, collaboration, critical thinking, and creativity in the socialization and mental development category are known as the 4C skills by Partnership 21 (2009). Students who possess these skills are expected to think critically when solving problems, propose solutions that include creativity and innovation, and communicate effectively with others to eliminate misunderstandings during collaborative work (Triana, Anggraito & Ridlo, 2020). In DSLs, students work collaboratively with their peers to solve problems or design a product. They can propose and critique different solutions to solve the problem, and they can create innovative and creative products during the design process. DSLs contribute to the development of students' 4C skills and prepare them for real-life challenges.

DSLs offer a variety of workshops, including music, drama, robotics/software, STEM, and outdoor and indoor sports, which enable students to explore their interests and talents while developing their manual skills and learning to use different tools and devices. Gülhan (2021) found that teachers, students, and parents in schools with DSLs believed that these environments help students get to know themselves. Additionally, Gündoğan and Can (2020) and Akıllı, Yıldız, Ateş, & Ateş (2020) have reported that DSLs support students' manual skills and personality development.

SUGGESTIONS

According to the findings of this research, compared to traditional learning environments such as classrooms or laboratories, DSLs are seen as spaces that prioritize student involvement in teaching activities, provide them with greater learning responsibility, and enable them to acquire diverse skills in the process. As the teaching activities change in these settings, so do the roles of teachers and students, leading to positive outcomes for students. DSLs offer an opportunity for students to develop 21st-century skills, which are considered essential skills for the future. Given the growing recognition of the role of student-centred teaching in fostering 4C skills (Prameswari & Lestariningrum, 2020; Triana, Anggraito & Ridlo, 2020; Weng, Cui, Ng, Jong & Chiu, 2022), the potential of DSLs to enhance these skills is significant. The results highlight the need for further research to investigate the effectiveness of DSLs using experimental designs. Specifically, it is recommended that future studies aim to examine changes in 21st-century skills among students at all levels of education.

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An inquiry and context-based activity supporting lifelong learning: Enzymes in Daily Life

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ABSTRACT

This research evaluated the effect of guided inquiry approach-based laboratory activity within the scope of lifelong learning, in which daily life context is used, on developing pre-service science teachers' learning processes. The study groups for the research consisted of six pre-service science teachers who were seniors in the science education department at a university in the west of Turkey. The holistic single-case design was used as the research method in this study. One of the topics related to enzymes we encounter in many areas of daily life is the concept of enzymatic browning. In this study, starting from a daily life context, an activity that includes the chemical change emphasis underlying the enzymatic browning event and the factors affecting the work of enzymes is discussed. In this context, the guided inquiry learning approach, in which the hypothetico-deductive reasoning cycle is used in laboratory practices in teacher education, is based on the activity. At the end of the activity, experiment reports, science journals, and concept maps were evaluated. As a result of the evaluation, it was seen that the students not only designed scientific research and tested their hypotheses consistently and accurately but also obtained subject gains related to enzymes and chemical change. Since it is understood that the activity supports lifelong learning in terms of both the skills developed and the ideas reflected by the pre-service teachers, using similar practices in teacher education can be recommended.

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INTRODUCTION

Due to the changing social, economic, and cultural conditions in the 21st century, the competencies expected of individuals are also changing. In this context, the individual can adapt to changing social needs, follow developments, and constantly improve himself. The concept of lifelong learning is essential in this context. Lifelong learning is "all purposeful learning activity undertaken on an ongoing basis to improve knowledge, skills, and competence" (Commission of the European Communities, 2000). Since lifelong learning focuses on continuous learning, problem-solving, and adaptation to social and physical environments, it is seen as the driving force behind development and transformation (Vargas, 2017). For this reason, Lifelong Learning has been the main emphasis of education policies in many countries (English & Carlsen, 2019, p. 207). According to Dolan (2012), these education policies include teacher education, and lifelong learning has become an essential element in teacher education.

We can say that a change in basic assumptions has taken place in our century, which includes the transition from teaching to learning, from there to learning by doing, and from there to lifelong learning. The expected outcome of this is to create a learning society (an information society). Lifelong learning, which includes all learning activities experienced, covers all formal, informal, and non-formal education. According to McLean (2022), lifelong education consists of four broad categories of activities: early childhood education, primary and secondary education, tertiary studies, and adult education. It is claimed that lifelong learning, which covers the whole spectrum of learning, including formal, informal, and non-formal learning, requires linking learning outcomes from different environments and contexts (Laal & Salamati, 2012). Similarly, according to Dinevski & Dinevski (2004), lifelong learning refers to all activities conducted throughout life to develop knowledge, skills, and competencies. These include all forms of learning: formal (courses and exams), non-formal (without exams), and informal (without courses or exams).

If lifelong learning is to be achieved realistically, the basic principles of lifelong learning must be adopted by both formal and non-formal education (Dolan, 2012). Integrating and contextualizing learning with everyday tasks should be flexible, and this flexibility should include learning anywhere and anytime, extending to the spatial and temporal dimensions (Friesen & Anderson, 2004). According to Aspin and Chapman (2000), who introduced the concept of lifelong learning for everyone, this process starts in preschool and continues with formal and non-formal education and beyond. It includes all formal and informal learning experiences at home, work, universities, and other educational, social, and cultural environments, institutions, and the community. It is a complex and multifaceted process that continues throughout life. As it is understood, one of the essential areas of this complex process is higher education. In this direction, from past to present, both in universities (Dinevski & Dinevski, 2004; Gelpi, 1991; Hernández-Encuentra & Sánchez-Carbonell, 2005; Longworth, 1997; Walters & Watters, 2001) and especially in teacher education (Beernaert, 1997; Dolan, 2012; Ordonez, 2005; Tatık & Ayçicek, 2022), studies have been conducted on the subject. Dolan (2012) suggests that teacher education programs should benefit from the theory and practice of lifelong learning.

Lifelong learning is essential for pre-service teachers' education programs (Finsterwald et al., 2013; Klug et al., 2014). In this context, pre-service teachers are expected to learn to be committed to lifelong learning and teach their students to learn independently (Siribanpitak, 2018). This perspective requires pre-service teachers to be committed to constructivism. Two aspects should be considered in the design of lifelong learning environments: (1) motivation toward education and (2) the ability to apply what has been learned successfully in concrete learning situations (Finsterwald et al., 2013; Weinstein & Hume, 1998). For this reason, inquiry and context-based activities are thought to effectively gain a perspective on lifelong learning.

Enzymes are specific biocatalysts in protein structure that coordinate the reactions in living organisms. They have the property of accelerating reactions much more than chemical catalysts (Alpat, 2017). Enzymes are vital to living organisms (Vartak et al., 2013). However, in science education, few studies have examined students' learning about enzymes (Bilen et al., 2016). According to the research of Sinan et al. (2006), which is one of these studies, university-level science students have important misconceptions about enzymes and the factors affecting enzymes. Some of the participating students stated that inhibitors are substances that accelerate the reaction. According to the authors, the reason for this misconception is that the concepts of catalyst and inhibitor are confused. The students in the study mentioned above show that they do not fully understand this concept by claiming that enzymes only work at the optimum temperature value and are not active outside of this value. There are other studies (Linenberger & Bretz, 2012; Selvi & Yakışan, 2004; Sinan et al., 2006) that examine students' understanding of enzymes and reveal that there are misconceptions.

One of the daily life-related issues related to enzymes is the concept of enzymatic browning. It is accepted that the browning/browning reactions that occur in raw fruits and vegetables due to abiotic stresses (such as excessive light, drought, or cold) are caused by the enzymatic oxidation of phenolic compounds (Adams & Brown, 2007). Similar darkening occurs in situations such as cutting fruits and vegetables for different purposes and peeling their skins, a situation we frequently encounter daily. The enzyme catechol oxidase mediates the enzymatic browning of fruits such as apples. Pyrocatechol is the substrate of the enzymatic reaction and is an antiseptic compound that it releases when it penetrates the outer layer of the fruit (Cole et al., 2020). When the enzyme interacts with pyrocatechol, the oxidation event, which we call browning, occurs in the fruit. As it is understood, when the apple is cut, the accumulation of phenolic compounds first occurs, followed by enzymatic oxidation and enzymatic browning with the change of tissue color. Sinan (2012) explains the production of dark-colored pigment molecules, which cause the familiar browning of vegetables, fruits, and mushrooms as they age or rot, through the enzyme polyphenol oxidase and states that it catalyzes a redox reaction in which various phenolic compounds are oxidized.

In the case of enzymatic browning, enzymes, the subject of biology, and chemical changes and reactions, which are the subject of chemistry, intersect. It is easy to present this intersection from different angles. We can show this when explaining the structure of enzymes in daily life contexts or describing the properties of chemical change. Enzymes are like chemical catalysts in a chemical reaction and are structures that help speed up biological/biochemical reactions inside and outside the cell (Gurung et al., 2013). Biochemical reactions are indicators of chemical change, one of the most critical issues for students to understand.

Regarding chemical reactions, students have the misconception that chemical reactions cannot occur unless there is an external intervention, such as heating (Ceylan & Geban, 2010). According to the study of Hesse and Anderson (1992), among the most common problems among students who cannot predict or explain mass changes in chemical reactions is the tendency to treat chemical changes, such as rusting, as physical changes in form or state. So, one of the ways to understand chemical reactions and relate them to daily life based on context lies in understanding the indicators of chemical change by observing them at the microscopic and macroscopic levels. A change in a substance's physical or chemical properties can cause a change in the wavelength of light that the atom, ion, or molecule absorbs at the molecular level and, as a result, change the substance’s color. In this context, when an effect is made on a substance, the color change determined by observation is based on a physical change in some cases and a chemical change in others (Ergül et al., 2020). It is essential to understand the subject of chemical change; even according to Hesse and Anderson (1992), chemistry is a science whose primary purpose is to describe and explain chemical changes.

The intersection of chemistry and biology is biochemistry. One of the principal areas of biochemistry is enzymology, which includes the structure, kinetics, and regulation of enzyme activity

(Sinan, 2012). We can establish a similar association between chemical reactions and enzymes because chemical reactions and transformations occur during enzymatic activity events. Enzymes are essential biomolecules for numerous life-sustaining chemical transformations (Gurung et al., 2013). Chemistry teaching is based on models representing basic molecular processes, structures, properties, interactions, behaviors, and physics that drive phenomenological chemical change (Bennie et al., 2019). One of the mentioned phenomenological chemical change events is the reaction in which enzymes take place. Therefore, there is a need to diversify the instructional experiences that will increase students' association with and understanding of the concepts in question and to use diverse ways to understand why the concept should be known, that is, to understand the essence of the context. One of the easiest ways to do this is to associate it with daily life. According to Demoranville et al. (2020), combining chemical concepts with real-world applications has increased retention, student attitudes, and performance. According to Slapničar et al. (2018), emphasizing that it is crucial to awaken students' interest in learning chemistry to prevent misconceptions in chemistry and revealing that students have misconceptions about many chemistry subjects, including chemical reactions, teachers can arouse students' interest by applying context and inquiry-based chemistry education. Besides this, it can be stated that daily life events are one of the most basic context examples and can be used in the questioning process.

One of the important aims of chemistry education is to enable students to apply and use scientific concepts to improve their understanding of daily life events and to explain events that occur in daily life (Kingir et al., 2013). As students form their views on concepts related to chemistry, they can be influenced by examples that have real-life counterparts. Many students in the study of Hesse and Anderson (1992) preferred explanations based on analogies associated with everyday events (for example, rust and rotting) rather than chemical theories. It is also known that persuasive information is usually obtained from objective observations and empirical experiences (Ergül et al., 2020). At this point, the easiest way to experience objective observations is through laboratories.

The laboratory is important because it allows students to learn science subjects and concepts directly related to daily life more effectively and meaningfully and provides real-life experiences (Bilen et al., 2016). The authors explained the laboratory this way. They examined the effectiveness of action research based on the predict-observe-explain technique in the science laboratory applications course on pre-service teachers' understanding of enzymes. As a result of the activities, it was concluded that the pre-service teachers had difficulties learning the subject of enzymes and had severeal misconceptions. Laboratories, which are effective in eliminating these misconceptions and embodying abstract topics such as 'enzymes' or 'chemical reactions,' are experimental classroom environments. According to Schmitz et al. (2022), the common feature of experimental classes is using real-world problems as starting points. This further contributes to reducing the abstractness of specific topics. One of the laboratory forms in which real-world problems are used as the starting point is the hypothetico-deductive reasoning cycle proposed by Lawson (2000), which begins with a causal question, continues with hypothetical propositions, and reaches conclusions through experimentation. In this cycle, a holistic approach is applied, and the analytical reasoning process is put to work. If a holistic approach to biological systems is not applied, according to Lazarowitz and Penso (1992), who state that the student may begin to assume that all information is on his or her own, determining the level of operational reasoning required for the student to assimilate and embed the concepts being taught is essential in terms of using new knowledge more analytically. In addition, according to the researchers, one of the most abstract concepts in the biology curriculum is enzyme activity. Therefore, it is crucial to realize the subject of enzymes in an effective research environment in which the hypothetico-deductive reasoning cycle is used. According to Vartak et al. (2013), who state that effective scientific research consists of three essential components, these components are: (1) applying concepts; (2) going through various processes such as observation, classification, correlation, and procedural understanding; and (3) applying skills. One of the best examples of an instructional environment where these essential components can be found together is the guided inquiry learning approach-based laboratory applications. The positive effect of the guided inquiry learning approach used in laboratory practices on student achievement has been demonstrated by many studies (Lazonder & Harmsen, 2016; Margunayasa et al., 2019).

Enzymes can affect our perspective, making sense of the events we encounter and experience in several parts of our daily lives. The related literature studies suggest using a context-based learning approach in teaching enzyme subjects (Demoranville et al., 2020) and the positive effects of a guided inquiry approach on student achievement (Lazonder & Harmsen, 2016; Margunayasa et al., 2019). For this reason, an activity was developed in this study to teach enzymes. In this context, the research question of this study is:

To examine the effect of a guided inquiry approach-based laboratory activity within the scope of lifelong learning using the context of daily life on the development of students' learning processes.

Theoretical Framework

The context-based learning approach is one of science education's most prominent ideologies, dating to the 1980s (Sevian et al., 2018). Bennett et al. (2007, p. 348) define the context-based learning approach as "the approach in which science contexts and practices adopted in science teaching are used as a starting point for the development of scientific ideas." Contexts, central to this approach, help students make sense of scientific concepts, laws, and principles (De Jong, 2006). The interaction expressed as "Why does this concept need to be known?" between context and science concepts (King, 2012, p. 3) is the essence of the context-based learning approach. It is stated that a realistic and compelling context is seen as a starting point for learning science and thus gives importance and meaning to the science content (Taconis et al., 2016). Daily life events, original scientific activities, or social dilemmas and debates are appropriate examples for contexts (Gilbert, 2006). In context-based learning environments, concepts are learned and derived from context. On the other hand, transfer to other contexts is usually organized in context-based learning environments by giving examples from other contexts and situations (Gilbert, 2006; Parchmann et al., 2006).

Context-based learning environments support students' understanding of their world by equipping them with scientific knowledge and skills that support a deeper understanding. One of the most critical features that context-based learning environments should have from an educational point of view is that they are organized from a constructivist perspective (Pesman & Ozdemir, 2012). This perspective considers a process in which learners construct meaning from their experiences rather than copying information from other sources (de Putter-Smits et al., 2013). For this reason, inquiry-based teaching methods, techniques, and strategies can be frequently used in designing context-based learning environments (Karsli et al., 2019; Ultay & Calık, 2012).

The National Science Education Standards published by the National Academy of Sciences in the United States define inquiry as a multidimensional activity at the center of science education. The same report states that these activities should be included in the science curriculum in relation to students' lives, organized around questioning, and in connection with other school subjects (NRC, 1996). As seen in Table 1, inquiry learning can be applied at four distinct levels, depending on the amount of guidance the teacher provides (Bell et al., 2005; Blanchard et al., 2010).

Table 1. *Levels of inquiry*

Levels	Source of the Research Questions	Source of Data Collection Methods	Source of Interpretation of Results
Level 0: Verification	Given by teacher	Given by teacher	Given by teacher
Level 1: Structured	Given by teacher	Given by teacher	Open to student
Level 2: Guided	Given by teacher	Open to student	Open to student
Level 3: Open	Open to student	Open to student	Open to student

In the zero-level verification inquiry, there is teacher guidance at all stages of an experiment (forming the research question, applying it, and interpreting the data). In the first level of structured inquiry, students are given a research question. Teacher guidance is provided while experimenting with which materials to use to solve this research question. The students then try to solve the problem by experimenting with themselves. In second-level guided inquiry, students are given only the research question. Students are responsible for formulating hypotheses from that research question, designing experiments to evaluate their hypotheses, and interpreting the experimental results. In the third level of open inquiry, students are expected to formulate their problems and design the entire process to reach a solution (Bell et al., 2005; Vroom et al., 2020). Although the level of guidance to be given to students is related to their age and cognitive development levels (Bell et al., 2005), it is seen that the effects of structured and guided inquiry learning activities on student success are more favorable than confirmatory inquiry activities in studies conducted in this area (Blanchard et al., 2010; Margunayasa et al., 2019). In addition, it is seen that the effects of structured and guided inquiry learning activities, in which students are provided with a certain level of guidance, are more favorable than open inquiry activities without any guidance (Alfieri et al., 2011; Lazonder & Harmsen, 2016; Minner et al., 2010; Yulanti et al., 2020). The social constructivism theory can explain this situation based on Vygotsky's work. According to the theory, appropriate guidance given by an expert is a way of constructing complex knowledge structures. More permanent, stronger structures can be built in the final product with suitable temporary structural supports, and at some point, no longer any support is needed (La Braca & Kalman, 2021). Based on these explanations, the study used guided inquiry at the second level, in which a certain amount of guidance was given to the students.

METHOD

Research Design

Based on the purpose of the research, the holistic single case design, which is one of the qualitative research designs, was chosen to examine the effect of the guided inquiry approach-based laboratory activity within the scope of lifelong learning, in which the daily life context is used, on the development of the learning processes of the students. Since a particular case and a single analysis unit were studied in the research, a holistic single-case design was adopted (Yin, 2018). In this research, we apply a guided inquiry approach based on laboratory activity in which daily life context is used. In this case, the change in the student's learning processes was examined in depth. The case study is a method that allows in-depth analysis by focusing on real-life-related phenomena, events, situations, and individuals (Creswell, 2003).

Participants

This research was conducted with 3rd-grade pre-service science teachers studying at a state university within the scope of the Science Teaching and Laboratory Practices course. This course aims to provide pre-service science teachers with the ability to design and implement experiments with simple and inexpensive materials on science subjects in the secondary school curriculum. In the activity designed with this aim in mind, the concept of chemical change, discussed at the secondary school level, was examined by associating it with the enzyme concept. Because the activity is held remotely through the Microsoft Teams Program, both for the course and the conditions of the Pandemic, an activity that can be done at home using simple and inexpensive materials has been developed. Four of the participants are girls, and two are boys. The academic achievement averages of the participants vary. Detailed information on these indicators can be seen in Table 2. In order to ensure the confidentiality of the names of the participants, their real names were kept confidential during the coding and reporting of the qualitative data. Participants were given codes from P1 to P6, each representing a participant.

Tablo 2. *Participant profile*

Student code	Gender	Academic achievement averages
S1	Boy	2.96
S2	Boy	2.86
S3	Girl	3.22
S4	Girl	3.37
S5	Girl	2.80
S6	Girl	2.80

Research Instruments

This study used experiment reports, science journals, and concept maps prepared by the students to evaluate the effect of the guided inquiry approach-based laboratory activity within the scope of lifelong learning, in which the daily life context was used to develop students' learning processes. In this context, data triangulation was made by using multiple measurement tools for the same purpose (Cohen et al., 2005), and the study was detailed.

Experiments Reports

One way to evaluate the effect of the applied activity on the development of students' learning processes is through the reports prepared before and after the experiment. Experiment reports, which can show the extent to which the student has mastered the conceptual and process knowledge contained in the experiment, are also expressed as a learning tool used for scientific communication and knowledge construction (Rijlaarsdam et al., 2006). The experiment reports in this study were designed by considering the steps of the hypothetico-deductive reasoning cycle that Lawson suggested being used in science lessons (Lawson, 1995).

Science Journals

One way to evaluate the effect of the applied activity on the development of students' learning processes is in science journals. Science journals provide information about students' learning competencies, experiences, and difficulties in teaching science concepts (Korkmaz, 2004). Science journals are effective reflective individual products that can give direct information about life. Considering the potential power of the science journals, they were used as a data collection tool in the study to understand and evaluate the student's learning processes. In this way, it was possible to evaluate the status of the learning processes related to the inquiry and context-based activity, which included an emphasis on the chemical change underlying the enzymatic browning event and the factors affecting the functioning of enzymes, from the science journals prepared by the students. Each of the students created a science journal for the activity. The students were given no limits, content information, word limits, or questions to create science journals, and it was left entirely to them.

Concept Maps

One of the ways to evaluate the effect of the applied activity on the development of students' learning processes is to evaluate the concept maps they have created. These graphical tools effectively show students' cognitive schemas about the related topic, concept, or process, how they construct the information about the topic in their minds, idea generation processes, and learning structures. It can be stated that concept map applications in science teaching provide students with an opportunity to organize and visualize the relationships between key concepts systematically and to reflect on the connections between the concepts they have learned (Novak & Cañas, 2006). Concept maps provide a picture of the mental structure of the related science subject, allowing students to make associations between concepts and create indicators for evaluating these associations (Author, 2021, p. 248). The students created a concept map in their pre- and post-experiment reports within the research process they started after they were given the problem scenario.

Process

In this section, information about the development and implementation processes of the activity is presented.

The development process for the activity

The study was carried out in the Science Teaching and Laboratory Practices course. The course in question is one of the mandatory courses in the Science Teaching Program in Turkey. In this context, the related course has been designed using laboratory practices based on a guided inquiry learning approach in which a hypothetico-deductive reasoning cycle is used. Within the scope of the course, 12 different activities were designed. Each activity takes two weeks to complete. Within the scope of this study, an activity designed to address the factors affecting the functioning of enzymes will be presented.

The completion of the color-changing fruits and vegetables activity covers two weeks. In the first week, a problem scenario taken from daily life regarding enzyme activities is presented. Students are asked to form their hypotheses regarding the solution to the problem in the scenario and to design an experiment to test one of these hypotheses. Four days after this stage, the students send the pre-experiment reports they prepared through the Microsoft Teams program to the course's instructor (also one of the authors of the research). The instructor gives students feedback through the same program. Students are asked to make the necessary corrections before the experiment. In the second week, the experiments designed to test the hypothesis are applied by the students. The students are expected to reach a result by comparing the predicted results with the observed results. After this stage, the lecture is concluded by interactively introducing the concept discussed by the instructor and associating it with daily life. After the lesson, the post-experiment reports prepared by the students are evaluated by the instructor, and the necessary feedback is given through the Microsoft Teams program. In the study, the hypothetico-deductive reasoning cycle was used to teach the lesson (Lawson, 1995, p. 115). This cycle is shown in Figure 1.

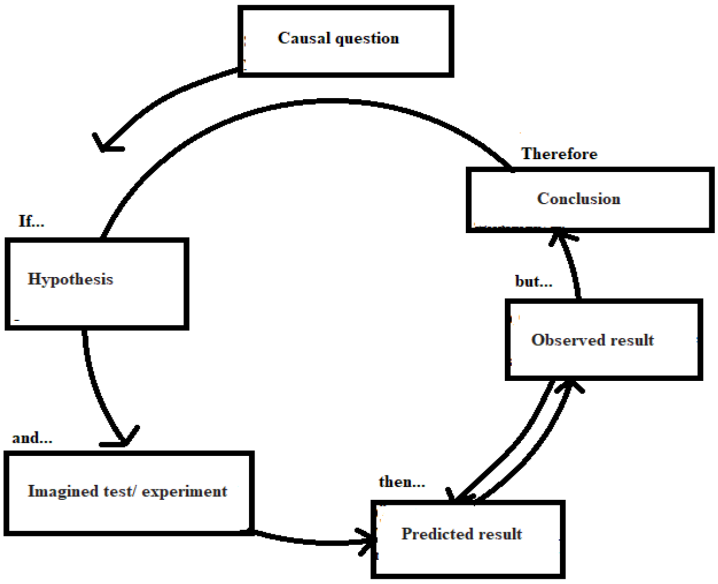

Figure 1. *Hypothetico-deductive reasoning cycle*

Note. From Science Teaching and The Development of Thinking (p.115), Lawson, A. E., 1995, Wadsworth/Thompson Learning

The implementation process of the activity

Phase 1: Scenario presentation and student opinions

At this stage, the instructor presented a problem scenario taken from daily life regarding enzyme activities. The visuals and scenario presented in the scenario are given below.

Figure 2. *The visual presented to the students in the scenario*

"Almost everyone, especially mothers, notices that some fruits and vegetables change color after they are peeled or cut. The darkening and color changes experienced after cutting fruits and vegetables are due to one of the enzymes, polyphenol oxidase. The enzyme in question, which can be called PPO in short, takes the oxygen in the air and provides a reaction with the chemical called tannin in the fruit or vegetable. This reaction creates browning. You are expected to identify hypotheses regarding the browning problem of cut fruits and vegetables and to solve this problem by testing these hypotheses."

At this stage, the students were asked their opinions about the causes of this problem. The examples of student opinions are given below:

Student 3:

"I've been thinking about things that might affect enzyme activation. For example, we can store apples in the freezer before they turn black. Drying the apples and removing their juice prevents them from darkening. Getting the tannin in apples out is impossible, so we have to think about oxygen contact and enzyme activation."

Phase 2: Preparation before the experiment

At this stage, the examples from the students' pre-experiment reports on the hypotheses proposed by the students regarding the solution to the problem, the experimental setups they designed to test these hypotheses, and the explanation of the predicted result of the experiment will be presented.

Student 4:

“My hypothesis(s) for this experiment are:

If the fruit is placed in water after cutting and its contact with air is prevented, it will not darken.

If lemon is applied to the cut part of the fruit, the contact of tannin and oxygen is prevented, and it does not turn black.

If we bake the fruits, the enzymes will be destroyed by heat, and the fruit will not darken.”

The hypothetico-deductive reasoning cycle I used in the experiment is below:

Causal question: How does the cut fruit not darken?

Hypothesis: If the fruit is placed in water after cutting and its contact with air is prevented, it will not darken.

Experiment: The fruit is divided into two. Half put in water; half left outside. The browning times of these apples are calculated.

Predicted result: Fruit placed in water does not darken."

Phase 3: Making a correlation between the predicted and actual results by testing the student hypotheses.

At this stage, there will be student explanations about the realization of the experiment they designed to test the hypotheses they propose regarding the solution to the problem and the correlation between the predicted result of the experiment and the actual result obtained because of the experiment.

Student 5:

Instructor: Can you explain the procedures you followed in this experiment?

“I sliced apples. I covered half of the apple with aluminum foil and left the other uncovered.

Instructor: Can you explain the dependent, independent, and control variables in this experiment?

“The independent variable(s) in this experiment: The contact of the apple with oxygen (whether there is foil on it)

Dependent variable(s) in this experiment: Darkening of the apple

Variable(s) controlled in this experiment: Apple variety, room temperature."

Instructor: Can you explain the situation you observed in this experiment?

The part of the apple that is in contact with oxygen (covered with aluminum foil) is slightly darkened. The other half is blackened. Oxygen caused the apple to darken. The experiment photo of the student is shown in Figure 3.

Figure 3. *Student 4 experiment photography*

Instructor: Can you explain the evidence supporting or refuting your hypothesis in this experiment?

“Oxygen exchange and late browning time of the cut apple supported my hypothesis.

Instructor: What is your conclusion from this experiment?

"The polyphenol oxidase enzyme found in apples reacts with oxygen and creates a reaction with a chemical called tannin. This reaction also causes a darkening. Enzymes cause chemical changes by lowering the activation energy. Browning of the apple can be prevented for a while by interrupting the oxygen exchange.

Instructor: In which situations can you use the result of this experiment in your daily life?

"After making the cake, pouring honey on the banana that I will use during the decoration process slows down the enzyme activity and makes the banana darker later. If I cover the apple, I cut in half to eat later with an oxygen-proof material, I can carry it with me for a longer time before it gets dark. Lemon slows down enzyme activity. By squeezing lemon on the quince, I can make the quince darken later. When choosing skin products to eliminate discoloration and color unevenness in my skin, I prefer those with vitamin C. Because vitamin C accelerates the production of collagen and elastin in the skin, helping to eliminate the color unevenness of the skin. "

Phase 4: Term introduction

At this stage, the students were first asked to summarize the results they obtained from their research so that they would explain and scientifically label the concepts they learned. Then, the properties of enzymes and the factors affecting the work of enzymes were discussed by the instructor, and the subject was reinforced with daily life examples related to the subject. However, at this stage, students were asked to design thought experiments and share them with the instructor to contribute to connecting the subject with daily life. A sample thought experiment prepared by the students is given below.

Student 4:

“While Zehra is eating quince and oranges in her room, her mother calls out and asks her to hang the laundry. So Zehra thinks about eating her fruits when she returns to her room. When Zehra returns to her room an hour later, she sees that the quince has darkened, but the orange remains the same. She thinks about the reason for this situation. What do you think is the reason for this?

My hypotheses:

While quince contains polyphenol oxidase enzyme, orange does not darken because there is no polyphenol oxidase enzyme in oranges.

Orange does not darken because it is colder.

Orange does not darken because it contains vitamin C.

The hypothetico-deductive reasoning cycle I used in the experiment is below:

Causal question: Why does the orange not darken while the quince turns black?

Hypothesis: Orange does not darken because it has vitamin C.

Experiment: The quince is divided into two. Orange juice is applied to half of it, and nothing is applied to the other half. Browning times of these quinces are observed.

Predicted result: The quince part with orange juice darkens later than the other part of the quince.

Observed result: The quince part with orange juice darkened later than the other.

Conclusion: Vitamin C affects the functioning of enzymes."

Data Analysis

The researchers prepared a scoring guide to evaluate the experiment reports prepared by the students before and after the experiment. While the first two of the themes of the scoring guide, which was created in parallel with the planning and managing steps of scientific research, were included in the pre-experiment reports of the students, the others included the sections in the post-experiment reports. The themes of the scoring guide consist of what the students did during the activity. When evaluated in terms of items, higher scores were given, especially to scientific process skills such as creating and performing the hypothetico-deductive reasoning cycle and making comments or transforming data into different forms. Another item group with a higher score is the items that associate the subject with daily life (presenting a daily life example and creating a thought experiment). The scoring guide developed for the color-changing fruit and vegetable activity is given in Table 3.

Table 3. *Experiment reports scoring guide*

Themes	Items	Item Scores
Problem statement	1. Student creates research problem(s) appropriate to the scenario	1
	2. Student proposes a reasonable hypothesis	2
Planning	3. The student creates a hypothetico-deductive reasoning cycle suitable for a hypothesis he/she chooses*	3
	4. The student supports the cycle created by theoretical research	1
Control of variables	5. Student defines a dependent variable(s)**	1
	6. Student defines an independent variable(s)**	1
	7. Student defines variable(s) under control**	1
Application	8. The student performs an experiment whose hypothesis can be reasonably tested and whose variables are appropriately controlled	3
	9. The student defines the steps of the experiment he/she performs with at least three steps	1
	10. The student shows the shape of the experimental setup by drawing, photographing, and similar ways	1
Presentation of evidence	11. Student explains the results of the observation	1
	12. Student explains the recorded data	1
	13. The student transforms her/his findings into tables, graphs, and similar forms.	2
Reflection	14. Student interprets experiment results	2
	15. Student compares hypothesis-outcome	1
	16. Student specifies the expression of achievement in terms of the subject area	1
	17. Student indicates possible experiment errors	1
Associating with daily life	18. The student presents examples that relate experimental results to daily life***	2
	19. The student designs a thought experiment based on daily life examples	2
	20. Student proposes a reasonable hypothesis for the thought experiment	1
	21. The student creates the hypothetico-deductive reasoning cycle by her/his hypothesis	3
Total point		32

*In item 3, the student is expected to create the cycle contextually and formally. If there are contextual deficiencies, it is evaluated as 1 point out of 3 points; if there are formal deficiencies, it is evaluated with 2 points out of 3 points.

**Variables were defined in items 5, 6, and 7, but no points were given if they were incorrect.

***In item 18, if the daily life example is not clear enough or only one example is used, 1 point is given.

Student journals were analyzed using descriptive analysis. Descriptive analysis makes complex situations understandable by drawing a picture of a situation or event (Punch, 2005). In the process, science journals were first evaluated in general, the probabilities of the themes were extracted, and evaluations were made. Later, the diaries were analyzed separately by the researchers; the codes were extracted and gathered under specific themes. The researchers determined both the agreed and the non-compromised codes by comparing the codes they created (regarding compatibility with the themes). Then, the final codes were decided by discussing the points of disagreement. The findings are presented in tables by quoting from student examples.

The concept maps of the students were evaluated using rubrics. The rubric comprises five sub-dimensions: 'proposition construction,' 'cross-link,' 'examples,' 'linking words or attachments,' and 'direction of link arrows.'These dimensions were created by considering the principles of concept maps consisting of propositions, cross-links as indicators of relational configurations, examples for associating the subject with daily life, and structural content principles. The success levels of the rubric were rated as 'limited performance,' 'recommended performance,' and 'successful performance.'The researchers first analyzed concept maps separately according to the rubric created. Afterward, the points of disagreement were discussed, and the final scoring was decided. The developed rubric is presented in Table 4, and the rubric evaluation results are presented in supplementary material 1.

Table 4. The rubric used in the evaluation of students' concept maps

Criteria	Achievement levels		
	limited performance (1)	**need to improve performance (2)**	**successful performance (3)**
Proposition	In the concept map, three or fewer propositions containing the subject's key concepts were created.	In the concept map, 4 or 5 propositions containing the subject's key concepts were created.	In the concept map, six or more propositions containing the subject's key concepts were created.
Cross-link	In the concept map, no cross-linkage was established between the different relational levels of the subject.	There is valid cross-linking between different associative levels of the subject in the concept map, but not significant (in terms of reflecting creative thinking).	In the concept map, there are both valid and important (reflecting creative thinking) cross-links between the different associative levels of the subject.
Examples	In the concept map, no examples were used for the subject's key concepts.	In the concept map, 1 example was used for the subject's key concepts.	More than 1 example was used for the subject's key concepts in the concept map.
Linking words or suffixes	The concept map does not use the link word and/or its suffixes.	The concept map has most link words and/or suffixes, but some are incorrect.	The concept map has all the linking words and/or suffixes and is correct.
The direction of connecting arrows	Most of the directions of the arrows in the concept map are wrong.	1-2 of the direction of the arrows in the concept map are wrong.	The direction of the arrows in the concept map is perfectly correct.

This study used different data sources to ensure credibility (internal validity). In addition, the credibility of the data, the consistency of the data obtained, and the way of using data collection tools in the evaluation process with the relevant literature were checked. According to Yıldırım and Şimşek (2013, p. 270), one of the methods recommended to ensure the transferability (external validity) of qualitative research is the detailed description of the study and analysis process. For this reason, to ensure external validity in the study, the activity development process, implementation process, implementation stages, characteristics of the research sample, research environment, data collection process, and data analysis are explained in detail. In addition, direct quotations from the communication with the students and the daily student discourses were frequently included during the implementation stages of the activity. In terms of ensuring reliability in the study, objective data was created by examining the consensus and disagreement of the researchers in the scoring of the student experiment reports, the analysis of the concept maps in line with the rubric, and the coding of the student journals.

Ethic

Ethical permission for the study was obtained from the Human Research Ethics Committee. (Letter dated 15.09.2020, numbered E.68899 and decision number 26437) In addition, the real names of the students were kept confidential in order to ensure the confidentiality of the students in the presentation of the qualitative data. Students were coded from P1 to P6.

FINDINGS

In this study, the scores obtained from the experiment reports used to evaluate the effect of the guided inquiry approach-based laboratory activity, in which the daily life context was used, on the development of the student's learning processes are given in Table 5.

Table 5. *The scores the students got in the context of the activity scoring guide items*

Themes	Items	Scores	S1 score	S2 score	S3 score	S4 score	S5 score	S6 score
Problem statement	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2
Planning	3	3	3	2	3	3	3	3
	4	1	1	0	1	1	1	1
Control of variables	5	1	1	0	1	1	1	1
	6	1	1	0	1	1	1	1
	7	1	1	0	1	1	1	1
Application	8	3	3	3	3	3	3	3
	9	1	1	1	1	1	1	1
	10	1	1	1	1	1	1	0
Presentation of evidence	11	1	1	1	1	1	1	1
	12	1	1	1	1	1	1	0
	13	2	2	2	2	2	2	0
Reflection	14	2	2	2	2	2	2	0
	15	1	1	1	1	1	1	1
	16	1	1	1	1	1	1	1
	17	1	1	0	1	0	1	1
Associating with daily life	18	2	2	1	2	2	2	2
	19	2	2	2	2	2	2	2
	20	1	1	1	1	1	1	1
	21	3	3	2	3	3	2	3
		Total score	32	24	32	31	31	26

In order to make more practical comments on the scoring guide for the activity in this research process, the scoring guide was divided into levels according to the score ranges, and level definitions were made. The value ranges of the scoring guide according to the levels are given in Table 6.

Table 6. *Value ranges of activity scoring guide by level*

Point range	Level	Level definitions	Indicator-Result
0-8	Level I	Performance with major shortcomings	Students could not test their hypotheses by designing scientific research.
9-16	Level II	Limited performance	The students tested their hypotheses by designing a scientific study, but their designs were contradictory.
17-24	Level III	Performance needing improvement	The students tested their hypotheses by designing scientific research, but there were some deficiencies in some design steps.
25-32	Level IV	Successful performance	Students designed scientific research and tested their hypotheses consistently and accurately.

As shown in Table 6, a student who participated in the research process of the color-changing fruits and vegetables activity scored between 0 and 8, indicating that he could not perform sufficiently in the research steps and had essential shortcomings. It is understood that the student at Level II can test his/her hypothesis in the learning process but show limited performance in the context of themes. It is seen that a student who scores at Level III can test his hypothesis appropriately in the context of the themes mentioned above. However, he has some deficiencies in some steps of the research design. The fourth level shows that the student has performed successfully and that their knowledge is at the desired level. One of the students in this study was at Level III; he tested his hypotheses by designing scientific research, but it was determined that he had some deficiencies in some steps of the experimental design. Other students took place in Level IV. For this reason, it can be said that the students are at the fourth level of the mentioned scoring guide. In other words, students designed scientific research and tested their hypotheses consistently and accurately.

The second way to evaluate the development of the student’s learning processes is to evaluate their science journals. The findings regarding evaluating students' science journals are given in Table 7.

Table 7. *Findings on the evaluation of students ' learning with science journals*

Theme	Code	Examples from Students' Science Journals
Thoughts on knowledge acquisition	Find out why fruits turn brown Learning how to prevent the darkening of fruits Learning that apples have polyphenol oxidase enzyme Learning the effect of enzymes on activation energy Learning that vitamin C (lemon juice) slows down the enzyme rate Learning that the enzyme and oxygen react with the chemical tannin in apples Learning that enzymes are affected by temperature Experimental learning ways to prevent darkening How to find out why apples turn black after cutting Learning how polyphenol oxidase enzyme reacts with oxygen Learning that vitamin C prevents the skin from losing water Learning that enzymes are everywhere in our lives Learning that honey prevents darkening by slowing enzyme activation Learning an observable chemical reaction Learn how fruit stays fresh in fruitcakes Understanding the reaction of enzymes with oxygen Learning ways to slow down the action of enzymes Understanding that apple browning is a scientific phenomenon Learning by observing the effect of enzymes on daily events Learning that serum used in skin care contain vitamin C	"In this week's lesson, I learned why fruits turn black and how we can prevent them from turning black. Now I know that I shouldn't leave out the fruits I cut. I knew it was getting dark, but I didn't know why or how." (#S6) "I learned that the polyphenol oxidase enzyme found in apples reacts with oxygen and creates a chemical reaction with the chemical tannin, which causes darkening. I learned the effect of enzymes on activation energy". (#S5). "The information I have learned is really information that I can use for the rest of my life because enzymes are everywhere, and learning and interpreting what happens in fruit was very productive. I learned information that I could use in my own life. (#S1)
Thoughts on the learning process	Finding it effective to repeat the experiment with multiple variables in the process Stating that you are doing research throughout the process Expressing that he/she applied the acquired knowledge by making a fruit cake Stating that she/he will create thought experiments with her/his students in her/his future professional life Finding useful/important what they learned in the process Stating that she/he will provide effective learning by using this experiment in her/his future professional life Appreciating what you learn in the process	"Thanks to the brainstorming we did in this week's lesson, I saw that I could reach more information when we examined this experiment in depth ."(#S3). "The experiment really got me thinking a lot because it was such that this experiment could be repeated with many variables, not just one." (#S1)
Attitude thoughts towards the lesson/experiment	Seeing the correctness of their hypotheses as a reward Seeing the lesson/experiment as fun Expressing that they have no difficulty in conducting experiments/research Finding it exciting to learn new things Describing the experiment as practical/easy Indicating that you like the problem scenario Finding it enjoyable to think about the experiment Indicating high-class participation	"It was good in terms of value because there was information that would be useful in our daily lives. I had no difficulty doing the experiments". (#S2) "I had no difficulties in this week's experiment; it was an easy and practical experiment." (#S6)

Thoughts on the method used	Understanding the relationship between experiment and hypothesis through the method used Thought experiments enable learning The idea that the method used facilitates the acquisition of knowledge Providing an in-depth review of the experiment Understanding the relationship between variables and hypothesis End-of-course discussions eliminating misconceptions about concepts Preparing a concept map encourages research	"I realized that I needed to design an experiment by my hypothesis with the method used. And while experimenting, I experimented wrongly that I had to choose my dependent and independent variables according to my hypothesis. I eliminated this problem by changing my hypothesis." (# S5)
Thoughts of associating with daily life	Inferencing that the cut fruits should not be left open Expressing that when you make a banana cake, you will drip honey on it to prevent browning Specifying that you will apply lemon on the fruits to slow down their darkening Noting that enzymes are present in many places in your daily life The statement that the experiment left a mark on his/her life Stating that she/he can use the knowledge she/he has learned throughout her/his life Indicating that you will put it in lemon juice to prevent the fruits from darkening	"We can apply lemon to prevent the fruits from darkening. We do this to prevent the enzyme from encountering oxygen. I can apply all this learning in my daily life." (#S4) "In terms of the mark it left on my life, I had the opportunity to observe the effect of cold on enzyme work." (# S2)

Analyzing the students' science journals, they were categorized as thoughts on gaining knowledge, thoughts on the learning process, thoughts on attitude towards the lesson/experiment, thoughts on the method used, and thoughts on associating with daily life. In the theme of thoughts on knowledge acquisition, the students' science journals include their thoughts on what they learned and understood and the enzyme-chemical reaction relationship. The students said they found what they learned during this activity valuable and important. They would like to use these and similar activities in their lessons in their future professional life. The student's thoughts about the learning process reflected in their science journals on this subject were included in the theme. At the same time, the students wrote sentences in their science journals indicating positive attitudes towards the science laboratory lesson where this activity was carried out and the experiments. They said they had fun, were not forced, and found it enjoyable. The diary entries were grouped as attitude thoughts towards the lesson/experiment. Another focus point mainly expressed in science journals is the hypothetico-deductive reasoning cycle based on the activities and scientific research steps, such as determining variables, forming hypotheses during the cycle's operation, and elements such as class discussions and concept maps. In this direction, the students' writings were thematized as thoughts on the method used. The last theme in evaluating students' science journals is their thoughts on associating with daily life. In their science journals, the students expressed their thoughts on how they would carry their gains from the activity into their lives and presented examples that we understand to create awareness.

The information showing the pre-experiment, post-experiment, and total scores because of the evaluation of the students' concept maps with rubrics is presented in Figure 4.

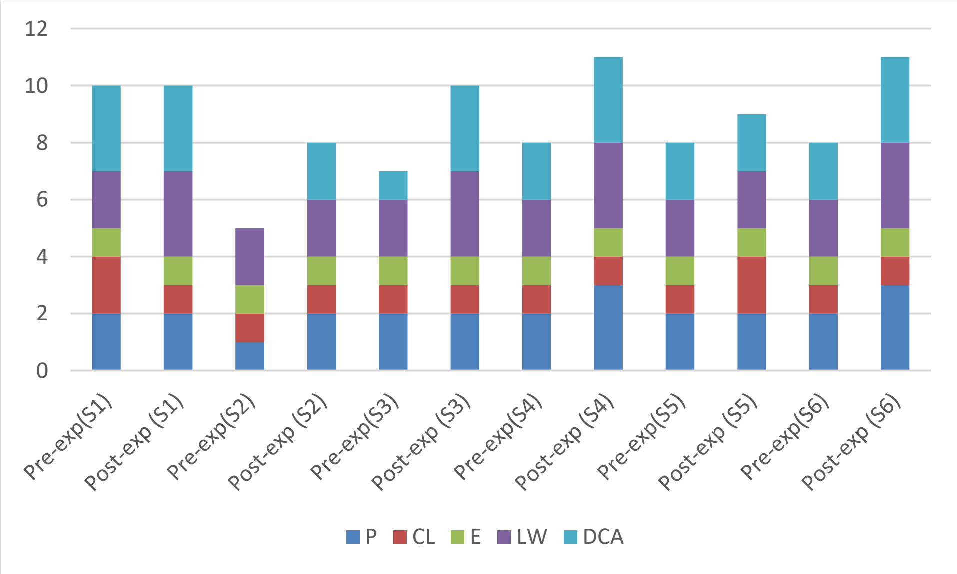

Figure 4. *Rubric evaluation results of students' concept maps*

As seen in Figure 5, the level of association in the students' concept maps increased compared to the pre-experiment. This shows that students' conceptual gains about enzymes have increased. When examined in more detail, it was understood that the students considered enzymes as one of the organic substances that catalyze the biochemical reaction in their concept maps. They made conceptual associations by emphasizing the factors affecting the work of enzymes. Among these factors, conceptual links have been established, especially on the effects of inhibitor and activator, pH value, temperature, amount of water, and the cause-and-effect component between enzymes. Students' concept maps reveal they have established correct connections between chemical and enzyme reactions. The students reflected on the inference that the color change in fruits could occur due to the reaction of the polyphenol oxidase enzyme with the oxygen and tannin chemicals in the form of propositions on their concept maps.

DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

In the 21st century, we all need to be lifelong learners (Laal & Salamati, 2012). Higher education policy documents worldwide are increasingly using lifelong learning as a philosophical and conceptual framework to define the role of education in narratives of global and national transformation (Walters & Watters, 2001). Teachers, trainers, researchers, and all employees in the education and training industry have a high priority in providing lifelong learning opportunities (Chapman et al., 2005). Pre-service teachers who will form future teachers are also included in this priority group, and learning opportunities that support lifelong learning should be offered to them. A variety of learning opportunities characterizes lifelong learning, and these opportunities are shaped by the needs and contexts defined by the learner (Friesen & Anderson, 2004). According to Tatık and Ayçiçek (2022), lifelong learning should be adopted as a principle to train individuals who can meet today's needs, who develop themselves, who know how to access information, who use the information, and who are open to development. For this reason, activities and opportunities should be carried out to increase the lifelong learning competencies of teacher candidates. In this context, it is aimed at supporting lifelong learning through research and context-based activities associated with daily life.

Enzymes are found in almost every aspect of life today. Enzymes are used in many areas, from textiles to food processing or pharmacy, to diagnose and treat various diseases. These biomolecules are utilized in effective and eco-friendly manufacturing processes, particularly in the industrial sector. Enzymes are used daily as one of the methods of making the recycling processes of artificially produced polymers, which we generally know as plastic, efficient and biodegradable (Sarıgul, 2018). Hence, comprehending enzymes, which play a significant role in our everyday lives, is a crucial matter concerning both specialized educational resources and fostering scientific awareness and lifelong learning. In this study, an inquiry and context-based activity were designed to model the factors affecting the work of enzymes, which are organic substances that catalyze many biochemical reactions. The design of the activity was based on a guided inquiry learning approach in which daily life contexts and hypothetico-deductive reasoning were used. In this activity, many causal and correlational relationships that may affect the work of enzymes were analyzed. In this way, it has contributed to understanding the problems encountered in daily life and the solution process. In this context, pre-service teachers' perspectives on lifelong learning would be thought to deepen.

In the study, data obtained from pre- and post-experiment reports, science journals, and concept maps prepared before and after the experiment were analyzed in order to evaluate student performances. In this context, firstly, the pre-and post-experiment reports were evaluated with the activity scoring guide, which was created in parallel with the planning and management steps of the scientific research. It was observed that most of the students designed scientific research and tested their hypotheses consistently and accurately. This result of the study is thought to affect the method applied. According to the results of the study by Tatık and Ayçiçek (2022), in which they investigated the program proposals of teacher candidates for lifelong learning, some of the personal qualities of students with lifelong learning skills are the ability to participate in learning, organize, and conduct research actively. Here, the outputs of inquiry and context-based learning activities, in which independent ideas are developed to provide knowledge and skills, intersect with the point of using the learning ability gained through inquiry for lifelong learning. Findings from student science journals support this prediction. Studies based on context-based learning and guided inquiry approaches revealed the positive effects of interventions on students' scientific inquiry and scientific process skills (Af'idayan et al., 2018; Koksal & Berberoglu, 2014; Ngozi, 2021). Unlike other studies, this study operated the activity through a hypothetico-deductive reasoning cycle. It is thought that this cycle (Lawson, 1995, p. 115), which is recommended to be used in lessons by Lawson, contributes to understanding the subject by providing a clear visualization of the process steps and a summary of the process. It is seen that this contribution of the hypothetico-deductive reasoning cycle is emphasized in the student science journals. One of the most striking findings in the data obtained from the student science journals is the positive attitude of the students towards the lesson and experiment. Students stated that they found the experiment enjoyable and exciting because they learned new things. This shows that the activity has a positive impact on student attitudes and motivations. Comparable results are seen in studies based on context-based learning and guided inquiry approaches (Kaya & Gul, 2021; Misbah et al., 2018; Parchmann et al., 2006).

According to the results of this study, only one of the students took part in Level III according to the activity scoring guide in inquiry and context-based practices; that is, they tested their hypotheses by designing scientific research, but it was determined that there were deficiencies in some steps of the experimental design. Other students took place in Level IV. In other words, students designed scientific research and tested their hypotheses consistently and accurately. At the beginning of the sections in which the students got the best scores from the rubric, the "association with daily life" section comes first. It is thought that this is related to the fact that the activity is a situation they encounter daily and the operation of the context-based inquiry process by giving them a problem scenario. It is stated that giving the students scenarios containing the problems they may encounter daily will effectively solve them by concretizing them, which is important in structuring knowledge and providing permanent learning (Celiker et al., 2014). Considering the context-based nature of the inquiry, the laboratory activity based on a guided inquiry learning approach using the hypothetical-deductive reasoning cycle produced significant outputs. In such a learning process, students gain experience by forming their hypotheses and planning the research process. At this point, they developed independent ideas under the guidance of teachers and gained self-confidence with their research. They took responsibility by gaining control over their learning through these experiences. Pre-service teachers can use the learning abilities they have gained in this way for lifelong learning. Carr et al. (2018) say formal, non-formal, and informal education should be integrated with lifelong learning by blending pedagogy and andragogy.

Students presented examples that relate the experiment's results to daily life and designed thought experiments based on these examples. As a result, the students carried out scientific research steps and exemplified what they learned by associating them with certain contexts. According to Herranen et al. (2019), inquiry-based teaching is not just following certain steps or doing research. It is also to explain, discuss, or defend the research results and relate them to the world around us. In this process, pre-service teachers are provided with daily life through questioning and reflection. Reflective practices in teacher education are essential in their contribution to developing critical inquiry skills and supporting lifelong learning. Such activities, which enable the development of teacher education practice and create opportunities for reflection, should be included in teacher education programs within the scope of lifelong learning (Dolan, 2012).

As a result of the analysis of the concept maps, it is seen that with the applied context-based activity, the students consider enzymes as one of the organic substances that catalyze the biochemical reaction, and they make conceptual associations by emphasizing the factors that affect the work of enzymes. At the same time, it is seen that students make the correct connections between chemical reactions and enzyme reactions. This study's result matches the relevant literature (Ceran-Aydin & Ates, 2019). The development of students' conceptual associations can be attributed to the activity-based teaching process. Similarly, Zhang (2018) stated that activities increase student learning and deeper and more permanent learning is achieved; Klahr et al. (2007), on the other hand, state that hands-on activities enrich students' knowledge by presenting the details of concepts, facts, and events thanks to one-to-one experiences; and Avinal (2019) states that students have the opportunity to better and more deeply understand the subjects as a result of the activities carried out in teaching practices. Students' progress at the conceptual level can be explained by their ability to model the factors that affect the functioning of enzymes. Students proved these models with thought experiments at the end of the research steps. In the thought experiments, students were asked to create a problem scenario using the information they learned and to design a thought experiment to solve the problem in this scenario. In the experiments, the hypothetico-deductive reasoning cycle was used. According to Lawson (2003), "If you do not reason hypothetically-deductively, you will not know what you have 'discovered," even if you have 'discovered' it!". As a result, this process shows that students discover the meanings of the concepts. This shows that the application contributes to the in-depth learning of the subject by applying the information learned by the students to a completely different context.

In the study, pre-service teachers revealed that they would like to use the gains they obtained from the inquiry and context-based practice activities in their classrooms when they become teachers. Regarding this, the students stated in their science journals that they wanted to do experiments like the enzymatic browning experiment with their students in their future careers; they thought that such experiments would provide effective learning, and they wanted to use thought experiments and found what they learned valuable. This is also an indication of their self-confidence. Breslin (2016) says that learning is for life within the scope of lifelong learning, and we should build the capacity and confidence of each student to continue learning autonomously and creatively. These thoughts also relate to students' professional beliefs, attitudes, and values. In this context, in this study, an evaluation of the attainment levels of these variables was not made. It is predicted that this situation, which can be expressed as one of the limitations of the research, can be realized with long-term and multidisciplinary collaborative studies. In this context, it can be said that more research is needed through professional development programs that can shed light on the subject.

The scope of teacher education programs can be a precursor for teacher candidates to gain motivation and perspective on lifelong learning. Dolan (2012) states that skills such as questioning, analyzing, researching, critical thinking, problem-solving, communicating with others, and learning using information and communication technologies are lifelong learning skills. In this context, it can be suggested to expand the use of inquiry and context-based activities in this study in teacher education to support lifelong learning. In addition, it was concluded that science journals are highly effective in obtaining the output of inquiry and context-based reflective practices compatible with teacher education pedagogy. For this reason, it is recommended to use science journals, which are effective reflective individual products and can give direct information about life, to see the results of purposeful learning activities carried out to develop knowledge, skills, and competence, which are also included in the definition of lifelong learning.

Due to the pandemic, group work could not be done in this activity, as it was done remotely through the Microsoft Teams Program. Although classroom discussions were held within the scope of the activity, it is considered important to repeat a similar practice in group work, considering that cooperative learning skills are one of the lifelong learning skills and the positive results of in-group discussions and cooperative work on learning outcomes.

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What is Decision Making? What Do Secondary School Students' Mental Images Say?

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ABSTRACT

This research was carried out to determine the mental images of secondary school students regarding decision making, which is one of the skills included in the social studies curriculum. In this study, which was carried out in accordance with the qualitative research method, the metaphors developed by the students for the concept of decision making were examined. The study group of the research consists of 288 students studying in the 7th and 8th grades in two public schools of Kırşehir in the fall semester of the 2022-2023 academic year, who were selected according to the convenient sampling method. Content analysis was used in the analysis and interpretation of the data obtained from the participants in the study. As a result of the research, it was seen that secondary school students generally perceive decision making as "forced decision making", "realistic and alternative decision making", "emotional and anxious decision making", "avoidant decision making", "instant decision making", "connected decision making" and "risky decision making".

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INTRODUCTION

In today's World, the economic, social and technological developments and the changes brought with them create diversity in the facts and situations that people will encounter. This range of diversity that people are faced with makes them hesitate about which fact and situation they will tend towards. The fact that people nowadays are more likely to encounter such a situation compared to previous generations and that they get in a bind, make them think in the face of situations where they have to make important decisions in various ways (human relations, family life, health, education and career) and make the decision that is the basis of the modern life (Crozier & Ranyard, 2002, p. 5).

Many definitions of decision making are known in daily life extending from what we will eat for breakfast, what clothes we want to wear during the day (Brynes, 1998; 2003), what technological device and what kind of car we will buy, how the colors in our rooms should be, and moreover, what kind of person we want to marry to how many children we want to have, which has an effect almost everywhere in our lives. The reason for the difference in definitions is that studies on decision making and its various aspects have been put forward by scientists working in different disciplines in terms of educational and social requirement (Öncül, 2013, p. 5). When examining the literature on decision making, which is known as a humanistic function (Zeleny, 2011), Drummond (2002, p. 35) mentions that making a decision is generally about making a choice, while Adair (2017) states that it is also about deciding on an action to be taken. Shahsavarani and Abadi (2015) define decision making as a process that has begun continued and express this running process as the chance to have something else at the expense of losing something/things in different environments. In addition, Baron (2004; 2008) considers decision making as a smaller activity within the thinking activity of human beings and considers it as an action that people do to reach their goal on what to do or what not to do. On the other hand, besides being seen as an important cognitive activity that ends with the selection of one of the different options (Summerfield & Koechlin, 2009), decision making is also known as a structure that informs and shapes the decision-making process, which includes rationality in a broad sense (O'Sullivan, 2011). it is also known as gathering the information needed about any subject, evaluating the positive and negative aspects of what may be alternative to the decision to be made based on these, and stating that additional information is necessary if needed (Presseisen, 1984). On the other hand, Gärling, Karlsson, Romanus, and Selart (2002, p. 167) expressed decision-making as the necessity of making choices from the way of action that has future consequences and orientation to the future in terms of the decision-maker. Considering the definitions above, it is seen how important decision making is in human life both at the time of decision and in the later process. Since the ability to choose the right one from the alternatives in order to be happy in one's life is at the center of the concept of making the right decision, there is a close relationship between making the right decision and the personal success of the individual (Byrnes, 2003).

When we look at the decision-making process of people in general, this process starts with the decision-maker's awareness of what needs to be decided. Then, the individual who is the decision maker determines his decision by choosing one of the available options regarding the decision and applies the choice by transforming it into his behavior (Ersever, 1996). It is known that this mentioned process is very important for individuals to be successful, healthy and responsible. Therefore, the more accurate and effective the decision taken by the individual, the easier it is for the individual to reach the desired goals. Because there is a close relationship between decision-making competence and personal success of individuals. Due to this relationship, individuals who step into life should be taught decision-making skills from an early age. It is known that the productive period in which this skill can be acquired by individuals, like almost any other skill that can be useful in their lives, is when they start to learn and go to school (Ersever, 1996; Gologlu, 2009). The adolescence process, which covers a certain period in this time period, covers an extremely critical time period in gaining decision-making skills by individuals. In this time period, the peer group has a strong influence on individuals' personal styles and forming habits (Mann, Harmon, & Power, 1989). Considering that individuals spend a lot of time which is difficult to be supervised with their peers during this period, the fact that decision-making skills of young people improve may prevent possible undesired decisions that may arise in this period (Byrnes, 2003).

It is known that decision-making skills can be gained with the help of teachers in the secondary school years, which coincide with the adolescence period. While doing this, teachers should make the skill a direct target and give students the opportunity to generate, evaluate and practice ideas regularly (Ruggiero, 2009). While doing this, teachers can benefit from social studies education, which is thought to be directly related to the reasons for decision-making, consequences, individual and social response (Presseisen, 1984). Because, according to Gelen (1999), social studies course will enable students to acquire knowledge rather than transferring information, raising active and productive individuals, which is a requirement of the democratic system, who can overcome the problems that they may encounter throughout their lives, who can look at facts from a different perspective and it is a course that supports them to become individuals equipped with character and values education and citizenship education (Akdaş, 2013; Torun, 2015).

In this context, the current study was carried out to determine the mental images of secondary school students in adolescence period regarding decision making, which is one of the skills included in the social studies curriculum. It is thought that the results obtained will be beneficial both in determining the mental images of the students in the critical secondary school period and developing their decision-making skills accordingly, as well as preparing and revising the information about the decision-making skills in the textbooks revealed in accordance with the social studies curriculum. With this thought, answers to the following questions were sought in the study:

1. What are the mental images that secondary school students develop about decision making?

2. Are there common categories of mental images that middle school students have developed about decision making?

METHOD

This study, which aims to determine the mental images of secondary school students regarding decision making, one of the skills included in the social studies curriculum, was carried out in accordance with the qualitative research paradigm.

Study Group

The study group of the research consists of 288 students (151 seventh grade students, 137 eighth grade students) studying in two public secondary schools located in the central district of Kırşehir province in the academic year of 2022-2023. These were chosen through convenient sampling. The suitability in determining the schools in which the study group is located can be explained by the fact that the first researcher is already working in these educational institutions and has worked there before. Appropriate sampling is defined as a preferred sampling selection method because it provides researchers with economic advantage in terms of speed, time and practicality (Yıldırım & Şimşek, 2006).

Data Collection Tool

The metaphor form used by various researchers (Ablak & Aksoy, 2018; 2021; Aydın, 2010; Güven & Güven, 2009; Saban, 2004; 2008; 2009) in their studies was used to determine the mental images of secondary school students regarding the meanings they attribute to decision making. In this form, besides personal information, decision making is ………. like. Because .... part is included.

Data Collection

The researchers went to the educational institutions they had previously determined and informed the school administration about the purpose of the study. Afterwards, the researchers entered the classrooms during the time periods deemed appropriate by the school administrations and informed both the teachers of the course and the secondary school students of the scope, purpose of the study and where the possible results would be used. Afterwards, the teachers of the course were reminded that they could stay in the classroom if they wanted to, and then the practice started. During the application, firstly a data collection form was distributed to the students. Afterwards, a short explanation was given to the students about the metaphor, examples of developing metaphors from different subjects were given without mentioning the concept of decision making (the Earth is like a watermelon because they are both round, the Sun is like an orange, because they are both yellow, etc.). After students were reminded that they should not forget the reason of why they developed the metaphor they developed as in the metaphors given examples for, and that they should not provide information such as name, surname and class number on the relevant forms. There was no evaluation criterion such as right or wrong in the created metaphors, and the metaphors to be formed can be anything such as animate-inanimate, positive-negative, concrete-abstract. Although there was no time limit in the application, data collection took an average of 20 minutes in each class. Then, after the researchers collected the data, they gave 5 minutes to ask questions about the application, However, since the participants did not ask any questions about the application, the researchers left the application environments.

Analysis and Interpretation of Data

Content analysis, which is frequently used in the research based on the qualitative paradigm, was used in the analysis of the data obtained. Content analysis is defined by Büyüköztürk, Kılıç-Çakmak, Akgün, Karadeniz, and Demirel (2010) as a technique that allows to study indirectly about various behaviors exhibited by individuals. In the study, the analysis and interpretation of the data was carried out in five stages, using Saban (2009) in addition to the content analysis. The forms obtained from the participants during the coding and sorting phase, which is the first stage of these stages, were numbered starting from 1. During application, among 288 students, the forms in which the reason for the metaphor was not explained, only its definition was included (Decision making is like a thought. Because…… [left blank by the student-S,138], Forms in which only the definition is included in the metaphor created for the concept of decision [Decision making is like a family. Because the family is the smallest element of the society-S,175]) and 98 forms that were left blank were not included in the analysis, and the remaining 190 forms (97 students from seventh grade, 93 students from eighth grade) formed the data set. In the second stage, the sample metaphor compilation stage, each metaphor produced by the participants was reviewed by using the "metaphor analysis" by Saban (2009) and "content analysis" by Yıldırım and Şimşek (2006) and the connection between the resembling ones was evaluated. As a result of this evaluation, metaphors consisting of weak structural images were removed. In the third stage, the category creation stage, the metaphors produced by the participants about decision making were categorized according to their justifications. In the validity and reliability phase, two researchers independently re-matched the connections between the metaphor and the category in order to determine whether the metaphors included in the conceptual categories reached as a result of the analysis could represent the relevant category. At this stage, as a result of the agreement of the two researchers, the conceptual categories of seven metaphors were changed. At the stage of transferring the data to the computer, which is the last stage, the findings section was created by calculating the metaphors divided into categories, reporting the exact quotations of the metaphor justifications, and with coding of the participants (*S103, S62*). While creating the findings part, the metaphors developed by the participants were presented modally with the help of the word cloud program.

Ethic

We think that the study is a study that can contribute to the field. We confirm that we act in accordance with scientific ethical principles and rules at all stages of the study. We also state that we refer to all data and information that were not obtained within the scope of the study and that these sources are included in the bibliography. In addition, we accept all the terms and conditions of the Publication Ethics Committee (COPE) and declare that we have not made any changes and that we comply with ethical duties and responsibilities.

FINDINGS

The mental images developed by the participants regarding decision making are presented in the word clouds below according to the frequency of repetition by the participants.

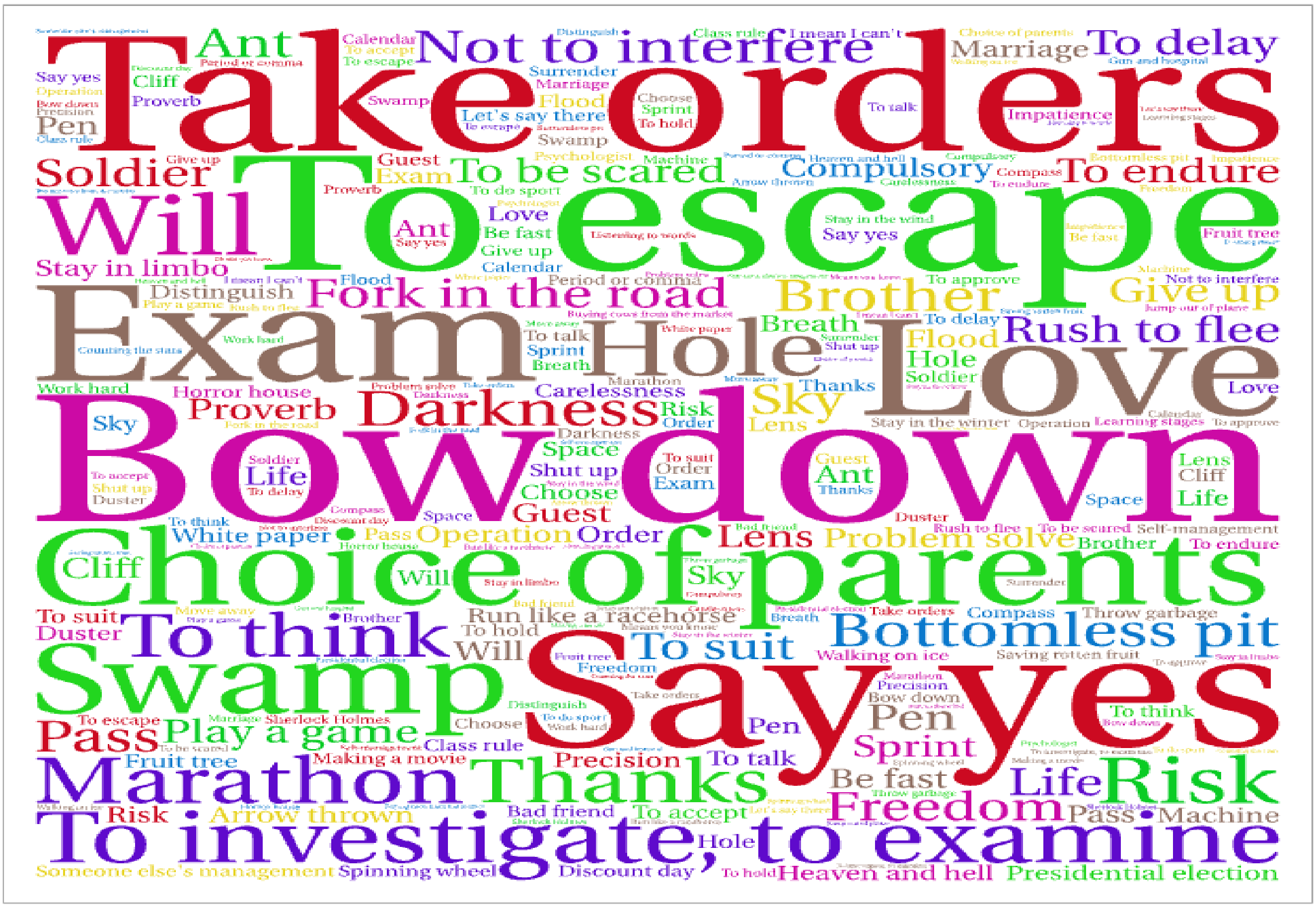

Figure 1. *Mental images developed by participants regarding decision making*

In the word cloud shown in figure 1 above, the metaphors created by the students participating in the research for decision making are shown by considering their frequencies. Accordingly, it is seen that the students participating in the research developed a total of 98 metaphors for decision-making. Among these developed metaphors, it was seen that the most frequent were “giving up the fight”, “taking orders” and “research-examination”. Apart from these metaphors, "escaping", "saying yes", "exam", "crossroads", "parent choice" are among the metaphors were developed. In addition to these, it was determined that each of the 66 metaphors were developed only by one student.

In Figure 2 below, metaphor categories created based on the metaphors developed by the participants for decision-making are shown.

Figure 2. *Metaphor categories created based on the metaphors developed by the participants about decision making*

In the word cloud given in figure 2 above, metaphor categories created based on the metaphors developed by the students participating in the research for decision making are seen. Accordingly, the conceptual categories developed by the participants regarding decision-making are grouped under seven titles in terms of their common characteristics. Here, each metaphor developed by the participants was grouped within the scope of the thought that constitutes the reason for the metaphor in line with the explanations made by the participants. In this context, it is the "forced decision making" category that contains the highest number of metaphors. This is followed by the categories of "realistic and alternative decision making", "emotional and anxious decision making", "avoidant decision making", "instant decision making", "connected decision making" and "risky decision making".

Forced decision making. When the figure above is examined, it is understood that the category of forced decision making is the category that contains the highest number of metaphors. When we look at the metaphors in this category, it is seen that the metaphors of "giving up the fight" and "taking orders" are the most common. When we look at the metaphors and justifications developed by the participants under this category; *"Decision making is like taking orders. Because you always say yes to what your family says in both." (S 143), "Decision making is like giving up the fight. Because both of them do what the elders say." (S 103), "Decision making is like a brother. Because both are none of your business. Your brother is older than you, you can't interfere, your family decides, and you can't interfere with that." (S 41), "Decision making is like a proverb.*

Because in both you listen to your elders. Nothing belongs to you." (S 82) and *"Decision making is like choosing parents. Because they both do what they say." (S 104)* is in the form.

Realistic and alternative decision making. When the above figure of the metaphor category is examined, it is understood that the category of realistic and alternative decision making is the second largest category in terms of number of metaphors. When the metaphors under this category were examined, it was seen that the metaphors of "research-examining" and "crossroads" took place more in the category. The metaphors developed by the participants and their reasons are: *"Decision making is like a crossroads. Because in both you choose one of the options and try to reach the right path." (S 117), "Decision making is like willpower. Because both make choices patiently and systematically." (S 62), "Decision making is like self-management. Because both are important in that whether you stop or move forward, that is, whether you make the decision or not." (S 13)* and *"Decision making is like a compass. Because both help to find the way." (S 87)* is in the form.

Emotional and anxious decision making. When Figure 2 is examined, it is seen that the category of emotional and anxious decision making is the third category in terms of containing the highest number of metaphors. When the metaphors in this category are examined, the most frequently used metaphors are "exam" and "love" metaphors. Considering the metaphor reasons of the participants who developed the metaphors under this category: "*Decision making is like an exam. Because both are ways with no return." (S 53). "Decision making is like a hole. Because both are bottomless, vast, dark places." (S 107). "Decision making is like throwing garbage. Because in the end of both, you'll be relieved." (S 57)* and *"Decision making is like love. Because in both of them, emotion outweighs." (S 14)* expressions were found to be similar.

Avoidant decision making: Looking at Figure 2 for this category, it is seen that the category of avoidant decision making is the fourth largest category in terms of incorporating the highest number of metaphors. When the frequencies of the metaphors in the category are examined, it is seen that the metaphors of "escape" and "thank you" are mostly used. When we look at the participants' reasons for the creation of the mentioned metaphors: *"Decision making is like procrastination. Because in both, you let things take their course." (S 89), "Decision making is like running away. Because you don't want a headache for either of them. It is best not to decide." (S 95), "It is like saying I can't make a decision. Because you can live comfortably in both" (S 98)* and *"Decision making is like being silent. Because if we don't get involved in both, nothing will happen." (S 146)* expressions are used.

Instant decision making. When the figure of the word cloud created for the metaphor categories is examined, it has been determined that the instant decision-making category is the fifth category that contains the highest number of metaphors. When we look at the metaphors in this category with a higher frequency, it is seen that the metaphor of "marathon" stands out the most. When we look at the reason for the development of this metaphor, it is as follows: *"Decision making is like hurrying up. Because in neither of you, want to miss the opportunity." (S 110). "Decision making is like impatience. Because both mean not stopping." (S 33), "Decision making is like a marathon. Because in both, the one who moves quickly will come out ahead." (S 140)* and *"Decision making is like a discount day. Because in both you have to act quickly." (S 122).*

Connected decision making. When we look at the word cloud of metaphor categories, it is seen that the connected decision-making category is the sixth category that contains the highest number of metaphors. When we look at the more repeated metaphors in this category, it is seen that the metaphors of "saying yes" and "obeying" are mostly repeated by the participants. When we look at the reasons for the development of these metaphors in the category, it is as follows: "*Decision making is like not getting involved. Because both of them burn your mouth. Let's not get involved and have headaches." (S 83), "Decision making is like obeying. Because in both, our elders decide. It works for us, we obey. It will be fine." (S 94), "Decision making is like obedience. Because in both, it is necessary to consult our elders." (S 85)* and *"Decision making is like the word of parents. Because it is them to make important decisions in both, it works for me." (S 131).*

Risky decision making. Considering the reasons of metaphor in the word cloud, it was determined that the category containing the least number of metaphors was risky decision making. Considering the frequency of the metaphors in this category, the most frequently used metaphor is the "risk" metaphor. When we look at the reasons for the creation of this metaphor by the participants, it is as follows: *"Decision making is like risk. Because they both have a winning and losing situation." (S 73), "Decision making is like a bad friend. Because both can lure you into bad behavior." (S 21)* and *"Decision making is like picking rotten fruit. Because you never know what will happen in either of them." (S 43)*.

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

In the results of this study, which was put forward to determine the mental images of secondary school students regarding decision making, it was found that the metaphors formed by the participants about decision making were generally grouped under the categories of "forced decision making", "realistic and alternative decision making", "emotional and anxious decision making", "avoidant decision making", "instant decision making", "connected decision making" and "risky decision making". Considering the literature of these emerging categories, it was found to be similar to the decision-making styles put forward by Scott and Bruce (1995). In their study, the authors classified decision-making styles in five different ways and defined these styles as rational, intuitive, dependent, avoidant, and spontaneous decision-making styles. In this context, it can be accepted that all categories emerging in the available study (except for forced decision making and risky decision making) overlap with the literature.

Considering the results of the research, it is seen that the forced decision-making category contains the highest number of metaphors. This situation can be considered as an indication that the majority of the participants are actually in a mood that makes decisions compulsorily and that they have to comply with the decisions taken against their will. Such expressions stated by the participants as: "Decision making is like enduring. Because in both you indispensably say yes to whatever your family asks for." (*S 12*) also support this situation. On the other hand, the students who participated in the study conducted by Yalın (2021), stated that they had difficulty in making decisions in their daily lives. While this situation overlaps with the results of the available study, it can be considered as a proof that decision making should not be seen as an easy behavior.

In the category of realistic and alternative decision making, which is another result of the research, it was determined that most of the participants of the research made their decision after researching the decision to be made and evaluating the alternatives of the decision. The participants who support this situation express their opinions as follows: "Decision making is like investigating. Because in both you have to be meticulous." (*S 34*) This situation coincides with the results of the study conducted by Öncül (2013), stating that the students benefit from their previous knowledge while making decisions, and that they benefit from their past experiences while determining positive or negative alternatives. On the other hand, while the fact that Anderson (2002) stated in his study that various facts are evaluated in making logical, that is, realistic decisions, and that in the study conducted by Yalın (2021), the participants stated that they thought, acted gradually and consulted the people around while making a decision are line with the results of the current study, it can also be considered as an indicator of the importance of research-examination in realistic and alternative decision making.

In the category of emotional decision making, which is another result of the study, the fact that some of the participants moved away from reality and decided in accordance with their feelings is understood by following expressions: "Decision making is like love. Because the emotion predominates in both of them" (*S 14*). This situation coincides with the research conducted by Öncül (2013), in which the participants stated that they tend towards the first option they encounter and that they decide by relying on their feelings. On the other hand, Johnson and Kruse (2012) stated in their research that individuals generally use their intuition in uncertain situations and think about what kind of results and reactions they will encounter. In fact, this is an indication that intuitions, senses and feelings are sought after when there is no way out for the thing to be decided, and thus the result that may emerge after the decision is expected.

On the other hand, some of the answers given by the participants are aimed at avoiding decision-making, such as avoiding the decision, not being included in the decision, postponing the decision. They consist of such metaphors as: “Decision making is like walking away. Because there is no headache in either of them.” (S 38). This situation coincides with Russell-Jones' (2000) articulation of avoidant decision making as a way of not taking responsibility because individuals generally have self-doubt and are reluctant to be held responsible for the consequences. In fact, making decisions in this way can lead to different reactions such as regret, anxiety or changing the previous decision as stated by Svenson and Hill (2002), and decision makers choose to relax for a short time by not taking responsibility.

It is understood from following similar expressions of participants who are considered to hasten and act without thinking while making decisions: “Decision making is like sprinting. Because the fastest in both wins.” (S 60), that some participants prefer to make instant decisions even a little; and that this can be considered as proof that this is due to the participants' lack of knowledge and their reluctance to explore alternatives. This situation is in parallel with the results of the research conducted by Öncül (2013). In his study, the researcher stated that students prefer to make reactive and hasty decisions instead of getting access to the information. In this context, the results of the present study are in line with the information presented by Eckel and Kezar (2006). He noted that the lack of information, the uncertainty of emergencies, the speed required in decision making and the large number of decisions can cause decision makers to rush.

It is understood from following similar metaphors of some participants in the study: “Decision making is like an ant. Because in both the universe is not that effective. They cannot live without getting help from others.” (S 48). that they constantly felt the support of others at the time of decision making and they could not implement the decision without support from anyone, that is, they were dependent decision makers. In the study conducted by Öncül (2013), it is seen that the students stated that they tend to act together with their friends at the time of decision and that they are influenced by their friends during the decision process. On the other hand, in the study conducted by Yalın (2021), it is stated that the participating students tend to ask the family at the time of decision. The results of these studies are consistent with the results of the present study.

Finally, the fact that some participants see the decisions they take as the risk of winning or losing or using the difficulty limits of a situation can be considered as evidence of their tendency to make risky decisions. This situation is also reflected to their following expressions: “Decision making is like risk. Because both have a winning and losing situation.” (S 73) This situation coincides with Kallet’s (2014) opinion on “decision criteria always involve risk" which is included in his study and with expressions of Fox and Poldrack’s (2009) studies that whether you are willing or not, when people are faced with risks at certain times in their lives, what will be the consequences of prior decisions can be left unresolved and thus decisions can be made.

Based on all these results, it has been determined that the mental images of secondary school students about decision making vary and this situation is similar to the information given in the literature and some previous studies. Based on these, the implementation of the necessary educational activities to improve the decision-making skills of the students should be applied, and such partners as family and people around who present arguments that can directly affect the students should also support this process. In the study, students' mental images of decision making were determined within the framework of the qualitative research paradigm. It may be recommended to carry out similar studies in different study groups and to conduct experimental studies to improve decision-making skills.

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The Relationship between Problematic Technology Use and Mental Health Problems in the COVID-19 Pandemic: A Meta-Analysis

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ABSTRACT

COVID-19 pandemic has had a negative impact on individuals both psychologically and socially. The current research shows that problematic technology use and mental health problems increased during the pandemic period. In this study, studies examining the relationship between problematic technology use and mental health problems in the COVID-19 pandemic were examined and a meta-analysis was conducted. The present meta-analysis focused on the problematic technology use (i.e., internet addiction, smartphone addiction, social media addiction, and game addiction) and mental health problems in the COVID-19 pandemic. Searches were conducted for relevant studies using the ProQuest, PubMed, Science Direct, Scopus, Web of Science, ERIC, and TR Dizin databases. A total of 56 studies met the inclusion criteria. A total of 53,047 participants were reached in these studies. Rosenthal's classic fail-safe N analysis reveals that the meta-analysis result is statistically significant (p=.000). Moreover, the fact that the Begg and Mazumdar rank correlation is not significant indicates the absence of publication bias (p=0.28). In addition, no missing studies were found in Duval and Tweedie's trim and fill analysis. The results demonstrated that problematic technology use was moderately positively correlated with mental health problems (r=0.33, n=53.047). In addition, the Q statistic (1833.059) examined to control heterogeneity shows that all variables are heterogeneous. The results of the I2 statistic (93.4%) show that a high level of heterogeneity has been achieved. This finding shows that problematic technology use was associated with various mental health problems during the pandemic period.

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INTRODUCTION

The COVID-19 pandemic, which emerged in Wuhan, China, affected the entire world in a short period of time. The current data show that there have been approximately 627 million confirmed cases and 6 million deaths due to COVID-19 (World Health Organization, 2022b). Especially during the first period of the pandemic, the lack of a preventive vaccine and information on treatment created fear and anxiety among individuals. Nations took numerous measures to reduce the rate of spread of the pandemic (BBC Turkish, 2020; World Health Organization, 2022a). The aim was to reduce the rate of spread of the virus with a number of implementations such as lockdowns, social distancing, mask wearing, and travel restrictions. Although these measures were successful in reducing the spread of the virus, they caused some problems related to individuals' psychological and social lives (Malesza & Kaczmarek, 2020). During this period, the decrease in individuals' social interactions and physical activities created problems such as spending more time with technological tools, loneliness, depression and stress (Akat & Karataş, 2020; Baltacı, Akbulut & Yılmaz, 2021).

During the COVID-19 pandemic, the amount of time individuals spent with technological tools increased significantly (King, Delfabbro, Billieux & Potenza, 2020; Statista, 2021). The increase in the time spent using technological tools may pose a risk in terms of problematic technology use (Block, 2008), because due to the increase in duration, control over technological tools can be lost and the use of these tools can have a negative impact on daily life (Caplan, 2010). Studies conducted in different countries reveal that during the pandemic period, the prevalence of problematic technology usage behaviors such as internet addiction, game addiction, and smartphone addiction increased (Duan et al., 2020). In a study conducted in China, it was reported that the symptoms of internet addiction and the length of time spent on the internet increased during the pandemic period (Sun et al., 2020). In another study, it was observed that during this period, the rate of internet use among children and adolescents increased and that approximately 36% of participants were problematic internet users (Dong, Yang, Lu, & Hao, 2020). In a study conducted with a Mexican sample, it was observed that 62.7% of participants were at risk of internet addiction (Priego-Parra et al., 2020). In addition to these, studies conducted with samples in Germany (Lemenager et al., 2021), the UK (Fernandes, Maia & Pontes, 2019), Turkey (Baltacı, Akbulut & Zafer, 2020), Indonesia (Siste et al., 2020), Taiwan (M. P. Lin, 2020), India (Prakash, Yadav & Singh, 2020), Spain (Gómez-Galán, Martínez-López, Lázaro-Pérez & Sarasola Sánchez-Serrano, 2020), and Italy (Panno, Carbone, Massullo, Farina & Imperatori, 2020) reported that problematic technology usage behaviors were common during the COVID-19 pandemic. The increase in the prevalence of problematic technology use negatively affected the psychological lives of individuals (Dong et al., 2020).

The decrease in social interaction during the pandemic period and the increase in the length of time spent with technological tools caused individuals to be more exposed to the psycho-social effects of the pandemic (Benke, Autenrieth, Asselmann & Pané-Farré, 2020). During this period, mental health experts stressed the importance of interaction with family members, performing physical activities, and engagement within the framework of social skills and hobbies in order to protect and strengthen psychological health, because due to the emergence of the pandemic, uncertainty about the future, catching the disease and deaths from the disease caused individuals to experience depression, anxiety and stress (Baltacı, Akbulut & Yılmaz, 2021; Chen et al., 2020; Jiang, 2020). In a longitudinal study conducted in Spain, it was observed that participants' levels of depression, anxiety and stress increased during the pandemic (Planchuelo-Gómez, Odriozola-González, Irurtia & de Luis-García, 2020). In another study in the UK revealing the prevalence of psychological symptoms before and during the pandemic, the prevalence of psychological symptoms increased from 18.9% to 27.3% (Pierce et al., 2020). These studies can reveal the negative effects of the pandemic on individuals' psychological health. Furthermore, the proliferation of problematic technology usage behaviors, which are a risk factor that can negatively affect mental health during the pandemic period, may cause individuals to further experience psychological symptoms such as depression, anxiety and stress (Dong et al., 2020; Priego-Parra et al., 2020). Studies have revealed that there are relationships between problematic technology use and psychological factors such as fear of COVID-19 (Elhai, Yang, McKay & Asmundson, 2020; Hashemi et al., 2020), depression (Dong et al., 2020), stress (Chen, Chen, O'Brien, Latner & Lin, 2020), sleep problems (Priego-Parra et al., 2020), symptoms on the SCL-90 checklist (Siste et al., 2020), neuroticism (M. P. Lin, 2020), and loneliness (Alheneidi, AlSumait, AlSumait & Smith, 2021).

If we can look at the relationship between problematic technology use and mental health problems in the COVID-19 pandemic, this can be of benefit to researchers and mental health professionals. Within this scope, studies examining the relationship between problematic technology use and mental health problems in the COVID-19 pandemic have been examined and a meta-analysis has been conducted. Although there are many studies examining the relationship between these two important variables, the lack of any research aimed at meta-analysis of these studies constitutes the strength and originality of this study.

METHOD

The study was carried out by following these steps: selection of the studies, coding of the data, preparation of the data for analysis, determination of the analysis model, and interpretation of the analysis results.

Selection of Studies

In meta-analysis studies, it is important to conduct the literature search process systematically in order to prevent publication bias (Berman & Parker, 2002). In the research, the selection criteria were determined for the selection of the studies, and the studies to be included in the meta-analysis were selected using the PRISMA protocol. In the research, the terms "internet addiction", "problematic internet use", smartphone addiction", "problematic smartphone use", "social media addiction", "problematic social media use", "game addiction" and "Instagram addiction" were used as the variables of problematic technology use. The terms "depression", "stress", "anxiety", and "psychological distress" were used as the variables of mental health problems. The literature search in the study was carried out in the ProQuest, PubMed, Science Direct, Scopus, Web of Science, ERIC, and TR Dizin databases. The following search string was used in the study: (("internet addiction" OR "problematic internet use" OR "smartphone addiction" OR "problematic smartphone use" OR "social media addiction" OR "problematic social media use" OR "game addiction" OR "Instagram addiction") AND (depression OR stress OR anxiety OR "psychological distress") AND (COVID-19 OR coronavirus)). Following the literature search, correlation studies examining the relationship between problematic technology use and mental health problems were selected. In addition, care was taken to ensure that the effect sizes were calculable in these studies. Only studies conducted in English and Turkish were included in the study. The final date of the search was 27 May 2022. After applying these criteria, 56 studies for inclusion in this meta-analysis yielded a total of 121 effect sizes (see Figure 1 for a flow diagram).

Coding of Data and Preparation of Data for Analysis

The 56 different studies to be examined within the scope of the research were coded and prepared for analysis. The coding process was performed with the study name, correlation coefficients and sample size variables. To ensure consistency in the coding process, the researchers held discussions between themselves.

Determination of Analysis Model and Interpretation of Analysis Results

Correlations were utilized to calculate the effect sizes for the relationship between problematic technology use and mental health problems during the COVID-19 pandemic. Within this scope, numerical data related to individual effect size values, the combined effect size value, and publication bias for all studies included in the analysis were calculated with Comprehensive Meta-Analysis (CMA) software. A random-effects model was used as the meta-analysis model in the study. Begg and Mazumdar rank correlation, Duval and Tweedie's trim and fill, and Rosenthal's classic fail-safe N tests were used to determine the presence or absence of publication bias in the studies (Borenstein, Hedges, Higgins & Rothstein, 2011). In addition, Cochran's Q statistic (1954) and I2 statistic analyses were used to control for heterogeneity. During the analysis process, the correlation values were converted to Fisher Z values and the analyses were performed on these values. In the process of evaluating the analysis findings, these were converted into correlation coefficients and interpretations were made on these values. In the interpretation of correlation coefficients, Cohen et al. (2007) used values and ranges. Accordingly, correlation coefficient effect sizes are interpreted as follows: between .00 and .10 = very small, between .10 and .30 = small, between .30 and .50 = medium, between .50 and .80 = large, and .80 and above = very large.

RESULTS

Scope of the Studies

A total of 121 effect size values were calculated from the 56 different studies included in the meta-analysis. A total of 53,047 participants were reached in these studies. The studies were conducted in 21 different countries: Bangladesh, Brazil, Canada, China, Egypt, Germany, Iran, Israel, Italy, Jordan, Lithuania, Malaysia, Pakistan, Poland, Saudi Arabia, Thailand, Tunisia, Turkey, the United Kingdom, the United Arab Emirates, and the United States. All of the studies employed appropriate statistical methods.

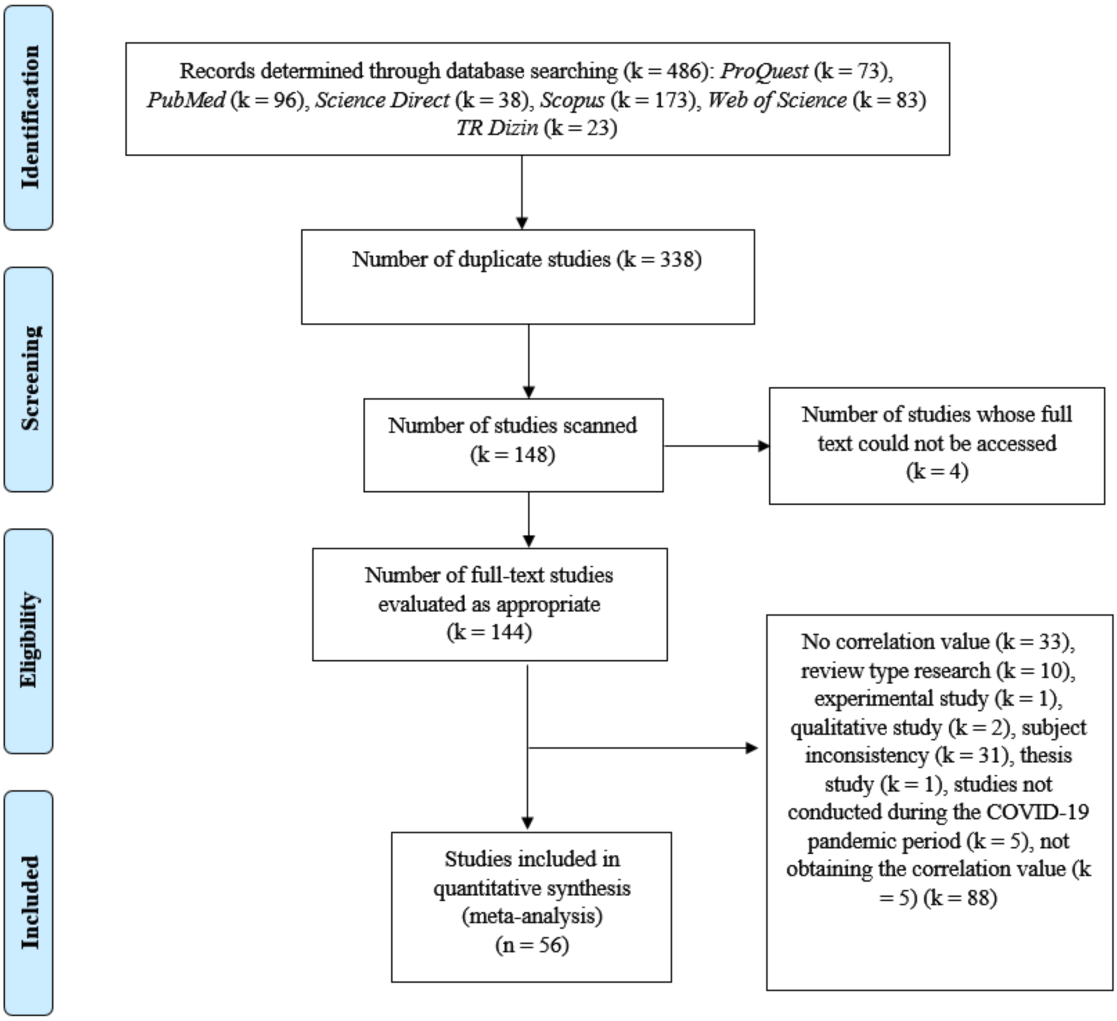

Figure 1. *PRISMA flow diagram of study selection*

Publication Bias

Following Rosenthal's classic fail-safe N, Begg and Mazumdar rank correlation, and Duval and Tweedie’s trim and fill analyses, which were performed to determine the presence or absence of publication bias in the studies, it was seen that there was no publication bias. Table 1 shows the results of the confidence tests performed to evaluate the existence of publication bias in the studies.

Table 1. *Results of confidence tests for analysis of publication bias*

Confidence Tests	Confidence Test Data	
Rosenthal’s classic fail-safe N	Z-value for observed studies	104.75425
	P-value for observed studies	0.00000
	Alpha	0.05000
	Tails	2.00000
	Z-value for alpha	1.95996
	Number of observed studies	121.00000
	Number of missing studies that would bring p-value > alpha	-5526.00000
Begg and Mazumdar rank correlation	Tau	-0.06643
	Z-value for tau	1.07982
	P-value (1-tailed)	0.14011
	P-value (2-tailed)	0.28022
Duval and Tweedie’s trim and fill	Studies trimmed	0
	Point estimate	0.33525
	Lower limit	0.31347
	Upper limit	0.35668
	Q value	1833.05891

Rosenthal’s classic fail-safe N analysis reveals that the meta-analysis result is statistically significant (p=.000). Moreover, the fact that the Begg and Mazumdar rank correlation is not significant indicates the absence of publication bias (p=0.28). In addition, no missing studies were found in Duval and Tweedie’s trim and fill analysis. These results show that there is no publication bias in the meta-analysis results.

In addition to these, clues about publication bias can be obtained with a funnel plot. In Figure 2, it can be seen that the individual effect sizes of the studies examined within the scope of the meta-analysis are mostly clustered inside the funnel and symmetrically. In addition, it can be seen that the overall effect size of the studies is clustered around the middle line. The funnel scatter plot shows that there is no publication bias related to the studies examined within the scope of the research. In sum, the results show that there is no publication bias.

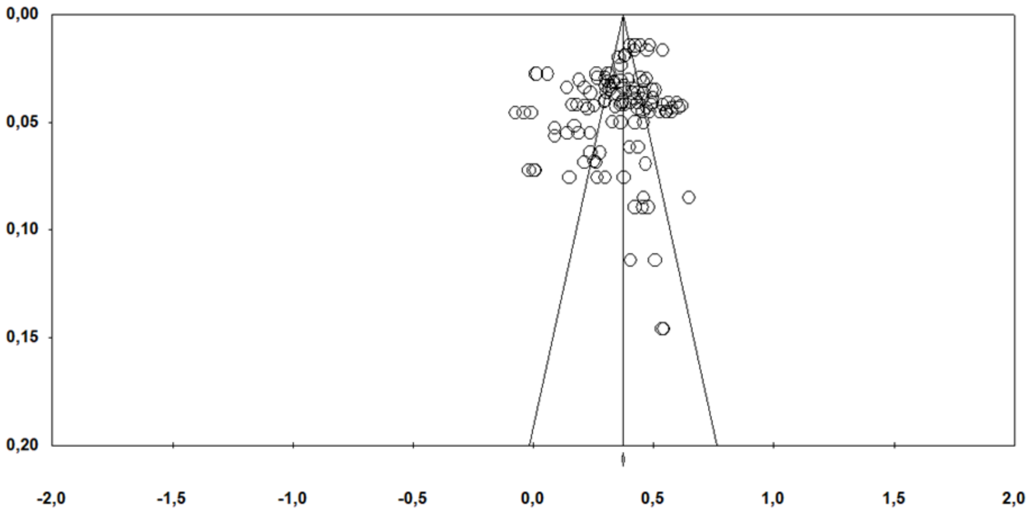

Figure 2. *Funnel plot*

Results of meta-analysis

The values in Table 2 were found in the meta-analysis performed to examine the relationship between problematic technology use and mental health problems in the COVID-19 pandemic. Table 2 shows the total number of independent correlation coefficients (k), total sample size (N), mean weighted effect size (r), and homogeneity statistics for relationships between problematic technology use and mental health problems.

Table 2. *Results of the meta-analysis for relationships between problematic technology use and mental health problems*

Variable	k	N	r	95% CI	Q	I^2 (%)
Mental health problems	121	53047	0.34	[0.32, 0.37]	1833.059	93.4

k: number of study outcome; N: total sample size; r: effect size; CI: confidence interval; Q: Cochran's homogeneity statistic; I^2: Measure of heterogeneity.

When Table 2 is examined, it can be seen that problematic technology use is moderately positively correlated with mental health problems (r=0.34). In addition, the Q statistic (1833.059) examined to control heterogeneity shows that all variables are heterogeneous. The results of the I^2 statistic (93.4%) show that a high level of heterogeneity has been achieved.

DISCUSSION

Together with the emergence of the COVID-19 pandemic, a great many studies have been conducted on the psychological and social impacts of the pandemic. In the literature, there are many studies examining the relationship between problematic technology use and mental health problems during this period (Arpaci et al., 2022; Bottesi et al., 2022; Chang et al., 2022; Hao, Jin, Huang, & Wu, 2022). In the current study, a meta-analysis of studies examining the relationships between problematic technology use (i.e., internet addiction, problematic internet use, smartphone addiction, problematic smartphone use, social media addiction, game addiction, and Instagram addiction) and mental health problems (i.e., depression, anxiety, stress, and psychological distress) during the pandemic period has been carried out. The research is among the first studies aiming to carry out a meta-analysis of the relationship between these two variables during the pandemic period. The study includes 56 different studies and 53,047 individuals.

In the study, it was found that problematic technology use (i.e., internet addiction, problematic internet use, smartphone addiction, problematic smartphone use, social media addiction, game addiction, and Instagram addiction) was moderately positively correlated with mental health problems (i.e., depression, anxiety, stress, and psychological distress) (r=0.33). This finding shows that there was a significant relationship between problematic technology usage behaviors and mental health problems during the COVID-19 pandemic. Studies conducted prior to the pandemic revealed positive and significant relationships of internet addiction, smartphone addiction and social media addiction with depression, anxiety and stress (Akın & Iskender, 2011; Y. J. Lin, Hsiao, Liu & Yen, 2019). In a meta-analysis study conducted by Ho et al. (2014), relationships between internet addiction and psychiatric comorbidity were examined. In their study, it was observed that mental health problems such as alcohol addiction, attention deficit and hyperactivity, depression and anxiety were associated with internet addiction. In a different meta-analysis study, a significant moderate positive relationship was found between internet addiction and depression and loneliness (Tokunaga, 2017). Together with the emergence of the pandemic, individuals' social interactions in their daily lives decreased and they began to spend more time with technological tools (Statista, 2021). This situation created a risk in terms of individuals' problematic technology usage behaviors (Duan et al., 2020). Negative psycho-social effects, both caused by the pandemic and resulting from problematic technology use, had a significant impact on individuals' psychological lives (Dong et al., 2020). Therefore, it can be said that there may be stronger relationships between problematic technology use and mental health problems in this period compared to the pre-pandemic period. The finding of a significant moderate positive relationship between problematic technology usage behaviors and mental health problems in our study supports the literature.

Conclusion

In the study, a significant moderate positive relationship was observed between problematic technology usage behaviors and mental health problems during the COVID-19 pandemic. The finding regarding the prevalence of problematic technology usage behaviors during the pandemic period and the fact that these behaviors have an important relationship with mental health problems can be of significant benefit to mental health professionals. It is important to implement intervention and prevention programs for individuals of all age groups in the post-pandemic period. Furthermore, by bringing together 56 studies examining the relationship between problematic technology use and mental health problems during the pandemic period and carrying out a meta-analysis, it is thought that the research can contribute to the literature and be of benefit to researchers.

Limitations, Implications, and Future Research

This study is unique in that it carries out a meta-analysis of studies examining the relationship between problematic technology use and mental health problems during the pandemic period. However, the study has some limitations. Firstly, only research articles published in English and Turkish were examined in this study. However, there may be different research articles or postgraduate theses other than those in English and Turkish, in which the relationship between the two variables is examined. Secondly, although the scanning process of the research was carried out from the university database, there may be some studies that could not be accessed in the relevant databases. Thirdly, incomplete data and selective reporting of results of studies in the analysis may have led to an overestimation of mean effect size. Fourthly, frequently studied variables of problematic technology usage behaviors and mental health problems were examined in the research. Therefore, it is recommended that other researchers focus on problematic technology usage behaviors and mental health problems that are not discussed in this study. Despite these limitations, this study provides important information on the relationship between problematic technology use and mental health problems during the COVID-19 pandemic. Considering that problematic technology use is associated with mental health problems, it can be said that it may be important to provide effective guidance and psychological counseling services aimed at preventing problematic.

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Zooming in the Timeline: Investigation of the Case of Pseudo-Archimedes by Preservice Teachers

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ABSTRACT

The study proposed an inquiry-based activity for an undergraduate History of Science (HOS) course. The activity aimed to promote collaboration, engagement, and motivation among students from various disciplines. The participants in this activity were 40 undergraduate students enrolled in different teaching programs at a private university. The course followed a timeline approach to teaching HOS, supplemented by weekly research questions and short activities. The specific focus of this activity was to investigate whether Archimedes designed a water clock. Students worked in groups to conduct research on the question and develop a group claim based on the evidence they collected. The course discussions resulting from this activity yielded comprehensive outcomes that contributed to the course's timeline, covering the transition from antiquity to the Middle Ages. These discussions touched upon various historical events, including the closing of the Platonic Academy, the birth of the House of Wisdom, cultural and geographical factors in the translation movement, and the concept of pseudepigrapha. Importantly, the study noted that many of these events between antiquity and the Middle Ages were not commonly mentioned in traditional HOS course books. By engaging in this activity, participants were able to zoom into the timeline and uncover fascinating historical events. The research, collaboration, and discussions brought about a sense of excitement among the students. This activity demonstrated that incorporating such an approach can enhance the narrative nature of HOS courses. The success of the activity depends on the time allocated and the content of the course, suggesting that it could be tailored to different contexts and course objectives.

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INTRODUCTION

Greater degree of understanding of science seems to me of importance for the welfare of the nation (Conant, 1947, p. 26).

The history of science is an academic discipline that explores the development and evolution of scientific knowledge and the scientific process. It involves researching and studying various aspects, including the origins of scientific facts, the contributions of scientists and their methodologies, the influence of society and the environment on scientific progress, and the interactions between science and other fields such as philosophy, religion, and the arts (Tekeli et al., 2012). The primary objective of studying the history of science is to shed light on the process of scientific development. It aims to provide insights into how scientific ideas and knowledge have evolved over time as well as the factors that have influenced their formation and dissemination. Engaging in the history of science as a research activity can serve multiple purposes. It can help motivate students to learn subjects that they may find challenging by presenting the historical context and narratives behind scientific concepts. Additionally, it can contribute to changing the public's perception of scientists by highlighting their contributions, methodologies, and the societal impact of their work. Studying the history of science can also encourage informed participation in discussions and decision-making processes regarding the application of technology and scientific advancements. Finally, it fosters an appreciation of science as an integral part of culture, emphasizing its interconnectedness with various disciplines and its role in shaping society. Overall, the history of science serves as a valuable tool for achieving educational, cultural, and societal goals by promoting a deeper understanding of the scientific enterprise and its significance in human history (Brush, 1989, p. 60).

Although the definition of history of science is related to many aspects of science education, it has become an important domain for every individual since it contributes to the development of the nature of science and attitudes towards science (Gallagher, 1991; Irwin, 2000; Krajsek & Vilhar, 2010; Lykknes & Wittje, 2012; Sonmez, 2008; Teixeira, Greca, & Freire, 2012), and eventually, scientific literacy (Abd-El-Khalick, 2005; Lederman, 1998; Lin & Chen, 2002; Turgut, 2007), which is a common aim for educational policies worldwide (Bybee, 1997). These intricate concepts can sometimes be seen in definitions of relatively new issues such as qualified individuals or 21st century skills, as the business world in this century has growing needs for individuals equipped with these skills more than ever (Roterham & Willingham, 2010; Wagner, 2008).

In the age of nanotechnology, quantum, or, according to some sources, the influence age, education cannot be separated from the needs of the world. However, there have been drawbacks in this relation, namely, curricular and pedagogical failings or beliefs that science subjects are too boring, which often result in the drifting away from science majors. In such a scenario, the history of science can help rectify the situation (Matthews, 1999). The history of science can either be taught per se or enrich other relevant disciplines with historical components through investigating historical cases and short stories (Clough, 2006; Rosell & Vilumara, 2010; Tasar, 2003). It can be taught at every level of education in the form of legends and anecdotes (Rosell & Vilumara, 2010). When teaching the history of science, the role of the teacher is crucial, yet most teachers have little or no instruction in the history of science (Brush, 1989, p. 60; Wang & Marsh, 2002).

In this study, a historical debate of interest, the case of pseudo-Archimedes, was chosen as a mediatory activity in order to advance from antiquity to the Middle Ages in an undergraduate history of science (HOS) course that was taught through a historical timeline approach. The activity was an in-class inquiry activity planned by the lecturer as it was suitable for the timeline approach, and it included several events from different time periods covering more than a thousand years.

The inquiry activity and the guided classroom discussion thereafter drew a high level of attention from the participants, resulting in them lasting longer than planned and revealing many issues related to the topic. Although the majority of these issues revealed were not in the course content, there were relevant, interesting, and significant results that are worth reporting in this article. In this respect, the outcomes of the class discussion activity were explained from a historical perspective with the necessary primary sources, which is thought to be useful for historians of science who teach non-history majors to create a more entertaining and attention-grabbing course atmosphere. The extracurricular historical information presented in this study can be used to extend the content of the traditional history of science courses by, indeed, zooming in on the timeline. The case of pseudo-Archimedes in the classroom discussion activity aimed to seek answers to the following research questions:

RQ1: How do preservice teachers gather information in order to support their claim regarding the question of whether Archimedes designed a water clock or not?

RQ2: What are the issues preservice teachers relate to the water clock of Archimedes in their discussion?

BACKGROUND

How to teach, what to teach, or how to support the student's learning in science education has always been a debated issue, resulting in many approaches that have been evolving since their first appearance (see Wavering, 1980). The path was bumpy, and there have been breakthroughs and retreats in the development process of science education.

The *post-Sputnik reaction* in the 1950s and 1960s, the *science for all* movement in the 1970s and 1980s, and *standards-based science education* reform in the 1990s were remarkable milestones in science education (Wang & Marsh, 2002). These initiatives unveiled the superiority of the constructivist theory against old-fashioned instruction and allowed science education to come together with a lot of benefits for every aspect of life (Martin, 2009, p. 196; Rosen & Salomon, 2007). Since then, practitioners no longer had to transfer their memorized knowledge but obtained the opportunity to create their own unique inquiry activities associated with daily life, individualize them for specific groups, and enrich them with certain skills, beliefs, awareness, and attitudes. Together, such a science educational philosophy was settled in educational reforms around the world as scientific literacy (Duschl, 1990, p. xi; Martin, 2009, p. 547). Scientific literacy, on the other hand, came with a sidekick in definition: scientifically literate individuals were expected to possess an understanding of scientific knowledge together with an understanding of the nature of science, which is one of the most commonly stated objectives of science education (Kimball, 1967). Lederman's (1985) research verified the process and reported that inquiry was a determinant factor in students' conceptions of the nature of science. Griffiths and Barman's (1995) research included more dramatic results, implying the necessity of the nature of science for a useful science education. In other words, scientific knowledge, the nature of science, and inquiry are mutually inclusive concepts. In a quick conclusion, it can be expected from free creative minds and imagination in an inquiry environment to be curious about the nature and the *story* of the research subject. In this respect, discovering the nature of science revived the earlier contextualist belief that science education should teach science by teaching it in its social, historical, philosophical, ethical, and technological contexts (Matthews, 1990). These concepts, together with the nature of science, are strongly related to each other and are mostly seen as a separate course covering all of these issues for non-history majors. They can be referred to under a more elderly and commonly used concept: the history of science.

It has already been mentioned that the history of science can be taught as a separate course or as an enrichment to other courses. Enrichment in a policy-based manner is mostly seen in K–12 grades' curricula. On the other hand, a separate type of such a course at the university level is usually encountered as *the history and nature of science* (HNS), *the history, philosophy, and nature of science* (HPNS), or simply the *history of science* (HOS). The inquiry activity subject to this study was carried out in a selective course named HOS.

As Matthews (1990) reported, the discussion of integrating the history of science into science education has a long history that dates back to 1855, beginning with some individual efforts in Britain. The discussion was heated, particularly in the mid-twentieth century (Duschl, 1990, p. 35; Teixeira, Greca, & Freire, 2012). It was shortly before the space race when James Conant (1947) declared the call for a union of forces to create a nationwide understanding of science with the aid of the history of science. While the social and academic discussions on understanding science were going on, Russia's victory in the first round of space exploration with the Sputnik-1 satellite supported Conant's claims. His book, *On Understanding Science* (Conant, 1947), was a strong hypothetical leap forward that would soon be realized and seriously reflected in the educational reforms.

The initial idea was pretty simple and similar to today's views: understanding science through understanding the nature of scientific endeavor (Matthews, 1990). Although there are benefits to supporting science education with the history of science, it should not be forgotten that science education is built upon a lot of components that have to work all together to create scientific literacy, which is briefly developing knowledge of subject matter and concepts, manipulative skills, logical structures, creative problem solving, scientific processes, and the nature of science (Wavering, 1980). Yet, with the support of the history of science, students can understand what science is about and how it is conducted, learn key skills such as the ability to read and interpret primary sources, which science curricula might not include, develop certain argumentation skills, learn about their disciplines' past and the original life story, and learn about the manner of work of major players in their fields (Gooday et al., 2008). The history of science can provide meaningful perspective about scientific concepts, processes, context, and culture (Wang & Marsh, 2002). It can show how science changes over time by explaining the dynamic and organic progress of science, which is very difficult to practice through inadequate textbooks. These benefits can contribute to the students' professional identity more effectively than their standard textbook and laboratory routines (Gooday et al., 2008).

Similar to scientific literacy, HPNS-related aims secured their positions in educational policies and curricula a long time ago. National Science Education Standards (NSES) by the National Research Council (NRC, 1996) aim to develop the tentativeness and empirical nature of science through inquiry; the national curriculum in England: science programs of study (NCE, 2013) aims to develop understanding of the nature, processes, and methods of science through inquiry; the Australian science curriculum is based upon developing understanding of how science works through inquiry (ACARA, 2022). These are just a few examples from three different continents of the world; however, the emphasis on scientific inquiry is remarkable. Accordingly, this study was produced from a scientific inquiry as well, relying on the question of whether Archimedes designed a water clock or not.

There are also misuses of history as well as science itself (as pseudoscience; see Martin, 2009, p. 46) arising from political agendas or anti-science views due to many factors, such as hyper-religiosity. Nevertheless, the collaboration of history of science and science education and ensuring efficient historical thinking about science can overcome such misuses (Gooday et al., 2008). Essentially, it is a reasonable aspiration to expect that a proper science education producing perfect scientific literacy will be highly resistant against such attacks on science. For this reason, the first research question in this study briefly investigates the sources that preservice teachers use in their scientific inquiry in terms of credibility and authenticity.

What is the Case of Pseudo-Archimedes?

The case of pseudo-Archimedes is about false attribution to Archimedes, which is believed to have originated from a translation error in the Golden Age of Islam. Translation was an important way of transferring knowledge in the 9th-century Muslim world. At the beginning of the century, classical works from Greece, Persia, and India began to appear in Arabic. While western knowledge was rapidly being internalized by Muslim scholars, translations continued, not in the way of today's translators. There is much evidence that Muslims were not just translating old manuscripts but were interpolating, which was a way of interpreting. Some interpretations misguided subsequent Muslim scholars as well as their modern-day colleagues, even Leonardo and Copernicus. The case of pseudo-Archimedes starts with the works of Muslim scholars such as Ridwan and al-Jazari, where they attributed two water clock designs to Archimedes depending on a treatise. Up until today, no proof has been found that Archimedes worked on a water clock.

METHOD

In this study, qualitative methods were used to compile the data. The participants were 40 undergraduate students who were registered for an elective history of science course (HOS) from teaching programs in the faculty of education at a private university in Turkey. There were 19 preservice teachers from the English language teaching department, 11 from primary school education, 8 from early childhood education, and 2 from psychological counseling and guidance who participated in the activity. Participants had already been working collaboratively in groups of five since the beginning of the course. In other words, members in each group were familiar with each other, and they were used to communicating and working together. There were 8 groups labeled with numbers 1 to 8, and each group included at least two participants from the English language teaching department since the participants from other departments have lesser proficiency in English. In this way, groups were balanced in terms of comprehending primary sources, which were in English.

The Procedure

The historical content of the HOS course was taught through a timeline approach supported with weekly research questions or short discussion activities. The timeline approach for the historical content was used in this course as it helps to teach the chronology of historic events and is a useful way to categorize these events into themes, eras, and topics (Fillpot, 2007). The discussion activity described in this study was presented to the participants at the end of the fourth week, and they had to carry out the research until the next course. Participants were guided by the question of whether Archimedes designed a water clock or not. They were also asked to support their claims with evidence.

The discussion was administered by the author of this article, who is also the lecturer of the course, through three steps in line with the research questions. In the first part of the course, a discussion question was asked again, and the lecturer requested the groups choose a foreperson to bring forward the answer with explanations based on their evidence. Each group presentation took 2 to 4 minutes. Meanwhile, other groups took notes. This first part lasted approximately 35 minutes. In the second part, each group had 5 minutes to prepare rebuttal questions for the other groups. The third part was the longest-lasting, which was basically a question-and-answer session but revealed many historical issues that were related to the water clock of Archimedes. Besides administering the discussion, the lecturer took field notes in the first part according to the claims and evidence presented by the group representatives, and in the second step, he recorded the discussion outcomes on the whiteboard in an effort to construct connections between the issues revealed in the discussion. The following findings are based on the notes taken by the authors during the classroom presentations and discussions.

FINDINGS

Findings were categorized according to the research questions of the study. The first part of the findings is about *the way of gathering information* (RQ1) and the second part is about the classroom discussion titled as *zooming in the timeline* (RQ2), which was investigated in three themes based on the data gathered, titled as *introduction to the Golden Age of Islam*, *transfer of the knowledge*, and *the case of pseudo-Archimedes*.

1. The Way of Gathering Information

The first research question investigated how preservice teachers gather information in order to support their claims regarding the question of whether Archimedes designed a water clock or not, and it was based on the first part of the discussion procedure. There were 8 collaborative groups that participated in the activity. 5 of the groups proposed that Archimedes designed a water clock (1, 2, 3, 7, 8: supporting groups), and the remaining groups were against this idea (4, 5, 6: opposing groups). As for the evidence in their presentations, it was seen that the research was fruitful. Although they did not present enough literary evidence, there was a high level of curiosity in their research. According to the presentations, most of the explanations were based on basic internet searches, that is to say, mostly from free encyclopedias, blogs or forums, online newspapers, and academic articles that include technical mechanisms of Archimedes that are related to water clocks. Supporting groups showed Clepsydra and Antikythera mechanisms as evidence, as they had seen in some internet sources that they were attributed to Archimedes. The table shows the sources of the information that groups had gathered.

Table 1. Sources of the information

Main source of the data	Groups	Sub-source of the data	Groups
Internet search engine	All	Online encyclopedias	1, 3, 4, 5, 7, 8
		Blogs or forums	1, 2, 3, 4, 6, 7
		Online newspapers	2, 3, 7, 8
		Academic articles	4, 5, 6

Shortly after the course, a confirmatory internet search was conducted by the authors in order to follow the search path that groups used. The internet inquiry focused on using the search criteria as an *Archimedes water clock*. As claimed by the supporting groups, there were a lot of websites reporting that Archimedes designed a water clock, including personal blogs, forums, online newspapers, and academic articles. These results can easily lead anyone to conclude that Archimedes had designed a water clock. In addition, the search engine suggestions after the first inquiry can easily misdirect the inquirer as they include Clepsydra and Antikythera mechanisms, which seem to be highly related to Archimedes. However, if the inquirer keeps searching, there will be more scholarly results. In this way, one can reach better answers than from the other non-scientific sources that will be investigated in the *discussion*.

2. Zooming in the Timeline

The second research question investigates the issues preservice teachers relate to the clock of Archimedes in their discussion questions. The reason this section and the article are titled zooming in on the timeline is that the questions preservice teachers asked in the course discussion revealed detailed information that is not included in most of the HOS courses or mentioned in most of the HOS/HPNS course books. As explained in the procedure, the third part of the activity was a question-and-answer session. Each of the groups spoke several times in this session, both asking and answering, in addition to predicting and interpreting. Relevant issues are taken into account for the in-depth investigation. The findings below are grouped into themes according to their outcomes.

2a. Introduction to the Golden Age of Islam

This part of the discussion was entitled as the *introduction to the Golden Age of Islam* due to the focus on the general features of the period.

The discussion started with two main questions from groups 1 and 2, respectively. The first one was about Archimedes and al-Jazari's connection and how al-Jazari could know about Archimedes in a very different time and location. The second one was about the survival of knowledge for centuries despite wars and marauding everywhere in history. Group 5 replied that books were very important sources of knowledge, therefore they were valuable, and al-Jazari knew about Archimedes because all of the ancient Greek books were translated into Arabic in this period, which is called the Golden Age of Islam. They elaborated on their idea by pointing out that in undesirable events, books were the first to be saved. Group 2 asked again whether Arabic books and knowledge survived too. Group 5 replied that Arabic knowledge also survived, but Europeans somehow captured Arabic books in the 15^{th} century and expanded their knowledge. They indicated that Ibn-i Sina is important in Europe under his European name, Avicenna.

2b. Transfer of the Knowledge

This part of the discussion was named *transfer of the knowledge* as the discussion was shifted to the noticeable events the Golden Age of Islam, mainly the translational events.

Group 3 asked how and why ancient Greek books were taken to the Arab lands. Group 4 replied that it was because both the library in Alexandria and the Academy of Plato in Athens were closed by the Romans, and most of the scholars there moved to other lands where science was more respected. Then group 7 asked how the foreign scholars worked collaboratively without a common academic language like English today. Group 4 replied that in the 9^{th} century, the translation movement started, and there were many people who spoke both Arabic and Greek, so language was not a big problem. Group 5 added that there were also translation mistakes. Group 4 asked what Group 5 meant by mistakes. Group 5 replied that there were not sworn translators like todays, so there were mistakes and modifications in those translations. They gave the example that there were many works of Archimedes in Arabic that were not, in fact, his works. Group 4 indicated that it was the reason they believe Archimedes never designed a water clock. Then group 8 asked if Archimedes had not designed a water clock and why al-Jazari described his water clocks. One member of group 4 then replied with excitement: *I think there is a fake Archimedes*. Group 1 then asked if Group 4 also knew who the fake could be and why someone would imitate Archimedes. Group 4 replied that they believe al-Jazari had made it clear when he wrote about al-Qatan or al-Qajan. They suggested that it is impossible that Archimedes could attribute a design to someone with an Arabic name, as seen in al-Jazari's book: *Otherwise, all the world should have known about al-Qajan or al-Qatan*. Group 2 asked about the consequences of this kind of mistake. Group 6 replied that it's called pseudepigrapha, which means false attributions in history due to translation errors and modifications.

2c. The Case of pseudo-Archimedes

The discussion moved forward to the relationship between Archimedes and al-Jazari and the interpretation of Group 8.

After their request to speak, Group 8 suggested that if it was the fake Archimedes al-Jazari was explaining about, al-Jazari might never have seen Archimedes' original works. Group 6 agreed with them and explained that it might be because of the facts that al-Jazari lived far away from Baghdad and also lived at the end of the Golden Age, so some translation errors were possibly known before, but after two centuries later, they were forgotten. Group 7 asked what would happen if al-Jazari already knew about the fake Archimedes and deliberately used the name. Then group 3 added, "What if the fake one's name is Archimedes too?" The end of the discussion was connected to al-Qajan's (or al-Qatan's) name again and whether he might be the author of the book al-Jazari used as a reference and if it might be another translation mistake, this time not from Greek to Arabic but Arabic to English or Turkish.

Naturally, the end of the discussion did not reveal any right answers but rather prosperous predictions. The main ideas were about the factors that led al-Jazari to explain the works of a fake Archimedes. In the course discussion, groups 4, 5, and 6 were in the answering position as they had more accurate answers, and the other groups were in the questioning position. In the presentation part of the course (see Findings *1, The Way of Gathering Information*), groups 4, 5, and 6 opposed the water clock of Archimedes. It can be concluded that their research was more comprehensive. Opposing groups contributed to the HOS course regarding the *closing of the Alexandria library and the Ptolemic Academy*, *the birth of the Golden Age of Islam, translation movement and the house of wisdom*, *internalization of misunderstandings and translation errors*, *the concept of pseudepigrapha*, and *the factors leading al-Jazari to explain the works of Archimedes*. In addition, the finding about *al-Qajan (or al-Qatan)* attracted attention and seems to be highly related to the case of pseudo-Archimedes.

DISCUSSION

Discussion is presented through the themes identified in the findings.

1. The Way of Gathering Information

Generally, the group presentations included bits of both correct and incorrect information. In the following paragraphs, how a classic internet search can lead to correct and incorrect sources is shown.

On the correct side, the major finding was that all groups provided al-Jazari's treatise, *The Book of Knowledge of Ingenious Mechanical Devices*, as academic evidence. This can be due to the fact that when the water clock of Archimedes is searched online in the most famous free encyclopedia, the water clock is strongly associated with Archimedes and al-Jazari with Donald R. Hill's reference (Hill, 1974). This treatise is easily accessible since the English version by Hill can be viewed online and the printed Turkish version (Tekeli, Dosay, & Unat, 2002) by the Turkish Historical Society is available in the university library. When the English version is viewed, one can by any chance find out that Archimedes never designed a water clock, which was described by al-Jazari, because Hill (1974) describes the issue in the additional notes section. On the other hand, in the Turkish version, one can most likely believe that Archimedes designed a water clock since there is no information about pseudo-Archimedes. So, as seen in the group presentations in the first part, it can be concluded that no one has noticed the pseudo-Archimedes in the notes section of Hill (1974).

On the incorrect side, it can be seen that in the top results of such a search, let alone the water clock, Archimedes also seems to be the inventor of all types of clocks. When the source of this information is pursued, for instance, the famous free encyclopedia cites an article by Moussas (2011) in which Archimedes is described as the inventor of the water clock based on the Arabic treatise, actually the pseudo-Archimedes, which will be discussed in the following sections (p. 15).

On the other hand, extending the scope of both the correct and incorrect sides, a classic internet search can come up with excessive information through various sources, such as blogs or newspapers. This kind of knowledge mostly appears without sources. However, in this case, it was the type of knowledge that enriched the course discussion since every participant had something to share, ask about, interpret, or predict. In this sense, the enrichment was more noticeable in the third part of the course. Since finding the right answer was not the aim of this research activity, the results were satisfactory for the sake of the course.

2. Zooming in the Timeline

Zooming in the timeline section is discussed under three sub-categories according to the findings.

2a. Introduction to the Golden Age of Islam

The concept of knowledge and how it can survive for centuries was the main issue in the third part of the course. Knowledge is the understanding of a subject that is based on experience. The definition lets us think about how persistent experiences can be against disappearing. Knowledge has the capability to survive for centuries and to move to other geographical locations, even if it is not recorded. The Muslim world had a thirst for knowledge starting at the beginning of the 9th century. Plus, they had an amazing opportunity to gather all their scientific experience from their neighbors, Byzantium, India, and others, where they could travel eagerly to collect knowledge (Mokyr, 1992, p. 39). Knowledge moved to thirst, and this period until the 13th century is named as The Golden Age of Islam. Muslims of the Golden Age were in the effort of developing scientific accumulation with or without knowing that the knowledge would move away from them in a few centuries.

The Muslim world played an important role in transferring the knowledge of classical scientific works to the western scientific community starting in the late Middle Ages (van Dalen, 2011). In other words, the Muslim world was the heir of classical civilization (Mokyr, 1992, p. 39). The transmission had important consequences for the development of Islamic thought and culture as well as the European Renaissance in the following centuries. For instance, the similarity between the works of Copernicus and the Islamic planetary theories is worth investigating (Sabra, 1987, p. 227).

The main reason for being the knowledge bridge was the loss of original scripts because of various events such as demolition of libraries, sacking of cities, hostile points of view on science, and being still unearthed. In this regard, al-Nadim explains the incident of the Romans burning fifteen camel-loads of Archimedes' books (al-Nadim, 2017, p. 683). It is also known that many treatises, such as *Lemmas of Archimedes* (Heath, 1897, p. 241; Hogendijk, 2014, p. 260) and the geometry works of Apollonious (Hill, p. 12), were available only in Arabic. However, the Muslim world was not just a repository of knowledge. Muslim scholars enhanced the then-present scientific knowledge in many fields such as mathematics, engineering, medicine, astronomy, and philosophy. In mechanical engineering, particularly clock making, the *Banu Musa Brothers*, *Ridwan al-Saati* and *al-Jazari* were some important characters of the Golden Age.

It would be interesting to answer the question of how and why ancient Greek knowledge was transferred to the Arabic lands with the dream of al-Ma'mun, the 7th caliph of the Abbasid Caliphate, as al-Nadim narrates. According to the story, al-Ma’mun saw in his dream that Aristotle was sitting on his throne. They had a philosophical conversation about goodness. After his dream, al-Ma’mun exchanged letters with Roman kings in order to get the books that were locked in the cellars of Roman lands (al-Nadim, 2017, p. 621). al-Nadim also describes a temple that a Muslim delegation somehow entered, which had been forbidden to be entered since the Romans became Christians, and where they had seen as many as a thousand camel-loads of ancient books. al-Nadim indicated that this event happened in the time of Sayf al-Dawla (916–967, the first ameer of Aleppo Emirate), which would be between the years 945 and 967 (al-Nadim, 2017, p. 622).

2b. Transfer of the Knowledge

This part of the discussion was mainly about the salient factors in the transfer of knowledge in the Middle Ages. There are many examples in the history of science of translations coming with restorations, interpolations, or amendments. Sometimes the aim was to *fill the gaps* of the former studies. For example, Hill informs us about Wiedemann’s identification of Apollonious of Perga (Hill, 1974, p. 12). Wiedemann presents sufficient evidence to suggest that the Arabic translation of Apollonius' works may not be original but rather a modified version created by a Byzantine craftsman, which was subsequently translated into Arabic in its modified form.

One recent example is the 17th-century translation of *Lemmas of Archimedes* (The Book of Assumptions) by Borelli and Ecchellensis (Hogendijk, 2014, pp. 260–261). The authors prepared their study based on one Arabic translation and one commentary, which is the 6th-century work of Eutocius of Ascalon (460–540). There were fifteen propositions in the Arabic editions, but seventeen in Borelli and Ecchellensis’ translation. Hogendijk identified that the authors had adapted the seventeenth proposition from Eutocius’ commentary; however, the sixteenth proposition, which could not be traced back to Archimedes, was from Arabic scholar Al-Kühi’s book *On Filling the Gaps*. The Arabic version of Lemmas is also not completely original in its acquired form, and some of it might be a collection of a later Greek writer (Heath, 1897, xxxii).

Heath compared various translations and original manuscripts of Archimedes that could be matched. Among successful translations in both Latin and Arabic, he presents detailed information about how corrections and interpolations took place in almost every translation (Heath, 1897, pp. xxviii–xxxviii). For instance, Heath makes a list of Archimedes' works that he verified and leaves off that section as follows:

"Some Arabian writers attribute to Archimedes works *(1) On a heptagon in a circle, (2) On circles touching one another, (3) On parallel lines, (4) On triangles, (5) On the properties of right-angled triangles, (6) a book of Data*; but there is no confirmatory evidence of his having written such works" (Heath, 1897, p. xxxviii; al-Nadim, 2017, p. 683).

The translation process was so massive that, at the beginning of the 11th century, it was reported that there were more than a million books in the Cairo library, including 18.000 volumes in the philosophy section (al-Andalusi, 2014, p. 37). In such an event, one can undoubtedly expect to find perfect translations to Arabic, too (al-Andalusi, 2014, pp. 15–39; Heath, 1921, v. I, pp. 361-364). For instance, Syria-born Greek Questa b. Luqa was known to be a master translator who used to bring books from Byzantium and translate them into Arabic (al-Andalusi, 2014, p. 24). Carra de Vaux confirmed a genuine and accurate translation of *The Mechanics of Heron* by Luqa from the year 864 (Hill, 1974, p. 11). Today, when talking about translation, people rely on the fact that the translated text has exactly the same meaning as the text in the original language. As mentioned before, there are many examples in the history of science where translations came with modifications. In the Golden Age, there were so many interpolated translations that many books had to be re-translated or restorated (al-Andalusi, 2014, pp. 38–39). On this issue, Abdelhamid I. Sabra used the concepts of interpretations, reconstructions, extensions, developments, reworkings, reception, and appropriation in his research (Sabra, 1987, p. 225). Believing that there were not any malicious intentions of Muslim scholars to make such changes, the word interpretation is more appropriate in the following investigation.

Elaborating on the concept of interpretation, first, it has a perfect definition for what the scholars did in history. According to the Lexico (2021), interpretation is *the action of explaining the meaning of something; an explanation or way of explaining; a stylistic representation of a creative work or dramatic role*. Each part of the definition suits the use of this concept. Early scholars, or translators, were unconsciously misguiding their successors, but it was their own way of explaining, their representation of the original work, like a cover version of a song. Perhaps they never imagined that the original resources would disappear.

Second, interpreting is an important element of school science as it is one of the science process skills to be taught in classrooms all over the world. This educational aim might seem irrelevant to the subject. In fact, it constitutes a portrait of early scholars who had certain scientific skills that are aimed at being taught in schools today. Moreover, those scholars never had the chance to be involved in a proper education system. This aspect of the discussion is related to science education and can be used to develop nature of science views as the aim of history of science courses (Irwin, 2000; Krajsek & Vilhar, 2010; Lykknes & Wittje, 2012; Sonmez, 2008), which is a basis for scientific literacy (Abd-El-Khalick, 2005; Lederman, 1998; Lin & Chen, 2002; Turgut, 2007).

In this section, the aim is to discuss the reasons why early scholars chose interpretation over exact translation. It can be seen that there are many variables that influence their way of reproducing and developing science. The variables that need to be considered when investigating the process of transmission of scientific knowledge were identified as: *the actors of the transmission process and their experience in the original language; Different characteristics of the languages and loss of meanings in translation process because of the lack of terminology; Proper understanding of scientific models and methodologies in the original works; Cultural background of the actors in the transmission process* (van Dalen, 2011, p. 448).

For instance, Thabit ibn Qurra (836–931) spoke Arabic, Syrian, and Greek perfectly and translated many Greek works. When he moved to his native city, Harran, he was excommunicated from the sect he belonged to, so he moved back to Baghdad (Duhem, 2012, p. 61). These translation issues can be presented as further examples to discuss the cultural aspect of the nature of science. Another issue was the change in Greek names in translation to Arabic and from Arabic to Latin. It is very well observed for Heron of Alexandria (i.e., Iran, Iranius), Archimedes (i.e., Arsamides, Arsanides, Ersemides, Arsamithes, Alaminides; in Duhem, 2012, p. 65), and Euclid (i.e., Uclides, Icludes; in Heath, 1921, v. I, p. 355). Heath describes the Arabic intention to adapt some of the Greek names to Arabic in order to show a romantic connection to the Muslim world, such as *Ucli-dis*, which means an integration of a key (*Ucli*) and a measure or geometry (*dis*), eventually meaning the key of geometry. As a result, let alone the scientific works, names barely survive in the translations affected by social, cultural, geographical, or other factors mentioned or not mentioned above.

Until the 19th century, how many scholars made false attributions to Archimedes or how many scholars realized it was not the real Archimedes is unknown. But it is sensible to express that there have been many intermediary works that misguided the successor scholars. Such falsely attributed or falsely ascribed treatises are called pseudepigrapha (Stone, 1996, p. 270). According to Canavas, knowledge of Archimedean treatises appears in direct translations and compilations of excerpts that are both originally Arabic and translations from other Greek sources (Canavas, 2010, pp. 207–212). Canavas presents a remarkable example of pseudodepigrapha in which the Arabic translation—the only sample available—of *Mechanics* by Heron of Alexandria includes quotations from Archimedes, some of which are attributed to Heron (Canavas, 2010, p. 210).

2c. The Case of pseudo-Archimedes

In this part of the discussion, participants questioned the relationship between Archimedes and al-Jazari and made predictions on the topic. The case of pseudo-Archimedes is based on the Arabic attributions to Archimedes, specifically those made by Ridwan and al-Jazari, who unknowingly attributed a treatise to Archimedes. Later, in the 20th century, some historians referred to the author of the Arabic treatise as Pseudo-Archimedes. The treatise is a compilation of mechanical works and water-clock designs, consisting of references to the works of Archimedes, Philon, Heron, and Vitrivius (probably), and including scientific elements from Greece, Byzantium, and the Muslim world (Hill, 1974, p. 271). The writer of the book is unknown; the English translation was published in 1976 by Donald R. Hill under the name *On the Construction of Water-clocks* (Hill, 1976).

Many of the works of Muslim scholars had not reached the scientific world for a long time. Starting with the valuable efforts of Eilhard Wiedemann (1852–1928) and Fritz Hauser, Bernard Carra de Vaux (1867–1953), Ananda Coomaraswamy (1877–1947), Rudolf Riefstahl (1880–1936), George Sarton (1884–1956), Aage Gerhardt Drachmann (1891–1980), and Donald Hill (1922–1994) are just a few examples of 19th and 20th century orientalists who presented Muslim works to the world. Carra de Vaux is probably the first observer on the list to see the manuscripts of al-Jazari before 1891 (Riefstahl, 1929, p. 206). Moreover, he was considered the first describer of the clock of Archimedes, which is believed to have never existed (Hill, 1974, p. 10).

In fact, before Carra de Vaux, 10th-century historian al-Nadim presented the earliest reference known to the clock of Archimedes in *The Fihrist* with the attribution to *The Water Clock Which Drops Round Weights* (clepsydra) (al-Nadim, 2017, p. 683). Moreover, Ridwan al-Sa'ati in his book named *Book on the Construction of Clocks and their use* (1203) with the descriptions of *The Bab Jayrun Clock of Damascus* (Flood, 2000, pp. 114-138) and al-Jazari in his book *The Book of Knowledge of Ingenious Mechanical Devices* (1206; Hill, 1974), are the other early describers of the clock of Archimedes. There were others, too. Niccolò Tartaglia (1499–1557) was a mathematician who translated the works of Euclid and Archimedes into Italian. He edited a book by 13th-century geometer Jordanus de Nemore and added a chapter named *Treatise on Weights* (for the electronic version of this treatise, see Echo, 1565), including attributions to Archimedes, which are proven to be not of Archimedes but someone continuing his works (Duhem, 2012, p. 99). These works were identified as those of an unknown author from the 8th century (Dugas, 1955, p. 95). Duhem discusses how these Archimedes-attributed works influenced subsequent scholars, such as Leonardo (Duhem, 2012, p. 100). For a long time, the conical valves of al-Jazari, for example, were thought to have appeared first in Leonardo da Vinci's drawings (Hill, 1974, p. xiii, in Foreword of Lynn White, Jr.). It is not known if they were independent inventions or if Leonardo took direct or indirect inspiration from al-Jazari. Conical valves have a chronological importance as they were not presented by Philon (1st century B.C.) or Heron (1st century A.D.) but used by *pseudo-Archimedes* (8th century), the Banu Musa Brothers (9th century), Ridwan (12th century), and al-Jazari (12th century) (Hill, 1996, pp. 354–355). Heron is known to be familiar with Archimedes' works (Heath, 1921, v. I, p. 295). If Archimedes had published a treatise about conical valves, Heron should have mentioned them, but they were not used. These dates provide evidence that the pseudo-Archimedes should be a very early Muslim work that was written before Banu Musa's time (Hill, 1974, p. 10). In conclusion, the use of conical valves in the treatise of pseudo-Archimedes presents an excellent example of interpretation as it is a compilation of earlier works that include original ideas and inventions of the writer.

I followed the method of the excellent Archimedes'remarks al-Jazari in the first chapter of his book, where he explains us his research and development process on water clocks. He then continues in following words: 'Archimedes described [another instrument] which he attributed to [a certain] al-Qajan or al-Qatan (Hill, 1974, p. 17). al-Jazari's statements deserve further investigation.

The first issue to discuss is the level of knowledge of Archimedes in the Muslim world. It is widely known that Muslims are quite familiar with the works of Archimedes (Canavas, 2010, p. 208). Undoubtedly, al-Jazari quoted many earlier scholars such as Archimedes (pseudo), Banu Musa, astronomer al-Usturlabi (10^{th} century), and Apollonious (this one is debated, and in some sources, it is also referred to as pseudo-Apollonious), which proves he could reach some earlier sources. However, al-Jazari's opportunities to reach scientific sources could be limited due to geographical and temporal factors: al-Jazari lived in Diyarbakir region of south-eastern Anatolia, which is not very close to the House of Wisdom in Baghdad (827 kilometers away in today's measurement). Correspondingly, about this issue, the 11^{th}-century Andalusian Muslim scholar al-Andalusi mentions that there were not enough books from India due to the distance (al-Andalusi, 2014, p. 60). Besides, al-Jazari lived in the late 12^{th} century, almost four hundred years after the beginning of the translation movement. He was an engineer in the palace, and there is no information about him leaving the Artuqid palace of Diyarbakir. For instance, both contemporaries, al-Jazari and Ridwan, were not aware of each other's works (Hill, 1974, p. 10). Another supportive proposition on the issue is that al-Jazari's reputation did not spread beyond the Jazira until sometime after his death (Hill, 1991, p. 181). With this information, considering the two clock descriptions are the only connections between al-Jazari and Archimedes, it can be assumed that al-Jazari could never reach an original work of Archimedes.

The second issue is Archimedes' attribution to clockmaker al-Qajan or al-Qatan, which also gained noticeable interest in the class discussion. Neither Hill nor other historians investigated this statement, and there is no one with this name in the history of science. This statement of al-Jazari is nonsense in every aspect, unless there was a clockmaker who lived before the time of Archimedes with the name al-Qajan. It can be assumed that there was none, because al-Qajan is an Arabic name and Archimedes visited Egypt far before Arabs settled there. On the other hand, if al-Jazari knew about Archimedes but did not know anything about al-Qajan—clearly he did not, as he also never mentioned him again and he only refers to him as pseudo-Archimedes referring to al-Qajan—there appears to be another piece of evidence for the probability that al-Jazari also did not know very well about Archimedes, provided that he would know about the date Archimedes lived.

There is a tendency for the historians to believe that a Muslim scholar had written a book under the name of Archimedes, which they later called pseudo-Archimedes, and al-Jazari thought it was an original work by Archimedes. In the Golden Age, there is no example of a Muslim scholar taking and using a western name as an author; therefore, it should not be the case that the author of the pseudo-Archimedes intentionally named himself Archimedes. Rather, al-Jazari might just have had a book with "Archimedes" written on the cover, and he might have known that Muslims had written it; maybe just the front matter of the book was missing. Dohrn-van Rossum has another idea about the names: *Perhaps the mention of Archimedes was merely intended as a generic name that honored the Greek authorities as a whole* (Dohrn-van-Rossum, 1996, p. 73).

CONCLUSION

The HOS course inquiry activity on the question of *whether Archimedes designed a water clock or not* has brought the discussion to an extensive investigation of the period from different perspectives. Besides *zooming in the timeline* by revealing many events through historical short stories, this discussion activity, as the main methodological approach of the course, covered a wide set of historical events and subjects and can be modified according to the time to be spent and the content of the course. In addition, it was observed that participants developed positive attitudes towards history, experiencing a lot of fun, imagination, and curiosity both in their collaborative research and classroom discussions. History of science courses mostly have gaps between certain dates with a timeline or any other teaching approach. Such a discussion activity would be beneficial for course students to fill the gaps in the historical transitions, and it might help to resist the boring nature of the narrative HOS courses.

The inquiry-based methodological approach of the course, with respect to the second research question, revealed a lot of historical events, eventually putting this research onto a side path where the author sought answers to the water-clock question. The discussion part was constructed upon historical evidence based on the claims of the groups. As it can be seen, history has much to show, and it can be zoomed in forever. As a non-history major HOS lecturer, the author of this research zoomed in on the timeline with the participants of the course in an effort to enrich the contents of the HOS courses. In that case, the final conclusions can be shaped by the historical outcomes of the research:

Interpretation of Muslim scholars via translation movements and loss of the original documents led to limitless examples of pseudo-pseudepigrapha, resulting in a snowball accumulation of misunderstandings reaching as far back as the 20th century, such as in the case of pseudo-Archimedes. Historians choose to use the pseudo-Archimedes name for the book itself. The pseudo-Archimedes is a compilation of earlier works, and the only evidence of Ridwan's and al-Jazari's connection to Archimedes is the pseudo-Archimedes, which builds evidence for the fact that they never knew about the original works of Archimedes. On the other hand, there is a probability that Muslim scholars were attributing this to the pseudo-Archimedes being aware that the writer of the book was a Muslim. Thus far, it is not known.

The main focus of the classroom discussion was based on al-Jazari's explanations about Archimedes' attributions to al-Qajan or al-Qatan. al-Jazari would have investigated if there had been a Muslim clockmaker, and he would not miss out on the fact that Archimedes' quote about someone who lived later than him was nonsense. With respect to 19th and 20th century historians, the aim of this discussion activity was to investigate the factors behind the case of pseudo-Archimedes, and the main claim on the topic was the fact that Ridwan and al-Jazari were aware that the author of the book was a Muslim and that the treatise of pseudo-Archimedes was not a direct translation but rather an interpretation since they were excellent observers and interpreters possessing very high levels of creativity and imagination, ahead of their time.

The technical elements of the water clocks and other mechanisms have been studied thoroughly by Donald Hill and other historians by now. Therefore, in order to find out more about the writer of the pseudo-Archimedes, future studies can focus on the mention of al-Qatan and what al-Jazari really meant by quoting him. Maybe the original Arabic script should be checked again in this respect. Furthermore, the archaeological work started in 2018 and is going on in Diyarbakir Artuqid palace, where al-Jazari used to live, and soon the world of history and science will learn more about al-Jazari, hopefully. It would be revolutionary to see a library, a book collection, or a storage facility for the mechanisms of al-Jazari come to light.

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Teaching English to Young Learners: Combining Theory and Practice through Practicum in Pre-service Teacher Education

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ABSTRACT

Recent years have witnessed an exponential growth in interest in teaching English to young learners (TEYL) across the world. Pivotally, there is some research focusing on in-class practices and teacher pedagogy on this issue, yet young learner teacher education has not been given much attention. Many teacher education programs in different countries prepare their pre-service teachers for young learners by offering TEYL courses without providing them with real classroom experiences. To this end, the researchers initiated a practicum project in which pre-service EFL teachers taught English to young learners besides taking the TEYL module at the university. Drawing on semi-structured interviews with 21 participants, it was aimed to examine the effectiveness of a practicum-integrated TEYL teacher education program. The findings revealed that practicum provided teacher candidates with a range of benefits in terms of putting young learner knowledge into practice, developing teaching skills, designing age-appropriate lessons and materials, and gaining confidence with TEYL. Different from previous practicum-related studies, the current study showed that practicum helped pre-service teachers have clearer minds on their future careers and teaching contexts in that some participants would choose to work with older learners considering the distinctive characteristics of children. This study offers implications for pre-service teachers and teacher education programs for training young learner English teachers more effectively.

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INTRODUCTION

Teaching English to young learners (TEYL) has attracted considerable attention in line with globalization and the role of English as a lingua franca across the world. Nowadays, a rising number of children are learning English at a younger age without being fully literate in their first language as a result of government regulations. Hence, the past several years have witnessed an increasing body of literature on TEYL focusing on various aspects such as pedagogy (Garton & Tekin, 2022), policy (Enever, 2016), use of technology (Cowie & Sakui, 2020), and theory for young learners (YLs) (Garton & Copland, 2019; Pinter, 2017). Considering this, much attention is given to TEYL both in educational contexts and in academia.

The advancement in TEYL makes it vital to efficiently educate pre-service teachers and equip them with the necessary pedagogical and management skills. Although the abovementioned sources provide YL teachers with valuable insights, gaining experience in the real classroom environment is undoubtedly the most useful and effective way to do this. At this point, offering pre-service teachers a practicum would be a good solution for them to get a sense of the classroom environment. Considering the importance of practicum in pre-service teacher education (Collinson et al., 2009; Lawson et al., 2015; Yildirim & Orsdemir, 2019), a practicum project was initiated, and it was aimed to explore the effects of practicum-integrated TEYL education in which pre-service teachers could gain experience and become more aware of working with YLs and their distinctive characteristics.

LITERATURE REVIEW

Characteristics of Young Learners

YL is a broad term referring to all children until the age of 18, but researchers in the field of TESOL present different perspectives. Scott and Ytreberg (1990), for example, described YLs as children between five and ten years of age, while Rathus (2021) makes a distinction between early childhood (ages 3-6) and middle childhood (ages 6–10). Cameron has a more holistic viewpoint by viewing YLs as children between five and twelve years old. Pinter (2017), on the other hand, specifically focuses on the children who are studying English at schools from as early as three years old until the age of 13–14. In this study, however, since primary school children between seven and ten years old learn English in Turkey, children in this age group are recognized as YLs.

YLs' developmental peculiarities also characterize their learning, and TEYL turns into a multifaceted experience that includes distinctive factors. In actuality, it is both captivating and challenging. Brown (2007, p. 101) specifies that "specific skills and intuitions that differ from those appropriate for adult learning" are essential for the teachers of young learners. Relatedly, it is noteworthy to discuss the characteristics of young learners to present a better understanding of TEYL. Highlighting the importance of recognizing YLs' nature and identifying them as "learners with a well-established set of instincts and skills", Halliwell (1992, p. 3) describes young learners as children who are very good at interpreting meaning without necessarily understanding the individual words and are creative language learners with the ability to use limited language. Through their ready imagination, they take great pleasure in finding and creating fun in what they do, and they take great delight in talking. More than that, Halliwell (1992) emphasizes that children learn indirectly rather than directly, which pivotally points out the significance of the classroom environment and activities. Understandably, focusing on meaning rather than structure or form, being both creative and imaginative, and providing indirect learning rather than direct learning are remarkable features that create differences between adults and YLs. Cameron (2001) also notes that YLs lose interest quickly and have difficulties being motivated. Specifically, the attention span of children is shorter than that of adults, and their source of motivation is considerably different. Tekin and Garton (2020) link YLs' motivation, mostly intrinsic, to their relationship with teachers and enjoying the lesson. In a similar vein, Shin (2006) pays close attention to YLs' short attention span and extreme physical energy. Considering these distinctive features, it is possible to mention specific challenges of TEYL that teachers of YLs should bear in mind during their teaching process.

Challenges of TEYL

In today's world, the discussions regarding the critical period in second language learning and other political and economic factors, as Copland, Garton, and Burns (2014) pin down in their study, such as economic globalization, educational policies across the world, or parents' positive attitudes towards early language learning, lead English to be included in the primary school curriculum. This trend, however, brings some essential issues to discuss in detail because teachers of adults find themselves in primary school classrooms without any specialized training. Drawing attention to the related point, Read (1998, p. 8) describes her experience with YLs as chaos: "The more I asked the children to sit down, the more they moved about. The more I raised my voice, asking them to be quiet, the louder the noise level grew".

Accordingly, the challenges behind TEYL are multiple. As aforesaid, the characteristics of YLs play a vital role in TEYL. More than that, YLs do not have well-established literacy skills, which may be a handicap for second language learning (Cameron, 2001). They are still at the very beginning of their educational lives and learning their first language, not to mention their second language. Nunan (2010) pinpoints that cognitive development, motivation, attention, multilevel groups, and assessment are the primary challenges for TEYL. Keskin (2019) similarly categorizes them in five groups: institutional problems (teaching hours, classroom environment, and class size); instructional problems (curriculum, materials, teaching techniques, and first language use); learner-related problems peculiar to YLs' characteristics (attention, motivation, anxiety, and development); teacher-related challenges (proficiency, classroom management, and ineffective body language); and community-related problems (parents' roles in the learning process and different first languages). Kayhan (2022) also argues that classroom management is probably one of the most challenging aspects of teaching YLs, and it has the potential to cause anxiety among teachers. Relatedly, TEYL requires teachers to adapt their teaching techniques, review YLs' pedagogical characteristics or needs, and subsequently rearrange the classroom environment. In line with this, TEYL courses offered in ELT departments in Turkey should be analyzed to support teachers of YLs in coping with relevant challenges.

TEYL in Turkish Universities

TEYL is a compulsory course offered in the fifth and sixth semesters in all ELT departments in Turkey. According to the Council of Higher Education (CHE), it offers theoretical information in the fifth semester and includes language structures, skills, and sub-skills between young and adult learners, misconceptions about young learners, and learning styles and strategies of young learners. In the sixth semester, it is based on teaching four skills, raising language awareness, and planning a lesson (CHE, 2021). CHE provides a general frame for the programs, yet instructors can customize the content of their courses in parallel with the latest advancements in the field.

However, despite the radical change made by the Ministry of National Education (MONE) in 2012, which lowered students' age of learning English to the 2nd grade (7 year-olds) from the 4th grade (10 year-olds) (Güneş, 2020), neither any revisions or arrangements were made for TEYL courses nor any adaptation seminars or workshops were organized for the employed teachers. Instructors of TEYL, hence, try to update their courses according to the requirements of the new system in line with the arguments of Bayyurt (2012), who emphasizes that teachers working with young learners should be trained and well-equipped in accordance with the learners' young age.

Relatedly, the TEYL course offered in the context of the current study mainly aims to improve awareness about the characteristics of YLs and child development theories in line with both the CHE's primary concerns and the needs of primary school teachers. It is also aimed at blending the related theories and applications so that teacher candidates will be more aware of how to put the theory into practice and gain hands-on experience teaching YLs. Thus, along with theoretical information, pre-service teachers are offered microteaching, during which they teach a language point to their classmates (pretending to be children) by drawing on what they learn about the theory. They individually teach the contents of the state primary school coursebooks, depending on their own choice, for 25 minutes. Following the presentation, they reflect on their performance and share it with their classmates. They also receive feedback from their classmates as well as from the module tutors. In this regard, it is regarded as an opportunity for the presenters to customize their teaching according to the feedback and for the rest of the class to learn from others' teaching.

Although the TEYL course contents and way of delivering this course in the context of this research are somewhat similar to those of most universities in terms of the abovementioned features, there are some aspects of training pre-service teachers that are special to this research. First, teacher candidates taking part in this research were exclusively given the valuable opportunity to experience YL classes in real settings. Rather than merely being presenters in micro-teaching sessions, they became actual teachers in a state primary school and felt the atmosphere of the teaching environment, experienced the complexity of teaching, and as Durmuşoğlu Saltalı (2022 p. 2) put it, they became aware of "complex and multi-dimensional profession that requires many skills", since there are various components of teaching, including students, teaching materials, classroom management, time management constraints, and so on. Second, it was not a one-off experience but lasted an extended period so that they had the chance to observe the improvements and changes in themselves, their way of teaching, and their students' behaviors over time. Third, they had the autonomy to plan the classes on their own in terms of their style of instruction and teaching materials. Moreover, they were observed while teaching in a real-world classroom setting by their tutors, who provided constructive feedback, which is regarded as valuable to enhance teacher performance (Feeney, 2010; Ovando, 2005). In this respect, this research has brought some new aspects to pre-service teacher training in terms of combining theoretical and practical aspects of teacher education.

Previous Studies

According to Shin and Crandall (2014), over 50% of the nations around the world have made English a compulsory subject for up to 3rd graders in primary schools. In line with this exponential growth of TEYL, there is an increasing number of studies investigating teacher education programs with particular emphasis on practicality. Focusing on the efficiency of initial teacher education programs in Turkey, Çelik and Arıkan (2012), for instance, found that a great majority of participants regarded these programs as insufficient for TEYL in an actual classroom. More specifically, although 40% of English teachers believed that undergraduate programs were sufficient in theory, they were insufficient in practice in that practice-based knowledge and skills were given in a limited way. Similarly, Zein (2016) examined pre-service education for primary school English teachers in Indonesia in his research and concluded that pre-service education was inadequate in terms of TEYL since it did not provide enough opportunities for teacher candidates to practice their skills. Moreover, participants stated that methodology courses did not offer practical perspectives as they were excessively theoretical. From a distinctive viewpoint, Güngör (2016) used an action research study that aimed to reduce the gap between theory and practice of teaching English to young learners and applied one-year reflective practices through the application of videos, feedback upon microteaching presentations, and diaries. The study revealed that reflective techniques and tools were beneficial to developing procedural knowledge for an effective TEYL. Furthermore, Çamlıbel-Acar (2016) investigated the challenges faced by pre-service teachers in TEYL and concluded that supporting theoretical courses with real classroom experiences was emphasized by nearly all of the participants. Based on these studies and others, Cesur (2022) carried out a systematic review consisting of 56 papers related to TEYL and concluded that teacher candidates do not receive much attention in terms of their training for real-life teaching, although TEYL is regarded as a trendy field in language education.

Based on the previous empirical and theoretical research, it could be argued that teaching in a real classroom environment could be much more useful for pre-service teachers to put their knowledge into practice. Therefore, as Reynolds et al. (2022) highlight, teacher education programs should take responsibility and offer teaching practice opportunities that allow pre-service teachers to put theoretical information into practice, particularly with YLs. At this point, the inclusion of practicum could be regarded as a solution, as the benefits of practicum in teacher education programs are well documented in previous research (Collinson et al., 2009; Lawson et al., 2015; Yildirim & Orsdemir, 2019). Moreover, practicum could enable pre-service teachers to see the previously mentioned challenges of teaching YLs and act accordingly. Focusing on this point, this study brought pre-service EFL teachers and primary school students together to underpin the significance and necessity of real teaching experiences in YL classrooms. It therefore addresses the following research questions:

1. What are pre-service EFL teachers' voices about the efficiency of education programs in terms of TEYL?

2. What are pre-service teachers' experiences about the integration of practicum with the TEYL modules?

METHOD

Research Context and Participants

The context of the study is two-fold, one being a public university and the other a public primary school in a small city in Turkey. The ELT department at the university is a young one; it was only founded around a decade ago. Similar to the other state and private universities in Turkey, the school offers pre-service teachers two modules specifically about teaching English to young learners. These modules focus on theoretical perspectives of working with YLs and practice, which is microteaching, with no actual teaching experience in YL classrooms.

As mentioned in the previous section, the TEYL module syllabus consists of theoretical information about several issues related to TEYL, including language structures, teaching and learning strategies, approaches towards children, planning lessons for YLs, child development theories, classroom management, and so on. Regarding the practical aspect, it offers teacher candidates micro-teaching sessions in which they can teach their peers who pretend to be YLs. Based on their performance, they do a self-evaluation and get constructive feedback from their peers and tutors.

The other context is a public primary school where teacher candidates had a practicum. They taught the 2^{nd}, 3^{rd}, and 4^{th} graders (7–10-year-olds) once a week over the course of three months. The class size was around 25–30 learners, and it was a two-lesson-hour practice per week (80 minutes in total). They taught children a variety of structures and language points in line with the ones in their coursebooks provided by MONE, including animals, family members, classroom objects, numbers, feelings, and so on.

Around half of the pre-service teachers taking the TEYL module in the 3^{rd} grade of the teacher education program volunteered to participate in the study. Of the 21 participants, 15 were female and six were male, all around 20–21 years old. They were all native speakers of Turkish and expected to graduate and become EFL teachers the following year. None had teaching experience with any age group of learners previously, so this was their first teaching experience.

Data Collection Method

This study employed focus group interviews as the main data collection method, which is based on the collective experience of participants' brainstorming, thinking together, and inspiring each other by creating synergy among participants (Dörnyei, 2007). Although this method has relatively recently been adopted in social research, it is commonly used for several reasons, including allowing participants to respond to other group members' views and have a personal view based on group interaction, which positively contributes to exploring the specific issue in depth and from various viewpoints simultaneously (Bryman, 2012). Since both shared understandings and beliefs and individual differences can be voiced in this method, focus group interviews are regarded as an effective way of collecting detailed data (Ghazali, 2014).

The interviewer in focus groups in this study behaved as a moderator or facilitator (Bryman, 2012), who guided the session without being too intrusive. It was ensured that no participant dominated the floor so that everyone had a chance to express their views. After setting a number of ground rules (e.g., not speaking over each other), their views were asked about the TEYL module at the university, the implementation of practicum in TEYL and teaching experience, and the comparison of the module contents and their actual teaching. The questions were mostly open-ended, allowing participants to express their beliefs and experiences more freely.

The interviews were conducted during the fall term of the 2021–2022 academic year. Each focus group included five participants (six in one group) and lasted between 40 minutes and approximately one hour. They were all audio-recorded. Based on participants' choices, interviews were conducted in Turkish, transcribed, and translated into English by the researchers.

Data Analysis

Thematic analysis was used to analyze the data, as it is an effective way to identify, analyze, organize, describe, and report themes found in a dataset (Nowell et al., 2017). The researchers particularly followed the five main steps of the "Framework" method, namely, familiarization, thematic framework, indexing, charting, mapping, and interpreting (Ritchie & Spencer, 2002). It provided great convenience in terms of processing raw data and turning it into meaningful elements. During this process, NVivo 12 was used, as it was beneficial in several aspects such as indexing, coding, and visual demonstration of the data.

Familiarization with the data started with listening to the audio recordings, transcribing, and translating. All interviews were transcribed and translated to achieve a fuller understanding of participants' accounts. However, literal or word-to-word translation was not chosen, as it would be challenging to achieve conceptual equivalence between different languages via this (Choi et al., 2012). Instead, non-literal translation was conducted to ensure that meaning is conveyed at a maximum level and that readability and coherence are achieved without the essential features being ignored.

Ethics

Ethical approval was granted by the relevant institutional Ethics Committee. The informed consent of the participants was obtained prior to data collection. They were provided with sufficient information regarding their rights, such as their willingness to participate and withdraw from the study at any stage without causing any negative outcomes, and it was ensured that there was no conflict of interest. Participants were held in a familiar setting at the university to facilitate trust and create a warm atmosphere.

FINDINGS

Efficiency of TEYL Module

The findings revealed mixed results in terms of the efficiency of the module. According to participants' accounts, the module included several positive aspects in terms of balance between theory and practice, their own engagement during the classes, microteaching, and various teaching strategies used throughout the term. However, they also believed that it still lacked an important element for them to be better prepared for actual teaching in primary schools. Regarding the contents of the module, they had similar views in that both theoretical aspects and practice were taught and emphasized equally by the module tutor. When asked about the balance, a participant from the first focus group explained it as follows:

> *In my opinion, they [theory and practice] were balanced. There were some sessions about theory at the beginning. And then, we focused on how to use and apply these in teaching.*

The module's focus on theoretical aspects at the beginning and then students' presentations were also supported by another participant who had positive attitudes towards this way of learning.

> *We worked on the child pedagogy for the first several weeks. We discussed how to behave towards them. We then did practice. It was a useful strategy to follow since we would have problems in teaching without theoretical knowledge.*

As seen in the above extracts, the module first focused on the theory of YL education, which was followed by microteaching. In microteaching, while their classmates behaved like students (in fact, children), pre-service teachers did presentations by teaching various language points taken from YL English books, such as animals, family members, numbers, greetings, and so on. According to participants, microteaching provided several benefits in terms of practicing and honing their teaching skills to some extent.

> *After learning several strategies in theoretical part such as classroom management, encouraging unwilling students, motivating them, and overcoming various problems in the class, it was quite useful to apply these in our presentations and to see how well we did.*

A similar explanation was given by two participants who built a conversation over each other's accounts and listed a number of benefits of microteaching.

> *Theory and practice may not always align with each other. If we only had learned theory without practicing it, we would not be sufficiently prepared for actual teaching. However, we can put what we learn into practice now.*

> *Moreover, it teaches us to choose age-appropriate activities. For example, in the feedback provided by the tutor following my presentation, I was told not to focus on lengthy writing activities for children whose literacy level is so limited.*

The extracts above show that participants benefited from microteaching as it offered them the chance to implement their knowledge. Each microteaching also included individual feedback, in which the tutor showed them their strengths and areas that should be improved. In line with the statements of the last participant above, other participants mentioned the benefits of detailed, customized tutor feedback. One participant explained it as "*There is a self-evaluation and tutor feedback after microteaching, which is the part I love most*". This account is quite in line with the one from another group, which is presented as "*We can fully benefit from microteaching with the help of tutor feedback*".

Although microteaching was found useful by participants in terms of gaining experience, a great majority of participants emphasized that it lacked some aspects of a natural educational context. They commonly stated that it was not entirely natural that presentations flowed smoothly, which is highly unlikely in real YL classes. They almost never encountered disciplinary problems during microteaching, but this is a very common issue with YLs. The students in microteaching (classmates pretending to be students) already knew the language points they were taught and were hence unable to behave like children all the time. From this viewpoint, participants felt the need for a natural environment in which they could put their knowledge into practice with real learners. In doing so, they would see what they would meet and behave accordingly.

> *Although the module is sufficient to some extent, it has some room to be improved. We need a natural environment to implement the information we learned. Our classmates are unable to pretend to be children during presentations, which prevents us from effectively practicing teaching skills.*

An interesting argument was made by a participant who emphasized the complexity of a real classroom and the difficulty of including every aspect of teaching in the module.

> *We cannot learn everything in microteaching because it is artificial. Real classroom is a very complex environment with lots of things happening at the same time. We should encounter this environment to be more familiar with it. However, it seems very difficult in microteaching.*

The unnatural environment of microteaching was elaborated on by a participant who shared her own experiences.

> *No matter how hard our classmates try, they cannot act like children. For example, someone did something mischievous and stopped when I warned them in my presentation. However, children's real reactions might be very different most of the time.*

Interview extracts above show that participants were happy with the contents of the module and the balance between theory and practice, as well as microteaching. Although they emphasized the role of microteaching in the development of several teaching skills, such as time management, their accounts revealed one negative aspect of microteaching, which is a lack of naturality. It was commonly mentioned that microteaching was not a natural way of practicing their teaching skills due to their classmates' inability to behave like children. Therefore, they believed that the module was not sufficient to prepare them for actual teaching in YL classes.

Integration of Practicum with the TEYL Module

As previously mentioned, participants in this study voluntarily took part in a practicum project while taking the TEYL module at the university. The project aimed to enable pre-service EFL teachers to gain experience with YLs and to have a sense of real-life classroom context by drawing on the theoretical knowledge they learned in the TEYL module. Regarding their experiences with this project, all participants commonly argued that it was a very beneficial practice to sense the YL environment. They emphasized that practicum was much more advantageous than microteaching since it took place in a natural environment full of children. One participant explained the main advantage by making the following comparison between microteaching and practicum:

> *In microteaching, classmates could answer all my questions correct. They were much quieter than the children in school context. They did not push the presenters in terms of their behaviors. However, we noticed in the practicum that this was not the case in a real classroom.*

Similarly, another participant highlighted that microteaching was only a one-off experience during the whole term, while they had a chance to regularly teach in practicum and improve themselves every week.

> *Unlike the microteaching which was done only once for each person during the whole term, we did teaching every week in practicum. We planned lessons and implemented our plan regularly. We did it as if we had been an actual English teacher.*

The complementary role of practicum for the TEYL module was also underlined by the participants, who viewed it as a nice opportunity for them to put what they learned in the module into practice and hence comprehend the knowledge better. This was elaborated on by a participant as follows:

> *We already learned lots of information in the module, but it was the practicum that really helped us to comprehend those. In fact, both the module and practicum were integrated with each other efficiently. For example, we learned student types in the module such as the ones raising hands, being offended, behaving mischievously, etc. We encountered all these student types in practicum and learned how to behave towards them.*

Preparing age-appropriate materials for children was another skill that some participants improved through practicum. They regularly prepared materials for YL English classes, and this helped them to be more confident with material design. A participant's account is provided below:

> *I personally did not have any clue about how to prepare materials for YLs until this module. I learned it in the module and improved this skill in the practicum. To be honest, I would have serious problems regarding teaching YLs after graduation unless we had practicum experience.*

The above extract also indicates that the participant was aware of the importance of practicum for their future teaching experience. For her, it had a proactive role in terms of preventing possible problems in actual teaching after graduation. This aspect of practicum was also voiced by several other participants who felt more confident teaching YLs:

> *We now have experience in teaching YLs and therefore will be able to draw on our experience to overcome any difficulties that might occur in our future career. I am sure that we would not know what to do after becoming a real teacher if we did not have any experience.*

When asked to elaborate on the benefits of practicum for their future experience, one participant explained it as follows:

> *I can now guess how children can behave in a particular situation. They can be bored, give up, easily get distracted by something, deal with something else, or explicitly say that they are bored. At that moment, it is necessary to attract their attention.*

In addition to practicum's role in the professional development of pre-service teachers mentioned above, the results revealed that it had a major impact on some of them in terms of building positive attitudes towards working with YLs. Following spending time with children in practicum and hence establishing a good bond with them, two participants stated that they were happy teaching English to YLs and hence might consider it for their future career:

> *At the very beginning of the term, the tutor asked me whether I wanted to become a YL English teacher. Although I replied negatively at that time, I am now more positive about the idea of working with YLs after graduation.*

A similar attitude was also expressed by another participant from a different group:

> *I was deeply affected, and I loved them after seeing that they were so pure-hearted and hugged me unconditionally.*

Although the practicum was found useful by participants in terms of feeling the real classroom atmosphere, three participants stated that TEYL was not a career path they would choose for their future. Being more cognizant of the challenges of working with YLs by means of practicum, they would work with older learners. One participant expressed her experience as follows:

> *Practicum changed my mind. Previously, I was planning to work in primary schools, but now I do not think I will do it. Teaching children is not for me. It requires lots of energy and patience. It is challenging for me to deal with a class full of children.*

Similar to the account above, another participant from a different group explained his future plans based on his experiences with YLs:

> *I am now more aware that working with children is not for me. I cannot imagine myself as a YL teacher. The practicum helped me to see it better. Although it was very useful for me to improve my teaching skills, I prefer working with older learners.*

The data revealed that practicum, along with the TEYL module, had great benefits in terms of pre-service EFL teachers' professional development. It offered teacher candidates a unique opportunity to put their knowledge into practice and see their strengths and areas that needed improvement. It also allowed them to get a sense of the real classroom context so that they would be aware of what would be expected of them in their future careers. Above all, participants felt more confident working with children through practicum. There were also some who planned their future careers based on their experiences in the practicum.

DISCUSSION AND RECOMMENDATIONS

This study aimed to examine the effectiveness of the TEYL course through the lens of pre-service EFL teachers and initiated a practicum project in which teacher candidates taught English to children. It also aimed to find out the effects of practicum on pre-service teachers in terms of developing professional skills. The results show that pre-service teachers were mostly happy with the quality of the TEYL module in terms of contents, the balance between theory and practice, and the use of microteaching. From this viewpoint, the module was in line with the broad framework determined by the CHE (2021). However, findings indicate that the practical aspect lacked an important element of actual teaching in a natural environment. Thus, they believed that the module could be improved for them to better prepare for actual teaching in YL classes. In terms of this finding, this research is in line with previous studies (Cesur, 2022; Çamlıbel-Acar, 2016; Çelik & Arıkan, 2012; Zein, 2016). Zein (2016) found that a lack of practicality in teacher education was one of the most important problems for teacher candidates. Revealing similar findings on the practical aspect of teacher education, Çamlıbel-Acar (2016) concluded that TEYL courses should be supported by real classroom experiences and distinctively suggested various practices such as observation of YL classes in a real environment and teaching YLs in a classroom context. Alternatively, in order to integrate theory and practice in terms of TEYL, Güngör (2016) actively used micro-teaching sessions by video recording them and helping participants reflect on their teaching. Participants were able to develop themselves professionally by watching their own performances. However, this technique still lacks the features of teaching in a natural environment. One of these features could be regarded as classroom management, which is viewed as one of the most challenging issues (Read, 1998).

The findings of the current study also revealed the great benefits of practicum for pre-service teachers. Participants highlighted that practicum allowed them to feel the real atmosphere of YL classes and apply their knowledge by considering the characteristics of YLs. They also experienced the challenges of working with YLs, assessed their own performance, and adjusted their way of teaching accordingly. At this point, this study concurs with previous research highlighting the integration of teaching practice and teacher education (Bayyurt, 2012; Collinson et al., 2009; Lawson et al., 2015; Reynolds et al., 2022; Yildirim & Orsdemir, 2019). Reynolds et al. (2022) found that teaching experience was extremely useful for teacher candidates to evaluate themselves and take appropriate actions. Similarly, Lawson et al. (2015) argued that pre-service teachers had the chance to face unpredictable challenges of teaching, deal with these, and become aware of such situations for their future teaching. As Collinson et al. (2009, p. 9) argued, participants in this study regarded practicum as an essential part of effective and successful teacher education "to improve teachers' skills and to extend the body of knowledge on effective teaching practices". They became more equipped and confident, which is extremely important for effective teaching with the help of actual teaching experience (Bayyurt, 2012). Therefore, it could be argued that this study helped to create a more effective and successful YL teacher education.

As an emergent finding of the study, practicum helped pre-service teachers more consciously choose their career path for their future professional lives. In other words, practicum had an impact on their choice whether to work in primary schools, as they were more aware of the considerations and challenges of TEYL (Cameron, 2001; Garton & Tekin, 2022; Nunan, 2010; Pinter, 2017; Read, 1998; Shin, 2006; Tekin & Garton, 2020). In one sense, practicum enabled them to possess the skills Brown (2007) described as necessary, considering the characteristics of YLs, which are different from those of older learners in terms of motivation, literacy skills, and ways of learning. Having experience working with YLs, some participants realized that TEYL was not for them, as they would be more confident with older learners, while others were more in favor of working with YLs. In one sense, practicum was a useful way for them to make informed decisions after graduation. Therefore, it could be argued that this research adds an innovative finding to the related literature, different from previous research focusing on the benefits of practicum for teacher candidates (Collinson et al., 2009; Lawson et al., 2015; Yildirim & Orsdemir, 2019).

Initiating a practicum-implemented TEYL education, this paper contributes to YL teacher education, as it is an ignored issue in teacher education programs (Cesur, 2022). Based on the findings, it offers important implications. Considering the benefits of practicum introduced to pre-service EFL teachers at a state university in Turkey, it can be a good practice to implement it with other teacher candidates as a complementary part of TEYL teacher education programs so that they can be better prepared for actual teaching in YL classes. In line with what Bayyurt (2012) highlights, teacher candidates can be well-equipped and trained specifically to address YL education and hence become more confident working with children. It could also be a good practice to enhance YL teacher education and a complementary action to MONE's (2012) lowering learners' age to learn English (from ten to seven), since quality of education is much more important than learning a new language at an earlier age (Garton & Copland, 2019).

CONCLUSION

This study focused on TEYL teacher education and investigated pre-service EFL teachers' perspectives and experiences on this issue with the implementation of practicum. Overall, the findings of the study suggest that practicum in YL teacher education provides pre-service teachers with a range of benefits, such as putting theoretical knowledge into practice in a natural environment, improving their teaching strategies, designing age-appropriate activities and materials, and feeling the YL atmosphere and hence making decisions for their future teaching career path. The findings therefore have the potential to provoke discussion about enhancing teacher education programs with reference to YL education.

This study is not without limitations, though. It is a small-scale study carried out in one teacher education context in one country, and therefore the results cannot be generalized to broader contexts. It is recommended that similar studies on practicum in YL teacher education be conducted in different settings so that our findings can be confirmed or disproved, and new perspectives can be obtained. Moreover, future research could utilize multiple data collection methods, including classroom observation, which could help identify how pre-service teachers apply the knowledge in YL classes.

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Teachers' Views on the Effects of Inquiry-Based Science Education on the Learning Process of Bilingual Students

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ABSTRACT

New learning methods have been applied every day regarding education and training, and these methods have been used for students to better understand and structure knowledge. As one of these methods, inquiry-based learning is used in primary school science teaching. Turkiye has a rich and diverse cultural structure. Thanks to this diversity, different languages are spoken in various regions apart from Turkish as the official language in Turkiye. In our study, it is aimed to benefit from teacher views about the learning processes of bilingual students who are applied inquiry-based science teaching. The experiences of teachers who have bilingual students in their class were questioned. The study used the phenomenological research model, one of the qualitative methods. The research group consists of 7 teachers who are chosen voluntarily from teachers with bilingual students in the classroom. A semi-structured interview form developed by the researcher was used to collect the research data. While these forms, which included open-ended questions, were applied, the interviews were recorded. These collected data were analyzed by content analysis method. Research findings indicate that inquiry-based science teaching positively affects the learning processes of bilingual students. It has been determined that students' conceptual understanding, participation and interest in the lesson, group working and cooperation skills, science lesson attitudes, problem solving skills and permanent learning are increased.

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INTRODUCTION

In this time when the world is experiencing the information period, many things have changed, including people's needs and views. Although the need for knowledge and learning is crucial in every period of humanity, it has become much more important in the century we live in. In this sense, it has gained importance to train literate individuals in order to be able to think scientifically and to follow developments closely. The aim of science education is rasing individuals, can produce solutions for problems that individuals constantly encounter, who can closely follow the developing and changing world, and who can transfer the knowledge and values they learned at school to their lives (Çepni & Çil, 2009). The way of accessing information today is different from the methods used in the past. While information was given directly to students in the past, John Dewey advocated using inquiry-based teaching in science education, and suggested that students should be active at every stage of the process and that the teacher should be guiding (Barrow, 2006).

In the most general sense, inquiry-based teaching is to develop research on situations that arouse curiosity in individuals and to express the results they reach in this process by showing evidence. Inquiry-based learning is also called inquiry-oriented learning and inquiry-questioning based learning in the literature. Inquiry-based learning approach has been used since the first years of the 20th century. Between 1940 and 1960, the idea of using inquiry-based teaching as a learning approach continued to be increasingly discussed and consulted (National Research Council [NRC], 2000).

Inquiry-based learning approach includes a process, problems are created and then students try to solve these problems by creating questions (Wood, 2003). The responsibility of the subject to be learned in inquiry-based science teaching rests entirely with the student. Because students are responsible for all research processes such as the selection of materials to be used and the creation of research problems (Karamustafaoğlu & Havuz, 2016). Since science is intertwined with nature, students associate the science concepts they encounter in the process with daily life. This approach allows students to discover knowledge directly on their own. When the definition of inquiry-based learning is examined in general, students' research processes are similar to the working systems of scientists.

Inquiry-Based Teaching

Inquiry-based learning is divided into various classes from teacher-centered to student-centered. Keller (2001) classified inquiry-based teaching as directed research, structured research, and unlimited research. Chin and Chia (2006) analyzed it under two headings as guided research and fully open research. When the literature is examined, various classifications are seen. However, in the most general sense, science educators divided inquiry-based learning into three: Structured inquiry, Guided (Directed) inquiry, and Open-ended (Limitless Discovery) inquiry.

Structured Inquiry

Although this type of inquiry is suitable for younger age groups, it is a type of inquiry suitable for traditional classrooms. It puts the teacher in the center. The selection of the questions, the activities to be done and the planning are made by the teacher, and the student is only trying to find the result. The teacher presents many things to the student (material, method of solution of the problem, etc.) ready. In structured inquiry, students focus on finding the result and they are usually not given the opportunity to be active (Çalışkan, 2008).

Guided (Directed) Inquiry

In guided inquiry, the teacher determines research problem and transfers it to students. Students create their own data collection methods and the teacher guides the students in the remaining process (Bayır, 2019). In guided inquiry, the teacher should pay attention to the question that the teacher will ask at the beginning of the lesson, to attract the attention of the student and to encourage them to investigate by arousing their curiosity. It would be more appropriate for students who have experienced structured inquiry to apply guided inquiry. Likewise, guided inquiry prepares students for open-ended inquiry. In guided inquiry, the teacher ignores the direct disclosure of information, but according to open-ended inquiry, he/she can direct students' assumptions more and guide students in the process (Lim, 2001, as cited in Demirci, 2015). In summary, guided inquiry is a process, teacher is guide and student conducts inquiry, experiments and activities to solve problem given to him/her.

Open-ended (Limitless Discovery) Inquiry

This type of inquiry is the type in which the student is the most responsible and the teacher is the most passive. It is more suitable for students who have practiced structured and guided inquiry. Since students conduct their own inquiry, they need to use higher-order thinking skills. In this sense, open-ended inquiry is more suitable for older age groups. In open-ended inquiry, students identify their own problems, apply their own methods, and make their own inferences (Llewellyn, 2002). Open inquiry is similar to guided inquiry, but students also prepare the research problem themselves (Colburn, 2000). Students carry out all processes themselves, such as identifying the problem, collecting data, making analysis, and reaching a solution by making inferences. In this sense, open inquiry is known as the closest type of research to the work of scientists (Çalışkan, 2008).

Language and Bilingualism

The dictionary meaning of language is defined as "*the agreement people make with words or signs to say what they think and hear, language*" (Turkish Language Association [TLA], 2005). Language is a natural tool that provides agreement between individuals, a living entity that has its own rules and develops only within the framework of these rules, a system of secret agreements whose foundation was laid in ancient times, a social institution woven from sounds (Ergin, 2009). Many definitions of language have been made from the past to the present. Although the definitions are different, common feature between them is that they emphasize that language is a means of communication. Language is also an important tool used to perform cognitive functions such as thinking, perceiving and remembering.

Communities have to learn a language other than their mother tongue for some reasons. Syrian students studying in the official languages of the countries they took refuge in as refugees from the civil war in their country can be given as an example to this situation. Although their mother tongue is Arabic, they have to learn a second language according to the country they took refuge in. Students in this situation are called bilingual. In other words, they can use other languages other than their mother tongue. Such societies are called bilingual.

Bilingualism in Turkiye differs according to regions. There are societies that speak languages such as Kurdish, Arabic and Balkan languages as their mother tongue. There are many different definitions of bilingualism. For instance, when students start school, they start as monolingual and become bilingual by studying in a different language. Again, students may start as bilingual and with the education they receive, their second language may become atrophied and disappear (Yılmaz, 2014). According to Aksan (2009), individuals learning or using more than one language for different reasons and under different conditions or learning a second language at a level close to their mother tongue is called bilingualism.

Inquiry-Based Teaching and Bilingualism

Inquiry-based teaching is a teaching method that aims to develop students' scientific process skills (Martin, 2009). Communication skills are the basis of skills such as observation, classification, measurement, data recording, and hypothesis formation. Students frequently use the research process to work with their friends, listen to others, and transfer the data they have obtained to someone else, thus improving their communication skills (Mortimer & Scott, 2003). This development, which is provided by communication between students in inquiry-based teaching, is further strengthened by the teacher-student relationship. Because in this teaching method, the teacher cares about the ideas of all students and takes time to listen to them. Students who see that their ideas are patiently listened to are encouraged to talk more (Scott et al., 2006). This situation causes them to talk frequently in class and to communicate with their friends and teachers. Bilingual students usually have difficulties in expressing in a language other than their own, which is the main reason for the problems they experience. This is a situation that has negative effects on their academic and social lives. Considering all these situations, answers to the following sub-problems were sought in the study in order to evaluate the opinions of teachers about the effects of inquiry-based science teaching on the learning process of bilingual students:What are the teachers' views on the effect of inquiry-based science teaching on the conceptual understanding, classroom interaction structures, participation and interest, science attitudes, problem-solving skills, group working and collaboration skills, permanent learning of bilingual students?

METHOD

This research was carried out using the phenomenology pattern, one of the qualitative research methods, suitable for the purpose and questions of the study. Phenomenology is based on the meanings revealed by experience. Any human experience (event, phenomenon, happiness, accident, relationship, situation, thought, feeling, etc.) can be a subject in phenomenological inquiry (Van Manen, 2014). Phenomenology, which seeks to explore phenomena that manifest in many ways in the world we live in, such as events, experiences, perceptions, inclinations, concepts, and circumstances, focuses on the phenomena that we do not fully and thoroughly understand (Yıldırım & Şimşek, 2006). In this study, the phenomenology design was preferred because it includes teachers' opinions and teachers' experiences about the learning processes of bilingual students in lessons taught with inquiry-based science teaching.

Study Group

The study group of the study consists of 7 teachers who work in different cities of Turkiye and have bilingual students in their classes. Participating teachers were determined by snowball sampling method. Snowball sampling is the process of determining other participants by learning from that person after reaching a participant who has experienced the phenomenon (Ersoy, 2019). Particular attention was paid to the experience and volunteering of the participants in the selection of the sample. All of the participating teachers are classroom teachers working in public schools. The demographics of the participants are presented in Table 1.

Table 1. *Demographic Characteristics of Participating Teachers*

Participants	Seniority	Gender	Age
Participant 1(T1)	0-3 Years	Female	26
Participant 2(T2)	0-3 Years	Female	24
Participant 3(T3)	0-3 Years	Female	26
Participant 4(T4)	4-7 Years	Male	28
Participant 5(T5)	8-11 Years	Female	30
Participant 6(T6)	0-3 Years	Female	32
Participant 7(T7)	0-3 Years	Female	24

Examining Table 1, it can be shown that the professional seniority of the participating teachers is mostly in the range of 0-3 years, and the most senior teacher is in the group of 8-11 years. Six of the participating teachers are female and 1 is male. Again, examining Table 1, it can be shown that that the ages of the participating primary school teachers vary between 24 and 32.

Data Collection Tool

The researcher created a semi-structured interview form that was used to collect the study's data. Three experts in the field of primary school education were asked to comment on the semi-structured interview form after it had first been created as a draft. Necessary adjustments were made according to the feedback from the specialist, questions about different ethnic origins were excluded from the form as they could cause misunderstandings and the final interview form became available. Before starting to collect data, a pilot study was conducted with a teacher and it was tested whether the questions were clear and understandable. The interviews lasted for an average of 20-30 minutes. A voice recorder was used to capture the responses to the questions, which was followed by transcription. Data loss is thus avoided.

Analysis and Interpretation of Data

The content analysis method, which is one of the qualitative analysis methods, was used to analyze the opinions of teachers about the learning processes of bilingual students in inquiry-based science education. In the qualitative study, the data are analyzed in 4 stages. Content analysis is a coding job and is done to convert raw data into standard formats (Babbie, 2006). First of all, coding was done. Then, the extracted codes were transformed into themes and sub-themes. Then, the themes and sub-themes were tabulated, and the data in the tables were supported by direct quotations from views of the teachers. These codes were used in the analysis of the data and in the direct quotations from views of the teachers. The codes and themes obtained in the analysis of the data were presented in a tabular form in the findings section. Likewise, the codes and themes obtained by the content analysis method were turned into frequency and frequence tables and presented in the findings section.

Validity, Reliability and Ethics

After the preparation of the semi-structured interview form used in the study, an expert opinion was obtained from three experts in their field, and the necessary arrangements were made according to the suggestions. A pilot study was conducted with a teacher to test the suitability of the interview form (clearness and clarity of the questions, etc.). While determining the participant teachers, they were chosen from among the teachers who had the conditions to know inquiry-based science teaching, to have bilingual students in their class, and to have teachers volunteer for study. A voluntary consent form was also obtained from the participating teachers, stating that they were volunteers. The names of the teachers participating in the study were never shared at any stage of the study and were kept confidential. The participants were given codes as T1, T2, T3.

During the coding of the collected data, assistance was obtained from an auditor who was out of the study. The data were evaluated together by taking the opinions of the external auditor. Apart from the coding made by the researcher, a second coding was made and the compatibility between the two codings was calculated with Miles and Hubberman (1994) formula.

Reliability Coefficient = Number of Consensus / (Total Consensus + Disagreement)

The percentage of coding compliance was found to be 87%. In addition, before starting the study, necessary permissions were obtained from the Bartin University Social and Human Sciences Ethics Committee, indicating that the study was in compliance with ethical rules by number 2021-SBB-0245.

FINDINGS

In this section, the themes and codes compiled from the answers given by the participating teachers to the semi-structured interview form are presented, supported by the opinions of the teachers.

Conceptual Understanding of Inquiry-Based Science Education and Bilingual Students

When teachers were asked to provide comment in an inquiry-based science lesson to learn more about bilingual students' conceptual understanding, their responses are shown in Table 2.

Table 2. *Theme, Sub-theme, Sample Statements and Sample Opinions of Participant Teachers on the Opinions of Inquiry-Based Science Education on the Conceptual Understanding of Bilingual Students*

Theme	Sub-theme	Example Statements on Sub-Themes	*f*	%	Sample Expressions from Teachers' Opinions
Conceptual Understanding Difference Against	Differences between languages	Difference in Meaning Between Languages	3	30	*"Yes, I think there is a difference. We explain the concepts in Turkish, because they translate them directly into Kurdish in their minds, so they have*

Bilingual Students		Incorrect Translation into Mother Tongue	1	10	*difficulties in their conceptual understanding."* T2
		Word Association	1	20	*"Of course I do. Because they speak Turkish as a second language. They don't speak as clearly as we do. A concept has different meanings in both languages. Therefore, it can lead to differences in their conceptual understanding."* T7 *"Conceptually, there is a significant difference between word deficiencies and associations. Turkish students somehow encounter those concepts. Students can identify a word they have heard before, especially in science-related concepts."* T6
	Misconceptions	Incomprehensibility	3	30	*"... So there are concepts between the two that can cause such confusion. That's why there is a difference."* T1
Conceptual Understanding Difference in Favor of Bilingual Students	Full Concept Learning	Encountering the Concept for the First Time	1	10	*"I think the effect of conceptual understanding is in favor of foreign students. To give an example from the concepts of heat and temperature, our non-bilingual students have a certain concept, a certain framework in their minds. So it's pretty hard to change that. However, since foreign students will learn for the first time, it is easier to teach them. Because it is very difficult to change a concept that is learned incorrectly."* T5
		Not Having Misconceptions	1	10	

Teachers stated that inquiry-based science teaching has results both in favor and against bilingual students between the conceptual understanding of bilingual students and the conceptual understanding of students receiving education in their mother tongue. Teachers who think that there is a difference against them made their explanations on the themes of difference between languages and misconceptions. The teachers who talked about the differences between languages mentioned the sub-themes of difference in meaning between languages, erroneous translation into mother tongue and word association. The teachers who thought that there was a difference in their favor made their explanations on the theme of full concept learning. The teacher, who made a statement on the theme of full concept learning, emphasized that the student did not have a misconception since the student encountered the concept for the first time.

It is seen that all of the participating teachers mentioned that there is a difference between the conceptual understanding of bilingual students. 14.2% of the participating teachers stated that this difference was in favor of bilingual students, while 85.8% stated that this difference was against bilingual students. It is seen that the emphasis on conceptual understanding difference is the highest rate (50%) between languages. While the rate of those who talked about conceptual understanding differences and misconceptions is 30%, the rate of those who talked about full concept learning is 20%. When the difference between the conceptual understanding of bilingual students and other students is examined in general, it can be said that there is a difference against bilingual students due to differences between languages and misconceptions.

In-Class Interaction Structures of Inquiry-Based Science Education and Bilingual Students

The interaction structure is categorized as triadic and chain order. In the triadic order, teachers ask questions, student answers them, and the teachers evaluates. In chain order, the teacher starts the conversation with a question. Students answer, the teacher reflects the answer to that student or other students with new questions. There is no evaluation and the dialogues are long. Teachers' opinions were asked about which order is used more in the classroom interaction structures of bilingual students of science lessons taught with the research-based teaching method, and the answers given are presented in Table 3, thematically.

Table 3. *Exemplary Statements and Sample Opinions Regarding Themes, Sub-Themes, Sub-Themes About Which Order of In-Class Interaction Structures the Participant Teachers Use in Inquiry-Based Science Education*

Theme	Sub-theme	Example Statements on Sub-Themes	*f*	%	Sample Expressions from Teachers' Opinions
Chain Order	Learning Through Discovery	Curiosity, Doubt	1	10	*"I think the chain order is used more. Because in the chain order, the child is constantly trying to be thought through with questions, since he or she will investigate a problem based on the phenomenon of curiosity."* T1 "*We use the chain layout more. Because students are mostly trying to find answers and solutions themselves."* T2
		The student gets the information.	3	30	
		Guidance with questions	2	20	
	Process Oriented	Process is important, not evaluation.	1	10	*"We use chain order more. Because we involve the whole class in the process and we do not present the information directly, we ensure that the students find it…"* T3 *"I think the chain order is used more. Talking about a question in a conversational atmosphere will increase the student's retention time. In inquiry-based science teaching, chain order is used more because the process is more important than evaluation."* T7
		Everyone is included in the process.	1	10	
	Constructivist Approach	Student-centered	1	10	*"The chain order is used more. The triadic order is more suitable for traditional education. But our approach to inquiry-based science teaching is innovative and student-centered."* T5
		Innovator	1	10	

All of the participating teachers emphasized that chain order, one of the classroom interaction structures, was used in inquiry-based science teaching. Participating teachers made their explanations on the sub-themes of teaching by discovery, process-oriented and constructivist approach. Teachers who talked about learning by discovery stated that they arouse the feelings of curiosity and doubt in the students, they enable the students to reach the information themselves, and they guide the students with questions. The teachers, who emphasized the process-oriented sub-theme, stated that they included everyone in the process and that the process, not the evaluation, was important. Teachers emphasizing the constructivist approach, on the other hand, stated that the chain order is student-centered and innovative.

It is seen that all of the participating teachers prefer chain order among classroom interaction structures in inquiry-based science teaching. It is seen that the emphasis on chain order is the sub-theme of teaching by discovery with the highest rate (60%). It is seen that the rate of those who talked about being process-oriented and those who emphasized the constructivist approach sub-theme are equal to 20%. Interaction structures are divided into triadic order and chain order. It is seen that chain order is preferred among these interaction structures in inquiry-based science teaching.

Inquiry-Based Science Education and Bilingual Student Participation and Interests

In order to determine the effects of science lessons taught with the inquiry-based teaching method on the participation and interest of bilingual students, the opinions of the teachers were asked and the answers given are presented in Table 4, thematically.

Table 4. *Exemplary Statements and Sample Opinions of Participant Teachers on Themes, Sub-Themes and Sub-Themes Regarding the Effects of Science Lessons Taught with Inquiry-Based Teaching Method on the Participation and Interests of Bilingual Students*

Theme	Sub-theme	Example Statements on Sub-Themes	*f*	%	Sample Expressions from Teachers' Opinions
Increase in class	Constructivist Approach	Student-Centered	3	18,75	*"In the lessons where we use the lecture method, the children are in a passive position, they themselves get bored*

participation and interest		Configuring Information	2	12,5	*and they are constantly distracted. But when we move through programs that center the student, such as inquiry-based, children's interest in the lesson increases and their participation increases."* T4
		Active participation of passive students	2	12,5	*"The child researches and analyzes a subject he/she is curious about and comes to a conclusion about it. He/she creates his/her own knowledge. Therefore, student participation will be more."* T1 *"Their participation and interest in the course is definitely increasing. Even normally distracted students can focus their attention on more subjects with inquiry-based science teaching."* T6
	Motivation	Curiosity	3	18,75	*"As there are interesting topics, their participation and interest in the course increases."* T3
		Motivation	2	12,5	*"The active role of the student in solving a problem increases their motivation. A motivated student also increases his/her interest in the lesson."* T7
		Proximity to Life	1	6,25	*"...student has more control over these subjects since science lessons are things that we constantly encounter in life and that we constantly see. Therefore, their participation and interest in the course increases."* T5
	Interaction	Social Relations	2	12,5	*"But when we progress through programs that center the student, such as research-based, children's interest in the lesson increases, their participation increases and their social relations increase."*T4
		Everyone to share their opinion	1	6,25	*"...Because we take the opinions of all students here and we care about them, so the student participates in the lesson more actively."* T5

When Table 4 is examined, it is seen that the participation and interest of bilingual students in inquiry-based science teaching has increased. It is seen that the participant teachers made their explanations on the sub-themes of constructivist approach, motivation and interaction. Teachers who mentioned the constructivist approach theme expressed the positive effects of student-centeredness, knowledge structuring, and passive students' active participation. Teachers who talked about the theme of motivation talked about the positive effects of curiosity, motivation and closeness to life on the active participation of students in the lesson. Teachers who talked about the theme of interaction, on the other hand, emphasized that social relations and sharing everyone's opinion positively affected students' participation and interest in the lesson.

All of the participating teachers stated that inquiry-based science teaching positively affected students' participation and interest in the lesson. The sub-theme (43.75%) with the highest emphasis on participation and interest in the course is the constructivist approach. It is seen that the rate of effect of motivation on student participation and interest is 37.5%. It is seen that the effect of the interaction on the participation and interest in the course is 18.75%. When the effect of inquiry-based science teaching on the participation and interests of bilingual students is examined in general, it can be said that it is positive and increases the interest of the students in their participation in the lesson.

Inquiry-Based Science Teaching and Bilingual Students' Group Working and Collaboration Skills

In order to determine the effect of science lessons taught with the inquiry-based teaching method on the bilingual students' group working and cooperation skills, the opinions of the teachers were taken and the answers given were tabulated and presented in Table 5.

Table 5. *Exemplary Statements and Sample Opinions of Participant Teachers on The Effects of Inquiry-Based Science Education on Bilingual Students' Group Working and Collaboration Skills on Themes, Sub-Themes, Sub-Themes*

Theme	Sub-theme	Example Statements on Sub-Themes	*f*	%	Sample Expressions from Teachers' Opinions
Working with the Group and Collaboration Increases	Interdependence	Cooperation	4	17,39	*"In inquiry-based science teaching, students are already researching a topic that needs to be researched as a group. They transfer their skills collaboratively."* T1 *"Working together allows students to work more harmoniously. Here they support each other."* T6 *"Affects positively. Because we produce as a group and share as a group."* T5
		Solidarity	2	8,69	
		Sharing	2	8,69	
	Accountability	Working with a Group	4	17,39	*"Because the students are doing research here as a group, not just individual research…"*T4 *"They are active in group work and collaboration. A responsibility is placed on the child."* T3
		Responsibility	2	8,69	
	Social Skills	Communication	3	13,04	*"... In this sense, working with groups also increases the interaction and communication betweenstudents."*T1 *"It provides a significant increase. Working together allows students to work more harmoniously."* T6 *"Each group talks about their duties and responsibilities within themselves, and this creates a strong bond and cooperation between them."* T5
		Socializing	2	8,69	
		Working together	2	8,69	
		A Strong Bond	1	4,34	
No Group Working Skills	Individual Goals	Individual Study	1	4,34	*"For the first time, I usually try not to train with the group. Because it wanders off. So it is better when they work individually."* T2

When Table 5 is examined, it is seen that inquiry-based science teaching has a positive effect on bilingual students' group work and cooperation skills in general. Teachers who talked about their positive effects focused on the sub-themes of interdependence, accountability and social skills. Teachers who talked about interdependence mentioned the positive effects of cooperation, helping and sharing. The teachers, who emphasized the sub-theme of accountability, emphasized group work and responsibility. Teachers talking about social skills, on the other hand, talked about communication, cohesion, working together and strong bonds between students. The teacher, who stated that he/she did not have the skills to work with a group, stated that he/she trained his/her students individually.

The majority of the participating teachers stated that inquiry-based science teaching positively affected bilingual students' group work and cooperation skills. The sub-themes with the highest emphasis on group work and cooperation (34,78%) are the sub-themes of interdependence and social skills. It is seen that the rate of the effect of the sub-theme of accountability on the ability to work with the group and cooperation is 26.08 %. It is seen that the rate of those who state that they do not work with a group but rather do individual work is 4.34 %. When the effects of inquiry-based science teaching on bilingual students' group working and cooperation skills are examined in general, it is seen that it increases their group working and cooperation skills.

Inquiry-Based Science Education and Bilingual Students' Attitudes to Science Lesson

In order to determine the effects of science lessons taught with the inquiry-based teaching method on the lesson attitudes of bilingual students, the answers given to the teachers when their opinions were asked are presented in Table 6 by being themed.

Table 6. *Exemplary Statements and Sample Opinions on Themes, Sub-Themes, Sub-Themes of Participant Teachers' Views on the Effects of Inquiry-Based Science Education on the Attitudes of Bilingual Students towards Science Lesson*

Theme	Sub-theme	Example Statements on Sub-Themes	*f*	%	Sample Expressions from Teachers' Opinions
Positive Attitude Increase	Affective Effects	Motivation	2	18,2	*"Inquiry-based science teaching makes students love science more. Because we put students in confusion, we make them doubt what they know, which motivates them."* T3 *"As this method ensures active participation of students in the lesson, it increases their motivation. It makes them more willing to participate in the lesson. This increases students' science attitudes."* T7
		Self-confidence	1	9	
		Motivation	2	18,2	
	Student Participation	Active Participation	2	18,2	*"...my bilingual students had a lot of fun despite knowing very little Turkish. My Syrian students were incredibly happy to participate in those activities and to observe them. As such, it made them love science class."* T5
		Learning by Doing and Experiencing	2	18,2	
	Teacher Influence	Teacher Influence	2	18,2	*"The science lesson starts in the 3rd grade and continues in the 4th grade. 3rd grade students are generally unfamiliar with science lessons. Since there is uncertainty, it causes negative emotions and attitudes in the student. This may cause bias. Especially in bilingual students, this may be more common in students who have communication problems. In other words, their attitudes towards science lesson may be low at the beginning of the process. If we cannot turn this student's attitude into a positive one, it continues like this…"* T4 *"...It's actually a little bit about how the teacher conveys, whether it's research or experiments. If the teacher expresses it well and especially emphasizes the concepts for bilingual students, the effect is positive."* T1

Emphasizing that inquiry-based science teaching positively affects the attitudes of bilingual students, the teachers made their explanations on the themes of affective effects of the method, effects on student participation, and teacher effects in the method. Teachers who talked about affective effects mentioned positive effects on motivation, self-confidence and motivation. Teachers who stated the effects on student participation talked about the effectiveness of active participation and learning by doing. Those who talked about the teacher effect in the method emphasized the importance of teacher guidance in the process.

It is seen that all of the participating teachers mentioned that the method positively affects the attitudes of bilingual students towards the science lesson. It is seen that the emphasis on affective effects towards attitude was made with the highest rate (45.4%). The rate of those who talked about the effect on student participation and contribution to attitude is 36.4%. The rate of those who talked about the teacher effect is 18.2%. When the effects of inquiry-based science education on the attitudes of bilingual students towards the science lesson are examined in general, it can be said that it causes an increase in positive attitudes thanks to the positive effects in the affective field, and the support provided to the active participation of the students in the lesson creates a positive attitude.

Inquiry-Based Science Teaching and Bilingual Students' Problem Solving Skills

In order to determine the problem-solving skills of bilingual students in science lessons taught with the inquiry-based teaching method, teachers' opinions were taken and the answers given are presented in Table 7 by being themed.

Table 7. *Exemplary Statements and Sample Opinions of the Participant Teachers on the Effects of Science Lessons Taught with Inquiry-Based Teaching Method on the Problem Solving Skills of Bilingual Students*

Theme	**Sub-theme**	**Example Statements on Sub-Themes**	***f***	**%**	**Sample Expressions from Teachers' Opinions**
Increase in Problem Solving Skills	Implementation Process	Access to Information	2	15,38	*"...We leave student alone with the problem. The student himself/herself decides how to solve this problem and what steps to take."* T5 *"...The child is trying to find something to solve these problems, doing researches."* T4 *"Since they can recognize the connection when it is inquiry-based, they can generate ideas to solve the problem there. As a result, their problem-solving skills increase."* T6
		Doing research	1	7,69	
		Generating Idea for Solution	1	7,69	
		Relationship Building	1	7,69	
	Implementation Objective	Being Problem-Focused	3	23,07	*"Because inquiry-based science teaching already includes problem solving and is interlocked with each other…"* T3 *"There is always a problem in inquiry-based science teaching. We present a problem to the student."* T4
		Being Student-Centered	1	7,69	*"As inquiry-based science teaching already includes problem solving, and because they are interlocked with each other, their problem solving skills develop because students are in the center."* T3
Difficulty in Solving Problems	Lack of Skills	Teacher Support	3	23,07	*"If we think about problem solving, students have difficulties in solving problems when there are concepts they do not know because they are bilingual in this sense."* T1 *"Problem solving skills do not develop much. They are not prone to problem solving. They often ask for support for a solution."* T2 *"Because the biggest problem of our new generation, especially our new generation, is that families do not expose their children to too many problems, every problem is solved by the family themselves, and the student comes to primary school in this way. When they start primary school, many students do not know what to do in the face of the problem they are experiencing. For example, not being able to establish friendships or not knowing how to behave in a classroom environment. As such, the student tends to avoid more problems."* T5
		Tendency to Avoid the Problem	1	7,69	

When Table 7 is examined, it is seen that the problem solving skills of bilingual students generally increase in inquiry-based science teaching. It is seen that the participant teachers made their explanations on the application process, application target and lack of skills. Teachers who talked about the application process theme talked about the positive results of accessing information, doing research, generating ideas for solutions and establishing relationships. Emphasizing the sub-theme of the application goal, the teachers stated that the problem-oriented and student-centered nature of the application positively affects the problem-solving skills of the students. Emphasizing the theme of lack of skills, the teachers mentioned the students' need for teacher support and their tendency to escape from the problem.

It is seen that the majority of the participating teachers stated that inquiry-based science teaching improves the problem-solving skills of bilingual students. The sub-theme (38.45%) with the highest emphasis on problem solving skills is the application process. It is seen that the effect of the application target on the problem solving skill is 30.76%. It is seen that the effect of the theme of difficulty in problem solving is again 30.76%. When the effect of inquiry-based science teaching on the problem-solving skills of bilingual students is examined, it can be said that it has a positive effect in general. In other words, it is seen that students increase their problem solving skills.

Inquiry-Based Science Education and Its Effect on Bilingual Students' Permanent Learning

In order to determine the effect of science lessons taught with the inquiry-based teaching method on the permanent learning of bilingual students, teachers' opinions were taken and the answers given are presented in Table 8 by being themed.

Table 8. *Exemplary Statements and Sample Opinions of the Participant Teachers on the Effects of Science Lessons Taught with Inquiry-Based Teaching Method on the Permanent Learning of Bilingual Students on Themes, Sub-Themes*

Theme	Sub-theme	Example Statements on Sub-Themes	*f*	%	Sample Expressions from Teachers' Opinions
Provides Permanent Learning	Active Participation	Learning by Doing and Experiencing	5	20	*"In inquiry-based science teaching, children already learn by doing. They do a lot of thin gs themselves."* T4 *"... we think that when we explain a subject well, students understand it very well. But the important thing is that the students are active in this process, not us."* T5 *"It provides permanent learning because it provides more permanent learning because the student tries to solve the problems encountered in daily life, and because the student is in the center and deals with himself/herself."* T3
		Class Participation	5	20	
		Student-Centered	3	12	
	Cognitive Constructivism	Access to Information on Their Own	3	12	*"It provides very permanent learning as they wonder and find it and research and find it themselves."* T2 *"But in inquiry-based science teaching, the information is permanent as the student learns the information through their own experiences."* T4 *"In the lessons we teach with the lecture method, old learnings are often forgotten because the child memorizes and then forgets."* T4
		Learning by Experience	1	4	
		Far From Memorization	1	4	
	Scientific Process Skills	Doing Research	2	8	*"...provides permanent learning as they search and find themselves."* T2 *"They do experiments, they observe, they draw conclusions, sometimes they do groupwork."* T4 *"In inquiry-based science teaching, students do not easily forget what they have learned because they are in the middle of the process and ask questions because they work in cooperation and communication."* T5
		Making Inferences	2	8	
		Experiment and Observation	2	8	
		Communication	1	4	

When Table 8 is examined, it is seen that it affects the permanent learning of bilingual students positively in inquiry-based science teaching. It is seen that the participant teachers made their explanations on the sub-themes of active participation, cognitive constructivism and scientific process skills. Teachers who talked about the theme of active participation emphasized the importance of learning by doing, participating in the lesson and being student-centered. Talking about the cognitive constructivism sub-theme, the teachers mentioned the importance of students' accessing the information themselves, learning from their own experiences, and the importance of inquiry-based science teaching being away from rote learning. Teachers who emphasized scientific process skills, on the other hand, emphasized that students' research, inference, experimentation, observation and communication provided permanent learning.

It is seen that all of the participating teachers stated that inquiry-based science teaching positively affects the permanent learning of bilingual students. The sub-theme (52%) with the highest emphasis on permanent learning is active participation. It is seen that the effect of cognitive constructivism sub-theme on permanent learning is 20%. It is seen that the effect of scientific process skills on permanent learning is 28%. When the effect of inquiry-based science teaching on the permanent learning of bilingual students is examined in general, it can be said that it is positive and this method increases the permanent learning of the students.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

The aim of this study is to determine how inquiry-based science teaching affects the learning processes of bilingual students. In this section, the results obtained from the research findings, the relations of the results with other studies and suggestions for future studies are included. In this study, which was conducted with primary school teachers within the scope of phenomenology design, one of the qualitative research methods, it was observed that inquiry-based science teaching improved the learning processes of bilingual students in general, supported their learning, and increased some skills.

According to the results of the study, it was determined that inquiry-based science teaching positively affected the conceptual understanding of bilingual students and minimized their misconceptions. When the relevant literature was examined, some studies supporting the results of the research were found. İnal (2013) concluded in his/her study that inquiry-based teaching reduces students' conceptual misconceptions and their conceptual understanding is positively affected. Kula (2009) stated in his/her study that inquiry-based teaching positively affects concept learning and at the same time reduces misconceptions. Parim (2009), in his/her study, concluded that inquiry-based teaching had positive effects in eliminating misconceptions in the experimental group. A study conducted with students who were taught in a language other than their mother tongue revealed that inquiry-based science teaching was effective in learning science for these students, even if they were at a disadvantage in communicating (Fradd et al., 2001).

According to the results of the study, it was concluded that inquiry-based science teaching positively affected the science lesson attitudes of bilingual students. It has been concluded that the positive effects of this approach, such as students' motivation, self-confidence, motivation, active participation, learning by doing, have a positive effect on students' attitudes. Similar results were found in the literature. Akpullukçu (2011), Duban (2008) and Tatar (2006) examined the effects of inquiry-based teaching method on students' attitudes towards science lessons in their study. The findings obtained in these studies demonstrate that inquiry-based science teaching affects students' attitudes positively.

According to the results of the study, it was concluded that inquiry-based science teaching increased the problem-solving skills of bilingual students in general, while some students had difficulties in solving problems and could not solve it without help. In a study that followed the inquiry-based teaching process of bilingual students, it was observed that bilingual students were more problem-solving oriented when they received encouraging support (Hampton & Rodriguez, 2001). When the literature was examined, similar results were found regarding problem solving skills. Altunsoy (2008), in his/her study, concluded that the students in the experimental group had higher post-test scores of scientific process skills. Again, Tatar (2006) concluded in his/her study that inquiry-based science teaching positively affects students' scientific process skills. Yıldırım and Berberoğlu (2012) concluded in their study that inquiry-based science teaching has no effect on the development of students' scientific process skills.

According to the results of the study, it was concluded that the participation and interest of bilingual students in inquiry-based science teaching increased. The fact that it is suitable for the constructivist approach, provides motivation and interacts with the students has been revealed as a result of the opinions of the participating teachers. When the literature is examined, studies that overlap with the results of the study have been found. McPhedran (2006), in his study in which inquiry-based learning tried to determine students' interest, concluded that students' interest in science lessons increased. Similar to our research, it has been determined that bilingual primary school students, who receive inquiry based science education in a language different from their mother tongue, participate more actively in the lesson, comprehend the content information more easily, and therefore, their interest increased (Hampton & Rodriguez, 2001).

According to the results of the study, it was concluded that inquiry-based science teaching positively affects the permanent learning of bilingual students. It has been concluded that the use of active participation, cognitive constructivism and scientific process skills support permanent learning. When the relevant literature is examined, there are similar studies with the study result, as well as studies that do not overlap. Aydede (2006) investigated the effects of active learning approach on the level of retention and found a significant difference between the experimental and control groups. Fife (2003) tested the effect of teaching with activities on permanent learning and could not observe a significant difference between the experimental group and the control group. He/she claimed that the reason for this was that he/she kept the duration of the study short. It has also been emphasized by various studies that the inquiry based education of bilingual students has positive effects on their skills and active participation (Thomas & Collier, 1995; Nieto, 2000).

In conclusion, it has been determined that inquiry-based science teaching improves classroom interaction structures towards student-centeredness, supports the conceptual understanding and permanent learning of bilingual students, contributes to their participation and interest in the lesson, increases their science attitudes positively, and develops problem-solving, group work and cooperation skills. For these reasons, it is suggested that science lessons be based on inquiry in classrooms with bilingual students. Considering the situations emphasized by the participating teachers, it is revealed that bilingual students need teacher support. Therefore, providing bilingual students with a guided inquiry-based science education may be beneficial to them.

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Lifelong Learning Motivation Scale (LLMS): Validity and Reliability Study

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ABSTRACT

The aim of this study is to develop a scale to measure lifelong learning skills of young and adult individuals. The participants of the study consisted of 275 individuals between the ages of 14-55. While creating the scale item pool, firstly, a detailed literature review was conducted. Scales similar to the subject were examined and an 18-item form was created after the examinations. The scale item pool was presented to two experts who are academicians in the field of lifelong learning and a scale development expert. After the corrections were made, the scale trial form was sent to the participants. Exploratory factor analysis was conducted to determine the construct validity of the scale. As a result of the factor analysis, 7 items were removed from the scale. As a result of the exploratory factor analysis, it was determined that the scale consisted of five factors. The first factor consists of 5 items and the other factors consist of 3 items each. Confirmatory factor analysis was conducted to determine the relationship between the factors, the relationship between the variables and the factors, the relationship between the factors and each other, and the level of explanation of the factors to the model. The Croneach alpha reliability value of the scale was determined as .646. As a result, the Lifelong Learning Motivation Scale (LLMSS) is intended to be a scale that fills the gap in the literature and can be developed and used.

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INTRODUCTION

If we compare the current century with the last century in terms of the creation, acquisition and sharing of knowledge, we can see that incredible changes have taken place. As a result of this change, the age we are in is called the ‘information age’. “Knowledge has become a superior economic resource, more important than goods and often more important than money. Information and knowledge, which are considered as economic goods, are now more important than cars, oil, steel or other products of the industrial age” (Ata, 2006). Thanks to technological tools such as the Internet, the breadth and depth of information has increased. The effects of this change on the people needed by society are inevitable. That is why nowadays almost all students take a course outside school and many adults attend courses and certificate programmes for various knowledge and skills. Therefore, the concepts of education and learning are no longer the concern of educators only, but have become more relevant to the general public than ever before. At this point some questions arise. These are: - How can we create autonomous (continuous, stimulating and resource-rich) learning environments that develop learners’ abilities? - How can we create lifelong learning environments in which cognitive and psychological conditions are favourable to the development of learners’ achievement and personal autonomy (Derrick, 2003).

Today, the aim of education is to ensure that individuals become individuals with active adaptation capacities that will carry the society beyond its current level and be the change itself, rather than unquestioning compliance with environmental conditions and remaining as they are (Yeşilyaprak, 2010). Obligations such as adapting to change, not being indifferent to change, and moving oneself and the society forward have invalidated the limitation of education only to schools in terms of space and years covering basic education in terms of time. This has led to the birth and development of the concept of lifelong learning.

Kulich (1982) defined lifelong learning as the provision of education to individuals throughout their lives, while White (1982) saw it as the acquisition of the knowledge necessary for individuals to manage their lives (Günüç, S., Kuzu, A., & Odabaşı, H. 2012). In other words, lifelong learning refers to various activities carried out for learning from birth to death.

In the ‘Strategy Document on Lifelong Learning in Turkey’ prepared by the Ministry of National Education and approved by the High Planning Council on 5 June 2009, lifelong learning is defined as ‘all kinds of learning activities in which individuals participate throughout their lives in order to improve their knowledge, skills, interests and competences in personal, social, community and professional fields’.

Today, lifelong learning is a contemporary phenomenon that constitutes the guiding element of educational policies. In order to analyse this phenomenon in all its aspects, it is necessary to define it conceptually and to determine what is understood and attributed to it. The terminology and definition of lifelong learning have changed within various systems and due to social, psychological and economic influences. Based on these changes, it is possible to draw a general picture of lifelong learning. “The reason why almost all of the educational experiences usually referred to as lifelong learning/education practices are adult education activities is due to the ambiguity of the dividing lines between the concepts of adult education and lifelong learning/education. However, at the point where lifelong learning/education discussions have reached, it is stated that the concept has a broader content summarised as “from cradle to grave”, which includes restructuring at all levels of education systems, and although it includes the dissemination and development of adult education practices, this concept cannot be reduced to this” (Bağcı, 2007).

The four main objectives of lifelong learning are learning to know, learning to do, learning to be and learning to live together. Learning is understood as acquiring knowledge from different sources and using this knowledge in problem solving, planning or decision making phases of everyday life; it is also understood as using the computer as a tool to access information. Lifelong learning requires specific skills such as supporting learning and organising the learning process itself. In order to realise lifelong learning, literacy skills such as information literacy, digital literacy and media literacy are needed to acquire, process, assimilate and evaluate new knowledge and skills. Lifelong learning involves questioning one’s environment, knowledge, skills and interactions, as well as exploring and appreciating new ideas to gain a new perspective. It develops the ability to use the mind actively (Edwards, 2008).

When the studies conducted in Turkey are examined, lifelong learning dispositions in university students (Demirel & Coşkun, 2012), prospective teachers (Tatlısu, 2016, Erdoğan, 2014), educational administrators (Gürkan, 2017), adult employees (Babanlı, 2018) and graduate students (Adabaş, 2016) samples were addressed. Lifelong learning tendency (Gür Erdoğan & Arsal, 2016; Diker Coşkun, 2009; Yaman, 2014), attitude (Karaca, Çalışkan, Dönmez, & Durak, 2021), perception (Ünal & Kalçık, 2017), online interaction (Kara, Kukul & Çakır, 2021), skill (Çiftcibaşı, Korkmaz, & Karamustafaoğlu, 2020) and competence (Uzunboylu & Hürsen, 2011) were also addressed in the scales developed. In this study, the motivation variable, which is one of the necessary conditions for learning, is discussed. A scale was developed aiming to reveal the motivation status of lifelong learners.

Therefore, this study aims to examine the digital well-being of individuals. Depending on this purpose, the following sub-objectives will be sought:

- ➔ What is the construct validity of the Motivation for Lifelong Learning Scale?
- ➔ What is the reliability of the Lifelong Learning Motivation Scale?
- ➔ What is the level of lifelong learning motivation of the participants?

METHOD

This research is a scale development study. The processes applied in the validity and reliability study of the Lifelong Learning Motivation (LLMS) Scale and the characteristics of the research group are presented below.

Research Design

This study, which aims to develop a valid and reliable scale to determine the cognitive, affective and psychomotor motivation of a lifelong learner, was conducted in a descriptive survey model. Descriptive survey model is a research model that serves to describe the situations that have been experienced or are being experienced as they are (Karasar, 2007) and summarises the characteristics of the collected data (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2017). For this reason, the survey model was used in this study.

Research Universe and Sample

While creating the item pool, 87 sentences were written in total. Overlapping, distancing from the definition framework, etc. were taken into consideration and as a result, it was decided to include 31 items in the item pool. As a result of the opinions of educational technology, psychological counsellor and language experts, it was decided to include 18 items in the pilot application. In scale development studies, it is recommended that it would be correct to reach at least 10 times the number of participants in the item pool (Korkmaz, Usta, & Kurt, 2014). Research data were obtained from 275 participants in the first half of 2023. The demographic information of the participants is presented in the table below.

Table 1. *Demographic data*

Gender	Male	Female	Total
14-24 years	25	28	53
25-34 years	30	47	77
35-44 years	52	35	87
45-55 years	28	30	58
TOTAL	**135**	**140**	**275**

Establishing the Item Pool

The European Framework of Key Competences for Lifelong Learning has identified eight key competences that need to be developed for personal success, active citizenship, social inclusion and employment in the knowledge society (European Commission, 2007; as cited in Beycioğlu & Konan, 2008). In the first step of the scale development process, the relevant literature was analysed in a wide range (Bryce 2006; Knapper & Cropley, 2000) including skills, perceptions, attitudes, dispositions and knowledge variables.

The item pool was started to be formed by considering many dimensions, especially the items in the scales. The researchers wrote 87 sentences for all dimensions. 31 items were included in the item pool, and 31 items were kept in the pool as a result of the pilot study and new expert opinion. After the necessary arrangements were made, the scale form consisting of 18 items (14 positive and 4 negative) was made ready for the actual application. The scale was coded on a 5-point Likert scale with the premises of fully reflects (5), reflects a lot (4), reflects moderately (3), reflects a little (2) and does not reflect at all (1) for positive items; negative items were coded in the opposite way.

Data Analysis

During the development of the scale, SPSS and AMOS software were used to analyse the data. Principal component analysis was used to determine the construct validity and factor loadings of the scale developed to measure the motivation of lifelong learners (Büyüköztürk, 2002). In case of suitability for factor analysis, Kaiser- Meyer- Olkin (KMO) coefficient and Barlett Sphericity test results were examined. In the exploratory factor analysis (EFA), 18 items, 4 of which were negative, were coded and factor loadings of 0.40 and above were applied to examine the suitability of the items to the selected model (Büyüköztürk, 2002). Therefore, this lower limit was determined as 0.40 in this study. Eigenvalue and scree plot were analysed to determine the number of factors. With 11 items, item discriminations were analysed by independent sample t-test. In addition, the significance of the 27% lower and upper group item scores were analysed to see how the scale items affected the motivation levels of individuals. The validity of the scale consisting of 11 items in total was ensured. After the exploratory factor analysis, confirmatory factor analysis was performed. Some value ranges (CFI, GFI, RMSEA, AGFI, NFI) were taken into consideration to verify the acceptability of the scale (Byrne, 2011; Çokluk, 2014).

Internal consistency coefficient was calculated for the reliability of the scale. Crobach alpha, Guttmann split-half, Sperman-Brown values were analysed for internal consistency coefficient.

FINDINGS

Findings Related to Validity

The construct validity and item discrimination values of the lifelong learning motivation scale were calculated. The results obtained are as follows.

Construct Validity

Findings Related to Exploratory Factor Analysis (EFA): The KMO coefficient and Barlett's test are used to determine whether exploratory factor analysis should be performed. KMO coefficient greater than 0.60 and Barlett's test being significant ($p<0.05$) indicate that the data are suitable for factor analysis (Büyüköztürk, 2002). KMO= 0.712 and Barlett's test $\chi2$= 745.00 sd= 55 (p= 0.000). As a result of the analysis, a structure consisting of 5 dimensions was obtained. Item loadings were analysed and items with loadings lower than 0.40 were not included in the analysis. Care was taken to ensure that the content validity was not impaired, and the factor loadings were re-examined according to the difference of 0.1 between the factor loadings for overlap control. As a result, it was determined that the items were grouped under 3 factors and explained 49.72% of the total variance. Accordingly, the distribution of factor eigenvalues is given in Graph 1.

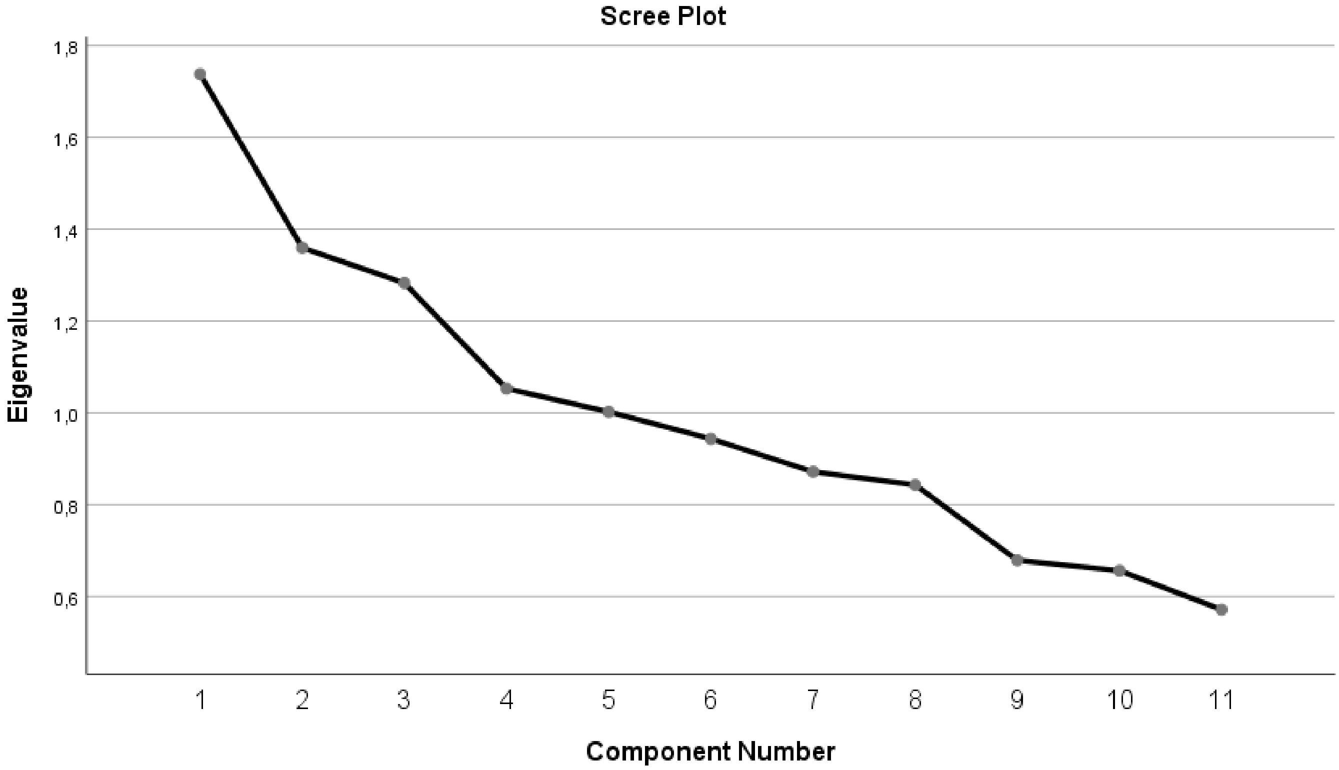

Figure 1. *Slope Slope Graph*

Table 2 shows the exploratory factor analysis. As seen in the table, a three-factor structure dimension was analysed. Item loadings and variance explanation amounts are shown in the table.

Table 2. *Results of exploratory factor analysis*

	F1	**F2**	**F3**
Item1	,707		
Item2	,679		
Item3	,672		
Item4	-,387		
Item5	,352		
Item6		,767	
Item7		,748	
Item8		-,403	
Item9			,546
Item10			,497
Item11			-,456
Variance explained	15,800	17,362	16,558
Eigenvalue	1,738	1,360	1,283

As seen in Table 2, the first factor of the scale includes 4 items and the factor loadings are in the range of 0.352-0.707. When we look at the whole scale for this factor, it is seen that the eigenvalue is 1.738. It is seen that it has the power to explain 15.800% of the overall variance. The second factor of the scale has 3 items. The factor loadings are in the range of 0.403-0.767, the eigenvalue is 1.360 and the variance is 17.362. The third factor consists of 2 items. Factor loadings are in the range of 0.456-0.546. The eigenvalue of the factor is 1.283 and its variance is 16.558%.

Findings Related to Confirmatory Factor Analysis (CFA): As a result of the exploratory factor analysis, a scale consisting of 11 items with 3 factors was obtained. Confirmatory factor analysis was conducted using AMOS software with the data obtained from the analysis. Confirmatory factor analysis is used to determine the relationship between factors, the relationship between variables and factors, and the level of explanation of factors to the model (Brown, 2015).

Table 3. *Comparison with standard goodness-of-fit measures*

Fit Dimensions	Perfect Fit	Acceptable Compliance	Research Data
$\chi2$/sd	$0 \leq \chi2 \leq 3$	$3 \leq \chi2<5$	2.212
RMSEA	$0 \leq$ RMSEA $\leq .05$	$.05 \leq$ RMSEA $\leq .08$	0.058
GFI	$.90 \leq$ GFI ≤ 1	$.85 \leq$ GFI $\leq .90$	0.88
AGFI	$.90 \leq$ AGFI ≤ 1	$.80 \leq$ AGFI $\leq .90$	0.84
CFI	$.95 \leq$ CFI ≤ 1	$.90 \leq$ CFI $\leq .95$	0.90
NFI	$.95 \leq$ NFI ≤ 1	$.90 \leq$ NFI $\leq .95$	0.90

Confirmatory factor analysis results are given in Table 3. According to these results, when the fit index values of the CFA model established with 275 data were examined, it was determined that the scale exhibited an excellent fit with a chi-square value of 2.212 (Byrne, 2013). When the RMSEA value is examined, it is below the critical value, indicating that it is within the acceptable fit index range (Schermelleh-Engel, Moosbrugger, & Müller, 2003). When the remaining GFI, AGFI, CFI and NFI values are examined, it is seen that they exhibit acceptable fit according to the critical values (Marsh, Balla & Mcdonald, 1988; Byrne, 2013).

Item Discrimination

In the method of calculating the discrimination power of the scale items, the results obtained from the individual items are sorted from largest to smallest and the lower 27% and upper 27% groups are found. At this stage, independent sample t-test analysis was applied with the lower and upper groups and the t values indicating the discrimination powers are shown in Table 4.

Table 4. Item Discrimination

F1		**F2**		**F3**		**F1**	17,42
I.	**t**	**I.**	**t**	**I.**	**t**	**F2**	13,20
I1	-12.520	I1	-6.124	I1	-4.752	**F3**	7,99
I2	-8.102	I2	-10.842	I2	-4.305		
I3	-9.351	I3	-9.415	I3	-6.345	**Total**	-42,054
I4	-8,523						
I5	-7.125						

When Table 4 is examined, it is seen that the values found with the independent sample t-test for the 11 items that make up the scale are between -4.305 and -12.520. The total t-value of the scale was -42.054 and the results were found to be significant (p<0.001). Accordingly, it can be stated that the discrimination level of the scale is high.

Item factor correlations

Item-total correlation method was used to find out the level of serving the purpose of the items. The item-factor correlation values of the items are given in Table 5.

Table 4. Item Discrimination

F1		F2		F3	
I.	**t**	**I.**	**t**	**I.**	**t**
I1	.721	I1	.612	I1	.636
I2	.646	I2	.752	I2	.702
I3	.762	I3	.710	I3	.686
I4	.611				
I5	.645				

It was observed that the item factor correlation coefficients given in Table 5 took values between 0,611 and 0,762. Each item was found to have a positive and significant relationship with the whole scale ($p<0.001$). According to this result, considering the item factor correlation values, it is seen that each item in the scale serves the purpose.

Findings Regarding the Reliability of the Scale

In order to calculate the reliability of the scale, the following analysis results were examined.

Internal Consistency Level

Spearman Brown, Cronbach's Alpha and Guttmann Split-Half coefficients were examined for the five factors and the whole scale. Table 6 shows the reliability coefficients.

Table 5. Factor reliability coefficients

Factors	Item Number	Spearman Brown	Gutt-mann Split-Half	Cronbach's Alpha
F1	5	.713	.642	.726
F2	3	.623	.492	.611
F3	3	.531	.565	.598
Total	**11**	**.566**	**.652**	**.664**

When Table 5 is examined, the Spearman Brown coefficient of the scale consisting of 11 items and 3 factors in total is 0.566; Guttmann Split-Half is 0.652; and Cronbach's alpha value is 0.664. It can be said that the reliability coefficients of the scale on item basis and in its entirety are within the appropriate value range (Eroğlu, 2008; Kline, 1994). Accordingly, it can be concluded that the items and the whole scale are reliable and consistent.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

In this study, a scale for measuring lifelong learning motivation was developed and a validity and reliability study was conducted. As a result of the research conducted in this direction, the Lifelong Learning Motivation Scale (LLMS) consisting of 3 factors and 11 items was developed. The first factor consists of 4 items and the other two factors consist of 3 items each.

The scale was prepared in a 5-point Likert scale. Positive items were coded with the premises of completely reflects (5), very reflects (4), moderately reflects (3), slightly reflects (2) and not reflects at all (1); negative items were coded in the opposite way. Exploratory factor analysis revealed a five-dimensional scale. In the process of factor allocation, items with factor loadings greater than 0.40 were assigned to the factors. In the construct validity analysis stage, factor loadings, variance explanatory power and eigenvalues were analyzed and as a result, it was seen that the construct validity of the scale was at an appropriate level. After the exploratory factor analysis revealed that the scale consisted of five factors, confirmatory factor analysis was conducted to confirm the factor structures. As a result of the confirmatory factor analysis, it was seen that the scale model was confirmed by the data. The validity and reliability studies of the scale were conducted with 275 individuals between the ages of 14-55. The reliability analysis of the scale was examined with Spearman Brown, Guttman split-half and Cronbach's alpha values. These values show that the scale can provide reliable measurements (Büyüköztürk, 2002). As a result of the independent samples t-test conducted to determine the difference between the upper and lower 27% groups in item discrimination, the discrimination of the scale items and the entire scale is high. With this scale, it is thought that a measurement tool measuring lifelong learning motivation has been introduced to the literature. Today, one of the attitudes required from students in primary, secondary and higher education is lifelong learning. In a way, we can say that our education system is shaped on the basis of this phenomenon. However, this process needs to be examined in more detail in terms of adult design in order to shed light on all learning activities. Ertürk (1979) listed the basic questions that educators who develop curricula should answer and stated that efficient educational experiences can be organized to the extent that these questions can be answered. In this sense, the aim is to examine lifelong learning with curriculum development methods and to offer suggestions for the identification, organization and evaluation of effective educational experiences. In this way, new programs can be developed more effectively. Curriculum development is defined as a set of dynamic relationships between the objectives, content, teaching-learning processes and evaluation elements of an educational program (Demirel, 2004). At this point, how all components of an educational program will be structured according to the lifelong learning approach gains importance.

Lifelong learning is a characteristic that students need to develop throughout their educational life. University education is not sufficient to acquire this characteristic. For this reason, the philosophy of lifelong learning should be taken as a basis at all levels of education, starting from pre-school education, and 'learning to learn' should be essential. "Learning to learn", "using learning resources effectively", "setting and achieving learning goals", "valuing knowledge and personal development". These educational experiences should be part of the basic practices of national education rather than slogans. Lifelong learning should not be perceived as a new teaching method. It should be adopted as the philosophy of all educational environments where 'learning' takes place.

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No	Lifelong Learning Motivation Scale	Not reflective at all	Less reflective	Moderately reflective	Too reflective	Completely reflectiver
Factor 1						
1	I strive to acquire new knowledge and skills without feeling any obligation.	1	2	3	4	5
2	The difficulties I face in the learning process encourage me to make more effort.	1	2	3	4	5
3	The constant effort to learn something is a passion for me.	1	2	3	4	5
4	I try to learn new things every day.	1	2	3	4	5
5	I focus on acquiring new knowledge to achieve my goals.	1	2	3	4	5
Factor 2						
6	I am excited to learn new subjects.	1	2	3	4	5
7	I take opportunities to continuously improve myself.	1	2	3	4	5
8	Not learning fast enough or experiencing failure does not affect me negatively	1	2	3	4	5
Factor 3						
9	I enjoy sharing my knowledge and skills with others.	1	2	3	4	5
10	It is important for me to continue learning at every stage of my life.	1	2	3	4	5
11	I like to strive to learn new things and pursuing different interests.	1	2	3	4	5

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Examining the Lifelong Learning Competencies of Teachers

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ABSTRACT

In today's technology-driven era, the significance of continuous learning has grown exponentially, as individuals are required to acquire and develop new information and skills. This need has given rise to the concept of lifelong learning, which emphasizes the ongoing process of learning regardless of age, time, and location. This study aims to investigate the lifelong learning competencies of teachers, who play a crucial role in the learning processes of individuals, considering various variables.
Convenience sampling was used to select 329 teachers, and they were administered the 'Lifelong Learning Competency Scale' developed by Hürsen (2011). The scale comprises sub-dimensions such as 'self-management competencies', 'learning to learn competencies', 'initiative and entrepreneurial competencies', 'knowledge acquisition competencies', 'digital competencies', and 'decision-making competencies'. Data analysis was performed with JAMOVI program using descriptive statistics, Independent Sample t-Test, ANOVA, Pearson Correlation Analysis and regression analysis.
The findings of the study indicated that teachers' lifelong learning competencies were at a high level, particularly the 'self-management competencies' sub-dimension, which demonstrated exceptional results. The remaining sub-dimensions also displayed high competency levels. Furthermore, the study concluded that teachers' lifelong learning competencies did not exhibit significant differences based on their gender, marital status, or the type of school they worked in.

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INTRODUCTION

In today’s digital age, the rapid progress and continuous renewal of information have created the need for individuals to acquire and develop new knowledge and skills required by the age, by adapting to this situation both in their daily and professional lives. This has increased the importance of learning and learning environments that are not limited to age, place, or the completed vocational education, but can also be continued in professional life. Emphasized particularly in ensuring social development, continuous learning has taken its place in the literature as the concept of lifelong learning in recent years.

Through the need for new learning, changes in science and technology have revealed that continuing learning everywhere and at every age is crucial for the development of humanity (Akbaş & Özdemir, 2002). Continuous learning is a natural part of life in today’s conditions. Toprak and Erdoğan (2012) define lifelong learning as the process of developing individuals’ personal and professional competencies throughout life in line with their own wishes. Güleç, Çelik, and Demirhan (2012) state that lifelong learning enables individuals to keep up with social and cultural development and participate in the economy in every environment and time while the limitation of formal education is eliminated. Berberoğlu (2010) defines lifelong learning as the completion of missing and insufficient data in formal education or the discovery of previously undiscovered talents. Odabaş and Polat (2008) express that the European Union defines educational activities to improve knowledge, skills, and competence as lifelong learning. In the definitions of lifelong learning, all kinds of educational programs that individuals need in adapting to constantly changing and developing conditions both in their daily and professional lives attract attention.

Teachers are role models in terms of gaining lifelong learning skills in individuals; thus, the level of changing and developing competencies that they have is important (Gencel, 2013, p.248). Due to the increasing importance of lifelong learning, the General Directorate of Lifelong Learning under the Ministry of National Education was established in 2009 to plan and carry out studies on supporting and improving teachers’ professional competencies in our country. In the “Turkey: Lifelong Learning Strategy Paper” by the General Directorate of Lifelong Learning under the Ministry of National Education, LLL competencies are listed as communication competencies in the mother tongue, communication competencies in a foreign language, basic competencies in mathematics and science-technology, digital competencies, learning to learn competencies, and entrepreneurial competencies (Doğan & Çalışkan Toyoğlu, 2019). In this context, this study aims to determine the views of teachers working in public schools affiliated with the Ministry of National Education regarding lifelong learning competencies.

METHOD

The study was conducted as survey research. Survey research is the process of collecting and analyzing data in order to determine the views of a certain group. It is a research method used to examine and analyze a subject or problem area (Büyüköztürk et al., 2020). In the study, the teachers’ views on lifelong learning competencies were analyzed in terms of whether there was a significant difference according to gender, age, marital status, education level, length of professional life, type of school they work in.

Participants

The participants in this study are teachers employed in public schools affiliated with the Ministry of National Education in Ankara. The sampling method used was convenience sampling, which was selected to obtain a sample that was readily available and easily accessible. This approach was chosen to ensure practicality and cost-effectiveness in conducting the study

(Yıldırım & Şimşek, 2011). Table 1 presents the demographic characteristics of the 329 individuals included in the sample.

Table 1. *The Participants' Demographics*

Variable	Descriptive Features	n	%
Gender	Female	211	64 %
	Male	118	36 %
Marital Status	Single	78	24 %
	Married	251	76 %
Age	30 years and below	29	9 %
	Between 31-40	89	27 %
	41 and above	211	64 %
Education Level	Bachelor's	200	61 %
	Master's	129	39 %
Professional Seniority	1-10 Years	62	19 %
	11-20 Years	113	34 %
	21 Years and above	154	47 %
Type of the School They Work in	Preschool	60	18 %
	Primary School	119	36 %
	Secondary School	50	15 %
	General High School (Anatolian or Science High School)	48	15 %
	Vocational High School or Anatolian Technical Vocational High School	52	16 %

According to the data in Table 1, 64% of the participants were female and 76% were married. The ages of the participants showed that 64% were 41 years old and above, 27% were 31-40 years old and 9% were 30 years old and below. While 61% had a Bachelor's degree, 39% had a Master's. 47% had been working for 21 years or more, 34% for 11-20 years, and 19% for 1-10 years. In terms of school type, 36% had been working in primary school, 18% in preschool, 16% in vocational high school or Anatolian technical vocational high school, 15% in secondary school, and 15% in general high school.

Research Instruments and Processes

The study's data collection tools are the personal information form and the "Lifelong Learning Competency Scale (LLLCS)" to measure teachers' competencies regarding lifelong learning. Developed by Uzunboylu & Hürsen (2011), the five-point Likert-type scale consists of six sub-dimensions: "learning to learn competencies", "self-management competencies", "initiative and entrepreneurial competencies", "digital competencies", "knowledge acquisition competencies", and "decision-making competencies". The internal consistency of the scale reliability was determined by calculating the Cronbach Alpha coefficient. The reliability coefficients found in Hürsen's (2011) and the current study are given in Table 2.

Table 2. *Findings on Reliability*

The Scale and Its Subdimensions	n	Hürsen (2011)	Current Study
LLLCS	329	.96	.95
SMC	329	.91	.94
LLC	329	.91	.95
IEC	329	.91	.80
KAC	329	.81	.87
DC	329	.87	.90
DMC	329	.85	.91

Self-Management Competencies (SMC), Learning Learn Competencies (LLC), Initiative and Entrepreneurial Competencies (IEC), Knowledge Acquisition Competencies (KAC), Digital Competencies (DC), Decision-Making Competencies (DMC).

According to the data in Table 2, Cronbach's Alpha reliability coefficient for the scale is .96 while the reliability coefficients of the sub-dimensions vary between .80 and .95.

To gather the data, a questionnaire was distributed electronically to teachers employed in public schools under the Ankara Provincial Directorate of National Education. The researchers reviewed the participants' responses and proceeded with the analysis phase. A social sciences analysis software was employed to analyze the data, utilizing mean and difference tests. In order to assess the normality of the data, the skewness and kurtosis coefficients were examined. Table 3 presents the findings regarding the skewness and kurtosis coefficients.

Table 3. *Findings on the Data Normality*

The Scale and Its Subdimensions	n	Skewness	Kurtosis
LLLCS	329	-0.51	0.70
SMC	329	-0.52	-0.16
LLC	329	-0.21	-0.77
IEC	329	-0.45	0.18
KAC	329	-0.83	0.90
DC	329	-0.66	0.05
DMC	329	-0.47	0.04

Self-Management Competencies (SMC), Learning Learn Competencies (LLC), Initiative and Entrepreneurial Competencies (IEC), Knowledge Acquisition Competencies (KAC), Digital Competencies (DC), Decision-Making Competencies (DMC).

Since the skewness kurtosis coefficients of the data are between -1 and +1.0, it is assumed that the data are normally distributed (Hair et al., 2013). Since the data were normally distributed, they were analyzed with parametric analysis methods. Independent Sample t-Test, ANOVA, Pearson correlation and regression analyses were performed for difference tests.

Ethic

The ethics committee application of the study was made to Istanbul Sabahattin Zaim University Ethics Committee.

RESULTS

The findings of the study which aimed to examine teachers' views and attitudes toward lifelong learning competencies according to different variables, are presented here. The teachers' competency levels toward lifelong learning are given in Table 4.

Table 4. *Teachers' Attitude Levels Toward Lifelong Learning Competencies*

The Scale and Its Subdimensions	n	Mean	Standard Deviation	Level
LLLCS	329	4.15	0.43	High
SMC	329	4.22	0.58	Very High
LLC	329	4.13	0.61	High
IEC	329	4.14	0.45	High
KAC	329	4.20	0.67	High
DC	329	4.12	0.77	High
DMC	329	3.98	0.74	High High

Self-Management Competencies (SMC), Learning Learn Competencies (LLC), Initiative and Entrepreneurial Competencies (IEC), Knowledge Acquisition Competencies (KAC), Digital Competencies (DC), Decision-Making Competencies (DMC).

According to the data in Table 4, the teachers' mean score in the LLLCS was found to be at a high level (x=4.15). Analysis of the sub-dimensions revealed that the mean score in the 'self-management competencies' dimension was very high (x=4.22) and the mean scores in the other sub-dimensions were at a high level.

As a result of the difference analysis, no significant difference was found in the teachers' mean scores on the LLLCS according to their gender, marital status, and the type of school they work in. The results of the independent sample t-Test conducted to see whether the teachers' mean scores on the LLLCS showed a difference according to their education level are given in Table 5.

Table 5. *Comparison of the Teachers' LLLCS Mean Scores with Their Education Levels*

The Scale and Its Subdimensions	Groups	*n*	*M*	*SD*	T	p
LLLCS	Bachelor's	200	4.10	0.44	-2.83	0.00
	Master's	129	4.23	0.40		
Self-Management Competencies	Bachelor's	200	4.14	0.60	-3.31	0.00
	Master's	129	4.35	0.51		
Learning to Learn Competencies	Bachelor's	200	4.07	0.63	-2.19	0.03
	Master's	129	4.22	0.58		
Initiative and Entrepreneurial Competencies	Bachelor's	200	4.10	0.46	-1.86	0.06
	Master's	129	4.20	0.45		
Knowledge Acquisition Competencies	Bachelor's	200	4.18	0.65	-0.60	0.55
	Master's	129	4.23	0.70		
Digital Competencies	Bachelor's	200	4.08	0.78	-1.26	0.21
	Master's	129	4.18	0.73		
Decision-Making Competencies	Bachelor's	200	3.93	0.75	-1.57	0.11
	Master's	129	4.06	0.72		

Based on the data presented in Table 5, there is a significant difference in the mean scores of teachers' LLLCS (Lifelong Learning Competency Scale) based on their education level. Specifically, teachers with a Master's degree (mean score: 4.23) exhibited a significantly higher LLLCS mean score compared to teachers with a Bachelor's degree (mean score: 4.10). Additionally, significant differences were observed in the mean scores of the sub-dimensions 'self-management competencies' and 'learning to learn competencies' based on teachers' education level. The mean score of teachers with a Master's degree significantly differed from the mean score of teachers with a Bachelor's degree in these sub-dimensions as well.

ANOVA Test was conducted to see if there was a significant difference among the teachers' LLLCS mean scores according to their professional seniority. Thus, the teachers' LLLCS total mean scores did not differ according to their professional seniority while the mean scores in some of the sub-dimensions differed according to it. The data on the sub-dimensions in which the LLLCS mean scores differed significantly according to professional seniority are given in Table 6.

Table 6. *Comparison of the Teachers' LLLCS Mean Scores According to Their Professional Seniority*

The Scale and Its Subdimensions	Groups	*n*	*M*	*SD*	Sum of Squares	*F*	*p*	Difference
Self-Management Competencies	1. 1-10 Years	62	4.17	0.55	Within 2 Between 326 Total 328	4.13	0.017	2>3
	2. 11-20 Years	113	4.35	0.55				
	3. 21 Years and above	154	4.15	0.59				
Learning to Learn Competencies	1. 1-10 Years	62	4.01	0.62	Within 2 Between 326 Total 328	6.77	0.001	2>3-1
	2. 11-20 Years	113	4.29	0.61				
	3. 21 Years and Above	154	4.05	0.59				

Based on the data provided in Table 6, significant differences were observed in the mean scores of the 'self-management competencies' ($F=4.13$, $p<.05$) and 'learning to learn competencies' ($F=6.77$, $p<.05$) dimensions based on the teachers' professional seniority. Further analysis using the Post-Hoc test revealed that in the 'self-management competencies' dimension, teachers with 11-20 years of professional seniority (mean score: 4.35) displayed a significantly higher mean score compared to teachers with 21 years and above (mean score: 4.15). Similarly, in the 'learning to learn competencies' dimension, teachers with 11-20 years of professional seniority (mean score: 4.29) exhibited significantly higher mean scores compared to teachers with 1-10 years (mean score: 4.01) and those with 21 years and above (mean score: 4.05).

ANOVA Test was conducted to assess whether the teachers' mean scores on the LLLCS showed a significant difference according to age. The teachers' total LLLCS mean scores were found to not differ according to it. However, the mean scores in some of the sub-dimensions differed according to age. The data on the dimensions in which the LLLCS mean scores differed significantly according to age are given in Table 7.

Table 7. *Comparison of Teachers' Lifelong Learning Competency Scale Mean Scores by Age*

The Scale and Its Subdimensions	Groups	n	Mean. (x)	SD	Sum of Squares	F	p	Difference
Learning to Learn Competencies	a. 30 Years and Below	29	4.12	0.63	Within 2	3.33	0.037	b>c
	b. 31- 40 Years	89	4.27	0.61	Between 326			
	c. 41 Years and Above	211	4.07	0.60	Total 328			

According to the data in Table 7, the mean score in the LLLCS 'learning to learn competencies' (F=3.33, p<.05) was found to differ significantly according to the teachers' age. As a result of the Post-Hoc test, it was seen in the 'learning to learn competencies' dimension that the mean score of the teachers between the ages of 31-40 (x=4.27) was significantly higher than that of the teachers between the ages of 41 and above (x=4.07).

DISCUSSION, CONCLUSION, RECOMMENDATIONS

The study findings indicate that teachers' mean scores in the domain of 'Attitude Levels Toward Lifelong Learning Competencies' were generally high. Specifically, the mean score for the 'self-management competencies' sub-dimension was exceptionally high, while the mean scores for the sub-dimensions of 'learning to learn competencies', 'initiative and entrepreneurial competencies', 'knowledge acquisition competencies', 'digital competencies', and 'decision-making competencies' were also at a high level.

Regarding the factors analyzed, no significant differences were found in teachers' attitudes toward lifelong learning competencies based on gender, marital status, or the type of school they work in. However, there was a significant difference based on their education level. Teachers with a Master's degree demonstrated significantly higher attitude levels toward lifelong learning competencies compared to those with a Bachelor's degree. This difference was particularly evident in the 'self-management competencies' and 'learning to learn competencies' sub-dimensions, where the mean scores of teachers with a Master's degree significantly differed from those of teachers with a Bachelor's degree.

Overall, the teachers' attitude levels toward lifelong learning competencies did not exhibit significant differences based on years of professional seniority. However, significant differences were found in certain sub-dimensions. Specifically, in the 'self-management competencies' sub-dimension, teachers with 11-20 years of professional seniority demonstrated a significantly higher mean score compared to teachers with 21 years and above. Similarly, in the 'learning to learn competencies' sub-dimension, teachers with 11-20 years of professional seniority displayed a significantly higher mean score compared to teachers with 1-10 years of experience and those with 21 years and above.

These findings suggest that teachers with 11-20 years of professional seniority exhibit higher levels of lifelong learning competencies and are more open to new learning experiences compared to those who are new to the profession and those who have been working for 21 years or more.

The teachers' attitude levels toward lifelong learning competencies were observed to not differ significantly according to age in general, but in the 'learning to learn competencies' subdimension, the mean score of teachers between the ages of 31-40 was significantly higher than the mean score of teachers between the ages of 41 and above.

Kazu and Erten (2016) conducted a study on teachers' lifelong learning competencies and found that teacher competencies were at a significantly high level. They also discovered that female teachers had higher knowledge acquisition and digital competencies compared to male teachers. The same study revealed a decline in knowledge acquisition and digital competencies with increasing age. However, the level of learning to learn, decision-making, and lifelong learning competencies remained consistent across different years of work experience. Moreover, the study found no significant differences in teacher competencies based on education levels but did observe variations according to the type of school where teachers were employed.

Similarly, Özçiftçi and Çakır (2015) reported higher lifelong learning tendencies among female teachers compared to male teachers. Şahin and Arcagök (2014) did not find gender differences in the sub-dimensions of lifelong learning competencies but identified significant variances based on professional seniority and education level. Torun and Seçkin (2021) investigated lifelong learning competencies and observed significant differences based on gender and school grade level but not according to age, education level, and seniority. Other studies by Babanlı (2018), Ayra (2015), Diker Coşkun, and Demirel (2012) also indicated significant differences in competencies based on gender.

Demirel, Sadi, and Dağyar (2016) found that teachers' lifelong learning competencies were high and did not differ significantly based on gender, years of work, or school type. Yıldız Durak and Tekin (2020) noted no significant differences in teachers' lifelong learning tendencies based on gender and professional seniority but did observe variations based on age and education level.

The collective findings from these studies highlight the importance of lifelong learning processes for teachers to continuously enhance their professional skills and adapt to evolving technology. It emphasizes the need to support teachers' lifelong learning practices, plan education based on needs analysis conducted by relevant institutions, and make lifelong learning the fundamental policy of national education. It is crucial to enrich and integrate lifelong learning practices with information and communication technologies, as well as foster collaboration between universities and educational institutions to improve the quality of lifelong learning processes.

To gain a deeper understanding, future research can be designed to explore the variables of gender, age, marital status, education level, professional seniority, and school type through qualitative methods alongside quantitative approaches. This would provide a comprehensive examination of teachers' lifelong learning competencies and their implications.

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