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Dear Readers,

We are delighted to present the first volume of the 10th issue of e- Kafkas Journal of Educational Research. Our goal with this issue is to provide you with a diverse selection of insightful and thought-provoking articles from esteemed researchers and scholars in the field of education.

This issue contains nine articles, each offering a unique perspective on current educational research topics. Our contributors have explored the complexities of education and presented innovative ideas and research findings that are sure to provoke discussion and debate.

- Kaymakcı, G., Çelik, C. & Görecek Baybars, M. (2023) conducted a phenomenological study to determine the mental models of gifted middle school students about earthquakes. The study was conducted on 41 gifted students from three different provinces in Turkey. The researchers developed an "Earthquake Mental Model Test" to determine the students' mental models about earthquakes. The findings revealed that the mental models of the students regarding the earthquake were gathered under the themes of natural disaster-energy-destruction, natural disaster-earth's crust movement-destruction, natural disaster-destruction, energy-protection, quake, quake-destruction, earth's crust movement, earth's crust movement-protection, and earth's crust movement-destruction.

- Özbey, N. & Özmantar, M. F. (2023) conducted a multiple case study to determine material features determinant in teachers' mathematical activity preferences. The study was conducted with three secondary school mathematics teachers, and six consecutive semi-structured interviews were conducted with the participants. The data were analyzed by thematic analysis method. The findings showed that teachers' activity preferences had a complex structure and pointed out that instructional decisions were not only shaped on a pedagogical basis and were not only concerned with students' mathematical development. The evaluations of the teachers concluded that the predictions about the affordances and constraints of the materials were decisive in the activity selection.

- Kurtulmuş, Z. & Şamlı, H.Ö. (2023) conducted a descriptive research study using the document analysis method to determine how preschool teachers handle mathematics learning processes in their mathematics activity plans and which contents they include. The study examined 200 mathematics activity plans applied by 10 preschool teachers working in preschool education institutions. The findings revealed that preschool teachers planned mathematics activities mainly in large group activities and integrated them into their activity plans. On the other hand, they also found that teachers included concepts such as number/counting and quantity more in their mathematics activity plans and they planned mathematics activity plans as classroom activity plans. In addition, they included family participation activities in mathematics activity plans.

- Su Tonga, E. & Şahin, S. (2023) conducted a meta-synthesis study to investigate the interaction in synchronous and asynchronous distance education processes. The aims of the study were to determine for what purposes interactions were established in synchronous and asynchronous distance education processes, through which features and functions interactions can be increased in distance education, and what factors adversely affect this process when interactions are established. The study revealed that interaction plays a crucial role in the learner's academic performance, attitude and motivation, participation in the lesson, and the acquisition of instructional goals and behaviors.

- Altunbey and Çelikler (2023) conducted a study to investigate the impact of educational games on 7th-grade students' awareness of household waste and recycling. The study involved 96 students from two secondary schools in Rize and Çayeli of Rize province. The experimental groups played four instructional plays - "Who Won the Cup?", "I Got it?", "Reflection", and "Ring!" - while the control groups used instructional program activities of the science lessons. The *"Household Wastes and Recycling Knowledge Test"* was used to measure the knowledge level and awareness of the students before and after the experiment. The results showed that the instructional plays were effective in increasing the students' knowledge and awareness of household waste and recycling. Additionally, the students reported that the plays helped with learning, raised

awareness, developed affirmative emotions, and ensured effective learning. In summary, the research suggests that instructional plays can be a valuable tool for enhancing students' knowledge and awareness of household waste and recycling while also promoting effective learning and positive attitudes.

- Feyman Gök and Ölmez's (2023) study aimed to explore preschool teachers' perspectives on the use of social media for professional development. The research utilized a qualitative case study approach, and the participants were twenty-five preschool teachers. A semi-structured interview form consisting of eight questions was used to gather data, which were analyzed using descriptive analysis. The findings revealed that preschool teachers use social media platforms effectively for professional development. While social media was considered to have a significant contribution to their professional development, teachers emphasized the importance of being cautious against disinformation. It is recommended that teachers receive media literacy training and be mindful of children's rights and ethical principles when using social media for professional purposes.

- The study conducted by Kurtça and Gezgin (2023) aimed to investigate the effectiveness of virtual reality technology in teaching pedestrian skills to children with intellectual disabilities. The study utilized a single-subject research model called multiple probe design with inter-participant probe trial. Three intellectually disabled children aged between 11 and 15 participated in the study. The results showed that all participants learned pedestrian skills and continued to use the skills they learned even after one, three, and five weeks after the completion of the instruction. Moreover, all participants were able to apply their skills to the real environment. Social validity data collected from the participants and their mothers indicated that teaching with virtual reality applications is not only interesting and fun, but it can also be used for different educational purposes. This study provides evidence that virtual reality technology can be an effective tool in teaching pedestrian skills to children with intellectual disabilities, thus helping them to lead more independent lives.

- Başaran and Candan (2023) conducted a qualitative grounded theory study to determine the educational philosophy of Doğan Cüceloğlu, a Turkish psychologist and academician who recently passed away. The researchers collected data by analyzing Cüceloğlu's speeches and writings on education using the document analysis method. The collected data were examined by coding and making inferences from Cüceloğlu's sentences to answer the questions of why, what, and how to teach. The findings revealed that Cüceloğlu's educational philosophy was existentialism in terms of the purpose and content of education, and progressivism and existentialism in terms of the method of education. Overall, Cüceloğlu's perspective on education reflected an existential understanding. This study fills a gap in the literature by shedding light on the educational philosophy of a prominent educator in Turkey.

- Orhan and Mirici's (2023) study focuses on dynamic assessment (DA), an approach that has gained attention in the fields of psychology and general education, but is still considered a relatively new approach within the field of second language acquisition. DA is an instructional approach that aims to guide learners through hints or prompts, based on the framework of sociocultural theory. This study provides a review of the fundamental principles and constructs associated with DA, including the theoretical framework, the zone of proximal development (ZPD), mediation, and internalization. The authors compare dynamic assessment with non-dynamic assessment and discuss criticisms of DA. They also discuss the potential advantages of DA for language teaching and learning processes. The study concludes with final remarks and implications for educators and researchers in the field of language acquisition.

As we continue to navigate the challenges of the COVID-19 pandemic, the importance of education research has become even more evident. We hope that the articles in this issue will serve as a valuable resource for researchers, educators, and policymakers who are dedicated to improving education and addressing the inequalities that exist within it. We would also like to take this opportunity to express our condolences to the families of those who lost their lives in the recent earthquake that struck Kahramanmaraş and surrounding areas in the southern region of Turkey. Our thoughts are with all those affected by this tragic event.

We would like to extend our sincere gratitude to all the authors who contributed to this issue, as well as our dedicated reviewers who worked tirelessly to ensure the quality and rigor of the articles. We also thank our readers for their continued support and interest in our journal.

We hope that you find this issue informative and engaging, and we welcome your feedback.

Sincerely,

<div align="right">

Assoc. Prof. Dr. Ali İbrahim Can GÖZÜM

Editör in Cheif

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Determination of Gifted Middle School Students' Mental Models of Earthquake

Güliz Kaymakcı[1]   Cüneyd Çelik[2]   Meryem Görecek Baybars[3]

Abstract

This study aims to determine the mental models of gifted middle school students about an earthquake. The study employed the phenomenological design. In this context, the study was conducted on 41 students having gained the status of gifted students are results of the exams conducted by Science and Art Centres (BİLSEM) in three different provinces of Turkey. In these centres, gifted students, are diagnosed and can recognize their areas of special talent and get education to develop these areas in addition to the formal education they receive in their schools. In the current study, the "Earthquake Mental Model Test" was developed by the researchers in order to determine the mental models of the gifted students about the concept of an earthquake. According to finding mental models of the 41 gifted students are gathered under the mental models of natural disaster-energy-destruction (f=1), natural disaster-earth's crust movement-destruction (f=6), natural disaster-destruction (f=2), energy-protection (f=1), quake (f=4), quake-destruction (f=16), earth's crust movement (f=2), earth's crust movement-protection (f=1) and earth's crust movement-destruction (f=8). According to the findings obtained, the mental models of the students regarding the earthquake are gathered under the themes of Natural disaster-energy-destruction model. Natural disaster-energy-destruction model: Natural disaster-earth's crust movement-destruction model, Natural disaster-destruction model, Energy-protection model, Quake model, Quake-destruction model, Earth's crust movement model, Earth's crust movement-protection model and Earth's crust movement-destruction model.

Keywords: Mental models, earthquake, gifted students, middle school students

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Introduction

Natural disasters are natural events that can be of natural, technological or human origin, causing physical, economic and social loss of human beings and damaging nature (Turan & Kartal, 2011). In other words, disaster can be defined as the injury of living things and the loss of life and property in the face of a risky or dangerous situation that arises as a result of changes in the physical structure of the earth (Kasapoğlu & Ecevit, 2001). Events such as floods, landslides, volcanic eruptions, avalanches and earthquakes are considered to be natural disasters (AFAD, 2022). Earthquake is one of the most commonly experienced natural disasters in Turkey because Turkey is located in the Alpine-Himalayan seismic belt, which is one of the most important earthquake belts in the world. The Anatolian Plate, on which Turkey is located, is surrounded by the Eurasian Plate in the north, the African and Arabian Plate in the south, the Eastern Anatolian Block in the east and the Aegean Block in the west. Due to this tectonic location, almost all of Turkey's lands are at risk of earthquakes (Bikçe, 2015).

Also, disasters are known to cause other disaster. For this reason, they are discussed multi-dimensionally in the literature in terms of their effects. Earthquakes are also a good example of this; an earthquake can trigger many different disasters such as fire, explosion, environmental pollution and flooding (Kadıoğlu, 2011). The formation process of earthquakes includes more complex processes than many other disasters. For this reason, it is more difficult to understand how earthquakes occur. Earthquake is defined as the shaking of the environment and the ground surface with vibrations that occur suddenly due to the breaks in the earth's crust (Babüroğlu, 1998). It is one of the disasters that can even destroy continents (Akyel, 2000). One-fifth of the earthquakes that occur every year in the world occur on the Mediterranean-Alpine-Himalayan seismic belt, which includes 93% of Turkey's territory (The Union of Chambers of Turkish Engineers and Architects [TMMOB], 2012). Therefore, earthquakes that occur at frequent intervals are one of the natural events that cause the most loss of life and property in Turkey (AFAD, 2018). Land pieces with different thicknesses and densities make up the Earth, or in other words, the plates are in a constant state of equilibrium depending on the movement of the mantle layer. Fractures in the earth's crust are called 'faults'. Faults are formed by the compression and breaking of rocks under high pressure. Due to the hot and fluid nature of the magma layer under the earth's crust, stress-related slips or new fault fractures occur in the fault fractures. This causes sudden vibrations and the formation of shock waves on the plates. These shock waves spreading throughout the earth's crust are also called earthquake waves. The severity of earthquake waves can reach very large sizes depending on the intensity of the shock waves (Watt, 2010).

Although it is not possible to prevent the occurrence of earthquakes with today's technology, it is possible to reduce the damage caused by the earthquake through education (Navakanesh, Shah & Prasanna, 2019). It has been accepted by almost all countries that earthquake education given in schools is very effective in raising earthquake awareness, and earthquake-related topics are included in different courses in the current primary and secondary education curricula (Demirci & Yıldırım, 2015). Earthquake education in Turkey is given at every grade level from the first to the fourth grade of primary education under the name of disaster education to inform students about the effects of earthquakes, precautions to be taken against earthquakes, and earthquake preparedness. In middle school, students are educated about the causes of earthquakes, formation of earthquakes, some concepts related to earthquakes and earthquake protection methods in both science and social studies classes given at all grade levels (MoNE 2013a; MoNE, 2013b).

When the literature is reviewed, it is seen that there are many studies conducted with the participation of middle school students on the subject of the earthquake. After the earthquake that took place in Van in 2011, the effect of the earthquake on the social values of the students was examined in the study conducted with the participation of 455 students in the eighth grade (Akbaba, Kılcan & Çepni, 2013). In the study, which was carried out in the survey model using the Changing Values Form, it was determined that the values such as responsibility, solidarity, giving alms, peace, honesty and patriotism came to the fore in the students who experienced and did not experience the earthquake. In the study conducted by Aydın (2010), it was aimed to reveal the perceptions of 480 eighth-grade students attending schools in Ankara, Antalya and Karabük about the concept of earthquake. For this

purpose, a semi-structured interview form consisting of short and open-ended questions was used. As a result of the study, it was determined that the students generally perceived the earthquake as the collapse of buildings and the death of people, energy discharge due to plate movements, a natural disaster, shaking of the ground, tremors due to the movement of the earth's crust and fault lines, and a disaster whose harms can be reduced if necessary precautions are taken. In another study, the daily knowledge of middle school students studying in the city of Columbus in the USA, where the earthquake risk is low, and Aydın, where the earthquake risk is high, and their way of thinking about earthquakes was determined (Oğuz, 2005). A total of 506 middle school students from Turkey and 317 from the USA participated in the study. According to the results of the study, while there was no significant correlation between the ages of the students in Turkey and their knowledge about earthquakes, the knowledge of the students from the USA increased in proportion to their age. Ross and Schuell (1993) aimed to reveal the views of 91 middle school students who experienced and did not experience earthquakes based on their own experiences. While most of the students expressed the earthquake as a ground shaking, some students explained the earthquake by associating it with a volcanic eruption, core movement, thunder, rain, wind, mountains and the Sun heat. Thus, it is seen in the literature that studies on the subject of the earthquake are generally carried out on mainstream middle school students.

Since our country is located in an earthquake zone, it is important to raise awareness among future generations about earthquakes. Today, the understanding of carrying out remedial activities after earthquakes has left its place to the understanding of taking precautions and risk management. The priority in taking precautions against earthquakes and in risk management is to raise conscious individuals. It is thought that it is very important to determine the current mental model of gifted students (Camcı, 2011), who are thought to be more likely to have a career tendency with their awareness at a young age and to look at current issues from a different perspective (Camcı, 2011), about the phenomenon of earthquake. In this way, damages can be minimized with practical and permanent solutions proposed by the damages that may occur in the event of a possible earthquake, by designing an effective earthquake education and raising awareness among students, as in countries such as Japan where earthquakes are frequently experienced (Başıbüyük, 2004).

Gifted individuals are individuals who differ from normal individuals in terms of the distribution, frequency, timing and combination of physical, mental, social and personality traits (Akarsu, 2004). Gifted individuals have many superior characteristics compared to their peers. The characteristics of these individuals were listed by Çağlar (2004) in our country and by many researchers abroad. When these characteristics are examined, it is seen that there are characteristics such as "transferring knowledge to and using it in the best way in new situations, having deep and broad interest and knowledge in many fields". It is also thought that the investigation of the mental model of gifted middle school students will contribute to the design process of earthquake education within the scope of an enriched science education to be created for these students. In addition, this study aims to determine the mental models of gifted middle school students about earthquake. Mental models are internal representations of real situations in the minds of individuals to make sense of and comprehend events and phenomena in the world (Franco & Colinvaux, 2000). Mental models are a symbol of knowledge, indirect, unfinished, idiosyncratic, functional, and reflect people's beliefs (Günbatar & Sarı, 2005). It grows and evolves with the addition of new information. It provides the individual with the opportunity to explain and reason about the phenomenon he/she wants to express (Ünal & Ergin, 2006). When the knowledge and experiences of individuals are considered, it is seen that their mental models are of great importance. As each individual's cognitive processes differ, mental models can be used to determine how they learn information (İyibil & Arslan, 2010). To this end, answers to the following questions are sought:

1. What is the mental model of gifted middle school students regarding earthquakes?
2. Does the mental model of gifted middle school students about the concept of earthquake vary depending on their state of experiencing an earthquake?
3. Does the mental model of gifted middle school students vary depending on their source of information on earthquakes?
4. Does the mental model of gifted middle school students vary depending on their gender?

5. Does the mental model of gifted middle school students vary depending on their city of residence?

Method

The current study employed the phenomenological design. Phenomenology is seen as a suitable research ground for studies that aim to investigate phenomena that are not completely foreign to us and that we can not fully comprehend (Yıldırım & Şimşek, 2006). "Earthquake" is one of the phenomena that we encounter frequently and that we experience frequently throughout the world, even if we do not experience it directly. For this reason, it is thought that the chosen method is suitable for the nature of the study.

Study Group

The sample group of the current study was determined by using criterion sampling, one of the purposive sampling methods. In this study, the criterion used to select the sample was that the cities where the science and art centre (BİLSEM) schools are located are in the 1st - degree earthquake zone. In this context, the study was carried out with the participation of students who gained the status of gifted students in the exams held by BİLSEM from three different cities of Turkey in the second semester of the 2021-2022 school year. Under the rules of this institution, the cities from which the students were selected for the sample were kept confidential. Instead, codes were used to represent the cities where the students in the sample resided (1st city, 2nd city and 3rd city). The BİLSEM schools included in the sample of this study are in the provinces located in the 1st - degree earthquake zone and 18 of the gifted students continue their BİLSEM education in the painting talent group and 23 in the general talent group. The characteristics of the study group is presented in Table 1.

Table 1.
Specification of the Study Group

Cities	Grade Levels	N	Total
1st City	5th Grade	5	
	6th Grade	5	11
	7th Grade	1	
2nd City	5th Grade	10	
	6th Grade	1	11
	7th Grade	-	
3rd City	5th Grade	13	
	6th Grade	3	19
	7th Grade	3	
Gender	Girl	18	41
	Boy	23	

In the study group, there are 11 students from the 1st city, 11 students from the 2nd city and 19 students from the 3rd city. On the other hand, there are 28 fifth graders, 9 sixth graders and 4 seventh graders in the study group. Of the students participated, 18 are girls and 21 are boys.

Data Collection Tool

When the relevant literature is reviewed, it is seen that there are different data collection tools used to determine mental models. These data collection tools can be open-ended questions that require explanation and drawing, as well as multiple- choice questions and interviews (Chia- Yu, 2007). In the current study, the "Earthquake Mental Model Test" was developed by the researchers in order to determine the mental models of the gifted students about the concept of earthquake. This form consists of two parts. In the first part, there are questions that determine the demographic characteristics of the students, and in the second part, there are three open-ended questions to determine the mental models of the gifted students about the concept of earthquake. In other words, in the second part, the student answers questions requiring drawing and explanation about the concept of earthquake. The data collection tool is shown in Appendix 1. In order to check the suitability of the data collection tool for the study, the opinion of an expert in the field of physics education was sought. In line with the expert opinion, necessary corrections were made to the data collection tool, and the data collection tool was

finalized. Thus, the final data collection tool consisted of two parts. The first part consists of 4 questions to determine the demographic characteristics of the students, and the second part consists of 3 open-ended questions to reveal the mental models of the students about the concept of earthquake. The first and second open-ended questions are asked to be answered in writing and the third question by drawing.

Data Collection

A pilot study was conducted by applying the data collection tool to 15 gifted middle school students different from the ones in the study group. With the pilot study, it was checked whether the questions were comprehensible, and the time required to complete the data collection tool was determined. As a result of the pilot study, it was determined that one class hour would be sufficient for the students to complete the data collection tool. During the actual implementation process, first of all, BİLSEM administrations in the cities were contacted and necessary permissions were obtained for the application of the data collection tool (Final decision of Tokat Gaziosmanpaşa University Social and Human Sciences Research Ethics Committee's meeting dated 27/04/2022, the session number is 07 and the decision number is 01-62).

Data Analysis

Before moving on to data analysis, the papers of the students were coded. Coding analysis in qualitative studies is very important as it guides the next stages (Ragin, 1995). Codes are guiding tags for data. Most researchers can give different and unique names to the sets of codes. With this feature, coding should be able to address both the researcher and other researchers who may be involved in the research. In the current study, "S" represents the student and the number represents the student's rank in the coding. For example, the code "S7" refers to the 7th student. In the data analysis, first of all, the papers belonging to the students were handled as a whole; all of the data were read and examined. At this stage, no coding was performed by the researcher. Thus, the researcher had the opportunity to think deeply. After this stage, the data were analyzed and thematic content analysis was used in the data analysis. The analysis of the data was carried out by two coders (Coder 1 and Coder 2) who are experts in the field of science education. The first and second questions in the second part of the data collection tool are about description and the third question is about visualization. While determining the mental models of the students about the concept of earthquakes, three questions were evaluated together.

Since there is no study in the literature to determine the mental models of individuals about earthquakes, the themes were created by considering the answers given by the students to the questions in the second part of the data collection tool. Information on these themes is given in Table 2.

Table 2.
Themes of the Mental Models on the Concept of Earthquake and Explanations Corresponding to These Themes

Theme	Explanation
Natural disaster-energy-destruction model:	While an earthquake is described as a natural disaster, it is described in writing that energy is effective in the formation of an earthquake, and there are images of destruction in the visual images.
Natural disaster-earth's crust movement-destruction model:	While an earthquake is described as a natural disaster, it is described in writing that the earth's crust is effective in the formation of an earthquake, and there are images of destruction in the visual images.
Natural disaster-destruction model:	While an earthquake is described as a natural disaster, there are images of destruction in the visual images.
Energy-protection model:	While the occurrence of an earthquake is associated with the concept of energy, images related to the ways of protection from an earthquake are included in the drawings.

Table 2 continuing

Quake model:	The concept of a quake is included in both written and visual descriptions.
Quake-destruction model:	While both written and visual descriptions include quakes, there are also images of destruction.
Earth's crust movement model:	In both written and visual descriptions, earthquake is associated with the movement of the earth's crust.
Earth's crust movement-protection model:	Written descriptions contain explanations about the movement of the earth's crust, while visual images include ways of protection from earthquakes.
Earth's crust movement-destruction model:	Written descriptions contain explanations about the movement of the earth's crust, while visual images contain images of destruction.

One of the important stages of qualitative data analysis is the confirmation of the findings. Confirmation of findings can be accomplished by testing and validating the results obtained (Merriam, 1998). At this point, there are various ways that the researcher can follow. The coding of the same data set by different field expert coders and the similarity ratio of the consistency in the codes of these coders is one of them. This similarity ratio supports reliability in qualitative research. According to Miles and Huberman (1994), an agreement between coders should be at least 80%. In this connection, the compatibility of the codings made by two researchers for the same data set was checked. Accordingly, the analyzes of coder 1 and coder 2 were consistent in 37 of 41 students and inconsistent in our students. Thus, it can be said that there is a 90% agreement between the coders (Miles and Huberman, 1994). In order to minimize the disagreement between the coders, the data were examined with the joint participation of coder 1 and coder 2, and the sources of the disagreement were identified and resolved.

Findings

In the current study, the mental models of the gifted middle school students about the concept of earthquake were examined and the findings are presented in the tables below. In addition, examples of student drawings and explanations are given in the findings section

Findings of the First Research Question

It was tried to determine the mental models of the gifted middle school students about earthquake. The written and visual descriptions of the students were analyzed by using thematic content analysis. The obtained findings are presented in Table 3.

Table 3.
Mental Models of the Gifted Middle School Students about Earthquake

Models	f
Natural disaster-energy-destruction model	1
Natural disaster-earth's crust movement-destruction model	6
Natural disaster-destruction model	2
Energy-protection model	1
Quake model	4
Quake-destruction model	16
Earth's crust movement model	2
Earth's crust movement-protection model	1
Earth's crust movement-destruction model	8

When Table 3 is examined, it is seen that the mental models of the 41 gifted students are gathered under the mental models of natural disaster-energy-destruction (f=1), natural disaster-earth's crust movement-destruction (f=6), natural disaster-destruction (f=2), energy-protection (f=1), quake (f=4), quake-destruction (f=16), earth's crust movement (f=2), earth's crust movement-protection (f=1) and earth's crust movement-destruction (f=8). In addition, according to the mental models of the students,

it is thought that the mental model related to the ways of protection from earthquakes (f=2) is not given enough attention. Sample student answers are given in Table 4.

Table 4.
The Drawing Produced as A Response to the 3rd Question

Drawing	Student Answers
	S14 / Quake-destruction model The answer given to the 1st question: "As a result of the shaking of the ground, the living and non-living beings above feel this vibration." The answer given to the 2nd question: "Earth's crust quakes and collides with other crusts of Earth."
	S6 / *Natural disaster-energy-destruction model*: The answer given to the 1st question: "Earthquake is a natural disaster and ground shaking." The answer given to the 2nd question: "The fluctuations that come as a result of the energy that suddenly emerges in the earth's crust and the shaking of the earth by these fluctuations."
	S25 / *Natural disaster-earth's crust movement-destruction model*: The answer given to the 1st question: "Earthquake is a natural disaster that can cause loss of life and property." The answer given to the 2nd question: "It is caused by shaking in the earth's crust."

Findings of the Second Research Question

It was tried to determine how the mental models of the gifted middle school students on the concept of earthquake vary depending on the state of experiencing an earthquake. The written and visual descriptions of the students were analyzed by using content analysis. The obtained findings are presented in Table 5.

Table 5.
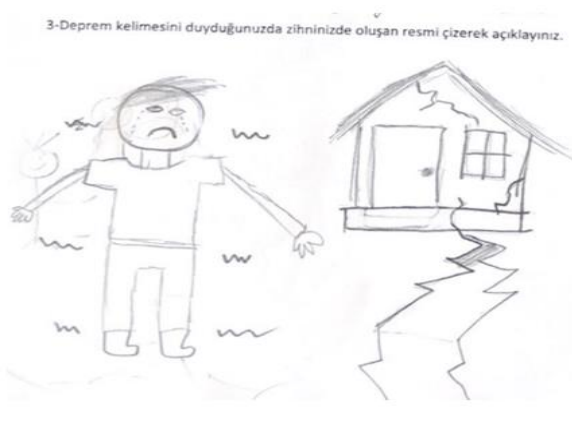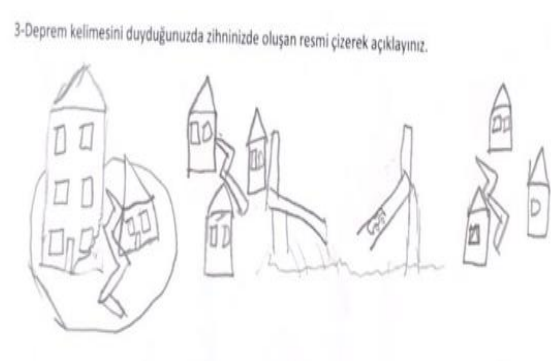Mental Models of the Gifted Middle School Students Depending on the State of Experiencing an Earthquake

Models	State of experiencing an earthquake	
	Yes (n=20)	No (n= 21)
Natural disaster-energy-destruction model	1	-
Natural disaster-earth's crust movement-destruction model	3	3
Natural disaster-destruction model	2	-
Energy-protection model	1	-
Quake model	2	2
Quake-destruction model	7	9
Earth's crust movement model	4	1
Earth's crust movement-protection model	1	1
Earth's crust movement-destruction model	3	5

It was determined that the concept of earthquake in the students who experienced an earthquake was explained with nine different mental models. On the other hand, the concept of earthquake in the students who did not experience an earthquake was explained with six different models.

The written and visual descriptions of the 20 students who experienced the earthquake phenomenon were found to be gathered under the models of natural disaster-energy-destruction (f=1), natural disaster-earth's crust movement-destruction (f=3), natural disaster-destruction (f=2), energy-protection (f=1), quake (f=2), quake-destruction (f=7), earth's crust movement (f=4), earth's crust movement-protection (f=1) and earth's crust movement-destruction (f=3). In addition, the visual images of the students in this group include images related to the feeling of fear and the post-earthquake process. Sample student answers are given in Table 6.

Table 6.
The Drawing Produced as A Response to the 3rd Question

Drawing	Student Answers
	S18 / Experiencing an earthquake / Quake-destruction model The answer given to the 1st question: "Shaking of the earth" The answer given to the 2nd question: "Cracking of fault lines"

Table 6 continuing

S40 / Earth's crust movement-destruction model / Not experiencing an earthquake

The answer given to the 1st question: "Vibration of crusts underground"
The answer given to the 2nd question: "Tiles overlap"

On the other hand, the written and visual descriptions of the 21 students who did not experience the earthquake phenomenon were found to be gathered under the models of natural disaster-earth's crust movement-destruction (f=3), quake (f=2), quake-destruction (f=9), earth's crust movement (f=1), earth's crust movement-protection (f=1) and earth's crust movement-destruction (f=5). According to the findings, the students who have earthquake experience have a wider perspective on the mental models of the concept of earthquake.

Findings of the Third Research Question

It was attempted to determine how the mental models of the gifted middle school students on the concept of earthquakes vary depending on their source of earthquake information. The written and visual descriptions of the students were analyzed by using content analysis. The obtained findings are presented in Table 7.

Table 7.
Mental Models of the Gifted Middle School Students Depending on their Source of Information on Earthquake

Source of information on earthquake	Models	f
Family (n=4)	Natural disaster-energy-destruction model	1
	Quake-destruction model	2
	Earth's crust movement-destruction model	1
Internet (n=7)	Natural disaster-earth's crust movement-destruction model	2
	Quake model	1
	Quake-destruction model	3
	Earth's crust movement model	1
Daily experience (n=14)	Natural disaster-earth's crust movement-destruction model	4
	Energy-protection model	1
	Quake model	1
	Quake-destruction model	4
	Earth's crust movement-destruction model	4
School (n=14)	Natural disaster-destruction model	1
	Quake model	1
	Quake-destruction model	6
	Earth's crust movement-protection model	1
	Earth's crust movement-destruction model	3
Book (n=1)	Natural disaster-energy-destruction model	1
Media (n=1)	Quake-destruction model	1

According to the findings, the students obtain information about earthquakes through family, internet, experience, school, books and media, and their mental models are constructed in line with this information.

It was determined that the written and visual descriptions of the 4 students whose source of information is the family are gathered under the models of natural disaster-energy-destruction (f=1), quake-destruction (f=2), earth's crust movement-destruction (f=1) and that the written and visual descriptions of the 7 students whose source of information is the internet are gathered under the mental models of natural disaster-earth's crust movement-destruction (f=2), quake (f=1), quake-destruction (f=3), earth's crust movement-destruction (f=1). The written and visual descriptions of the students whose source of information is their daily experiences were found to be gathered under the mental models of natural disaster-earth's crust movement-destruction (f=4), energy-protection (f=1), quake (f=1), quake-destruction (f=4), earth's crust movement-destruction (f=4). The written and visual descriptions of the 14 students whose source of information is a school were found to be gathered under the mental models of natural disaster-destruction (f=1), quake (f=1), quake-destruction (f=6), earth's crust movement-protection (f=1) and earth's crust movement-destruction (f=3). Moreover, the written and visual descriptions of the students who learn from books about earthquakes were found to be gathered under the mental model of natural disaster-energy-destruction (f=1) while those of the students who learned from media were found to be gathered under the mental model of quake-destruction (f=1). Sample student answers are given in Table 8.

Table 8.
The Drawing Produced as A Response to the 3rd Question
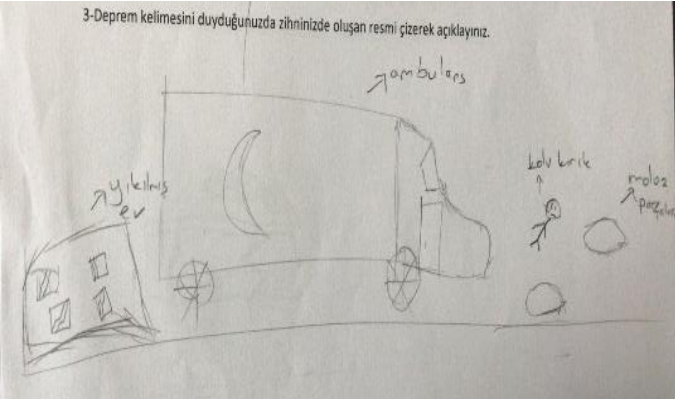
Drawing	Student Answers
	S31 / Internet / Natural disaster-earth's crust movement-destruction The answer given to the 1st question: "Earth's crust shaking" The answer given to the 2nd question: "Shaking of the ground when the plates in the earth's crust move"
	S7 / School / Quake-destruction model The answer given to the 1st question: "Earthquake, shaking off the earth's crust" The answer given to the 2nd question: "Compression of the fault line"

Table 8 continuing
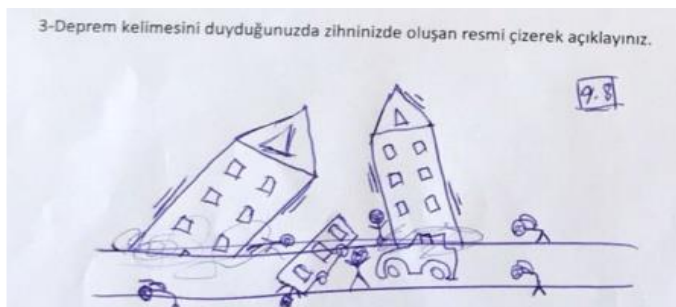
S11/ School / Quake-destruction model

The answer given to the 1st question: "Earthquake"

The answer given to the 2nd question: "Earth's crust moves and an earthquake happens."

Findings of the Fourth Research Question

It was tried to determine how the mental models of the gifted middle school students on the concept of earthquake vary depending on gender. The written and visual descriptions of the students were analyzed by using content analysis. The obtained findings are presented in Table 9.

Table 9.
Mental Models of the Gifted Middle School Students Depending on Gender

Models	Gender	
	Girl (n=18)	Boy (n= 23)
Natural disaster-energy-destruction model	1	-
Natural disaster-earth's crust movement-destruction model	3	3
Natural disaster-destruction model	2	-
Energy-protection model	1	-
Quake model	2	2
Quake-destruction model	4	12
Earth's crust movement model	1	1
Earth's crust movement-protection model	1	-
Earth's crust movement-destruction model	3	2

The written and visual descriptions of the 18 gifted female students about the concept of earthquake were found to be gathered under the mental models of natural disaster-energy-destruction (f=1), natural disaster-earth's crust movement-destruction (f=3), natural disaster-destruction (f=2), energy-protection (f=1), quake (f=2), quake-destruction (f=4), earth's crust movement (f=1), earth's crust movement-protection (f=1), earth's crust movement-destruction (f=3). On the other hand, the written and visual descriptions of the 23 male students about the concept of earthquake were found to be gathered under the mental models of natural disaster-earth' crust movement-destruction (f=3), quake (f=2), quake-destruction (f=12), earth's crust movement (f=1), earth's crust movement-destruction (f=5).

It was determined that the concept of earthquake was explained with five different mental models by the male students. Accordingly, it is seen that the concept of quake is more emphasized in both the written and visual descriptions of the male students than the others (f=12). However, while the written descriptions contain explanations about the movement of the earth's crust, some descriptions contain images of destruction in the visual images (earth's crust movement-destruction model (f=5)). On the other hand, it was determined that the concept of earthquake was explained with nine different mental models by the female students. Accordingly, while the concept of earthquake was described as a natural disaster, the female students included images indicating the effects of the earth's crust on the formation of earthquake and images of destruction, as well as the quake-destruction model. On the

other hand, different from the male students, there are models related to the ways of protection from earthquakes for female students. Sample student answers are given in Table 10.

Table 10.
The Drawing Produced as A Response to the 4th Question

Drawing	Student Answers
	S40 / Male/ Earth's crust movement-destruction The answer given to the 1st question: "Vibration of crusts underground" The answer given to the 2nd question: "Tiles overlap"
	Ö19 / Female / Earth's crust movement-protection model The answer given to the 1st question: "Ground shaking" The answer given to the 2nd question: "Frictional movement of broken ground pieces"

Findings of the Fifth Research Question

It was tried to determine how the mental models of the gifted middle school students on the concept of earthquake vary depending on the city where they live. The written and visual descriptions of the students were analyzed by using content analysis. The obtained findings are presented in Table 11.

Table 11.
Mental Models of the Gifted Middle School Students Depending on the City Where They Live

Models	Cities		
	1st City	2nd City	3rd City
Natural disaster-energy-destruction model	-	-	1
Natural disaster-earth' crust movement-destruction model	2	4	-
Natural disaster-destruction model	1	1	-
Energy-protection model	-	-	1
Quake model	1	1	2
Quake-destruction model	4	3	9
Earth's crust movement model	1	-	1
Earth's crust movement-protection model	-	-	1
Earth's crust movement-destruction model	2	2	4

The written and visual descriptions of the gifted middle school students in the 1st city about the concept of earthquake were found to be gathered under the mental models of natural disaster-earth's crust movement-destruction (f=2), natural disaster-destruction (f=1), quake (f=1), quake-destruction (f=4), earth's crust movement (f=1) and earth's crust movement-destruction (f=2); the written and visual descriptions of the gifted middle school students in the 2nd city about the concept of earthquake were found to be gathered under the mental models of natural disaster-earth's crust movement-destruction (f=4), natural disaster-destruction (f=1), quake (f=1), quake-destruction (f=3), earth's crust movement-destruction (f=2) and the written and visual descriptions of the gifted middle school students in the 3rd city were found to be gathered under the mental models of natural disaster-energy-destruction (f=1), energy-protection (f=1), quake (f=2), quake-destruction (f=9), earth's crust movement (f=1), earth's crust movement-protection (f=1), earth's crust movement-destruction (f=4).

Conclusion, Discussion and Suggestions

In this section, the findings obtained in the current study are discussed in light of the results of the existing research in the literature and suggestions are made for researchers and educators who will work in this field in the future.

In the first sub-question of the study, it was aimed to determine the mental models of the gifted middle school students about the concept of earthquake. When the findings were evaluated, it was seen that the gifted middle school students had nine different mental models related to the concept of earthquake. When these mental models are examined, it can be said that "quake-destruction" and "earth's crust movement-destruction" models come to the fore. In the answers of only nine of the students participating in the study, the earthquake was expressed as a natural disaster. This result is consistent with the results of the studies in the literature. Similar results were obtained in the studies conducted by Aydın (2010), Aydın and Çoşkun (2010), Buluş-Kırıkkaya et al. (2011), Savaşçı and Uluduz (2013), Yalman and Yalman (2019). In addition, it was seen that the students often tried to explain earthquakes with the concepts of earth's crust movement, quest and destruction. Similar results were obtained in the studies conducted by Aydın (2010), Aydın and Çoşkun (2010), Demirkaya (2007), Ross and Schull (1990; 1993), Savaşçı and Uluduz (2013), Yalman and Yalman (2019). At this point, it can be said that the definitions, concepts and visuals used by students to describe and visualize the concept of earthquake are insufficient. The reason for this situation can be shown as the fact that students do not have a scientific mental model about the concept of earthquake.

In the second sub-question of the study, it was tried to determine how the mental models of the gifted middle school students about earthquake vary depending on the state of experiencing an earthquake. When the findings were evaluated, it was seen that there were nine different mental models in the students who experienced an earthquake and six different mental models in the students who did not experience an earthquake. In both groups, it can be said that the greatest emphasis was put on the "quake-destruction" model. While only six of the students with earthquake experience described the earthquake as a natural disaster, only three of the students who had no earthquake experience described the earthquake as a natural disaster. When the findings were evaluated, it was seen that some of the students in both groups mentioned the ways of protection during an earthquake in their visuals. However, at this point, it was determined that the students in both groups drew individuals who sought protection by hiding under the table, desk and furniture-like structures during the earthquake. However, if we are inside the building at the time of the earthquake, what we need to do is to create a triangle of life for ourselves by crouching or lying down under a table supported by solid chairs, if any, or next to items that can provide protection, such as a full and bulky armchair, sofa, and a full chest. At this point, it can be said that students in both groups have misunderstandings.

In the third sub-question of the study, it was tried to determine how the mental models of the gifted middle school students on the concept of earthquake vary depending on their source of information about it. When the findings were evaluated, it was seen that the students mentioned daily experience, school, internet, family, books and media as their sources of information about the concept of

earthquake. Cvetkovic et al. (2015) concluded that middle school students' information sources about earthquakes could be listed as television, internet, lessons, video games and radio. It can be said that experience and school came to the fore in the current study. When the mental models of 14 students who pointed to their daily experiences as a source of information were examined, it was seen that five different mental models came to the fore and when the mental models of the students who pointed to school as a source of information were examined, it was again seen that five different mental models came to the fore. It can be said that the most emphasized mental model in both groups is the "quake-destruction" mental model.

In the fourth sub-question of the study, it was tried to determine how the mental models of the gifted middle school students about earthquake vary depending on gender. When the findings were evaluated, nine different mental models were determined for the female students and five different mental models for the male students. It can be said that the model that came to the fore in both groups is the "quake-destruction" model. Unlike the male students, "natural disaster-energy-destruction", "natural disaster-destruction", "energy-protection" and "earth's crust movement-protection" mental models were determined for the female students. This result can be interpreted as women or girls are more affected by earthquakes than men or boys due to their gender roles in society.

In the fifth sub-question of the study, it was tried to determine how the mental models of the gifted middle school students about earthquake vary depending on the city where they live. When the findings are evaluated, it can be said that the "quake-destruction" model is the most common mental model in all the cities. All the cities included in the study are located in the earthquake zone and have recently experienced an earthquake.

When the findings obtained from the research are evaluated in general, it can be said that gifted middle school students do not have an adequate understanding of earthquake. The most common mental model among the students in the current study was the "quake-destruction" model. Individuals can have very different sources of information about earthquakes. However, Tsai, Lin and Tsai (2001) drew attention to the importance of family, television and radio at this point. Especially in our country, the publication of images of collapsed buildings and debris in the news about the earthquake, and the headlines "shaking like a cradle, the shaking continues, we have rocked again, etc" in the news may have been effective in the formation of this mental model about the earthquake in individuals.

In the current study, it was tried to determine the mental models of the gifted middle school students about the earthquake and it was tried to determine how these mental models were affected by variables such as earthquake experience, source of information about earthquake, gender and city of residence. In this study, different variables that may have an effect on mental models about earthquake are discussed. Future studies can be carried out by using different variables such as grade level, economic status of the family and students' ability. In this study, description and visualization questions were included in the data collection tool. Open-ended questions and drawings can contain a lot of data. For this reason, it may be recommended to support data collection tools with interviews in further studies. In addition, the research findings were obtained from three science and art centers in Turkey and are limited to 41 participants. The subject can be studied within larger samples.

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Material Features That Determine the Activity Preferences of Mathematics Teachers

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Abstract

Researchers working on activity-based mathematics teaching suggest that the materials deeply shape the design and implementations. Despite this effect, empirical knowledge about how teachers approach the materials in their activity selection, and which features of the materials are decisive in their preferences is quite limited. Hence this study aims to designate material features determinant in teachers' mathematical activity preferences. This research was designed as a multiple case study and was conducted with three secondary school mathematics teachers. During the data collection process, six consecutive semi-structured interviews were conducted with the participants. While structuring the interview process, multiple activities were prepared with different materials to serve the same gain. The data were analyzed by thematic analysis method. The analyses yielded five distinct features that accounted for teachers' selection and preferences of mathematical activities with regard to materials: serving to the mathematical gains, functionality, accessibility, being proficient in use and student familiarity. The findings showed that teachers' activity preferences had a complex structure and pointed out that instructional decisions were not only shaped on a pedagogical basis and were not only concerned with students' mathematical development. Based on the evaluations of the teachers, it was concluded that the predictions about the affordances and constraints of the materials were decisive in the activity selection.

Keywords: Mathematical activity, material features, teacher preferences

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Introduction

Activity-based mathematics teaching has been a research focus for many years. For example, since 1980s, studies on the concept of academic tasks coined by Doyle and colleagues (e.g., Doyle, 1983; Doyle & Carter, 1984) have put efforts to determine significant components of activity-based teaching. One reason behind continuous research interest on activity-based mathematics teaching is related to the fact that it encourages students to take the responsibility of their own learning and allows learners to develop rich understandings (Lozano, 2017).

Even though there are varieties in the definitions of mathematical activity (Gürbüz, Pırtıcı & Toprak, 2014; Levenson, Swisa & Tabach, 2018; Margolinas, 2013; Özgen, 2017), there appears an agreement that mathematical activities are structured around an academic task (see Bozkurt et al., 2022; Swan, 2008). An example of an activity that was built on a mathematical task is given in Figure 1. In this activity, colourful yarns were used and by means of instructions, students were asked to undertake certain works. It was aimed in this activity that students to complete an academic task that can be summarized as determining the necessary conditions in order to form a triangle with three-line segments and to discover the concept of triangle inequality.

Application Steps

- Cut parts at the lengths of 15cm, 20cm and 30cm out of a white yarn
  (Use the scissor carefully!)

Tools and Materials

- White and Black yarns
- A ruler
- A pair of scissors

- Cut parts at lengths of 15cm, 20cm and 30cm out of a black yarn
- Try to make a triangle by keeping the white parts stretched
- Try to make a triangle by keeping the black parts stretched
- Tell with what colour yarns you could form a triangle
- Order white and black yarns according to their lengths
- Do the processes below separately for white and black yarns
-- Add the lengths of first and second ones in the yarns you ordered. Compare the total sum with the length of the third one.
-- Add the lengths of second and third ones in the yarns you ordered. Compare the total sum with the length of the first one.
-- Add the lengths of first and third ones in the yarns you ordered. Compare the total sum with the length of the second one.
- Benefitting from the comparisons you made, explain what kind of a relation was between the length of the yarns comprising the triangle

Figure 1: An Example of a Mathematical Activity (Zeybek et al., 2018, p. 13)

A concise definition of mathematical activity comes from Özmantar et al. (2010) who consider mathematical activity as a task in practice. This perspective is shared by Jones and Pepin (2016) who highlight that the process of putting the activities into practice corresponds to a certain pedagogical approach. Such viewed, every activity has a pedagogical potential shaped by the teacher whose preferences determine how this potential is reflected to the students. In this sense, activities are instructional tools that only become meaningful with the practitioners or teachers.

Activity-based teaching, in and of itself, is not a learning model or theory. Rather, it refers to the instructional practices in which activities are included as learning resources (Memiş et al., 2021). Because of its very structure, activity-based teaching aims to hand over responsibility of learning to students. In this respect different approaches and/or theoretical perspectives rely on mathematical activities. For example, structured problems presented as activities found a strong base in the context of

realist mathematics education (Van den Heuvel-Panhuizen & Drijevers, 2020). Similarly, didactical engineering theory (Artigue, 2009) and lesson study (Doig, Groves & Fujii, 2011) place a heavy emphasis on instructional practices structured around activities. In this sense, activities are widely used in teaching practices.

The curricular change that took place in 2005 in Turkey placed a particular importance on mathematical activities as part of classroom practices. Since then, activities and activity-based teaching have constituted an important agenda for especially the secondary education teachers. With this curriculum, activity-based teaching drew attention to a great number of researchers in the field of mathematics education in Turkey and it has become an important research area (Çenberci & Özgen, 2021; Karataş, 2021; Taşpınar-Şener & Bulut, 2022).

One strand of research on activities concerns the features and components of mathematical activities. These studies mostly focus on teaching-learning process and extract effective features of this process in determining components of activities and characteristics of effective activity implementation. As an example, while explaining the determining features in the quality of activities, Smith and Stein (1998) put mathematical development in the centre. These researchers directed their attention on classroom works allowing the development of students mathematical thinking. Margolinas (2013) indicates the importance of practices allowing students to discover the mathematics embedded in the tasks by taking responsibilities of their own learning through active participation in the activities. Powell et al. (2009) evaluate the success of activity depending on its implementation process and point to the quality of guidance offered by the teacher. Some researchers draw attention to more particular issues related to the tasks used for activities and implementation process. Suzuki and Harnisch (1995), for instance, point to the importance of tasks allowing multiple solution strategies while Baturo et al. (2007) insist on cognitive conflict; Horoks and Robert (2007) are concerned with the use of time and fluency in the transition between stages; Swan (2008) puts an emphasis on tasks that make connections among mathematical concepts and representations; Bozkurt (2018) focuses on the type of directions given to the students to regulate their efforts.

Research studies focusing on the qualities of mathematical activities proposes several features to be considered during design and implementation processes. Bozkurt et al. (2022) propose an evaluation rubric for activity design and implementation and suggested such design principles as use of materials, classroom management, student responsibilities and mathematical outcome. As is the case in this rubric, use of materials is considered to be one of the discriminating components of mathematical activities (see Jorgensen, Dole, & Larkin, 2020; Sullivan et al., 2013; Yazlık, 2018). As Özgen (2017) implies, materials play a decisive role on a variety of activity components ranging from student responsibilities to level of their involvement, emergence of hidden mathematics to the completion of the academic task.

The concept of teaching material is of a detailed use in the studies carried out into mathematical activities. Yeşildere (2018) deals with teaching materials as a phenomenon comprising real world objects together with written, visual, audial, motional, concrete or any kind of digital educational tools. This perspective is compatible with the meanings attached to the notion of teaching materials as conceptualised in the relevant literature on mathematical activity (Doyle, 1983; Henningsen & Stein, 1997; Sullivan et al., 2013). In an evaluation of instructional tools employed in mathematical activities, Özmantar & Bingölbali (2009) argue that these tools are designed or selected to serve particular purposes and consider that they are materials with pedagogical dimensions. Tools play a mediating role in learning and performing particular actions (Hardman, 2019; Wertsch, 1998). As pointed out by the researchers adopting the tradition of Vygotsky, just as tools shape the mind of the users, they are also shaped by the users (Daniels, 2012).

An important framework dealing with the relation between tool and user relationship mentioned here is the theory of instrumental genesis. While examining the interaction between the tool use and learning, instrumental approach focuses on the techniques of individual's tool use and their cognitive development process in an activity (Tabach, 2011). Drijvers & Trouche (2008) highlight two interconnected yet particularly crafted processes called instrumentation and instrumentalization. Instrumentation is conceptualised with regard to effect of instruments on shaping users' thinking. This effect comes into being due to affordances and limitations of tools, which eventually has a formative

power on users' working method and knowledge development. As for instrumentalization, it is the process where the instrument is shaped and personalized by the subject (user). Instrumentalization is comprised of four basic stages. The first stage is discovery; the second one is selection; the third one is personalization of the instrument; and the fourth one is the stage of transformation.

As our consideration hitherto suggests, materials used in mathematical activities have profound effects on the design and implementation processes. Jones and Pepin (2016), for instance, point out that teachers' pedagogical design capacities are determined by the tools or materials they decide to use. Swan (2008) goes even further and considers the task itself employed in a mathematical activity as a tool. When viewed from the perspectives of instrumental genesis, tools or materials employed in an activity impose certain limitations on teacher practices as well as provide affordances that enrich teaching in particular dimensions. Despite such deep impacts, we have limited knowledge about how affordances and limitations of tools (including any kind of materials and tasks) prescribed to be employed in an activity are reflected in teachers' selection and preferences of mathematical activities in actual settings. That is, given the important effect of teaching materials on teachers' instructional decisions and practices, empirical knowledge about how teachers approach the materials in their activity selection and which features of the materials are decisive in their preferences is quite limited. Hence this study aims to designate material features determinant in teachers' mathematical activity preferences. This issue is of particular importance, due to the fact that activities selected and implemented by the teachers play an important role in shaping students' perceptions of what mathematics is all about as well as in providing opportunities for students to gain experience of doing mathematics (Stein, 2019). Further to this, gaining insights into the material features prioritised by teachers could allow us to develop a better understanding for the foundations of teachers' pedagogical design capacities (Jones & Pepin, 2016). Besides, when we realise that activities also offer particular learning opportunities to students (Sullivan et al., 2012), this study will make a contribution to our understanding of what material features are taken as references by the teachers in the prescription of these learning opportunities.

Method

This research was designed as a multiple case study. Case study is considered to be particularly useful to develop theoretical understanding of a real-life phenomenon (Meriam, 2015). Yin (2014) suggests that multiple case studies should be preferred, when possible, over single case studies as multiple case study is a functional method to draw realistic inferences by comparing and contrasting the observations across cases. Multiple cases also provide more analytical benefits than a single case as this method allows corroboration or refutation opportunities to the researchers in terms of research inferences. In this connection, to study the phenomena under investigation to yield a deeper understanding, three secondary school mathematics teachers were chosen as separate cases in this study. In this section, we provide details about the participants, data collection tools and procedures, and data analysis method along with validity and reliability studies.

Participants

In multiple case studies, participants are chosen by a purposeful sampling strategy with a non-random method (Merriam, 2015). The current study was carried out with three secondary school mathematics teachers. Because of privacy reasons, the participants were called as Teacher Merve, Teacher Aslı and Teacher Ümit other than their real names. Teachers were selected through criterion sampling strategy. The selection criteria for the teachers were as follows: (1) working as a mathematics teacher; (2) using activities in teaching; (3) being volunteered; (4) working in the city center (for ease of access). Along with these criteria in the selection of the participants, attention was paid to diversity in terms of educational backgrounds, type of school, professional experience and gender. With these considerations, it was aimed to reach a more detailed understanding by focusing on similar and different evaluations of the participants regarding our focus in this study. Features regarding the participant teachers are summarized in Table 1.

Table 1.
Features of the Participants

Participant	Educational Information	Type of School Worked for	Professional Experience	Gender
Teacher Merve	Undergraduate Study: Secondary mathematics teacher education Master's degree: Mathematics education Doctorate: Mathematics education (in progress)	Secondary School	5 years	Female
Teacher Ümit	Undergraduate Study: Secondary mathematics teacher education	Secondary project school (İmam-Hatip)	11 years	Male
Teacher Aslı	Undergraduate Study: Faculty of Arts and Science (Mathematics dept.) Pedagogical Formation Education	Private secondary school	1 year	Female

Data Collection Tools and Procedures

Data collection from different sources is considered as a basis in case studies (Yin, 2014). In this study, six subsequent semi-structured in-depth interviews were conducted with the participants in order to form a chain of evidence (Yin, 2014) by collecting data from different sources, and the forms (see below) prepared by the participants were collected. To collect data, a series of activities were prepared with different materials but serving to the same mathematical gain. While planning the activities to be used for interviews, three gains from the official curricula document (MEB, 2018) were determined. These gains were chosen because they were considered to have potential to develop mathematical activities with different types of materials. The first gain was "to construct median, bisector and height in a triangle" (#M.8.3.1.1., p.74) from 8th grade. In relation to this gain, we developed activities focusing only on the median in a triangle. The second gain was "to determine the relations between central angles and corresponding arcs and angle measurements" (#M.7.3.3.1, p. 69) from 7th grade. The third gain was "to relate the sum of the length or difference of two sides of triangle with the length of the third side" (#M.8.3.1.2, p.74). For each of these gains a series of activities were developed: 8 activities for the first gain, 10 activities for the second and 6 activities for the third. Activities involved variations in terms of teaching materials and/or prescribed ways of their usage. A pilot study was conducted with two mathematics teachers to check the suitability of the activities to our purpose in this research. Brief descriptions of the activities in relation to target mathematical gains are presented in Table 2.

Table 2.
Brief Description of Activities Employed During Data Collection

Gain and Teacher	Activity No	Tools & Materials	Definition of Activity
Teacher Aslı: To construct median in a triangle	A1	Geogebra program, computer or smart board	Teacher builds up circles with equal radius first with the help of 12 sign boxes given readily, then builds up bisectors, and finally proves with the help of equal triangles formed.
	A2	Geogebra program, computer or smart board	Teacher builds up bisectors by clicking 3 sign boxes given readily beforehand respectively.
	A3	Geogebra program, computer or smart board	Teacher forms a triangle in the interface designed as a blank page and builds up the bisectors of this triangle with the help of a bisector drawing tool given readily beforehand.

Table 2 continuing

	A4	Geogebra program, computer or smart board	Teacher firstly builds up a triangle and then the bisectors in the interface designed as a blank page with the help of menu keys and the instructions on the screen.
	A5	Geogebra program, computer or smart board	Teacher firstly determines the circles in various radius lengths with the help of 9 sign boxes given readily beforehand and then forms the perpendiculars with intersection points. With the help of command button changes the radius lengths of the circles, forms collinear points, and builds up bisectors.
	A6	Protractor, paper, pencil	Students determine angle measures with the help of a protractor divide them to build up suitable bisectors. Students are expected to discover the similarity of building of a bisector in different kind of triangles.
	A7	Compass, paper, pencil	Students draw circles with equal radius with the help of a compass, determine intersection point and build the bisector combining it with the vertex. Students are expected to discover the similarity of building up bisectors in different kind of triangles.
	A8	Paper, pencil, scissors	Students build up bisectors with the help of paper folding in the guidance of teacher. Students are expected to discover the similarity of building up bisectors in different kind of triangles.
	A9	Symmetry mirror, pencil, paper	Students place the symmetry mirror in the guidance of teacher in way to overlap one leg of angle with the display of the other and build up bisectors. Students are expected to discover the similarity of building up bisectors in different kind of triangles.
	A10	Counting sticks	Students make a triangle each with the long counting sticks in the guidance of teacher and build up the bisectors by forming congruent triangles at the corners with the help of short sticks. Students are expected to discover the similarity of building up bisectors in different kind of triangles.
Teacher Merve: to determine the relations between central angles and corresponding arcs and angle measurements	M1	Geogebra program, computer or smart board	There is a ready-made circle marked with center and perimeter angles that see the same arc on this circle. With the help of the checkbox, the ratio between the measures of the angles is determined. It is shown that the ratio between the center and perimeter angle measures does not change.
	M2	Geogebra program, computer or smart board	Through readily given sign boxes, teacher respectively draws a circle, then creates an arc and then central and perimeter angles. It shown that the rate between the measures of central and perimeter angle does not change.
	M3	Geogebra program, Computer, or smart board	Teacher builds up the circle firstly following the instructions given and then the arc, central and perimeter angle corresponding to the arc; then determines the measures of angles. It shown that the rate between the measures of central and perimeter angle does not change.
	M4	Protractor, compass, paper, pencil	Students draw a circle and an arc individually with the help of protractor with the guidance of teacher, and the determine and rate the measure of the central and perimeter angles for the same arc. Students are expected to discover that rate does not change in different lengths of circles and arcs.
	M5	Paper, pencil, scissors	Students draw a circle on the paper with the help of a compass and cut it. Then cut the central and perimeter angles corresponding to the arc and take them out. Folding the central angel into two, they overlap it with the perimeter angle and observe that the rate between them is constant.

Table 2 continuing

(rotated left label:) Teacher Ümit: to relate the sum of the length or difference of two sides of triangle with the length of the third side.	M6	Pizza model, scissors	Students determine the central and perimeter angles for the same arc out of three circles in the shape of pizza model given them and they cut the perimeter angles of two circles, then they combine them in a way that the sides overlap with the central angle of the third model. They are expected to discover that even if circle and arc change, the rate does not.
	M7	Compass, paper, colour pencils, scissors	Students determine the central and perimeter angles for the same arc on the circle they draw and then paint it. They then cut the perimeter angles and combine them to match with the central angle. The relation between the angles is observed. Students are expected to discover that even if circle and arc change, the rate does not.
	M8	Geogebra program, computer or smart board	Readily given circle, arc and the slides formed for the angles are moved in a way to overlap with the perimeter angles for the same arc and central angle. Perimeter angles are moved in a way to overlap with each other and the relation between the measures are explained.
	Ü1	Geogebra program, computer or smart board	Teacher enters the values for lengths as prescribed in the instruction into the input boxes readily given beforehand and forms line segments with the common points. Whether a triangle is formed or not by moving the endpoints is discussed and triangle inequality is discovered.
	Ü2	Geogebra program, computer or smart board	Teacher enters the values for lengths as prescribed in the instruction into the input boxes readily given beforehand and a triangle is formed on the screen if the numbers are appropriate, if not, "triangle cannot be formed" appears on the screen. Students are expected to discover triangle inequality depending on the shaped formed with the change of side lengths.
	Ü3	Geogebra program, computer or smart board	Teacher enters the values for lengths as prescribed in the instruction into the input boxes readily given beforehand and so forming circles taking the endpoints of line segments as the centre and these lengths as radius. With the help of sliding bar, radiuses are changed; discussing when the triangles was formed, the idea of triangle inequality is developed.
	Ü4	Geometric strips	Students use geometric strips and try to form triangles having the side lengths given in the instructions. With the classroom discussion, students are expected to develop the idea of triangle inequality.
	Ü5	Spaghetti sticks, scissors	Students try to form triangles having the side lengths given in the instructions using spaghetti sticks. With the classroom discussion, students are expected to develop the idea of triangle inequality.
	Ü6	Geogebra program, computer or smart board	Teacher draws circles with suitable centres with the help of menu keys following the instructions in the interface and examines the case of forming triangles with students by focusing on the intersection points of these circles. With the classroom discussion, students are expected to develop the idea of triangle inequality.

The activities as briefly described in Table 2 were prepared as texts containing necessary details with instructions and the materials/tools were provided to the teachers. The data of the study was collected through semi-structured face-to-face interviews with the participant teachers in their schools in a weekly basis. In these interviews, the participants were asked to examine the activities given to them in a week, decide which ones they would use in their classes and to fill a form to explain their preferences and reasons. The interviews were audio-recorded, and the forms filled by the participants were collected. All the participants were informed about that the data obtained will only be used in the process of the research in line with the ethical principles and also it was also declared that no other parties would have

access to the records. The purposes of the interviews carried out with the participants in data collection process and the procedures are given in Table 3.

Table 3.
The Purposes of the Weekly Interviews and Procedures

Interview	Purpose	Procedure
Week 1	• Informing the participants about the purpose and content of the study • Delivering the activities and materials • Taking the views of the participants about activity use and intra class practices	• Participants were informed in general aims for the study and activities were delivered. Geogebra program was set up and the expectations were explained. • At the end of the interview, the participants were asked to examine the activities. They were given also a form to indicate the ones that they could use (or not) in their classrooms.
Week 2	• Taking the views of participants about activities • Taking the reasons behind the preferred or dismissed activities	• Forms given in the previous meeting were collected. • An interview was conducted to determine the features taken into consideration while deciding on which activities to use or not in their classes. • At the end of the interview, the participants were asked to make an order of priorities for the activities regarding the applicability in actual teaching.
Week 3	• Determining the features taken into consideration among activities while making a list of priorities	• Forms given in the previous meeting were collected. • An interview was conducted to determine the features taken into consideration among activities while making a list of priorities. • At the end of the interview, the participants were asked to think about how the materials in activities affected their priority orders and then make any change in their order if they wish.
Week 4	• Determining how the materials in the activities are reflected on their priority orders.	• Forms given in the previous meeting were collected. • An interview was conducted to determine how the materials in the activities are reflected on their priority orders. • At the end of the interview, the participants were delivered the materials used in the activities and they were asked to try out the activities by using the materials and then make any change in their order if they wish.
Week 5	• Allowing participants to experience the activities with the help of researcher	• Forms given in the previous meeting were collected. • Each activity was applied with the help of researcher. • The goal and scenario of each activity to reach the goal was explained to the participants by the researcher • At the end of the interview, the participants were asked to make a final order of priorities regarding the activities by considering their experience in this session taking all the process into consideration and then make any change in their order if they wish

Table 3 Continuing

	• Determining the changes introduced into the order of activity preferences • Determining the considerations and evaluations of participants for the function of teaching materials in activities	• Forms given in the previous meeting were collected. • The evaluations of the participants regarding the changes introduced into in activity orders as a result of experiences were taken and an interview was conducted to find out their reasons for changes if any.
Week 6		

Data Analysis Process

The data were analyzed by thematic analysis method. The thematic analysis method adopts a phenomenological approach (Creswell, 2016). The most important distinguishing feature of thematic analysis is that it focuses on designation of the notions that could best explain the phenomenon under investigation rather than the frequency of certain codes (Vaismoradi et al., 2013).

In this study, thematic analysis was performed through the stages proposed by Creswell (2016). In this respect, the initial stage was the preparation of the data for analysis. Audio-records of the interviews were transcribed and repeated readings were performed until grasping the data. In order to conduct data analysis, a team of six persons were formed. The team was informed about the purpose of the research and interview scripts were shared. At the second stage, team members were asked to work independently to determine important expressions in relation to research purposes. Sentences or clauses were chosen as unit of analyses and the data were reduced to meaning units through key words. At the third stage, the expression having a significance were examined; meaning units and themes were formed. While determining the meaning units, clauses or expressions referred by the analysis team were considered. At the fourth stage, appropriate quotations were chosen from among the expressions commonly identified by the analysis team as designating the similarities and differences in participants' accounts. These selections were firstly performed by the first author of this paper and then by a second independent coder. The coding differences occurring between the researcher and independent coder were discussed in meetings with the participation of a field expert until reaching a consensus. At the fifth stage, the structural examination of the expressions was carried out. The aim here was to reveal the conditions of teacher decisions, rationale behind choices and the contexts to which teacher accounts referred. Thus, the scope of the previously determined meaning units and the features teachers referred to have been deepened. The final stage of the analysis process was synthesis. Reflections and discussions took place on different combinations that would best explain the similarities and differences between the participants' evaluations. The analysis process was completed by creating passages emphasizing the agreed features as a result of the synthesis.

Reliability and Validity Studies

As is seen in the details given up to now, the analysis process was carried out by a research team with different background, experience and expertise. The reliability of the research was ensured with the formation of an analysis team, repeated cooperative work cycles, independent coding procedures and transparency. In addition, thick descriptions were provided regarding the research process and the results obtained from the analysis. Detailed descriptions, rearrangement of the raw data according to the themes, and direct quotation without adding any comments were also included in the study as a feature that increases reliability.

Analysing the data by experts and providing the confirmation of the field specialists are important for validity (Özmantar & Batdı, 2020). Supporting the interpretations about the cases determined within the scope of the research with data and the consistency of the findings also increase the internal validity (Silverman, 2016). To ensure internal validity, we had regular meetings with the analysis team, obtained participant confirmation – when felt the need – and coded the data independently as well. The generalization of research results to similar situations is related to external validity (Morse, 2016). In order to achieve this, it is important to share the details of the research. To this direction, detailed descriptions were shared with the reader, and the scope of the study and the procedures followed were explained.

Research Ethics Committee Approval

In the process of the conduction of the research, all ethical rules were obeyed at the stages of data collection and analysis. In addition, the ethical approval of the research was taken from Gaziantep University, Ethical Committee of Social Sciences and Humanities, dating on 02.04.2021 and permission number of 2021-06-18.

Findings

The analysis of the data pointed to the five material features determinant in teachers' activity preferences: (1) serving to the mathematical gains, (2) functionality, (3) accessibility, (4) proficiency in use and (5) student familiarity. In this section we delve into each of these features, provide explanations in the light of appropriate quotations from the participant teachers.

Serving to the Mathematical Gain

Participants put a special emphasis on the issue that materials should serve to the mathematical gains. In their selections and priority orders of the activities, teachers often referred to the instructional potentials of materials employed in the activity. In this respect, teacher Ümit, for instance, made the following comment:

> You give a pencil as an example of a line segment, show something like a stick in the class, and it can be an example as its length can be measured but … you show a pen and the child has a trouble this time since the length of this (the pen) is known. How does it look like a light? Mustn't it go endlessly? I am not sure if the pen here causes a misconception.

Teacher Ümit here made an evaluation of particular materials in terms of communicating a mathematical idea to the students. His judgments considered the extent to which a material could potentially lead to the development of a misconception. The teachers negatively evaluated the situations in which use of materials curtain the real purpose of an activity. In this regard, Teacher Merve expressed that: "I mean students … started to deal with the compass too much. In this case, they cannot reach out (mathematical) target…I wouldn't use this kind of activities in my instruction" Teacher Merve makes a similar explanation in her evaluations regarding M7 activity in the 3rd interview:

> I drew the shape and painted … There is a possibility of mixture of paints … then which one will be cut in the first place … They must cut the central angle first, if they start to cut the perimeter angles, there is nothing left… I think that the student will focus on a lot of things that such activities as painting, drawing, cutting will curtain the real purpose of the activity in this way.

Teacher Merve's idea here was that materials and their usage would not shadow the mathematical purpose of the activity. In addition, teachers did not prefer activities which could create a heavy workload due to the materials, inhibiting students from focusing on mathematics. In this sense, teacher Merve's remarks about M6 in the 6th interview were as follows:

> Children will bring 3 pizzas. They will find separate centres for each one. They will determine the points. So, there is a big workload. I think students' focus here becomes the work itself, I mean, instead of instructional purpose...

As this quotation indicates, whether materials serve to students' mathematical development assumed by the activity could become a matter of concern for teachers. This concern was reflected on teachers' activity choices. Teacher Aslı also shared similar concerns as was clearly expressed in her evaluations in the 2nd and 4th interviews:

> The practice and purpose must be integrated with the outcome here. So, what is my purpose and did I reach what I wanted to give at the end … what we are going to reach while doing the activity, using that material could cause a problem in reaching the real target, this is what I think. I mean they (students) can have some problems in understanding what we are doing, they might not reach to the point we want them to reach.

In her expressions here, Teacher Aslı indicates the mediating role of the material in reaching the desired level of student comprehension with the activity. Teacher Aslı also pointed out that students must not

have problems with the understanding of the works carried out via the material in the content of the activity. While dealing with the serving of material for the purpose, Teacher Ümit also indicated the importance of ease for students' comprehension: "it must be easy to perceive and should not astray them (students) from the outcome, I mean, students should be able to focus the (mathematical) outcome". Teachers expected that materials and their usage would not distract students from focusing on mathematical gains. In this respect, Teacher Ümit made the following comments while explaining why he did not prefer activity Ü6:

> This activity looks as if it aims to teach the program of Geogebra, I mean how it is used... it looks like program information. It is as if we teach Geogebra instead of teaching triangle inequality, so I would order it in the last place.

As our considerations hitherto indicate, the materials and their usage, teachers expect, must be related to the mathematical focus of the activity and the target outcome. At the same time, teacher choices were observed to be shaped by whether or not the materials curtain the purpose, shadow the outcome, create irrelevant workload and support students' mathematical growth.

Functionality

Functionality was another material feature that participants considered while choosing and ordering the activities. Functionality was expressed in terms of affordances and constraints of particular materials employed in an activity. That is, the functionality was conceptualized on the basis of difficulties that material may cause in practice and contributions that materials can make to produce a fluent implementation. Negative aspects such as difficulties experienced in the use of material, its potential to produce errors, to cause unnecessary repetitions for teaching-learning process and to create an extra workload on teachers or students were expressed as features that reduced the functionality of the material. It was observed that the activities considered to employ such kind of materials neither preferred nor prioritised. Teacher Aslı's comments were exemplary in this respect while sharing her evaluations for activity A10:

> As a matter of fact, counting sticks are nice but I cannot use it while making bisectors...We cannot find it exactly. It might not be possible to measure with a protractor or with other things since they are always moving and deforming. So, I thought I wouldn't do much progress with the sticks and discarded

Activity A10 deals with the formation of triangles with counting sticks and it also deals with building up a bisector determining the equal distances from these sides with counting sticks as well. Although Teacher Aslı found the sticks "nice", she focused on the possible troubles resulting from deformation of the shapes of the sticks on the table; in other words, sticks would easily move, distorting the constructed triangles. Such concerns negatively affected Aslı's choice of this particular activity.

Functionality effect did not only appear in activities with concrete materials but also in the activities containing technology-supported materials. As an example, teacher Ümit explained the reason why he left activity Ü6 at the bottom of his list as follows:

> Ü6 is an activity increasing the challenges. You must start from the very beginning... I mean all the stages must be done flawlessly. If a mistake is made, then everything needs to start from the scratch. This was the reason why I put it to the bottom. It has a lot of challenges...

The activity Ü6 deals with the concept of triangle inequality discovered by using the menu on the dynamic geometry software of Geogebra program through a chain of instructions. Here, Teacher Ümit judged that when students made a mistake in executing prescribed actions, they then had to start the whole process from the beginning. This was considered by Ümit as a formidable constraint of this activity with technology-related materials.

Such positive sides as the fact that realizing the activity with the help of recommended materials to be used in the activity is easy and teaching could be realized without too much effort with the activity thanks to the materials were regarded under the theme of functionality. In this respect, Teacher Ümit explained the reason why he placed Ü4 activity in the first place in the 2nd interview as follows:

> It will be effective for a student to see whether a triangle is formed by putting in just two numbers without needing extra information, but just by manipulating the objects on the screen. For this, students need not so much information. I mean it is easy to use for the teacher and student as well. This is the reason I put it in the first place. Ü4 comes to the forefront in terms of practicality and functionality.

Ü4 was an activity formed with the help of the buttons on Geogebra program and based on the drawing of a triangle possible to form with three lengths input. Here Teacher Ümit regarded this activity practical since he thought building up a triangle was easy to perform as prescribed in this activity.

Accessibility

Accessibility of the material was another feature to which teachers attached importance. Teachers paid attention that the materials involved in activities should be in reach; and if not, they should be at least easily supplied. For that purpose, teachers preferred activities for which the materials were already available in their classrooms or schools. The explanations of Teacher Aslı regarding the accessibility of materials on her preference were as follows: "I prefer what they have in hand rather than asking different things. Like paper, pencils and so, whatever they readily have. I generally prefer such materials to use" Teacher Aslı preferred activities that could be carried out with the materials at her students' disposal and prioritize such activities. Similarly, Teacher Merve also emphasised accessibility of the materials and it was clear from her following statements that she tended to employ real world objects as materials as long as they were readily available: "I sometimes use even a book as a material. I use it while showing the length, the width of it, while making a comparison. I mean anything can be used as a material in the class." In this quotation, Merve stated the importance of availability and ease of access to objects which she could turn into instructional tools instead of bringing materials from outside of the class. On the other hand, teachers' preferences are negatively affected if an activity requires materials only relevant to this particular activity or if the materials need to be supplied from outside of the school either by students or teachers. In this sense, Merve explained the difficulties in supplying materials for particular activities as follows:

> I used to bring some materials for certain activities I mean borrowed from the University. I carried lots of them. My students were able to use them, there were sufficient numbers for each of my students. But it was really hard to carry them…bring here and then take back to the University. I am now hesitant because it is really hard, not easy.

Whether students are required to supply materials does also affect teachers' activity choices. Teacher Merve explained that if activity prescriptions required students to bring their own materials, she would be negatively affected. She explained that "accessing pizza model is not so easy to me, I mean if I asked them [students] to bring pizza model to the class, I am sure they wouldn't." Teacher Aslı also shared the same perspective and pointed out particular problems caused by giving students responsibility for the supply of materials: "where we think of a material that is not in the class, I am thinking of this problem. What can we do when there are those who do not bring and hence is not involved?". As could be inferred from teacher statements, they are not favouring activities which ask for materials from the students. Similarly, the lack of materials to be used in the activity at school was regarded negatively. This is clear from Ümit's statements: "if the school is insufficient to provide the necessary materials, this activity is placed as the last choice."

Proficiency in Use

Being proficient in use was another feature that teachers looked for. The fact that teachers have knowledge and experience in the use of materials or that they can use the materials without any problems affects their activity preferences positively. Conversely, teachers' concerns about the teaching practices with the involvement of the materials and the problems that, they think, might be experienced during the implementation stage of the activity are negatively reflected in their decisions and preferences. For instance, Teacher Aslı explained the material effect on activity selection as follows:

> I can think of everything in concrete materials, but something is missing about what to do with the technology at some points. You stay behind it at that time, but you see that you can reach the result by making yourself involved in it. On the other hand, I'm not confident … you search

for it on the smart board or computer, you learn something, but when teaching if you don't use it with the full capacity then what you teach remain shaky.

Teacher Aslı feels self-confident when using concrete materials in activities. However, she had worries and concerns in using technology. Hence, she felt competent while teaching concrete materials; yet she did not feel to have necessary skills to carry out technology related or computer-based activities. Teacher Ümit made an emphasis on his competency while explaining the reasons behind his preferences for the technology-assisted activities: " Would I choose them if I weren't so good in using computer? My interest is that I design web pages and this is my connection with computer. It is an advantage for in using it in my courses." Although Teacher Ümit did not use Geogebra program before, the knowledge and competence he had regarding computer programs came to the forefront. As is seen in these quotations, the activities comprising the materials upon which teachers are competent reflect the preferences of them directly.

Student Familiarity

Student familiarity with the material was another sought-after feature. It was observed that teachers paid particular attention that students were in good command of material use, had experiences from their previous works, have known the material features relevant to activity. Teachers referred to these characteristics while explaining their reasons in selecting and ranking mathematical activities. For example, teacher Aslı explained the reason why she put A8 activity in the first place in the sixth interviewed as follows:

The reason why I ranked it in the first place is that they had paper in their hand. It is a material known by all and they will not find it strange. As it is a material, they are familiar and it is not a different material, I put it in the first place since I thought they would do it easily.

There is a need to do paper folding work for building bisectors in A8 activity. Teacher Aslı stated clearly that she put this activity in the first place because she thought that her students were used to the paper folding, and because her students could work with this material competently. These ideas were effective on Aslı's activity choices. Teacher predictions about students' difficulties and lack of competencies in using particular materials were observed to have negative effects on teacher preferences of activities. This observation could be traced in Teacher Merve's evaluations about advantages and disadvantages of activities in the fourth meeting:

You must use a compass for example for some activities, but children don't know it, I mean they must learn to use a compass firstly. Then, they must learn to use an protractor… They do not use a ruler, you see. For example, while measuring with ruler, they start counting from one; normally they must start from zero. Let's say you start from one, you can subtract it one at least, but they cannot do it. There are such kind of problems. To me, former teachers did not use it and the student also did not use it at home. I believe the student didn't feel the need to measure a thing.

Teacher Merve thought that her students were not familiar with the use of materials such as compass or ruler and reflected her thoughts in her preference. For that reason, the ideas regarding the level of material familiarity of the students by teacher Merve and for other participants were effective in their activity preferences.

Discussion, Conclusion, and Suggestions

In this study, our analysis yielded five features of materials sought after by the teachers in their selection and preferences of mathematical activities: (1) serving to the mathematical gains, (2) functionality, (3) accessibility, (4) proficiency in use and (5) student familiarity. Participants' evaluations contributed significantly to our understanding of these features from the practitioners' perspectives. The first determining feature of materials was related to whether prescribed materials served to the mathematical gains. In this respect, participants made evaluations about what the material was, how it was used, what kind of workload it created, how and in what ways it supported students' mathematical growth and understanding. The research has well established that teachers' selection is shaped by a consideration of mathematical gains targeted with activities (Bozkurt, 2012). In our study we observed that teachers

approached this aspect at a micro level and made an assessment specific to the materials as well. This suggests to us that mathematical gain of an activity is an issue that demands a holistic consideration. Researchers suggest that components of an activity such as product, student responsibilities and operations (Doyle, 1988) need to be considered while making sound judgments about whether an activity serve to its purpose (Güzel, 2020). Our study revealed that teachers made such judgments by considering the materials prescribed in an activity script as well. Further research on teachers' considerations of other components in relation to mathematical gains would enrich our understanding of teachers' instructional priorities in activity-based teaching.

Functionality of materials was another determining feature for teachers' activity selection. The functionality, generally speaking, has become apparent in teacher evaluations in connection with affordances and constraints of prescribed materials. In this respect, while making judgements about the functionality, the contribution of materials to the conduct of an activity (e.g., ease of use) as well as the actual and potential challenges they may cause (e.g., unnecessary repetitions, extra workload) were taken into consideration. The problems that material use could cause in practice have received research attention directly or indirectly in the related literature and the functionality of materials is found to be an important quality in the success of activity-based teaching (Stein, 2019). For that reason, the evaluations made by the teachers regarding the materials with the perspective of functionality are consistent with the research findings. Considering the mediating role of the materials in any learning process (Hardman, 2019), our study suggests that teachers tended to limit their material choices to the ones judged to be "functional". When viewed from the perspectives of instrumental genesis, it could be argued that the functionality was shaped depending on how materials were personalized by the teachers (Drijvers & Trouche, 2008). As a matter of fact, teachers made evaluations regarding functionality based on the potential contributions and possible limitations imposed by the materials in an activity. From this perspective, it could be stated that teachers' interaction (mental and/or actual) with the materials determine the kind of mathematics at students' disposal, communicate to students what mathematics is all about and how it could be learnt as well as extend or limit the depth of students' understanding (see also Jones & Pepin, 2016). Therefore, it should be pointed out that while functionality is important for a smooth implementation of an activity, judgments in this respect always reflect teachers' personalised interaction with the materials, which, in turn, include important decisions about student's mathematical growth. In the light of these observations, further research will be useful to examine teachers' perceptions of the functionality of materials (such as unit cubes, fraction sets, geometry stripes) available in schools that could be integrated into activity-based teaching.

The third feature that teacher evaluations point to is accessibility. The ease of access to the materials to be used in the activity reflected positively on the preferences of the teachers. Supplying the materials from outside the school negatively affected the activity preferences of the teachers. In addition, it has been seen that materials that could be accessed quickly were preferred in the selection of activities. In relation to this, teachers preferred materials that were naturally found in the classroom in the first stage. If this was not possible, they selected activities using the materials available at the school. If this was not possible, materials that were easy to obtain from outside the school were preferred. This order of preference applies to the materials used by both students and teachers.

It is known that the activities used in teaching play a decisive role in the mathematical development of students (Haggarty & Pepin 2002; Törnroos 2005). Therefore, teacher choices based on the accessibility of the material also determine the learning opportunities offered to students. As stated by Brown and Harris (2009), activities reflect teachers' pedagogical design capacities. Based on observations in our study, it can be argued that the accessibility of the materials has a decisive effect on the pedagogical design capacity of teachers. The issue of accessibility, in and of itself, can also turn into a limiting factor for pedagogical design capacity. Therefore, the possibility of accessing the materials also shapes the mathematical substance of the instruction. Similarly, teachers' pedagogical approaches can be determined based on accessibility. From this point of view, mathematical development of students does not seem to be a sole concern for teachers while selecting activities (see Sullivan et al. 2012); access to material stands out as an important factor shaping this process. Based on our observations and inferences, we believe that it would be informative to conduct further research on the access of different

kinds of materials available in different school types (public-private, city centres-suburbs, primary-secondary etc.) and if, and how, these materials are employed in instructional practices.

Another characteristic that determines teachers' activity preferences is proficiency in using the prescribed materials. Teachers prioritized the materials they had knowledge and experience with. In addition, materials that they thought to be integrated into teaching smoothly and fluently were also preferred. On the other hand, the limitations they felt regarding the use of materials and the assumed material-related difficulties had a negative impact on their activity preferences. As these observations point out, the phenomenon of proficiency refers to a personalized relationship between teachers and materials. As researchers (e.g., Hardman, 2019) emphasize, all tools act as mediators in carrying out certain actions. This also applies to the instructional actions performed using the materials. The actions that teachers perform with materials also shape themselves and their teaching practices. In addition, performing an action cannot be reduced to either tool or user (Werstch, 1998). From this point of view, proficiency also means that the relationship developed based on teachers' previous interactions with the materials is reflected in their preferences. As a matter of fact, studies (eg, Birgin et al., 2020; Kaleli-Yılmaz & Koparan, 2015; Önal, 2014) have shown that teachers who think they are not competent in computer-assisted teaching are reluctant to integrate technology into their instructional practices. As we see it, the notion of proficiency, when viewed from the instrumentalization perspective (Drijvers & Trouche, 2008), corresponds to teachers' quest for the personalization (either imagined or experienced) of a material in terms of the possibilities it offers and the limitations it imposes. On this basis, we argue that quest of proficiency is a visible reflection of the complex relationship that teachers have with the material. We feel an exciting research agenda would be about the limiting effect of the proficiency on teaching practices and the efforts of teachers to expand their proficiency areas.

Student familiarity was another attribute identified in this study. While choosing activities, the teachers gave importance to the students' knowledge of, experience with and competence in using materials. Teachers did not prefer activities when they judged that the materials were not sufficiently familiar to the students who, hence, might experience difficulties. Our observations in this study regarding teachers' privileging the students' familiarity are considered by Özmantar & Bingölbali (2009) in relation to preliminary knowledge of the material. These authors relate successful implementation of activities to the sufficiency of students' prior knowledge about the materials. We recognize that student familiarity could make important contributions to a smooth and fluent implementation of activities. However, an overemphasis on this issue also poses a threat to students' developmental opportunities. This is particularly because materials are tools with a pedagogical dimension (Özmantar & Bingölbali 2009) and hence if familiarity becomes a driving force in the selection of activities, then this situation runs the risk of imposing restrictions on students' opportunities to extend their current understandings which could be supported by the use of different tools (Van de Walle et al., 2016). The fact that Teacher Merve avoided using compass and ruler because her students were not familiar with these tools could illustrate the restrictions we have in mind. We are aware that there is not an easy resolution to avoid such risks. However, we feel it necessary to seek a fine balance between ensuring students' prior knowledge with familiarity and their development opportunities that could be extended with the involvement of new and relevant tools or materials. Further research would be useful to gain empirical insights into if, how and when teachers allow the involvement of new tools or materials into their practices and the conditions under which they are encouraged to make necessary arrangements with this matter.

The findings and discussions shared hitherto showed that teachers' activity preferences had a complex structure and pointed out that instructional decisions were not only shaped on a pedagogical basis and were not only concerned with students' mathematical development. Based on the evaluations of the teachers, it could be concluded that the predictions about the affordances and constraints of the materials were decisive in the activity selection. The affordances of the tools and the limitations they impose are important issues focused by different theoretical perspectives, especially the ones concerned with the use of technological tools employed in instruction. The technological pedagogical content knowledge framework (Mishra & Koehler, 2006) and instrumental genesis theory (Drijvers & Trouche, 2008) are among the examples of these frameworks. According to these frameworks, technological tools have constraints that can negatively affect user performance as much as they provide affordances to support development. In our study, it was seen that teachers took into account the constraints and affordances of

concrete materials as well as technological tools. Teachers' evaluations were shaped based on these two qualities, and in their explanations, positive and negative emphases reflected their insights on these aspects while selecting mathematical activities. However, it is not known to what extent teachers' predictions about the affordances and constraints that guide their choices could be mapped with the realities of actual practices. It would be a productive research agenda to delve into more about teachers' predictions of the constraints and affordances of materials in relations to actual implementation of activities in real settings.

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Assessment of Mathematics Activity Plans of Preschool Teachers

Zeynep Kurtulmuş[1]   **Hacı Ömer Şamlı**[2]

Abstract

This study aimed to determine how preschool teachers handle mathematics learning processes in their mathematics activity plans and which contents they include. The study used the document analysis method as a descriptive research model. The study examined 200 mathematics activity plans applied by 10 preschool teachers working in preschool education institutions in the 2020-2021 Fall and Spring academic terms. The data of the study were collected with the Mathematics Activities Assessment List (AEL), which the researchers developed. The researchers analysed the data obtained in the study separately by using the coding system without specifying the teachers' names for confidentiality. As a result, the researchers determined that preschool teachers planned mathematics activities mainly in large group activities and integrated them into their activity plans. On the other hand, they also found that teachers included concepts such as number/counting and quantity more in their mathematics activity plans and they planned mathematics activity plans as classroom activity plans. In addition, they included family participation activities in mathematics activity plans.

Keywords: Preschool teacher, mathematics, activity plan

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Introduction

Mathematics is one of the areas that includes concepts and essential skills in people's daily lives and during the academic process. Children are unconsciously intertwined with mathematics by using many concepts such as numbers, shapes, time, and space in their daily lives. Through mathematics activities in the preschool period, they begin to make sense of these in their lives. Mathematical concepts and skills acquired in the early period form the basis of mathematical concepts and skills in advanced periods. Therefore, mathematics activities carried out in preschool are extremely important (Akman, 2002; Tarım & Bulut, 2006). The fact that children have a planned mathematics experience in the early period supports the children's love of mathematics and the development of a positive attitude towards mathematics (Henniger, 1987). With the mathematical experiences carried out in the preschool period, the differences in mathematical readiness between children and their peers decrease when they start school (Karakuş cited from Bowman, 2020). Preschool teachers support the development of children's mathematical concepts and skills in the early period by providing children with various concrete materials in educational environments. Preschool teachers plan daily activities suitable for children by combining children's environmental characteristics, cultural lives, mathematical ideas and learning strategies. Activities that develop children's mathematical thinking skills, help them develop positive beliefs about mathematics and themselves, and include mathematical experiences in which children actively participate are planned (Clements, 2001).

Children acquire skills such as classification, pairing comparison, sorting, problem-solving, measurement, etc., in many activities they carry out in daily life and learn the basics of mathematics (Kandır & Orçan, 2010; Aktaş-Arnas, 2013). The mathematics activities provided in the preschool period contribute to acquiring and developing these skills. Mathematics activities in the preschool period aim to contribute to children's cognitive development and develop a positive attitude towards mathematics. It also seeks to help children establish a connection between their pre-learning and newly learned conceptual knowledge and to help them understand where, why, and how to use mathematical concepts and skills. Thanks to the mathematics activities carried out in the preschool period, children can recognise and maintain the patterns in their environment, develop and test assumptions, solve problems, and communicate using mathematical concepts (MoNE, 2013). Teachers who are responsible for planning and implementing activities to support children's mathematical thinking skills in the preschool period are expected to shape their learning environments using appropriate methods and techniques (Kandır, Can Yaşar, Yazıcı, Türkoğlu, & Baydar, 2016). Preschool teachers should prepare and implement activities in a way that allows children to explore them throughout the learning process. Children should be included in mathematical activity practices that will enable them to interact with the world around them, not only in the form of plans for mathematical activities limited to paper and pencil (Tarım, 2015; Erdoğan, 2016). For this reason, teachers should create problem-solving encouraging learning situations in mathematics activities and include practices to support important skills such as establishing cause-effect relationships by creating connections. To implement these practices, it is also important that teachers, who are the practitioners of the program, have sufficient field knowledge about mathematical concepts and learning-teacher processes. Studies show that teachers enrich and strengthen their mathematical meanings as children try to understand the structure of mathematical ideas (Haylock & Cockburn, 2014). In the literature, there are studies examining the opinions and attitudes of preschool teachers about mathematics teaching (Tarım & Bulut, 2006; Thiel, 2010; Scrinzi, 2011; Anders & Rossbach, 2015;Sumpter, 2020; Çelik, 2017b; Gümüştekin Ertugay, 2019; Markovits & Patkin, 2020; Can & Gültekin Akduman, 2022; Taşkın, 2022), mathematical pedagogical content knowledge (Işıtan, 2020; Smith, 2000; Lee, 2017; argın, 2019; Bilgen, 2019; Dağlı, 2019), and the self-efficacy perceptions of preschool teachers about mathematics activities (Aksu, 2008; Bates, Latham & Kim, 2013; Chen, McCroy, Adams & Leow, 2014; Çelik, 2017a). Considering the studies, teachers' views, attitudes, and self-efficacy perceptions about mathematics education affect the mathematics activity plans and practices to be applied. For this reason, it is important for preschool teachers to prepare activities that will develop the mathematical concepts and skills necessary for children to facilitate their subsequent learning processes and present them to children at different times and in different environments. (Wortham, 2006).Preschool teachers use various materials, methods, and techniques in different activities to bring children in these concepts and skills within the scope of a specific plan. In the literature, there are studies examining the

activity plans of preschool teachers in terms of activity type (Alabay & Yağan Güder, 2015; Pekince & Avcı, 2016), family participation and assessment aspects (Kurtulmuş, 2016; Osanmaz & Akman, 2018; Kılınç, Kurtulmuş, Kaynak Ekici & Bektaş, 2021), studying styles and developmental areas (Greenes, Ginsburg & Balfanz, 2004; Clements & Sarama, 2007; Theil, 2010; Anders & Rossbach, 2015; Aydemir & Deniz, 2018; Kızıltaş, Ertör & Karademir 2018; Atıcı & Çamlıbel Çakmak, 2019; Büyüktaşkapu Soydan, 2019).

In light of these studies, it was obvious that there were a limited number of studies examining the practices of preschool teachers regarding mathematics activities. In this context, this study aimed to analyze the mathematics activity plans of preschool teachers to determine how they handle mathematics learning processes and what contents they include in their mathematics activity plans.

Method

Research Model

The study used the document analysis method, one of the descriptive research models and systematically examined the records or documents obtained as a data source (Karasar, 2011). It also employed a case study pattern as one of the qualitative research methods to determine the content of preschool teachers' mathematics activities. Additionally, the study examined the mathematics activity plans of preschool teachers working at independent kindergartens and primary-secondary schools affiliated with the Ministry of National Education. While selecting the study group, non-probability and convenience sampling, which is a type of this sampling method was preferred. In the easily accessible situation sampling, the researcher decides from whom the sample will be selected and chooses the most appropriate sample suitable for the study (Balcı, 2016). Within this scope, the research examined a total of 200 mathematics activity plans voluntarily applied by 10 preschool teachers working at Ministry of National Education institutions in the 2020-2021 Fall and Spring academic year.

Data Collection Tools

The research collected data with the Mathematics Activities Assessment List (MAAL) developed by the researchers. In the MAAL development process, the researchers used the content analysis method, defined as the technique of collecting and analysing information in text contents (Karasar, 2011). Moreover, it examined the types of activities and assessment processes in the MoNE (2013) Preschool Education Program, the status chart of including the concepts in the education program in the monthly education plans, and the standards determined by organisations such as the National Council of Teachers of Mathematics (NCTM) and the National Association for Education of Young Children (NAEYC). Three field experts examined the MAAL and put it into final form, which was used in the study. The final version of the Mathematics Activities Evaluation List (MEDL) consisted of a form that helps examine mathematics activities in terms of how they are planned (individual, large-small group activity, integrated activity) and the activity in which they are integrated. In the examination of mathematic activities, there were also some issues to be paid attention to, such as their inclusion of mathematics concepts, the environment of the activities, and the inclusion of family participation. Additionally, the inclusion of the NCTM process and content standards and activity evaluation questions were significant issues.

Data Analysis

In this study, the data obtained by the document analysis method, which includes the analysis of written materials containing various information about the intended subjects, were analysed (Yıldırım & Şimşek, 2021). The document analysis method involves collecting data from various documents, reviewing, and analysing them by questioning. (Sak, Sak, Şendil & Nas, 2021). In the research, the names of the teachers were not specified for confidentiality, they were specified T1, T2, T3...T10 with the coding system. In addition, the mathematics activity plans prepared by each teacher were numbered as A1, A2, A3...A20 in his/her activity group. The researchers coded these mathematics activity plans prepared by the teachers separately and obtained similar results.

Findings

The results obtained in this study, which examined the mathematics activity plans applied by preschool teachers, are presented below.

Table 1
Preschool Teachers' Inclusion of Activity Types in Mathematics Activity Plans

Activity Types	Individual Activity		Small Group Activity		Large Group Activity		Total
	N	%	N	%	N	%	N
T.1.	-	-	-	-	20	100	20
T.2.	-	-	-	-	20	100	20
T.3.	1	-	-	-	19	95	20
T.4.	-	-	-	-	20	100	20
T.5.	-	-	-	-	20	100	20
T.6.	2	10	-	-	18	90	20
T.7.	1	5	-	-	19	95	20
T.8.	-	-	-	-	20	100	20
T.9.	2	10	-	-	18	90	20
T.10.	1	5	-	-	19	95	20
Total	7	3.5	-	-	193	96.5	200

Table 1 shows the status and numerical distribution of the mathematics activity plans discussed within the scope of the research. Within the scope of mathematics activity plans, the research examined 200 mathematics activities and determined that 193 of these activities (96.5%) were planned as large group activities and 7 (3.5%) as individual activities. Besides, all teachers included large group activities in their mathematics activity plans. While T3, T6, T7, T9, and T10 teachers included individual mathematics activity plans in their activity plans, they didn't include small group activities in their activity plans.

Table 2.
How Preschool Teachers Plan Mathematics Activity Plans

Activity Types	Mathematics Activity		Integrated Mathematics Activity		Total
	N	%	N	%	N
T.1.	4	20	16	80	20
T.2.	4	20	16	80	20
T.3.	-	-	20	100	20
T.4.	-	-	20	100	20
T.5.	-	-	20	100	20
T.6.	1	5	19	95	20
T.7.	2	10	18	90	20
T.8.	1	5	19	95	20
T.9.	3	15	17	85	20

Table 2 continuing

T.10.	3	15	17	15	20
Total	18	9	182	91	200

Table 2 shows the planning methods and numerical distributions of the mathematics activity plans discussed within the scope of the research. According to the data, 18 mathematics activity plans were planned only as a mathematics activity plan, and 182 were integrated with other activities.

Table 3.
How Preschool Teachers Plan Mathematics Activity Plans and the Types of Activities They Integrate

Activity Types	MA		MA-LPA		MA-AA:		MA-TLA		MA-GA		MA-MuA		MA-SA		MA-MoA		MA-DA		Total
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
T.1.	4	20	2	10	8	40	1	5	3	15	1	5	-	-	1	5	-	-	20
T.2.	4	20	1	5	2	10	4	20	4	20	-	-	5	25	-	-	-	-	20
T.3.	-	-	1	5	3	15	2	10	9	45	2	10	1	5	-	-	2	10	20
T.4.	-	-	1	5	3	15	2	10	9	45	1	5	4	20	-	-	-	-	20
T.5.	-	-	3	15	5	25	3	15	3	15	1	5	5	25	-	-	-	-	20
T.6.	1	5	2	10	3	15	4	20	6	30	2	10	2	10	-	-	-	-	20
T.7.	2	10	2	10	6	30	5	25	4	20	1	5	-	-	-	-	-	-	20
T.8.	1	5	2	10	4	20	4	20	3	15	1	5	4	20	-	-	1	-	20
T.9.	3	15	3	15	2	10	1	5	4	20	2	10	4	20	1	5	-	-	20
T.10.	3	15	1	5	2	10	6	30	4	20	2	10	2	10					20
Total	18	9	18	9	38	19	32	16	49	24.5	13	6.5	27	13.5	2	1	3	1.5	200

*MA: Mathematics Activity, MA-LPA: Mathematics Activity-Literacy Preparation Activity, MA-AA: Mathematics Activity-Art Activity, MA-TLA: Mathematics Activity-Turkish Language Activity, MA-GA: Mathematics Activity-Game Activity, MA-MuA: Mathematics Activity- Music Activity, MA-SA: Mathematics Activity-Science Activity, MA-MoA: Mathematics Activity- Motion Activity, MA-DA: Mathematics Activity-Drama Activity

Table 3 shows the types and numerical distributions of the activities integrated with the mathematics activity plans discussed within the scope of the research. In the mathematics activity plans, 49 (24.5%) of them were integrated with a game activity, 38 (19%) with an art activity, 32 (16%) with Turkish language activity, 27 (13.5%) with a science activity, 18 (9%) with literacy preparation activity, 13 (6.5%) with music activity, 3 (1.5%) with drama activity, and 2 (1%) with motion activity. In accordance with the data, 18 (9%) mathematics activity plans were not integrated with any activity but were planned as direct mathematics activities.

Table 4.
Preschool Teachers' Inclusion of Concepts in Mathematics Activity Plans

Categories	Geometric Shapes		Dimension		Quantity		Location		Counting		Total
	N	%	N	%	N	%	N	%	N	%	N
T.1.	4	20	2	10	4	20	-	-	10	50	20
T.2.	5	25	1	5	7	35	2	10	5	25	20
T.3.	4	20	3	15	3	15	2	10	8	40	20
T.4.	4	20	2	10	7	35	-	-	7	35	20
T.5.	2	10	2	10	9	45	2	10	5	25	20
T.6.	6	30	2	10	3	15	-	-	9	45	20
T.7.	4	20	1	5	6	30	1	5	8	40	20
T.8.	7	35	2	10	3	15	1	5	7	35	20
T.9.	3	15	4	20	5	25	2	10	6	30	20
T.10.	4	20	2	10	6	30	3	15	5	25	20

Table 4 continuing

Total	43	21.5	21	10.5	53	26.5	13	6.5	70	35	200

Table 4 shows the status of including mathematics concepts and their numerical distribution in the mathematics activity plans discussed within the scope of the research. According to the data in Table 4, 70 (35%) of the mathematics activity plans included concepts in counting, 53 (26.5%) in quantity, 43 (21.5%) in geometric shapes, 21 (10.5%) in dimension, and 13 (6.5%) in location categories.

Table 5.
Areas Where Activities Take Place in Preschool Teachers' Mathematics Activity Plans

	In-Class Activities		Non-Class Activities		Total
	N	%	N	%	N
T.1.	20	100	-	-	20
T.2.	18	90	2	10	20
T.3.	20	100	-	-	20
T.4.	16	80	4	20	20
T.5.	18	90	2	10	20
T.6.	19	95	1	5	20
T.7.	19	95	1	5	20
T.8.	17	85	3	15	20
T.9.	20	100	-	-	20
T.10.	18	90	2	10	20
Total	185	92.5	15	7.5	200

Table 5 shows the status and numerical distribution of the mathematics activity plans discussed within the scope of the research. According to the data in Table 5, 185 (92.5%) of the mathematics activities were planned as in-class activities and 15 (7.5%) as non-class activities.

Table 6.
Preschool Teachers' Inclusion of Family Participation in Mathematics Activity Plans

Family Participation Statuses	Family Participation Included		Family Participation Excluded		Total
	N	%	N	%	N
T.1.	11	55	9	45	20
T.2.	15	75	5	25	20
T.3.	8	40	12	60	20
T.4.	13	65	7	35	20
T.5.	12	60	8	40	20
T.6.	4	20	16	80	20
T.7.	12	60	8	40	20
T.8.	13	65	7	35	20
T.9.	11	55	9	45	20
T.10.	17	85	3	15	20
Total	116	58	84	42	200

Table 6 shows the family participation statuses and numerical distribution of family participation activities in the mathematics activity plans discussed within the scope of the research. Following the data, 116 (58%) of the mathematics activity plans included family participation activities, while 84 (42%) did not include family participation activities.

Table 7.
Preschool Teachers' Inclusion of NCTM Process-Oriented (Thinking) Standards in Mathematics Activity Plans

Categories	Problem Solving		Reasoning and proof		Associations		Contact		Representation	
	N	%	N	%	N	%	N	%	N	%
T.1.	2	10	5	25	4	20	5	25	4	20
T.2.	3	15	5	25	8	40	6	30	5	25
T.3.	6	30	5	25	3	15	3	15	3	15
T.4.	1	5	6	30	2	10	4	20	4	20
T.5.	4	20	8	40	4	20	4	20	4	20
T.6.	1	5	4	20	5	25	5	25	3	15
T.7.	2	10	4	20	5	25	6	30	4	20
T.8.	7	35	7	35	6	30	5	25	2	10
T.9.	6	30	6	30	9	45	4	20	4	20
T.10.	9	45	8	40	8	40	7	35	7	35
Total	41	20.5	58	29	54	27	49	24.5	40	20

Table 7 shows the inclusion of NCTM standards for the process and their numerical distribution in the mathematics activity plans discussed within the scope of the research. Of the mathematics activity plans, 41 (20.5%) included problem-solving skills, 58 (29%) included reasoning and proofing skills, 54 (27%) included connection skills, 49 (24.5%) included communication skills, and 40 (20%) included representation skills.

Table 8.
Preschool Teachers' Inclusion of NCTM Content Standards in Mathematics Activity Plans

Categories	Number and operations		Algebra		Geometry		Measurement		Data analysis and probability	
	N	%	N	%	N	%	N	%	N	%
T.1.	12	60	1	5	4	20	4	20	4	20
T.2.	6	30	3	15	6	30	7	35	4	20
T.3.	12	60	1	5	5	25	3	15	3	15
T.4.	7	35	3	15	4	20	2	10	5	25
T.5.	6	30	3	15	3	15	4	20	4	20
T.6.	9	45	1	5	6	30	2	10	3	15
T.7.	8	40	2	10	7	35	1	5	4	20
T.8.	7	35	4	20	8	40	5	25	2	10
T.9.	11	55	3	15	5	25	4	20	4	20
T.10.	11	55	4	20	7	35	5	25	7	35
Total	89	44.5	25	12.5	55	27.5	37	18.5	40	20

Table 8 shows the inclusion status and numerical distribution of NCTM content standards in the mathematics activity plans discussed within the scope of the research. According to the data in Table 8, 89 (44.5%) of the mathematics activity plans included numbers and operations, 25 (12.5%) included algebra, 55 (27.5%) included geometry, 37 (18.5%) included measurement, 40 (20%) included data analysis and probability content standards.

Table 9.
Preschool Teachers' Inclusion of Activity Types in Mathematics Activity Plans

Activity Assessment Question Types	Descriptive Questions		Affective Questions		Questions for Achievements		Associating with Life Questions	
	N	%	N	%	N	%	N	%

Table 9 continuing

T.1.	17	85	16	90	17	85	4	20
T.2.	19	95	5	25	16	80	17	85
T.3.	20	100	13	65	20	100	9	45
T.4.	18	90	6	30	16	80	7	35
T.5.	18	90	7	35	14	70	10	50
T.6.	19	95	15	75	14	70	8	40
T.7.	19	95	10	50	19	95	9	45
T.8.	16	80	15	75	13	65	12	60
T.9.	18	90	14	70	16	80	14	70
T.10.	20	100	15	75	17	85	9	45
Total	184	92	116	58	162	81	99	49.5

Table 9 shows the inclusion of activity assessment questions in the mathematics activity plans discussed within the scope of the research and their numerical distribution. Following the data, 184 (92%) of the mathematics activity plans included descriptive questions, 116 (58%) included affective questions, 162 (81%) included questions for achievements, and 99 (49.5%) included questions about associating with life.

Discussion, Conclusion, and Recommendations

This study, examining the mathematics activities of preschool teachers, provided some descriptive information about the mathematics education process of teachers. For preschool children to successfully gain mathematics concepts and skills, it is necessary to organise the education environment effectively, for teachers to be sufficient in terms of professional-personal qualifications , and to implement an effective education program. The harmony and effectiveness of these three essential elements will enable children to develop a positive attitude towards mathematics in the following years and succeed in this field (Aktaş-Arnas, 2013). Uyanık and Kandır (2010) considered mathematics skills as early academic skills. They emphasised that it was essential to organise the educational environment and choose appropriate methods and techniques in the activity plans to develop mathematics skills. MoNE (2013) emphasises that the achievements and indicators supporting the multi-faceted development of children should be included in the activity plans in a balanced way. It also states that the activities should be balanced in their implementation (large group, small group and individual activities). In the mathematics activity plans examined within the scope of the study, teachers did not take this fundamental feature of the MoNE (2013) program into consideration, and they planned mathematics activities as large group activities at a high rate. In the study of Büyüktaşkapu Soydan (2019), mathematics activities were mostly planned as large group activities, followed by individual activities, and at least as small group activities. In their research, Sadık and Dikici Sığırtmaç (2016) found that preschool teachers did not conduct small group activities because they had difficulties in implementing small group activities. However, small group activities effectively develop literacy and mathematics skills (Clements & Sarama, 2007). In the study of Atıcı and Çamlıbel Çakmak (2019), according to their interviews and observations with nine teachers, the majority of teachers preferred large group activities, while individual and small group activities were not preferred much. The research findings are similar to other studies in planning mathematics activity plans in the form of large group activities. Large group activities were preferred more because of the thought that classroom dominance authority was difficult in small group and individual activities. Based on the idea that large group activities were easier to plan and implement for teachers, it was thought that teachers preferred large group activities. Since teachers mostly prefer large group activities, children could ignore individual interests, needs, and abilities, which might be inadequate in supporting the potential development of children.

In preschool education, more than one activity could be planned as an integrated activity by combining it with appropriate transitions. In a learning process, in the preschool curriculum, the back ordering of the activities is not an integrated activity (MoNE, 2013). In the mathematics activity plans examined within the scope of the study, teachers preferred to integrate mathematics activities mostly with game

and art activities. In the literature, some studies revealed that mathematics activities were integrated with different types of activities when appropriate transitions were provided (Alabay & Yağan Güder, 2015; Atıcı & Çamlıbel Çakmak, 2019; Yazlık & Öngören, 2018). Similar to the results of this study, which analysed mathematics activity plans, some studies revealed that mathematics activities were mostly integrated with game and art activities (Anders & Rossbach, 2015; Yazlık & Öngören, 2018; Atıcı & Çamlıbel Çakmak, 2019; Can & Gültekin Akduman, 2022). Considering the developmental characteristics of preschool children, play-based learning is the most appropriate learning method. Since playing was seen as the child's most important job in this period, teachers preferred to integrate mathematics activity plans with play activities

Since the preschool period, mathematical concepts and skills have developed in children and the knowledge and skills gained in this period form the basis of mathematics education in the future. It is crucial to provide children with mathematical concepts and skills in preschool (Clements & Sarama, 2007; Akman, 2019). Gaining these concepts and skills within a program and plan supports becoming more systematic and practical. In the study, while teachers included mostly counting concepts in the mathematics activity plans analysed within the scope of this study, they included fewer concepts related to location. Preschool teachers mainly included numbers and geometric shapes in mathematics activities in their studies by Yazlık and Öngören (2018). The study by Tarım and Bulut (2006) examined the perceptions and attitudes of preschool teachers towards mathematics teaching. They determined that most teachers' perceptions of mathematics activities were numbers and shape studies. In the studies of Atıcı and Çamlıbel Çakmak (2019), teachers primarily focused on number studies in mathematics activities. In the same study, numerical studies were followed by mathematical skills, pattern, graphics, process, and measurement studies. Moreover, the study of Can and Gültekin Akduman (2022) observed that while the mathematical skills that teachers mostly included in their activities were recognizing numbers, rhythmic counting back and forth, operations and geometric shapes, they gave less place to mathematical concepts and skills such as measurement, graphics, time, and location in space. In this study, examining mathematics activity plans, teachers were similar to other studies in terms of including mathematics concepts in mathematics activities. This was because teachers focused on certain concepts in a narrower scope due to the weak pedagogical content knowledge and attitudes towards mathematics education. For mathematics activities in early childhood to be successful, teachers must first have sufficient knowledge in this area. The teacher's experience, communication with the child, and the teacher's belief in the process affect mathematics education (Jung & Reifel, 2011). In the interviews conducted with the teachers in the studies of Atıcı and Çamlıbel Çakmak (2019), the fact that many teachers stated that they did not find themselves sufficient and they had difficulties during the application support this idea.

In preschool education, it is essential for teachers to include sufficient and regular outdoor activities in terms of both raising children in a healthy way and raising them as individuals who love and protect nature by enabling children to interact with nature (Alat, Akgümüş & Cavalı, 2012). As stated in the balance feature of the preschool education program, activities are expected to be balanced in terms of indoor and outdoor activities (MoNE, 2013). This study found that most mathematics activities were planned as classroom activities. Alabay and Yağan Güder (2015) stated in their research that most of them were planned indoors (in-class). In their research, Sadık and Dikici Sığırtmaç (2016) found that teachers rarely gave place to non-class learning activities due to possible risks (falling, injury, sickness due to weather conditions) and procedures (permission, transportation, etc.). In the study conducted by Alat, Akgümüş and Cavalı (2012) to reveal the thoughts, attitudes and practices of preschool teachers about outdoor activities, teachers did not include outdoor activities enough for similar reasons. In this study, most of the activities were similar to other studies in terms of planning them as in-class activities. The reason why teachers planned their mathematics activity plans in the form of indoor activities, in general, may be due to the thought that teachers would have difficulty in carrying out the learning process outside, carrying the activity materials to the outside environment, and that classroom authority would be more difficult in the external environment. The studies conducted also support this idea (Alat, Akgümüş & Cavalı, 2012; Sadık & Dikici Sığırtmaç, 2016).

The participation of parents in the education process in preschool education supports the academic achievement, language development, and social development of children (Ekinci-Vural, 2006).

Effective family participation can support these developments and become permanent (Temel, 2008). With the family's participation in the education process, continuity between school and home is ensured, and the knowledge, skills, and attitudes gained in the school environment are supported in the home environment and become permanent (MoNE, 2013). In addition to the preschool education program, "Family Support Education Guide Integrated with the Education Program (EBADER)" and "Family Support Education Guide Integrated with the Preschool Education Program (OBADER)" were prepared to present different methods and techniques to improve family participation to teachers. These guidebooks include studies and suggestions on how teachers can involve families in the education process. The activity plan format of the preschool education program also includes the "Family Participation" dimension. In this part of the activity plans, parents are offered activities at home to support their learning at school. In the preschool education program, family participation can also be supported by family participation in cases where family participation is not mandatory for each activity planned in the school environment (MoNE, 2013). In his study, Kurtulmuş (2016) stated that family participation studies included in the activity plans would effectively ensure the permanence of learning by bringing what the child learned in the school environment to the home environment and strengthening family-child communication. In the study, more than half of the teachers' activities included family participation. Alabay and Yağan Güder (2013) found that teachers included family participation activities at a low rate during or after the learning process. In his study, Kurtulmuş (2016) found that only 28 of the 60 mathematics activity plans included family participation activities. The family participation study included in the mathematics activity plans was planned as activities to support classroom learning and their association with life. Bartan and Aydemir Özalp (2019) found that most teacher candidates did not include the family participation dimension in their activity plans. Of the 286 activity plans examined in the study, only 34 mathematics activity plans included family participation studies. In the study of Ünüvar (2010), 23 of the 30 teachers fully included families in the activities, and seven partially included families in the activities. In their study, Atıcı and Çamlıbel Çakmak (2019) stated that six teachers out of nine teachers preferred to include family participation studies in mathematics practices. In the study of Güzelyurt, Birge and Ökten (2019), 19 of 36 teachers included family participation activities in the classroom. In the study of Kılınç, Kurtulmuş, Kaynak Ekici and Bektaş (2021), teachers planned activities in a home environment that supports in-class learning as a family participation study in their activity plans. The research findings are similar to other studies in terms of including family participation studies in more than half of the mathematics activity plans. Considering data, teachers included family participation in activities based on the fact that the family was an important stakeholder in the child's education process. Additionally, they mastered the idea that learning would be more permanent when learning in the school environment was supported in the home environment. In their study, Gömleksiz and Serhatlıoğlu (2013) revealed that the teachers' high self-efficacy beliefs about family participation studies were positively affected by family participation studies and supported this idea.

Children's mathematical thinking, problem-solving and reasoning skills, interest in mathematical applications and questioning skills can be developed and supported with mathematical applications offered to children (Kandır, Can Yaşar, Türkoğlu, Yaman-Baydar & Yazıcı, 2016). The American National Council of Teachers of Mathematics (NCTM) explains the concepts and skills in mathematics education in preschool education in the light of specific standards. Taking these standards into account in the mathematics learning process can provide more accurate and permanent mathematics learning (NCTM, 2000). The standards determined by NCTM are divided into two content and process. Content standards are numbers and operations, algebra, geometry, measurement, and data analysis-probability, while process standards are problem-solving, reasoning and proof, connections, communication, and representation (Sperry-Smith, 2016; Argın, 2020). In this study, the activity plans included mostly reasoning and proof skills from the process standards, including NCTM process and content standards. It was followed by activities like association, problem-solving, contact, and representation skills. In the study, activities were mostly comprised of numbers and operations, and it was followed by geometry, data analysis and probability, measurement, and algebra. In the literature, similar results were achieved regarding including NCTM process and content standards. Besides, teachers generally prefered including number and digit content in mathematics learning processes (Pekince & Avcı, 2016; Yazlık & Öngören, 2018; Atıcı & Çamlıbel Çakmak, 2019).

Since the process is essential, not the result, in preschool education, the multi-faceted assessment of the process comes to the fore in the program. Activities in preschool education are prepared by taking into account the gains and indicators in the program. It is essential to regularly assess the level of learning situations expected to occur in children during and as a result of the education process. Descriptive, affective, achievement-oriented questions, and life-related questions can be directed in the discussions held at the end of the activity to assess the activity (MEB, 2013; Işıkoğlu Erdoğan et al., 2021). The assessment questions of the mathematics activities discussed within the scope of the research included descriptive questions supporting what was done in the activity process, and questions about the achievements and indicators discussed in the activity to a large extent. The activity process rarely included the affective questions that enable us to get information about what emotions children experience and the questions of associating with life, which enable them to establish a relationship between their experiences and their own experiences during the activity process. Kandır, Özbey and İnal (2009) stated in their study that preschool teachers had difficulty in the assessment process while preparing daily plans. As a result of the observations and interviews made in his study, Özkan (2015) stated that teachers mostly preferred observation, question-answer, and chat methods in the assessment process. In their study, Tükel (2017) indicated that 73 of 90 preschool teachers stated that using questions about achievements, 70 stated that using descriptive questions, 61 stated that using questions about associating with life, and 52 stated that using affective questions would be helpful in the activity assessment process. In a similar result, Özsırkıntı, Akay and Yılmaz Bolat (2014) stated in their study that it would be helpful to rank descriptive, affective, achievement-oriented and life-related associations in the assessment process. In the studies of Kılınç, Kurtulmuş, Kaynak Ekici and Bektaş (2021), the most affective questions were included in the activity assessment questions, while it was followed by descriptive questions that revisited the activity process. The research findings differed in including more descriptive and achievement questions in mathematics activity plans. In different studies, although teachers stated that using different question types in activity assessment was significant, including all questions in the activities in a balanced way also had importance.

As a result, this study determined that teachers mostly included activities in their mathematics activity plans as large group activities. While mathematics activities were more integrated with games and art activities, they were less integrated with drama and movement activities. On the other hand, teachers mostly included the concepts of numbers and counting in mathematics activities but concepts such as dimension and location in space were less. Additionally, they planned mathematics activities more in the form of in-class activities and gave less space to mathematics activity plans in out-of-class environments. In general, they included family participation studies in their mathematics activity plans. Besides, they included NCTM process-oriented (thought) standards in the activities in a balanced way and included number and transaction contents more in terms of NCTM content standards. It was determined that mathematics activity plans included more descriptive and affective questions than activity evaluation questions in the evaluation process.

In light of the research findings and literature data, it is recommended to conduct the following studies;

- First, informative studies can be carried out for preschool teachers to include individual and small group activities more in their activity plans.
- They should include more individual and small group activities considering children's differences and supporting their potential development.
- In-service training can be given to preschool teachers to support them in having full knowledge of mathematics concepts and skills in activity plans and practices.
- Supportive in-service training can be given to teachers to include outdoor activities in a balanced way in the planning and practice of activities.
- Studies can be done that support teachers' awareness and qualifications of family participation activities in mathematics activity plans and practices.
- During the activity assessment process, teachers should be encouraged to use alternative assessment methods in assessing the process and the child, and in-service training should be carried out for these assessment methods.

Acknowledgment

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Interaction in Distance Education: Meta-Synthesis of Qualitative Studies

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Abstract

In distance education processes, interaction has a very important place in the learner's academic performance, attitude and motivation, participation in the lesson, and the acquisition of instructional goals and behaviors. The aims of this study, in which the interaction in synchronous and asynchronous distance education processes is investigated by the meta-synthesis method, are as follows: In synchronous and asynchronous distance education processes, for what purposes are the interactions established, through which features and functions can interactions be increased in distance education and what factors adversely affect this process when interactions are established?. According to these purposes, interaction in distance education is established for cognitive, affective, and cooperative purposes. Cognitive-oriented interaction is included question-answer, asking for and expressing opinions, giving feedback, making explanations, sharing information and experience, participating in discussions, and suggesting solutions and guidance. Affectively focused interaction, encouragement, and support, sharing of personal information show solidarity toward group members and provide emotional support. Collaborative interaction is determined by group qualifications (members and workspace), coordination among group members, distribution of tasks within the group (expertise), and group work processes. The categories that determine how the interaction frequency increase are: learner-teacher, learner-learner, learner-content, and multiple interactions. The most common in these categories are teaching strategies that encourage peer-to-peer counseling, course contents with detailed and explanatory demonstrations, the learner's feeling as being a part of a group, reducing social and psychological distance with a quick reply to the learner's e-mail, in-depth explanatory feedback on learner questions and comments, and using alternative web resources. Among the factors that negatively affect the interaction process are pedagogical inadequacy that negatively affects the cooperation between learners, negative experiences, slow connection or disconnection, conflicts between learners, insufficient time in an online class to interact due to the intensity of the content, and the dominant learner being at the forefront when the teacher can't manage the interaction process.

Keywords: Distance education, distance learning, interaction.

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Introduction

Interaction has a very important place in educational environments. At the same time, interaction is at a central point in the learning process (Sims, 1997). While physical proximity in face-to-face education allows for easier interaction, interaction in distance education can be more demanding than in face-to-face education. Moore (1980) states that the physical distance between the learner and the teacher will create both a communicative and a psychological deficiency. With some changes to be made in the behavior patterns of the learner-teacher, the dialogues, and the design (structure) of the lesson; This deficiency due to the interactional (operational) distance can be eliminated (Horzum, 2010). On the other hand, physical proximity is not very important for digital and virtual societies that are steadily increasing and developing due to the development of network technologies (Turkle, 1995).

Although not explicitly stated in many of the definitions of distance education, it is emphasized that interaction is an integral component (Bernard et al. 2009). USA Distance Education Association defines distance education as "learning activities in which interaction takes an important place in educational environments that provide K-12, higher education or professional continuous service" (Holden &Westfall, 2006). Daniel and Marquis (1988) defined interaction in distance education: the simplest form of learners being in two-way contact with a person or persons. Arnold Seigal, Ellen Wagner, Nofflet Williams, and Michael G. Moore discussed the following questions at the panel titled "The Surprising Component of Distance Education" held in Salt Lake City on April 16, 1989 (Moore, 1989).

- What level of education should be for effective learning?
- What is effective interaction?
- How to achieve effective interaction?
- What are the benefits of real-time interaction?
- Is it worth the cost to interact?

In the panel, Moore (1989) suggested that interaction should be examined in 3 sub-types "interaction with content", "interaction with the teacher" and "interaction with the learner" and stated that the distinction between these types should be understood and that this distinction would also be conceptually beneficial.
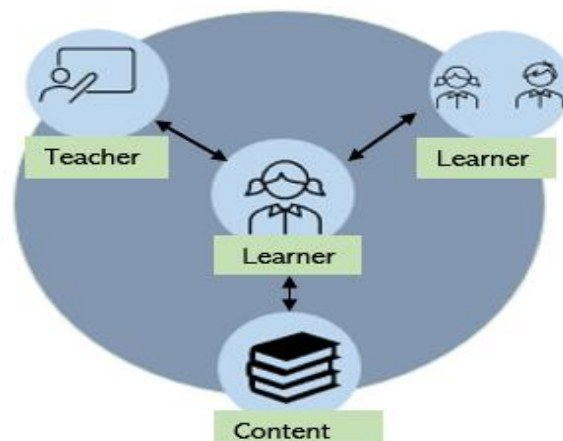
Figure 1. Types of Interaction

Apart from these interaction types, Anderson and Garrison (1998) expanded the interaction types specified by Moore. They brought the teacher-teacher, teacher-content, and content-content interactions into the literature. Bouhnik and Marcus (2006) suggested "interaction with the system" as a fourth interaction category and stated that the interface has an important place in learning processes. According to Jung et al. (2002); interaction has been examined in 3 dimensions according to its aims,

that is, academic, social, and collaborative interaction. There are also many types of interactions with classifications from various perspectives.

Interaction Types

Interaction increases the standards of learning processes and learner experiences. The effect of interaction on the development of active learning, high-level knowledge, and 21st-century skills is undeniable (Woo & Reeves, 2007). It would be beneficial to examine the interaction (Moore, 2001), which is one of the most important factors in distance education processes, in terms of learner-content, learner-teacher, and learner-learner.

Learner-content interaction: It is the state of mutual interaction between the learner and the content of the course. Through this communication, the learner achieves the targeted gains with individual study and effort. In the process, the learner reads or watches the content, performs the applications, receives feedback, and manages the learning process. In this way, the learner benefits from many structures at the same time (Tosun, Özgür & Şahin, 2009). Education cannot be fully realized without content interaction. Because this process enables the learner to change in mental and cognitive structures, understanding, and perspective and interact with the learning content in an intellectual way (Moore, 1989). It is an ancient method that Holmberg calls "internal didactic speech" and facilitates interaction with content. While the purpose of the texts in the Middle Ages was to provide instruction away from entertainment. The popularization of interaction tools and technologies changed the direction and amount of interaction with the content (Moore, 1989). As the amount and quality of learner-content interaction increases, the academic success of the student will increase as well. Sun, et al. (2017) analyzes the registration log of 426,211 learners in the e-learning portal of massive online learning systems and stated that the academic achievement of the learners who do not use the learning materials on the portal or who use it less often is lower than those who use it at a high level. In addition, similar results in 10 different types of learning materials show that learning content interaction is an important variable that predicts academic success. The frequency of interaction positively affects learning outcomes and contributes to learning task completion time was observed in another study investigating learner-content interaction on educational web pages (Brady, 2004).

Learner-teacher interaction: This interaction type is defined as the mutual interaction between the learner and the teacher who prepares the subject material (Moore, 1989). The teacher interacts as a person who provides content and instructional support and also shares with students. (Yılmaz & Aktuğ, 2011). According to Horzum (2007), communication between the learner and teacher forms the ground of learning, and interaction is based on dialogue (Bernard et al., 2009). According to Moore (1989), the learner-teacher interaction planned in the curriculum increases the learner's interest, motivation, and orientation by enabling the content to reach the teaching objectives. The interaction with the teacher plays an important role in the learner's reception and response to the information given in distance education. The teacher gives individual feedback and corrections to the learners by making applications and evaluations and also makes changes and adjustments in their own strategies. The frequency and intensity of interactions vary according to the learner's education level, the teacher's personality, philosophy, and many factors. Avoiding interaction with learners will affect the learner's academic success (Booher & Seiler, 1982).

In order to inspire students as "subject area experts", teachers need to be able to demonstrate to students that they have the capacity to transfer knowledge. Certain rules must be observed for successful communication in the teaching process. These are (as cited by Hurst, McInnerney & Roberts, 2004):

- Understanding: Limiting the use of jargon and complex expressions in the content,
- Common ground: Sticking to the plan given at the beginning of the learning process,
- Perception: Teaching knowing that the learners are not field experts,
- Awareness: Awareness that learners struggle with new ideas, concepts, and technology

- Self-confidence: Self-confidence and keeping the dose at an adequate level when communicating with learners,
- Clarity: Keeping the narrative short and simple.

Learner-learner interaction: Learners are not only interacting with the content or the teacher but also interacting with each other. Learners develop critical thinking skills by creating online learning communities, analyzing course content, and sharing ideas, and deep learning can be achieved at the same time (Fuller, Kuhne & Frey, 2011). In the process of learner-learner interaction, known as the interaction between learners, it is not important whether the teacher is present or not (Moore, 1989). Learners can share and communicate with each other through group work or various communication channels (Yılmaz & Aktuğ, 2011). Quality community and group work are one of the modern world requirements, and being a member of a team is important. It is stated in the literature that; it is difficult to establish direct interaction in traditional and crowded classroom environments where face-to-face education takes place (Özdemir & Yalın, 2007). Since an effective interaction cannot be achieved, this type of interaction can be achieved by using recorded video, computer interactions, online learning groups, synchronous chat tools, and e-mail tools with higher performance. At the same time, the learner and teacher need to benefit from the interactions between the learners in the application and evaluation stages (Phillips, Santoro & Kuehn, 1988).

Motivation, which is an important component that enables learners to establish interpersonal interaction, is also effective in learner and content interaction. The interaction between learners and teachers is an important component of the success of distance education (Çuhadar, 2008; Mantyla, 1999; Lynch, 2002). Mantyla (1999) states that besides the features of interaction such as attracting attention and maintaining it, it is established for various purposes such as asking and answering questions, feedback, and being aware of learning goals. Driscoll and Carliner (2005) state that interaction has benefits such as motivation, recall, and increased attention, but there may be some limitations due to individuals and technical conditions. These limitations are that the interaction requires a certain amount of time, time constraints, content development costs, high expectations of learners, and the difficulty of interacting with everyone in large groups.

The variety and frequency of interaction in learning processes increase learner experiences (Wright, Marsh & Miller, 2000). According to the interaction and communication theory, it is stated that if there is a well-designed interaction type in the learning process, less time can be spent on other types of interaction, but it is also a good situation to have more than one interaction type effectively (Anderson, 2003). Mason (1994) stated that interactions lead learners to deep and meaningful learning (Brewer & Klein, 2006) and prompt them to think critically, as well as increase their interest and motivation towards the course and content in an affective sense. With positive interaction in distance education, the learner will be influenced by the teacher and will be willing to interact effectively with the content by benefiting from the teaching experiences in line with the learning goals and needs.

Interaction Technologies in Synchronous and Asynchronous Education

When we look at the history of distance education, it has been observed that the situations that change the process are emerging technologies rather than educational resources. Moore compared the development of information communication systems in the 1990s to the future of radio at the beginning of the 20th century and television in the 1950s, referring to the failure of the expectation of dramatic change (Horzum, 2013). Developments in communication and interaction technologies have an important place in both face-to-face and distance education-based education systems. Today, developments in the dynamics of interaction technologies in distance education are an important factor in the increase of interactions in terms of more active and frequency. Simulations, hyperlinks, interactive games, virtual environments (Fuller, Kuhne & Frey, 2011), semantic web technologies, social networks, massive online courses (Kumtepe et al. 2019), and metaverse environments allow interactions to move from a limited understanding to a richer understanding. Interactive environments play a motivating role in the interaction of students with other students, teachers, and content in learning processes (Yılmaz & Aktuğ, 2011).

Various communication technologies used in distance education processes support both synchronous and asynchronous education. Jonassen and Kwon (2001) state that learners are in more interaction and communication in web-assisted learning environments than in face-to-face learning environments. In this respect, these learning environments attract the attention of educators (Özdemir & Kaya, 2007).

Synchronous education is realized by the simultaneous presence of students and teachers in virtual classrooms using tools such as computers, mobile phones, and tablets. Learners can ask questions and participate in discussions by establishing a live connection with each other or with the teacher (Pilancı, 2018). Virtual classrooms are environments where synchronous lectures or meetings are conducted. In addition, these environments can be divided into different sessions, and it is possible to conduct and manage courses and meetings at the same time. Most of the classroom experience, academic discussions, and social interaction opportunities allow instant audio and video interaction and sharing (file, desktop, etc.) with synchronous virtual classroom tools (Çınar et al., 2011). Zoom, Adobe Connect, Google Classroom, MS Teams, Blackboard Collaborate, and BigBlueButton are some of the virtual classroom implementations. Also, interactive web tools that can be used in synchronous education processes include Mentimeter, Quizizz, Socrative, Kahoot, etc. Learning management systems, which ensure the planned execution of e-learning activities, are like a connection point between asynchronous education and synchronous education (Baki et al., 2009).

In asynchronous education, there is no obligation to communicate at the same time. Audio-visual learning materials (such as interactive books, videos, presentations, and animations), messages, e-mail, forums, and blog pages support the asynchronous education process. These platforms both support the learning process and increase social interaction between learners. Social networking, collaborative learning material, software for preparing projects, etc. web tools allow learners to create virtual learning communities (Gürgan, 2012).

Asynchronous learning environments have the flexibility of time and space. This is also an advantage for learners. Since learners save time, they can structure their views and thoughts by examining them in detail (Kılıç, Horzum & Çakıroğlu, 2016), so their thinking skills also develop (Çuhadar, 2008).

Purpose of Research

With the spread and development of online education, interaction has ceased to be a secret situation. On the other hand, increasing interest in social presence situations (Huss, Sela & Eastep, 2015) is a factor that increases the importance of interaction. Establishing interaction in the learning process provides an advantage, and its lack or lack of sufficient amount can turn into a disadvantage (Gürgan, 2012).

In the distance learning process, teachers and other decision-makers should make an effort related to interaction, which is a way to make their engagement with learners meaningful, and they should be able to address and manage a large audience. Learning, teaching, and content interaction are the main features of distance education. In addition, the interaction of these elements shapes the experiences of the learners (Ustati & Hasan, 2013). Carefully planned interaction enriches the learning and teaching process.

The scope, balance, and structure of the interaction that both the learner and the teacher can initiate in certain contexts of distance education should be well-defined (Simpson & Anderson, 2012). The lack of face-to-face communication in distance education (De la Varre, Keane & Irvin, 2011), inadequacy of communication and interaction between learners and teachers (Özudogru, 2021), causes negative experiences in the process (Huss, Sela & Eastep, 2015) and disappointment (Thorpe & Godwin, 2006). At the same time, the dimensions of interaction also affect the success of learning objectives. On the other hand, there are synchronous and asynchronous interaction tools and applications, various multimedia technologies, strategies, methods, and techniques that support the active continuation of learner-teacher, learner-learner, and learner-content interactions. In this respect, there is no obstacle to establishing interaction. For this reason, this study focuses on effective and sustainable interaction. By examining the literature, 3 sub-objectives have emerged regarding which situations the research will deal with. These sub-objectives are; in synchronous and asynchronous distance education processes,

1. For what purposes the interaction is established,

2. Which features and functions will increase the interaction and,
3. While establishing the interactions, which factors negatively affect this process?

This study is thought to be important because it creates a framework for interaction for institutions, instructional designers, academics, and researchers who are interested in the interaction dimension of distance education processes. On the other hand, it is aimed to reveal a comprehensive result by examining international studies on interaction in distance education processes with qualitative meta-synthesis and turning them into codes and themes again. These studies were grouped under the determined criteria and re-evaluated with qualitative findings and comments. In this respect, it is considered to be important. On the other hand, there are various studies on interaction in distance education. However, these studies have generally been studied on a field basis. In this research, the interaction of the interaction elements with each other is discussed from a realistic and holistic perspective. And the interaction was re-examined by combining the findings of the selected studies to determine the whole. Because the number of interaction studies handled from this point of view in the literature is quite limited.

Method

In this study, which examines qualitative research on interaction in distance education, a three-stage path was followed to ensure the objective approach of the researchers and to reduce the bias. These steps are:

1. Determination of criteria for the selection of studies and databases to be examined
2. Evaluation of the studies depending on the criteria and determination of the studies to be included in the research
3. Qualitative meta-synthesis of studies included in the research process

The meta-synthesis method aims to interpret the qualitative findings of the studies to be examined within the criteria, organize, and divide them into themes (Sandelowski, Docherty & Emden, 1997). The synthesis of qualitative studies is the collection of findings that are conceptually larger than the sum of the parts under the determined themes (Campbell et al., 2011). When the literature is examined, it is seen that there are two different views on the meta-synthesis method. The first view states that only qualitative data should be used in meta-synthesis (Jensen & Allen 1996; Sandelowski, Docherty & Emden, 1997; Çalık & Sözbilir, 2014), the other view is that quantitative data can be used with qualitative data (Strobel & Van Barneveld, 2009). However, the use of quantitative data in the process complies with the structure of meta-analysis. In this study, it is thought that only qualitative findings are suitable for the structure of the meta-synthesis method. In order to avoid possible confusion due to differences of opinion, the research methodology of this study was emphasized as a qualitative meta-synthesis.

Qualitative findings of interaction studies in synchronous and asynchronous education were analyzed by content analysis and separated into codes. Codes with similar features were categorized and interpreted under the determined themes. These studies can be called "evaluation of evaluations" (Polat & Osman, 2016 cited by Patton). In this study, international databases that examine the subject of interaction in distance education and which have the most studies in terms of scientific quality were selected. The databases examined and the results found are given below.

Table 1.
Databases Examined within the Scope of the Research

Database	Conclusion
Academic Search Premier (EBSCO)	173
Scopus	434
Education Resources Information Center (ERIC)	424
Total	1031

Within the scope of the research, the most extensive search results were obtained in Academic Search Premier (EBSCO), Scopus, and Education Resources Information Center (ERIC) databases. In this respect, a total of 1031 studies were reached in these databases.

Table 2.
Inclusion Criteria for Research

Research Area	Criterion
Subject Terms	distance learning or far away education or online education or online learning and " interaction
Method	Qualitative research
Language	English

During the research, "distance learning, distance education, online education, online learning, interaction" keywords were used. These keywords were searched for subject terms in each database and as a result of the searches, 1031 studies were found and explained in the context of inclusion-exclusion in the PRISMA flowchart below.
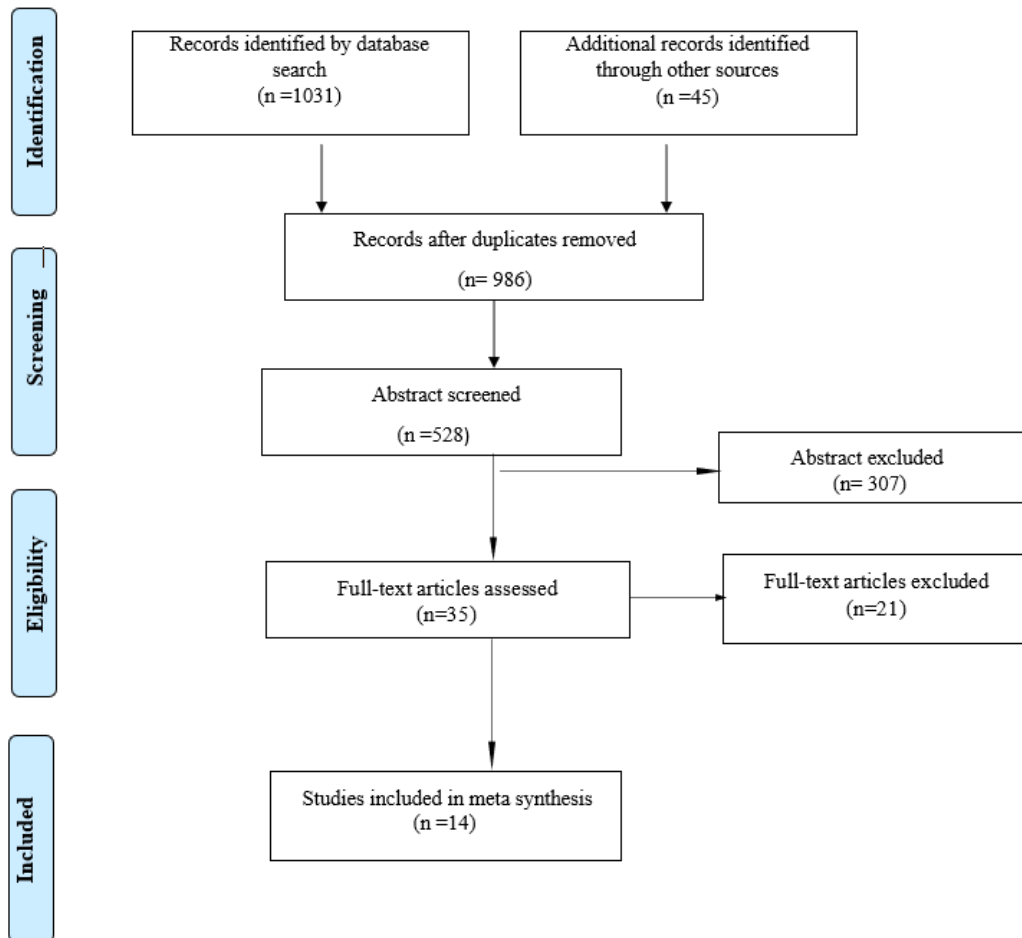
Figure 2. PRISMA flow chart of included studies

In this study by database search, 1031 records were identified. Of these studies, 45 were excluded because of duplications. After duplicates were removed, 986 records were screened by title. As a result of the title screened, 458 unrelated articles were excluded because they did not examine the interaction in distance education and did not match the problem situation of the research. 221 articles were excluded because they were not suitable for the research purpose. 270 articles did not comply with the research method, 21 articles were eliminated because they were thought not to provide a sufficient contribution to the research and according to the criteria, a total of 14 studies were considered suitable for qualitative meta-synthesis. Drawing attention to the importance of limiting between 10 and 12 studies in order to enrich the analysis and interpretation processes in meta-synthesis studies, Bondas and Hall (2007) emphasized the importance of less study-intensive analysis. In this study, 14 studies rich in data were included in the synthesis process, considering this matter.

The analysis of the identified studies was done by content analysis. The main purpose of content analysis is to determine the relationships between the data and to reach the concepts that will explain

these relationships. From this point of view, it can be expressed as an understandable interpretation of concepts similar to each other by combining them under determined codes and themes (Yıldırım & Şimşek, 2011). In line with the determined aims and criteria of the research, the articles were examined in detail, and themes were formed again in terms of meaning and structure. Accordingly, the themes of this study on interaction in synchronous and asynchronous distance education processes are as in Table 3.

Table 3.
Qualitative Meta Synthesis Code Template

Themes	Theme Code
The purposes for which interactions are established	E1
Through which features and functions, interactions can be increased	E2
What factors negatively affected this process at the time the interactions were established?	E3

The qualitative meta-synthesis process was carried out in January-June 2022. The studies included in the research process were coded as "M1, M2, M3….-M14" and content analysis was performed. First of all, the identified studies were examined in detail. All of the codes and themes in the findings of the studies examined were combined in a single file. Codes and themes were re-examined and categorized. Cohen's (1960) Kappa statistic was used to calculate the interrater reliability in the content analysis process. After a consensus was reached between the raters, it was observed that the coherence values for E1, E2, and E3 are as follows "0.83, 0.80, 0.82". At the same time, some studies in which codes and themes were determined were cited and it was aimed to contribute to the reliability of this study.

Table 4.
Studies Included in Qualitative Meta-Synthesis

Code	Writer	Year	Theme
M1	Niemann, R.	2017	E2
M2	Forrer, D., Bechtel, S., Brown, K., Mabesa Jr., J., Gunn, L., Hayes, RL, & Wilmore, T.	2019	E2
M3	Cetinkaya, L., & Keser, H.	2018	E2
M4	Huss , JA, Sela, O., & Eastep , S.	2015	E2, E3
M5	Diaz , LA, & Entonado , FB	2009	E2
M6	Offir , B., Barth , I., Lev , J., & Shteinbok	2005	E2
M7	De la Varre , C., Keane , J., & Irvin , MJ	2011	E2, E3
M8	Nandi , D., Hamilton, M., & Harland , J.	2012	E1
M9	Michinov , N., & Michinov , E.	2008	E1
M10	Vrasidas , C. & McIsaac , S.M.	1999	E2, E3
M11	Thorpe, M. & Godwin, S.	2006	E2, E3
M12	Vlachopoulos , D., & Makri , A.	2019	E2
M13	Kelsey, K.D.	2009	E3
M14	Muhirwa, J.M.	2009	E3

In Table 4, the codes of the articles included in the qualitative meta-synthesis, the authors, the year of publication, and the theme of the finding are shared.

Table 5.
Information About Studies Included in Qualitative Meta-Synthesis

Working Code	Source of research data	Methodology	Geography where the work took place	Data collection technique	Data analysis method
M1	10-12th grade (14) learner	Design-based research model	South Africa	Semi-structured interview	Content analysis
M2	Lecturer (36)	Case study	USA	Focus group interview	Content analysis
M3	Lecturer (9)	Case study	Turkey	Delphi method	Content analysis
M4	Lecturer (7)	Phenomenological research model	USA	Meeting	Content analysis
M5	Take an online course (8) teach (8) learner	Mixed research method	Spain	Interview and focus group discussion	Content analysis
M6	7th and 8th Grade (22) learner 11th Grade (25) learner	Mixed research method	Israel	Observation and interview	Content analysis
M7	Online learner-teacher message texts at K12 level	Mixed research method	USA	Document/record review	Content analysis
M8	Online course discussion forum learner message texts	Case study	Australia	Document/record review	Content analysis
M9	Online course 6 learners	Case study	France	Observation and interview	Content analysis
M10	Instructor and 8 learners	Case study	USA	Semi-structured interview, document /record review, observation	Content analysis
M11	15 online course students	Case study	Britain	Survey questionnaire	Content analysis
M12	Articles dealing with learners in higher education	Mixed research method	Britain	Document/record review	Content analysis
M13	Online course 47 learners	Phenomenological research model	USA and Canada	Observation and interview	Content analysis
M14	Online lecture video recordings	Action research	Africa	Document/record review and interview	Content analysis

In Table 5, the data collection source, research method, country of research, data collection technique (investigated in this study), and data analysis technique of the examined studies are given.

Results

According to the data obtained as a result of the qualitative meta-synthesis, the themes of the purpose of interacting in synchronous and asynchronous distance education processes, which features, and functions will increase the interaction in distance education and the negative factors affecting the interaction have emerged. The findings were also modeled with tables and figures. In addition, direct

citations from the articles that are the source of the meta-synthesis were interpreted in detail and the reliability of the research was tried to be increased.
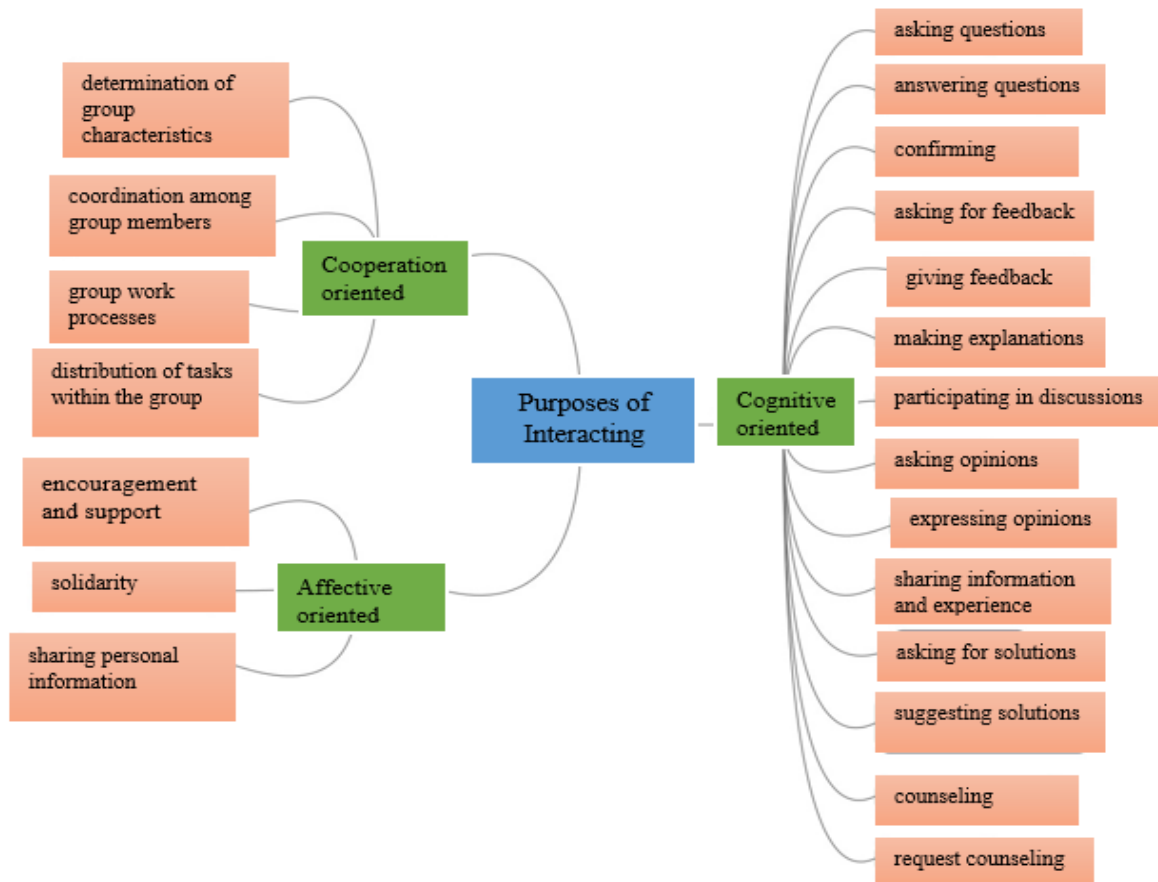

Figure 3. Purposes of interacting in synchronous and asynchronous distance education processes

In Figure 3, it has been observed that cognitive, affective, and collaborative interaction is established in the synchronous and asynchronous distance education process. The coding scheme of Bales' (1950) Interaction Process Analysis study was used to categorize the interaction objectives. Cognitive-oriented interaction purposes are "*asking questions, answering questions, confirming understanding, asking for feedback, giving feedback, making explanations, participating in discussions, asking opinions, expressing opinions, sharing information and experience, asking for solutions, suggesting solutions, counseling* and *request counseling*". Socio-emotional processes such as "*encouragement and support, sharing personal information, solidarity (emotional support)*" come to fore among the aims of establishing affective oriented interaction. The aims of establishing cooperation-oriented interaction are "*determination of group characteristics (members and work area), coordination among group members, distribution of tasks within the group (expertise), group work processes*". These aims are focused on the cooperation of learning groups in their working process. These codes are supported by the participants' opinions in the mentioned studies. In M8-page 14 stated that "I was wondering if there was some way once the first assignment had been uploaded to "web learn" whether it could be further modified or retrieved. (Intro to Prog_D)" Other comments were "Will you be placing an answers section to the tutorial questions, so we can mark our own progress? (Intro to IT_B)" and "When I access or send emails using a web-based account, such as yahoo or gmail, what protocols are at play? (Intro to IT_B)" In M8-page 15 stated, "Look very carefully at all of the proximity functions and you'll find one that is more suitable. (Intro to Prog_C)"

As a result of the coding and exemplary citations, it is possible to state that the purposes of interacting in synchronous and asynchronous distance education processes are actually made for the realization of instructional goals and meaningful learning, and interaction is directly related to learner participation.
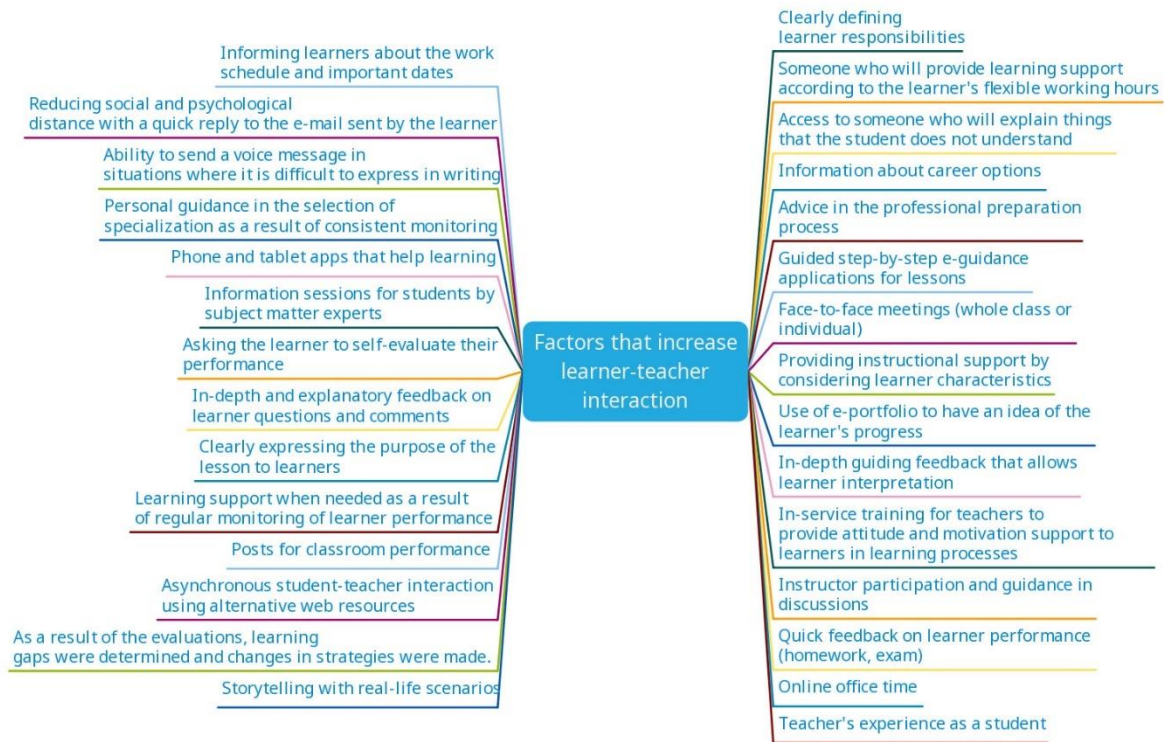
Figure 4. Factors that increase learner-teacher interaction

Findings on which features, or functions can increase the interaction were examined in 4 different categories. These categories are "learner-teacher, learner-learner, learner-content, and multiple interaction." The multiple interaction categories refer to the interaction of more than one situation. From these findings, the learner-teacher interaction category was first interpreted. To increase learner-teacher interaction, learning responsibilities should be clearly announced to learners. In addition, step-by-step e-guidance applications are required for the courses. When the learners need instructional support in the learning process, support should be offered and not delayed to reduce the social and psychological distance in education In the M1-page 97, "I mostly study at night and during weekends and then I need help.", in another comment "I don't want to wait for Impak's subject expert to respond on my e-mail." and in the same study, the learners say "We need more vocational options." From here, supportive advice should be given to learners regarding their career options. And online office time should be arranged. New methods and strategies should be produced by eliminating the learning gaps that arise as a result of learner assessments, and phone and tablet applications should be used while establishing interactions. Interactions should be supported through face-to-face meetings if possible. It should be possible to establish a rapport with the learners where they can be given attitude and motivational support when necessary. In M4-page 77, an instructor supports the findings, stating that: "I wanted to insert myself into a class; I wanted to insert my personality for rapport building. That's where the trust develops. I can push a student and challenge a student more when they know they can trust me."

In this respect, a teacher can increase interaction by taking a supportive role in teaching. Kassandrinou, Angelaki, and Mavroidis (2014) expressed the role of the teacher in a supportive manner as facilitating quality communication and interaction by promoting it.
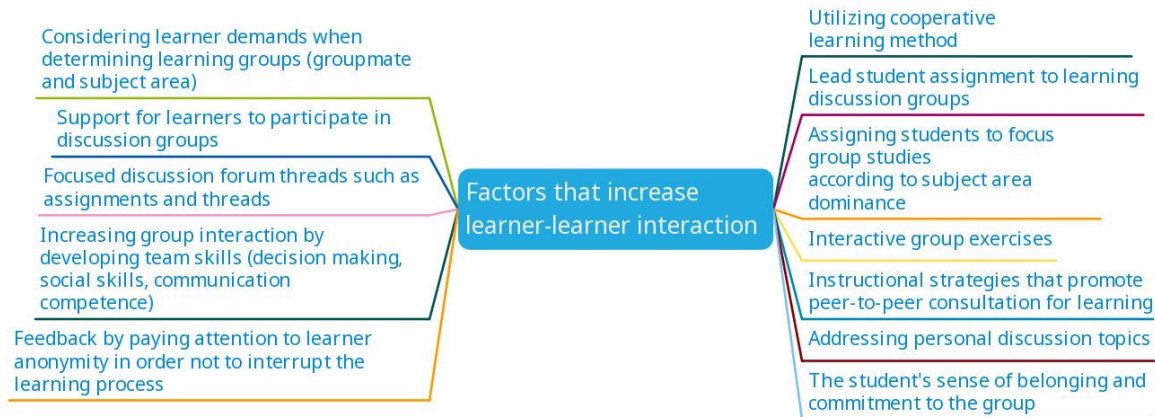
Figure 5. Factors that increase learner-learner interaction

Looking at Figure 5, the presence of learning tasks that require a cooperative learning method, team skills (decision-making, social skills, communication competence), and group work in the distance education process increases the learner-learner interaction. In M12-page 618, *"Online participants can communicate through interactive and collaborative projects by using synchronous and asynchronous tools."* In the study coded M2-page 6 stated, *"Collaborate sessions bring the professor into a traditional online course. Requiring online collaboration several times per term will make students feel part of the class and help them feel comfortable with the material."* On the other hand, in some cases, keeping the learner's identity confidential can positively affect peer communication. The learner can be kept confidential to ensure peer interaction. For example, in some learning situations, if the learner's identity remains hidden in the discussions, the learners express their thoughts more and participate. Thus, effective results can be achieved (Jong et al. 2013). For this reason, attention should be paid to learner anonymity. In summary, in order to increase communication and interaction between learners; group work and participation in discussion forums should be supported, and teaching strategies should be supportive of these interactions.
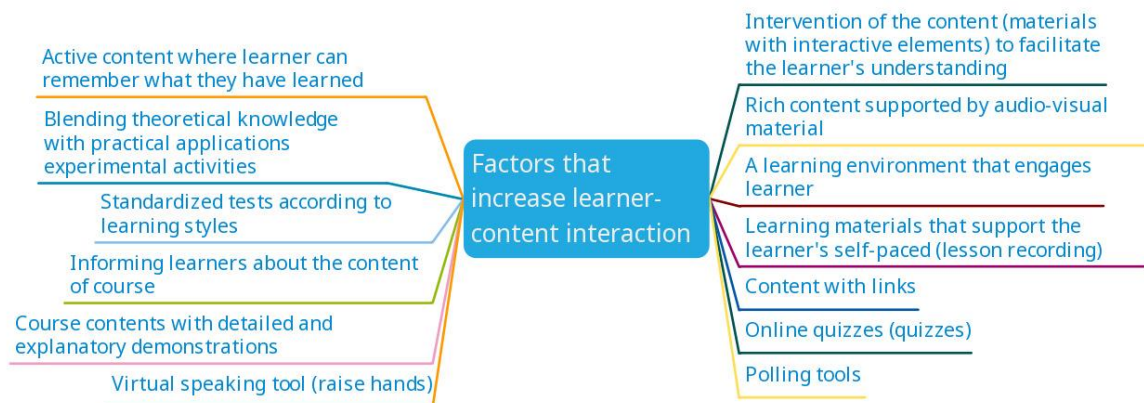
Figure 6. Factors that increase learner-content interaction

Some factors that increase learners' interaction with content include "a learning environment that engages learner, rich content supported by audio-visual materials, use of various interactive technologies and materials, availability of experimental activities where they can experience theoretical knowledge, course contents with detailed and explanatory demonstrations, use of standardized tests according to learning styles". At the same time, supporting learners to progress at their own pace in the learning process increases the interaction of the learners with content in distance education processes. In the study coded M6 page 169 states that it is "An additional, asynchronous option that enabled students to download each week's lesson for review at their own pace." In M1 page 98, "I'd like to see how things work, especially where there are practical applications" comment

is stated. In the same coded study on page 97, the comment "Please, creative, innovative online presentations – not tutors just talking about the work" reveals that learners want content rich in audio-visual materials that they seek in presentations.

Figure 7. Factors that increase multiple interactions

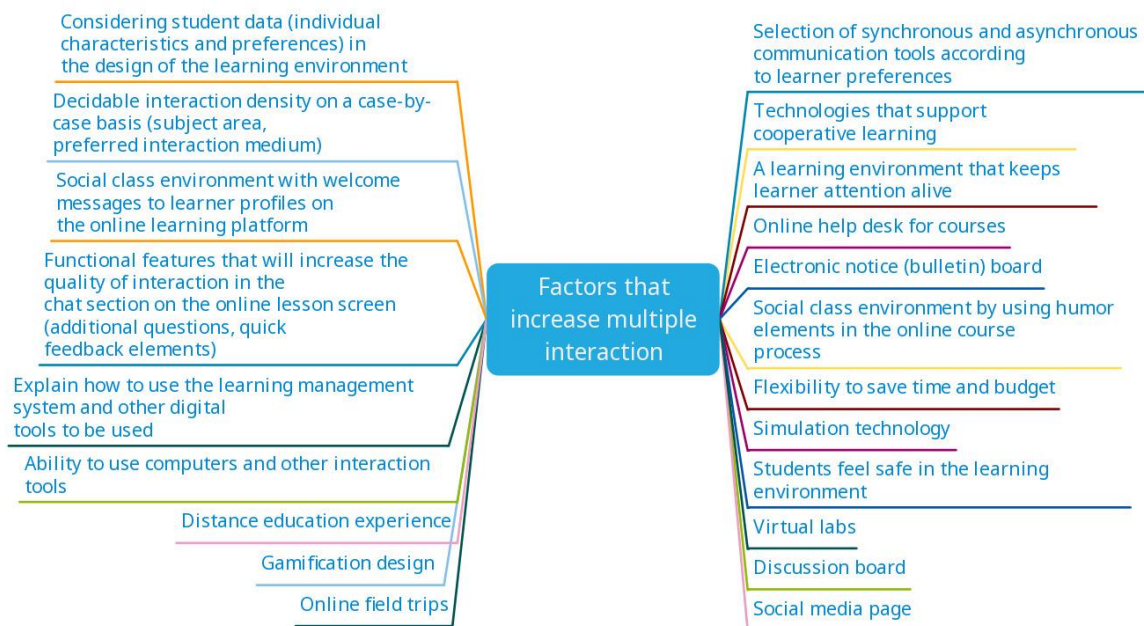Multiple interactions are valid when more than two interactions occur. In other words, it refers to the situations of learners interacting with more than one of them at the same time with teacher-content-interface. In literature, Martin, Parker, and Deale (2012) draw attention to the importance of this situation. For example, during an interaction that the learner has established by asking a question to the teacher through audio, video, written, or through the application, the involvement of other learners in the process, upon expressing their opinions, means multiple interactions.

According to the qualitative meta-synthesis findings in this study, to increase multiple interactions in the distance education process, the learning environment should be designed according to the interests and preferences of the learner, simulation technology, use of gamification elements in the design process, use of the virtual laboratory environment, online field trips, functional features in the chat section in the learning interface (feedback elements, etc.), a flexible distance education process, discussion boards, social media page for the course where current content and sharing can be made, an online help desk can be found in the learning environment. In the study coded M5 page 338 stated that "Intensity depends on the tool used in the online case where a link is created". While deciding the intensity of the interaction, the interaction tool determines the amount of interaction. In M3- page 147, the importance of learner preferences is emphasized by saying "learner characteristics in online interaction environments be considered and the employment of the synchronous and asynchronous tools which are appropriate could be useful." Forrer et al. (2019) also draw attention to a learning environment that attracts learners' attention by saying that designing the lessons in a way that will make the learners want to participate and increase the academic experience instead of just passing. In M11 page 210, a learner said "sharing ideas and gaining the confidence that my practice and ideas are similar to others. Being able to have questions answered quickly. (Education, level 1)" This learner who answers feels himself/herself in a positive and safe place by seeing that there are individuals with similar views in the learning environment he/she is in. At the same time, he draws attention to the importance of getting quick feedback in interaction processes.

Table 6.
Adverse Situations Affecting Interaction

	Negative Factors Affecting Interaction
Based on Learner Sourced	o Hang about to put in enough effort o Intention to get high marks o Reluctance to participate in asynchronous discussions o Negative experience in the process o A feeling of being left behind by seeing more versed learners o Feeling disappointment and anger due to negative perception of the lesson o Hurrying to master the course content o Incompatibility between learners o Bored learners o The learner thinks that it will be difficult to explain the problem in writing. o Worry about being seen on camera o Perceiving online discussions as a break o Conflict between learners o Concerns of dismissal in the community o Low number of participant learners
Based on Teacher	o The dominant learner is at the forefront when the teacher cannot manage the interaction process o Teacher's bias towards learner-learner interactions in online courses o Pedagogical inadequacy affecting the cooperation between learners negatively o Lack of face-to-face communication o Overpaid homework (workload) o Delay of feedback
Based on Learning Content	o The type of learning activities of the course does not allow for interaction o web (uptime) o Insufficient online course time to interact due to the intensity of the content o The idea that is sufficient to transfer existing resources to the digital environment o Incomprehensible learning material o Excess text-based learning content o The learning content consists of only low-level learning objectives
Other	o Lack or absence of technical support units o Ineffectiveness of interaction elements in the learning environment o Multitude of messages in online chat platform o Device incompatibility with interactive course component o Slow connection or disconnection o Lack of ability to use technology

Negative situations affecting the interaction process in distance education are given in Table 6. Negative situations affecting the interaction process were examined in 4 dimensions based on the learner, teacher, content, and others. In the study coded M11, page 215, "Online tutorials often attract a poor response. If there is a point you don't understand it is sometimes hard to express your thoughts in writing and tutorials are often stretched over a long period. (Social Science, level 2)" is stated as the negative experience encountered during the interaction process. This comment indicates the difficulty of stating the problem of the learner to the teacher in writing in the asynchronous interaction process. On the other hand, instructors' delay in feedback also negatively affects the interaction. In M10 page 9, it was stated that the learners perceived participating in asynchronous discussions as a "workload" and therefore they were reluctant to participate. In M14 page 12 the learners evaluated the interaction they experienced in distance education as "listening to the radio with high noise", which shows a significant deficiency in both the connection quality and the pedagogical approach (interactive materials, methods, and strategies). In the same study, it should be noted that:

> More importantly, from a pedagogy standpoint, it should be noted that the questions and answers above belong to the lowest levels of Bloom's Taxonomy of Educational Objectives

(1956). They are about knowledge and comprehension. Thus, they fall short of addressing the higher levels of application, analysis, and synthesis that professionals in SSA need so badly.

The M13 coded study the possible impact of negative situations in technology use "For example, time is in a contingent relationship with technology failures. If the technology failed, then there was little time during the presentation" reveals on page 69.

In M10 page 12 a teacher states that "I felt I got much less engagement from the students in the online portion because they saw it as taking a break from the class, rather than they were required to engage on those online weeks." The teacher states that learners do not see online interactions as a part of the learning process but feel like a break, and this perception reduces interaction.

Conclusion and Suggestions

As a result of the qualitative meta-synthesis of the subject of interaction in synchronous and asynchronous distance education processes, comprehensive results have been achieved. With the in-depth examination of 14 studies by making meta-synthesis, themes, and codes were reached in the title of the purposes of establishing interaction in distance education, factors that increase interaction, and the negative situations experienced in this process.

Based on the research findings, interactions are established with cognitive, affective, and collaborative purposes in the distance education process. The purposes of cognitively-focused interaction include asking and answering questions, validating, giving feedback, making explanations, participating in discussions, asking and expressing opinions, sharing knowledge and experience, suggesting and offering solutions, and asking for and giving direction. Díaz and Entonado (2009) stated that the purpose of the interaction is to coach learners by assuming the role of guide and mentor in e-learning environments, and Moore (1989) stated that interaction is made to change the mental and cognitive structures of individuals. The goals of affectively focused interaction include encouragement and support, personal information sharing, solidarity and emotional support. Jung et al. (2002) and Çuhadar (2008)'s social purpose interaction is compatible with the purpose of interaction. Interaction with the content is not included in this dimension, here it is more about social interactions about extracurricular issues. Jung et al. (2002) described one of the purposes of interaction as academic. In this study, it was thought that it would be appropriate to specify a cognitive focus since it was noticed that there were interactions to achieve cognitive goals and objectives. On the other hand, the purposes of establishing cooperation-oriented interaction include determining group characteristics, coordination among group members, distribution of tasks within the group, and group work processes. A group of learners working on a specific topic, expressing their opinions, preparing materials, and sharing (Adelskold, 1999; Jung et al., 2002) are among the purposes of cooperation-oriented interaction. When the literature (Gunawardena & Zittle, 1997; Kanuka & Anderson, 1998; Adelskold, 1999; Jung et al. 2002; Çuhadar, 2008) and the functions of interaction tools and technologies are examined, it is seen that the purposes of establishing interaction are compatible with these findings of the research.

Interaction was analyzed separately as learner-content, learner-teacher, learner-learner and multiple interaction. In order to have rich learning experiences in synchronous and asynchronous learning environments, learners should make an effort by knowing the way to establish learner-teacher-content interaction (Çuhadar, 2008). Among the features related to the content design process to increase learner-content interaction; there should be materials containing interaction elements that facilitate learner's understanding, active content that facilitates remembering, and rich content supported by audio-visual materials. While learning content blended with experimental activities (Niemann, 2017) provides permanence in knowledge, asynchronous education, which provides progress according to the speed of the learner, contributes to individual learning. The presence of links to various materials and educational web pages, detailed-explanatory demonstrations, and quizzes in online courses will increase the frequency of interaction of the learner with the content. In addition, the existence of standardized tests according to learning styles will increase the attractiveness of the learning environment.

The learner can interact with the content by ensuring learner participation in course materials and activities prepared in different types (Yılmaz & Aktuğ, 2011). Kaysi and Aydemir (2017) emphasize the importance of detailed and descriptive content rich in audio-visual materials, downloadable following the asynchronous education process, in increasing learner-content interaction. The instructions and explanations of the content, applications and tools that will support the asynchronous education of the learners should be presented understandably. Regardless of the learners' familiarity with new technologies, better learning outcomes can be achieved with appropriate guidance and access to course content (Vlachopoulos & Makri, 2019). Although interaction with content has a positive effect on academic achievement, interpersonal interactions have been examined more in previous studies (Bannan -Ritland, 2002; Zimmerman, 2012). For this reason, the use of links in learning content, the use of rich media that increase interaction (Carlson & Zmud, 1999; Daft & Lengel, 1984), raffles, educational games (Glover, 2013), and the use of humor elements (Vlachopoulos and Makri, 2019) can enable the learner to interact with the content.

Feedback and evaluation are of great importance in learner-teacher interaction (Graham et al. 2001). In distance learning processes, it is not always possible for learners to reach the teacher. For this reason, attention should be paid to the timing of feedback so that interactions are established healthily and teaching is not adversely affected (Çuhadar, 2008). At the same time, communication with the teacher should be easily accessible and fast. Quick feedback from the teachers (Kaba, 2019), being easily accessible, and a way of addressing students increase the participation of learners by attracting attention (Vlachopoulos & Makri, 2019). Holmes and Benders (2012) state that learners prefer lessons in which it is easy to establish a dialogue. Teachers must encourage the easy establishment of interactions (Kassandrinou, Angelaki & Mavroidis, 2014; Graham et al. 2001). It has also been observed that flexibility is an important issue in the frequency of interactions. Providing fast support at points that are not understood during the study hours of learners will increase mutual interaction. Benson and Samarawickrema (2009) state that the teacher will increase interactions by understanding learners, supporting dialogue and instructional structure, and at the same time, being flexible, adaptable, and active will facilitate the process. At the same time, online office hours and face-to-face meetings will also support efficient interaction (Huss, Sela, & Eastep, 2015). Kanuka and Anderson (1998) state that interpersonal and social interaction between learners and teachers may contribute to the frequency of interaction. Being able to communicate with the teacher through multiple communication channels and fast feedback will both provide richness in communication and help individual learning to take place (Bozkurt, 2016). In addition, the teacher should be able to provide personal direction and guidance as a result of consistent monitoring (Niemann, 2017) and should enable the organization of informative professional sessions for learners based on branches. So, teacher preparation is an important condition for the success of interaction (Andresen, 2009). At the same time, the teacher can give the learner opportunity to review the interaction bond by providing self-evaluation. It should be able to keep strong cognitive and affective interaction with learners by sharing about classroom performance. Teachers' positive experiences in distance education and their ability to use technology are among the features that increase the frequency of interactions and learner satisfaction (Jackson, Jones & Rodriguez, 2010). At the same time, the frequency of interaction also affects the interest in the course (Kaba, 2019).

The teacher should be able to support teaching strategies with appropriate technology to interact with and maintain learners (Çuhadar, 2008). Two-way interactions between learners and teachers should be supported technically and academically (Ustati & Hassan, 2013). In -service training for the teacher can be provided to support learners with affective-oriented interaction such as attitude and motivation in the learning processes. Padavano and Gould (2005) stated that the teacher's course roadmap and interactive content preparation, guiding learners will increase interaction. Horzum (2010) states that the development of materials in distance education, besides the educational dimensions, workforce, personnel, and financial elements should also be taken into consideration.

In learner-centered distance education courses, planning should be done at the beginning of the design process, which interaction element will be used, its' timing, which learning environments and technologies will be used, following the objectives and acquisitions, taking into account the learner characteristics. While planning, it should not be ignored that the learning process is learner-centered

(Çuhadar & Kıyıcı, 2007). In the design of the courses, many application tools enrich the interaction processes. Which one to use can be decided according to the purposes of the activity. The important point is the strategic use of technology that will increase the quality of educational experiences and ensure that learners are satisfied with the education they receive. Previous studies (Shackelford & Maxwell, 2012) have also focused on this issue.

As a way of increasing interactions between learners, a person selected from among the learners can be appointed as the leader of the discussion groups. This person leads the group as a moderator (Gueldenzoph, 2003) and can avoid conflicts. To increase interaction between learners, researchers generally resort to cooperative learning methods. Particularly in synchronous communication, being a part of collaborative teams such as question-answers, chat rooms, forums, and group work enables learners to develop positive relationships by socializing with peer support (McInnerney & Roberts, 2004). The development of positive social relations in the learning environment also reflects positively on the social development of learners (Lee et al., 2004). For a positive interaction process, it is necessary to pay attention to the demands of the learners while determining the learning groups and subject areas. Because when the learner manages the interaction process, there will be a desire to participate in the lesson (Díaz & Entonado, 2009). In order not to harm social relations between learners, feedback can be made by paying attention to learner anonymity (Jong et al., 2013).

Some issues need to be controlled to ensure effective and meaningful learning interaction among learners. These are support, competence, and independence. Instructional support is necessary for meaningful learning and the realization of targeted gains. Being able to use synchronous and asynchronous communication technologies and being sufficient in learning content enables independent learning to take place (Anderson & Garrison, 1998).

Multi-interaction is discussed in terms of involving learners in more than one interaction with the teacher, content, or other learners. The use of gamification design elements in the learning environment increases the interaction between learners (Glover, 2013; Yıldırım & Demir, 2016). At the same time, the use of gamification design elements in the learning environment increases the interaction of learners with the teacher (Bergmann & Sams, 2012). Because learners feel socialized and comfortable. The use of technologies that support cooperative learning in the learning process (Çetinkaya & Keser, 2018; Huss, Sela & Eastep, 2015) will increase the interaction of learners with content and between learners. On the other hand, the adequacy of technology skills (Tsui & Ki, 1996; Vrasidas & McIsaac; 1999) will affect not only the interaction of learners with the teacher but also the interaction of learners with both content and learners. In this respect, the presence of an online help desk will provide support on technical issues (Ofir et al., 2005), but initiatives to increase technology skills should also be supported. At the same time, students can be introduced to how to use learning management systems and other digital tools with orientation training at the beginning of the education process. Interaction tools through which learners interact with the teacher and content should be flexible and adaptive. Supporting different operating systems and supporting mobile applications will also be suitable for the flexibility of distance education. The functionality of tools that teach and interact with content affects the frequency and quality of the interaction. In this regard, items such as a quick feedback element and a question button can be used (Kuyath et al., 2013). As a result of rapid feedback, learners can reflect knowledge they have acquired, while teachers who identify knowledge gaps contribute to learners' learning experiences by encouraging various learning strategies (Vlachopoulos & Makri 2017).

A learning environment that considers learner characteristics and keeps the learner's attention alive will enable learners to interact in three ways. There should be an electronic notice board and a discussion board to maintain asynchronous interaction in the online learning platform (Huss, Sela & Eastep, 2015; Offir et al., 2005). Learners and teachers should be enabled to share actively. At the same time, multiple interactions can be supported by using social media tools. On the other hand, there should be initiatives that will increase the learner's sense of belonging and social presence. Social intimacy between learners, online communication, and interactive activities can create intimacy between learners. Because social presence and interaction increase in direct proportion (Tu & McIsaac, 2002). In an online learning platform, a social class environment can be created by using

welcome messages to learner profiles, the social class environment, and humor elements during the lesson (Wise et al. 2004). Having experience in distance education (Vrasidas & McIsaac, 1999) and knowing how the learning process works will reflect positively on multiple interactions. In this way, the learner will interact and maintain with other interaction elements because he/she feels safe. The learner can be supported to have real learning experiences or technologies such as simulation, virtual laboratory, and online field trips can be used to make them feel this. According to Klassen and Willoughby (2003), simulation is a method that reduces costs without endangering life. Studies have shown that learners participate more in the lesson while simulating the task. Active participation of the learner in the learning experience increases the permanence of knowledge and encourages a positive learning environment. Multimedia resources offer a learning process that learners enjoy and have a variety of learning experiences (Thorpe & Godwin, 2006; Díaz & Entonado, 2009). In addition, independent software, high-quality explanations, and audio-visual displays can be perceived as real by learners and there may be a better education process than face-to-face education (Thorpe & Godwin, 2006).

According to results obtained from findings for the third purpose of research, negative situations affecting interaction were examined in four different categories. These are differentiated as the learner, teacher, content, and other resources. Based on learner situations; De la Varre, Keane, and Irvin (2011) who talk about learners who are not enthusiastic about trying and are reluctant to participate in asynchronous discussions, state that asynchronous interaction requires more effort, and it is easier to communicate with the teacher during the synchronous lesson process. Some learners want to interact with high-grade intention (Vrasidas & McIsaac, 1999). Although this is not seen as a negative situation, the constant interaction of certain learners can create reluctance and anger in other learners. By thinking that other learners are more knowledgeable or advanced, their self-confidence may be shaken and a feeling of being left behind will occur. This is also a situation that can cause the teacher to be mistaken. Incompatibility and disagreement among learners also affect the interaction negatively. Negative perceptions about the lesson and feelings of anger can occur in negative experiences. On the other hand, the frequency of interaction may decrease as it is rushed to dominate the content. Because the presence of too many messages on the chat and messaging screen suggests that it may take time for learners to interact. Sometimes, discussion activities are seen as unnecessary and perceived as a break activity (Vrasidas & McIsaac, 1999) or the learner has difficulty describing the problem in written form. The fear of being disgraced by the community and the anxiety of being seen on camera (Kelsey, 2009) are also situations that negatively affect interaction. In synchronous lessons, low attendance affects learner interaction negatively, while its excess causes confusion and administrative problems (Üstündağ & Güyer, 2007).

In cases where the teacher cannot manage the interaction process, the dominant learner can be in the foreground. In addition, the prejudice of the teacher against the interactions between learners in online courses and inadequacy of the pedagogical knowledge of learner behaviors can negatively affect the social dynamics and cooperation of the classroom as well as affect the interaction process (Thorpe & Godwin, 2006). Moreover; Lack of face-to-face communication, over-given homework, workload, and delayed feedback (Stevenson, Sander & Naylor, 1996) are also negative situations. Among the situations that negatively affect the interaction with content in the literature, they provide low interaction due to one-way course activities or an increase in time spent online due to the intense content. Kelsey (2009) stated that learners have little time for interaction during the synchronous lesson, and the teacher hastily keeps interaction activities such as question-answer activities short in order not to exceed the lesson time. In addition, the direct transfer of learning content to digital media is considered sufficient by some teachers in the literature. Non-interactive and text-based learning content can negatively affect interaction and frequency. In this respect, the intensity of interaction should be decided according to saving time and budget in the subject area. In addition, discussion rules and ethical rules should be determined in asynchronous interactions so that the interaction does not lose its effect, and announcements of these rules should be made to the learners in advance (Çuhadar, 2008).

Lastly, there are other sources of negative factors affecting interaction in synchronous and asynchronous education processes. These are the lack of technical support units or insufficient

support, slow connection, non-functional interaction elements, interaction tool, device incompatibility, and lack of technological capability. Problems such as malfunctions and incompatible tool-software caused by interactive course components (web technologies) will inevitably cause feelings such as frustration and anger (Thorpe & Godwin, 2007, cited in Goodyear). To prevent such situations, it is recommended that the interaction process should be integrated into the course design in a planned way and that the technical support and live help units should work actively. In open and distance learning institutions, the number of personnel in support services for learners and teachers, system updates, and follow-up innovations in support services are important components in the frequency of 3 types of interaction (Durak, 2017). Especially in terms of ensuring active learner participation in lessons (Ak, Gökdaş, Öksüz & Torun, 2021) and continuity of interaction; organizing and periodically repeating training for teachers on interactions, content development, learning management system features and usage (Duzakin & Yalçınkaya, 2008) are necessary.

Finally, suggestions for researchers and application area of this study (learning designers, distance education centers, teachers) are before design, it is recommended to consider negative situations that affect interaction and factors that increase interaction. In addition, it is foreseen that it will be useful as a model for the purposes for which planned interaction will be established. On the other hand, based on the results of this study, interactive learning environments for different study groups can be developed. And the relationship between the level of interaction and variables such as academic achievement, motivation, and social presence can be examined.

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Raising Awareness in 7th Grade Students with Educational Games on Waste and Recycling

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Abstract

This research was conducted to determine the effect of educational games developed on "Household Wastes and Recycling" on raising awareness of this issue. In the research, a quasi-experimental design with a pre-test-post-test control group was used. The study group consisted of ninety-six 7th-grade students in total from two secondary schools located in the province of Rize and the district of Çayeli of Rize province. In the province experimental and control group, 29 students were included while the district experimental and control group comprised of 19 students. In teaching the subject of Household Wastes and Recycling, instructional plays called "Who Won the Cup?", "I Got it?", "Reflection" and "Ring!" developed by the researcher were played with the experimental groups while instructional program activities of the science lessons were used with the control groups. The quantitative data of the research were collected with the "Household Wastes and Recycling Knowledge Test" administered to all groups as the pre-test and post-test, and the qualitative data were collected with the "Semi-structured Interview Form" administered to the experimental groups. Quantitative data were analyzed using parametric and non-parametric techniques, while qualitative data were analyzed using content analysis. It was determined that the instructional plays used in teaching the subject of household waste and recycling are effective in enhancing the knowledge level and awareness of the students regarding household waste, recycling, the advantages of recycling, and what needs to be done for effective recycling and reuse. Instructional plays were determined to be evaluated as an effective tool in cognitive and affective aspects by students. In this regard, it was concluded that instructional plays facilitate learning, ensure effective learning, inform, raise awareness, develop affirmative emotions for the subject or lesson, hinder the boringness in the course of the lesson or subject, and help assure concentration.

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Introduction

Our world is subject to change due to global trade, consumption, to increase in human population, and urbanization. With the new world order, nature is losing its unique characteristics, the rate of extinction is increasing, and natural resources are being depleted (WWF, 2020a). Öktem (2016) argues that natural resources are limited, which creates the risk of not being able to meet future needs due to uncontrolled consumption. This consumption leads to waste production that creates problems for the environment, health, and economy, which in turn affects society, families, and individuals (BSTB, 2014; Gündüzalp and Güven 2016). Thus, it is crucial to control waste production and aim for minimal waste production and consumption, in order to create a habitable world (BSTB, 2014). Waste control strategies such as the 4Rs (Reduction, Reuse, Recycling, and Recovery) are essential in this effort (Singh and Sushil, 2017). Although waste control is determined by the state through laws and regulations, sensitivity, volunteerism, awareness, and a sense of responsibility are necessary for effective waste control. Adopting environmentalist approaches, reviewing priorities in life, and shaping vital activities in line with sustainability reveal recycling awareness.

Today, waste has become a major problem in a changing world due to global trade, consumption, human population growth, and urbanization (WWF, 2020b).

According to the World Wildlife Fund 2020 Annual Report (WWF, 2020c);

- ✓ In the present century, half of the world's wetlands have disappeared.

- ✓ There are problems in accessing fresh water. In fact, 1.1 billion people in the world do not have access to fresh water.
- ✓ Based on pre-industrial revolution data, there was a global temperature increase of 1.2°C in 2020.
- ✓ Approximately 10 million hectares of forests are destroyed every year in the world.

Additionally,

- ✓ Poorly managed wastes pollute the oceans, clog sewers and cause floods.
- ✓ Particles released into the air by waste incineration cause respiratory problems, harm animals that consume waste, and negatively affect economic development by reducing tourism (WB, 2018).

Waste management is therefore becoming a global issue that affects every single person on Earth. Hence, the importance of effective waste management is to help solve the problems affecting the world (WB, 2018).

Sustainable development requires a focus on waste management in educational institutions (Moqbel, 2018). It is seen that knowledge, attitudes, and behaviors towards waste management can be changed through education (Chow, et al., 2017). Studies show that an increase in the level of education leads to a decrease in waste generation (Grazhdani, 2016), and students who are educated about waste and recycling are willing to find solutions to waste-related problems, inform and encourage their immediate environment about recycling (Çelikler, et al., 2015). It is seen that the training given on this subject is effective in helping students gain knowledge on the subject, increase their sensitivity to the environment and realize that recycling is important for the environment (Aksan & Çelikler, 2019). For this reason, to reduce the waste problem, well-planned and awareness-raising training in schools will be effective in changing students' habits, behaviors, and attitudes that cause waste generation (Desa, et al., 2011). It is important to include programs that will encourage students to think in order to develop attitudes towards waste recycling and to have a high level of awareness towards the environment (Çelikler, et al., 2015). Therefore, it plays an important role in the education system to renew the curricula and to include curricula integrated into life in order to raise individuals with the knowledge and awareness that can meet the needs for sustainability in the age we live in. For this reason, the inclusion of waste management topics and concepts in schools at all levels of education, integrated with environmental education and school curricula, will enable students to understand waste

management, increase environmental awareness for a sustainable future and develop positive behaviors in waste management (Ifegbesan, 2010).

Curricula are prepared in line with the general objectives and basic principles of Turkish National Education. Among the main objectives of the Science curriculum prepared in this direction are to recognize the interaction between the individual, environment, and society, to develop an awareness of sustainable development regarding society, economy, and natural resources, to take responsibility for daily life problems and to use knowledge, scientific process skills and other life skills related to science in solving these problems, as well as to arouse interest and curiosity in the events occurring in nature and the immediate environment and to develop attitudes. In order to achieve these goals, the activities carried out with the education and training program progress in a complementary manner at all levels of education (MoNE, 2018).

Educational games, which means games designed for educational purposes (TDK, 2020), are games designed and used for education and training (Al-Azawi, et al., 2016). Educational games used for educational purposes have useful content (Lee & Lee, 2008) and include achievements such as a specific sub-discipline or basic competencies expected from individuals (Aytaş & Uysal, 2017). Educational games create an effective learning environment (Song & Zhang, 2008), because they combine fun and educational elements to increase students' participation and motivation in educational activities (Al-Azawi, et al., 2016). For this reason, students' motivation to learn increases and they move from passive learning to active learning. This leads to a change in learning quality (Song & Zhang, 2008).

The Fun Toolkit game, which was adapted into an educational board game, was found to contribute to 7-12-year-old students' knowledge about recycling and the development of their self-efficacy (Mostowfi, et al., 2016). It was found that training including educational games was effective in sorting waste (Taghdisi, et al., 2016). In the research conducted by Chow, et al. (2017), it was aimed to determine the effect of direct, applied, and simulation-based instruction on knowledge, attitudes, and behaviors towards plastic waste management. For this purpose, the research was conducted with 4th-6th grade (8-12 years old) students. In this direction, students were divided into 3 groups to learn about plastic waste problems and how to manage them. In direct teaching, students were given information about plastic problems and waste management by teachers with PowerPoint slides. In applied teaching, teachers guided students to learn actively through observation, experimentation, and interaction with the environment. In simulation teaching, a simulation game called Plastic City was played with the students. In order to test the changes in knowledge, attitudes, and behaviors related to recycling and plastic waste management, pre-test and post-test applications were carried out. As a result of the analysis of the tests applied, it was determined that all of the teaching methods increased student knowledge, while practical and simulation game-based teaching were slightly effective on attitudes and behaviors. In Kamar's (2018) study, it was aimed at raising recycling awareness among kindergarten and primary school students within the borders of AFAD Viranşehir Refugee Camp. For this purpose, individuals living in the camp area and included in the study group were given training on recycling. The study included painting competitions, computer games, and theater. During the one-year study, it was observed that 90% of the waste generated in the camp area was collected in waste collection containers. In another study aiming to raise awareness about recycling, it was determined that activities such as dramatization, improvisation, role-playing, travel-observation, show-and-tell, station, game, performance, music, and dance provided learning by having fun (Tosun & Demir, 2018). It is stated that learning about waste management and environmental protection issues can be provided with an Android-based educational adventure game (Satria, et al., 2020).

Within the framework of recycling awareness, it is important to think for future generations about the use of limited natural resources, to be aware of individual duties and responsibilities, and to take responsibility in this regard (Bozkurt, 2012; Harman, et al., 2015). Therefore, the importance of raising individuals emerges with recycling awareness who are aware that irresponsible behaviors will negatively affect the environment, understand the concept of sustainability, and organize their lives with this understanding. Studies show that training is effective and important for students in creating knowledge and awareness about household waste and recycling (Ifegbesan, 2010; Asmatulu & Asmatulu, 2011; Onur, et al., 2016). It is thought that this research will be a guide to reveal the

missing and incorrect information about waste and recycling with a validated and reliable knowledge test and to organize teaching activities that are important in raising individuals with awareness on the subject. It is also thought that the educational games within the scope of the research will help students recognize household wastes, know waste control, learn their roles in waste control, understand the importance of recycling and reusing, and develop positive behaviors on these issues.

The research was conducted to determine the effect of educational games developed on "Household Wastes and Recycling" on raising awareness of this issue. Although it is known that waste is recycled, it is seen that communication channels, training, and information on recycling are inadequate, a recycling culture is not formed, individual responsibilities are not fulfilled in the separation of waste, and recycling bins are not used sufficiently. Accordingly, it is noteworthy that the importance of recycling is not fully understood, and the necessary care is not shown in behaviors towards this issue (Ak & Genç, 2018). For this reason, in order to increase awareness about recycling, the transformation must first start with people (Kök, 2021). The most effective tool for this transformation is education (Schultz, 2002).

With the education given in schools, students should learn that the world's resources are limited and that wastes remain in nature for a long time without degradation, which harms the environment (Çimen & Yılmaz, 2012). The importance of waste and recycling in terms of sustainability, and the need to raise individuals who have a global perspective on waste generation and who are aware of the behaviors that guide recycling efforts reveal the necessity of conducting this research.

It is seen that educational games in schools are effective in raising environmental awareness (Akbayrak & Turaşlı, 2017). In addition, educational games ensure the comprehensibility of the subjects in students and reveal the behaviors of obeying the rules, and being helpful and respectful (Karamustafaoğlu & Kaya, 2013). Educational games create positive emotions such as pleasure, excitement, and fun during classes (Tosun, 2022). It's set forth in research by Dolunay and Karamustafaoğlu (2021) that educational games can be efficient in both cognitive and sensory domains. It is thought that the educational games developed in the research and used in practice will contribute to raising awareness about "Household Wastes and Recycling" in students and to the development of behaviors that reduce waste generation and support recycling in this framework.

Method

The Research Model

The quantitative structure of the research consisted of the data belonging to the multiple-choice questions in the knowledge test on household waste and recycling. In addition, it was aimed at reaching the opinions of the experimental groups about the educational games used in the application and teaching of educational games. For this reason, the questions in the semi-structured interview form were asked to the experimental groups. In this regard, qualitative data were obtained through a semi-structured interview form.

Research Design

In the research, a quasi-experimental design with a pre-test-post-test control group was used. Quasi-experimental designs based on pretest and posttest measurements between experimental and control groups (Evers, et al., 2006) are used to test the causal relationship between two or more variables (Bickman & Rog, 2009). The quantitative data of the research were collected with the "Household Wastes and Recycling Knowledge Test" administered to all groups as the pre-test and post-test, and the qualitative data were collected with the "Semi-structured Interview Form" administered to the experimental groups. In the research, the Household Wastes and Recycling Knowledge Test was applied to the experimental and control groups before the application. During the implementation process, the experimental groups were taught through educational games within the scope of the study, and the control groups were taught in line with the curriculum. After the application, the Knowledge Test on Household Wastes and Recycling and Semi-structured Interview Form were applied to the experimental groups, and the Knowledge Test on Household Wastes and Recycling was applied to the control groups.

Study Group of the Research

The study group of the research consists of a total of 96 students studying in the 7th grade in one middle school in Rize province and Çayeli district affiliated with the Ministry of National Education. The experimental and control groups in the middle school affiliated with the Provincial Directorate of National Education consisted of 29 students each, and the experimental and control groups in the middle school affiliated with the District Directorate of National Education consisted of 19 students each. The study group was selected using random sampling, which is a sampling method in which the elements in the population are given equal chances to be selected for sampling. In random sampling, all individuals have the same probability of being selected and the selection of one individual does not affect the selection of the other individual (Özen & Gül, 2007).

The research was conducted by obtaining the necessary permissions from the Ondokuz Mayıs University Social and Human Sciences Ethics Committee and Rize Governorship Directorate of National Education.

Research Process

The research was conducted with two 7th-grade classes of two middle schools, one in Rize province and the other in the Çayeli district of Rize province. The topic of "Household Wastes and Recycling" was taught with educational games developed within the scope of the research (Altunbey & Çelikler, 2021a) in the experimental groups and with the activities of the Science curriculum in the control groups. The lessons were conducted by two Science teachers working in the schools participating in the research and teaching 7th-grade classes. For the application to be carried out well, the teachers who would carry out the application were introduced to the educational games within the scope of the research and informed about how to apply the educational games. The knowledge test on household wastes and recycling used in the research was administered as a pretest to all groups included in the research at the beginning of the research. At the end of the research, the knowledge test was applied to all groups for the second time as a post-test. Opinions about the educational games used in the lesson and teaching with educational games were also collected with the questions in the semi-structured interview form.

Data Collection Tools Used in the Research

A test consisting of 38 items with four options, where each question contains one correct answer and three distractors, was prepared by reviewing the literature on the subject of Household Wastes and Recycling in line with the achievements in the Science curriculum prepared for the 7th grade of secondary school. The test was evaluated by a science teacher and four field experts for validity studies. As a result of the evaluations, it has been established that the test exhibits content validity and is suitable for the level of 7th graders. In addition, recommendations were made regarding the preparation of test items.

In this regard;

- ✓ There should be at least one question assessing one of the achievements;
- ✓ All questions should be multiple-choice questions;
- ✓ All questions should be easy to read;
- ✓ The expressions in the options should be compatible with each other and their length should be similar;
- ✓ The questions should be on the same page in such a way that their integrity remains intact without any division;
- ✓ Expressions to be noticed in the test should be written in bold and underlined, and a suitable standard font should be chosen in this regard.

After the revision, the revised test consisting of 25 items became ready for pilot application. The developed test has been administered to 248 8th-grade students who had previously received education on household waste and recycling. The data obtained at the end of the application were analyzed using the Microsoft Excel program (Altunbey & Çelikler, 2021b). Difficulty and selectivity indices of the items in the test were calculated. Items that were found to be non-fitting as a result of the analysis were excluded from the test. Afterwards, the Kuder Richardson (KR-20) reliability coefficient was

calculated, and the final version of the test was prepared. The values of the 18-item test, which was formed by removing 7 items from the test as a result of item analysis, are given in Table 1.

Table 1.
Test Values

	Values
Number of students who took the test	248
Item Number	18
Average	10.24
Difficulty	.57
Variance	18.76
KR_{20}	.825

After the item analysis, the number of questions related to the achievements related to the subject of household waste and recycling is given in Table 2. In the final version of the test, there are questions for all achievements.

Table 2.
Number and distribution of questions prepared for learning achievements regarding the subject of Household Wastes and Recycling.

Achievement	Number of questions
F.7.4.5.1. Distinguishes recyclable and non-recyclable materials among household wastes.	4
F.7.4.5.2. Designs projects for the recycling of household solid and liquid wastes.	3
F.7.4.5.3. Questions recycling in terms of effective use of resources. The contribution of recycling facilities to the economy is emphasized.	5
F.7.4.5.4. Pays attention to waste management within routine environments such as school, home, etc. a.The efforts of public and non-governmental organizations related to waste management are mentioned. b.It is reminded that medical waste should not be contacted.	4
F.7.4.5.5. Develops a project to deliver reusable items to those in need.	2

Interviews allow us to see people's perspectives and make these perspectives known, clear, and meaningful. Qualitative data can be collected through interviews, direct observation, and written documents. Interviews, one of these data collection methods, provide researchers with direct information about people's experiences, opinions, feelings, and knowledge (Patton, 2002). The interview form provides both flexibility for the researcher or interviewer and systematic and comparable information from different individuals. With this approach, it is also easy to organize and analyze the data. As a result of these features, interview forms have more positive aspects than conversational style interviews (Yıldırım & Şimşek, 2008).

In this research, it was aimed to reach the opinions of the experimental groups about the educational games used in the application and teaching through educational games. For this reason, the questions in the semi-structured interview form were asked to the experimental groups. These interview questions were developed by taking expert opinions.

Data Analysis

Quantitative Data Analysis

In the research, a multiple-choice Household Wastes and Recycling Knowledge test consisting of 18 questions was used to obtain quantitative data. In the analysis of the quantitative data obtained from the test, it was first checked whether the groups showed normal distribution for statistical evaluations. Shapiro-Wilk and Kolmogorov-Smirnov tests were used to determine the normality of the scores. If the group size is smaller than 50, the Shapiro-Wilk test is used, and if the group size is larger, the p-value of the Kolmogorov-Smirnov test is used. If this value is greater than .05, it is interpreted that the

scores are suitable for normal distribution (Büyüköztürk, et al., 2009). Since the size of the groups in this study was smaller than 50, the p values of the Shapiro-Wilk test were taken into consideration. Table 3 shows the p values of the Shapiro-Wilk test obtained from the pre-test and post-test data of the 'Household Wastes and Recycling Knowledge Test' applied in the study.

Table 3.
Pre-Test-Post-Test Scores of the Groups on the Knowledge Test on Household Wastes and Recycling Shapiro-Wilk Test Results

Group	Test	p
Province Experimental Group	Pre-test	.074
	Post-test	.000*
Province Control Group	Pre-test	.857
	Post-test	.061
District Experimental Group	Pre-test	.375
	Post-test	.257
District Control Group	Pre-test	.000*
	Post-test	.004*

*p<0.05

In the Shapiro-Wilk test, when the p-value is greater than .05, it can be accepted that the data are normally distributed (Can, 2017). According to Table 3, the province experimental group in the post-test and the district control group in the pre and post-test did not show a normal distribution (p < .05). For this reason, nonparametric tests were used in the analyses involving the district control group and the province experimental group in the post-test.

Qualitative Data Analysis

The qualitative data in the research were obtained from the answers given in writing to the semi-structured interview form used to determine the opinions about educational games and teaching with educational games in line with the educational games applied to the experimental groups and the student models prepared. Content analysis was used to analyze the data obtained from the semi-structured interview form.

First of all, the students' written answers to the interview questions were transcribed directly without any changes. Then, the answers given to each question were read one by one and the expressions in them were divided into meaningful parts. The meanings expressed by the concepts in the sentences formed by the students while answering the questions were determined and common expressions were brought together. Common codes were created from these expressions. All coding procedures were performed manually without using any computer application. While creating the codes, the data were read many times, and rearrangements were made where necessary. In line with these arrangements, there were changes in the number of codes from time to time. After all these procedures, the common points of the codes were determined. Finding the common points between the codes is called thematic coding and this process is the categorization of data through codes (Yıldırım & Şimşek, 2016). The codes were categorized in line with the common points between the codes. After this stage, the data were tabulated. The data were expressed numerically by determining the frequency of responses. Numerification of qualitative data increases the reliability of the research, reduces bias, allows comparisons to be made between emerging themes or categories, and allows small-scale research to be tested again later by reaching a larger study group (Yıldırım & Şimşek, 2016). In addition to all these practices, noteworthy student opinions were included in direct quotations.

For the data analysis to be reliable, the data must be coded separately by two different coders. For this reason, the codings made by each of the coders should be compared. After the comparison, the number of codes with consensus and disagreement should be determined. At the end of these processes, the reliability of the data analysis should be determined by using the formula $\frac{Consensus}{Consensus+ Dissent} \times 100$

(Miles & Huberman, 1994). Accordingly, in this research, the codings made by the coders were compared and the mean reliability was determined as 90%.

Validity of the Research

In scientific research, research results are expected to be accurate and reliable. For this reason, the researcher must conduct the research impartially as well as present the research data correctly. Therefore, the concept of validity comes to the fore in research (Akan, 2018). Validity is related to the research being reliable and free from errors. It is whether the feature to be measured can be measured (Zohrabi, 2013). It is the absence of errors that would harm the general accuracy of the research (Kazan, 2016).

Internal Validity of the Research

Internal validity in research is to believe that the results observed in the research are caused by the application (Akan, 2018). It is the power of the application carried out in line with the objectives of the research to reveal the reality studied (Karataş, 2015). The research was completed in accordance with the time allocated for teaching the subject of household waste and recycling in the Science Curriculum. Data collection tools were applied to the experimental and control groups in the same way. The path followed in the research process, data analysis, and analysis results were examined by experts.

External Validity of the Research

The external validity of the research is the generalizability of the research results. For generalization, information about the group, place, and time of the study can be expressed. In this way, research results become valid and applicable in other groups, places, and times (Kazan, 2016). The research was conducted in public middle schools and the conditions of these schools. The research was conducted in both middle schools within the time interval specified in the curriculum.

Findings

In this section, the findings obtained from the Household Wastes and Recycling Knowledge Test and the Semi-structured Interview Form are presented to answer the problems of the research.

Findings Related to Household Wastes and Recycling Knowledge Test

Descriptive statistics information about the pre-test and post-test scores of the province experimental and control group students in the Household Wastes and Recycling Knowledge Test are given in Table 4.

Table 4.
Descriptive Statistics of the Household Wastes and Recycling Knowledge Test of the Province Experimental and Control Group Students

Group	Test	N	$\bar{X}$	median	mode	S
Province Experimental Group	Pre-test	29	12.82	13.00	13.00	3.14
	Post-test	29	14.48	15.00	15.00	2.86
Province Control Group	Pre-test	29	12.72	13.00	11.00	2.81
	Post-test	29	13.96	14.00	12.00*	2.78

According to Table 4, it is seen that the pre-test mean scores of the province experimental and control group students in the Household Wastes and Recycling Knowledge Test are close to each other. The mean score was 12.82 in the province experimental group and 12.72 in the province control group. In the post-test, the mean score was 14.82 in the province experimental group and 13.96 in the province control group.

Unpaired t-test results for the pre-test scores of the province experimental and control group students are given in Table 5.

Table 5.
Household Wastes and Recycling Knowledge Test of Province Experimental and Control Group Students Unpaired T-Test Results for Pre-Test Scores

Test	Group	N	$\bar{X}$	S	sd	t	p
Pre-test	Province Experimental Group	29	12.82	3.14	56	.132	.895
	Province Control Group	29	12.72	2.81			

According to Table 5, it was determined that there was no significant difference between the pre-test scores of the province experimental and control group students in the Household Waste and Recycling Knowledge Test ($t_{(56)}$= .132; p > .05). It was determined that the knowledge levels of the province experimental and control group students about household wastes and recycling were close before the application. The Wilcoxon Signed Ranks Test results for the pre-test and post-test scores of the province experimental group students are given in Table 6.

Table 6.
Wilcoxon Signed Ranks T-Test Results for the Pre-Test and Post-Test Scores of the Household Wastes and Recycling Knowledge Test of the Province Experimental Group Students

Post-test - Pre-test	N	Rank Mean	Rank Total	z	p
Negative rank	8	9.81	78.50	-2.049	.040*
Positive rank	16	13.84	221,50		
Equal	5				

*p<0.05

According to Table 6, there was a statistically significant difference (z= -2.049; p < .05) between the pre-test and post-test scores of the province experimental group students in the Household Wastes and Recycling Knowledge Test. The fact that the mean positive rank (13.84) of the province experimental group students was greater than the mean negative rank (9.81) indicates that the significant difference was in favor of the positive rank that is, the post-test. Paired t-test results for the pre-test and post-test scores of the province control group students are given in Table 7.

Table 7.
Paired T-Test Results for the Pre-Test and Post-Test Scores of the Household Wastes and Recycling Knowledge Test of the Province Control Group Students

Test	N	$\bar{X}$	S	sd	t	p
Pre-test	29	12.72	2.81	28	-2.180	.038*
Post-test	29	13.96	2.78			

*p<0.05

According to Table 7, there was a statistically significant difference ($t_{(28)}$= -2.180; p < .05) between the pre-test and post-test scores of the province control group students in the Household Wastes and Recycling Knowledge Test. The fact that the post-test arithmetic averages of the province control group students (13.96) were higher than the pre-test arithmetic averages (12.72) shows that the significant difference was in favor of the post-test. The Mann-Whitney U Test results for the post-test scores of the province experimental and control group students are given in Table 8.

Table 8.
Household Wastes and Recycling Knowledge Test of Province Experimental and Control Group Students and Recycling Knowledge Test of the District Experimental and Control Group Students

Test	Group	N	Rank Mean	Rank Total	U	p
Post-test	Province Experimental Group	29	31.24	906,00	370,000	.428
	Province Control Group	29	27.76	805,00		

According to Table 8, there was no statistically significant difference (U=370.000; p > .05) between the post-test scores of the province experimental and control group students in the Household Wastes and Recycling Knowledge Test. However, the fact that the mean rank of the experimental group students (31.24) was higher than the mean rank of the control group students (27.76) shows that the post-test results were in favor of the experimental group students. This result shows that educational games about household waste and recycling had a positive effect on the province experimental group students. Descriptive statistics information about the pre-test and post-test scores of the district experimental and control group students in the Household Wastes and Recycling Knowledge Test are given in Table 9.

Table 9.
Mann-Whitney U Test Results Regarding the Post-Test Scores of the Household Wastes Household Waste and Recycling

Group	Test	N	X̄	median	mode	S
District Experimental Group	Pre-test	19	7.94	8.00	7.00*	1.80
	Post-test	19	12.05	11.00	11.00	2.48
District Control Group	Pre-test	19	11.10	12.00	11.00	2.74
	Post-test	19	13.52	14.00	14.00*	2.89

According to Table 9, the average pre-test score of the Household Wastes and Recycling Knowledge Test was 7.94 in the district experimental group and 11.10 in the district control group. In the post-test, the average was 12.05 in the district experimental group and 13.52 in the district control group. The Mann-Whitney U Test results for the pre-test scores of the district experimental and control group students are given in Table 10.

Table 10.
Mann-Whitney U Test Results for the Pre-Test Scores of the Household Wastes and Recycling Knowledge Test of the District Experimental and Control Group Students

Test	Group	N	Rank Mean	Rank Total	U	p
Pre-test	District Experimental Group	19	12.55	238,50	48.500	.000*
	District Control Group	19	26.46	502,50		

*p<0.05

According to Table 10, it was determined that there was a statistically significant difference (U=48.500; p < .05) between the pre-test scores of the district experimental and control group students in the Household Wastes and Recycling Knowledge Test. It was observed that the knowledge levels of the experimental and control group students about household waste and recycling were different from each other before the application. Paired t-test results for the pre-test and post-test scores of the district experimental group students are given in Table 11.

Table 11.
Paired T-Test Results for the Pre-Test and Post-Test Scores of the Household Wastes and Recycling Knowledge Test of the District Experimental Group Students

Test	N	$\bar{X}$	S	sd	t	p
Pre-test	19	7.94	1.80	18	-5.72	.000*
Post-test	19	12.05	2.48			

*p<0.05

According to Table 11, it was determined that there was a statistically significant difference ($t_{(18)}$= -5.72; p < .05) between the pre-test and post-test scores of the district experimental group students in the Household Wastes and Recycling Knowledge Test. The fact that the arithmetic average of the district experimental group students in the post-test (12.05) was greater than the arithmetic average in the pre-test (7.94) shows that the significant difference was in favor of the post-test. The results of the Wilcoxon Paired Rank t-Test for the pre-test and post-test scores of the district control group students are given in Table 12.

Table 12.
Wilcoxon Signed Ranks T-Test Results for the Pre-Test and Post-Test Scores of Household Wastes and Recycling Knowledge Test of District Control Group Students

Post-test - Pre-test	N	Rank Mean	Rank Total	z	p
Negative rank	4	8.38	33.50	-2.488	.013*
Positive rank	15	10.43	156,50		
Equal	0				

*p<0.05

According to Table 12, it was determined that there was a statistically significant difference (z= -2.488; p < .05) between the pre-test and post-test scores of the district control group students in the Household Wastes and Recycling Knowledge Test. The fact that the positive rank averages (10.43) of the district control group students were greater than the negative rank averages (8.38) indicates that the significant difference was in favor of the post-test. The Mann-Whitney U Test results for the post-test scores of the district experimental and control group students are given in Table 13.

Table 13.
Mann-Whitney U Test Results Regarding the Post-Test Scores of the Household Wastes and Recycling Knowledge Test of the District Experimental and Control Group Students

Test	Group	N	Rank Mean	Rank Total	U	p
Post-test	District Experimental Group	19	16.05	305,00	115,000	.054
	District Control Group	19	22.95	436,00		

According to Table 13, there was no statistically significant difference (U=115.000; p > .05) between the post-test scores of the district experimental and control group students in the Household Wastes and Recycling Knowledge Test. The pre-test and post-test mean scores of the students in the experimental groups are given in Table 14.

Table 14.
Pre-Test-Post-Test Mean Scores of the Students in the Experimental Groups

Group	Test	N	$\bar{X}$
Province Experimental Group	Pre-test	29	12.82
	Post-test	29	14.48
District Experimental Group	Pre-test	19	7.94
	Post-test	19	12.05

According to Table 14, the mean scores of the experimental group students in the pre-test of the Knowledge Test on Household Wastes and Recycling were $\bar{X}_{(Province\ experimental\ group)}$= 12.82, $\bar{X}_{(District\ experimental\ group)}$= 7.94; and in the post-test, $\bar{X}_{(Province\ experimental\ group)}$= 14.48, $\bar{X}_{(District\ experimental\ group)}$= 12.05. When the pre-test-post-test score differences are taken into consideration, the score increase is 1.66 for the province experimental group students and 4.11 for the district experimental group students. In this case, it can be seen that the highest score increase belongs to the district experimental group students.

Findings from the Semi-structured Interview Form

The findings obtained from the "Semi-Structured Interview Form" applied to the students in the experimental group in order to obtain the opinions of the students in the experimental group regarding educational games and teaching using educational games are given below.

The frequency distributions of the answers given by the students in the province and district experimental groups to question 1 of the interview form are given in Table 15.

Table 15.
Frequency Distribution of Responses to Question 1 of the Interview Form

Question 1: Have you ever learned a subject of a course by playing educational games?	Province	District
	Frequency (f)	
Yes	14	16
Math lesson	-	9
Digits	-	5
Angles	-	1
Science lesson	7	4
Organelles	2	-
Effort	-	1
Turkish lesson	3	2
Words	1	-
English lesson	1	1
Words	1	1
Religious Culture and Ethics lesson	-	1
No	15	3

According to Table 15, it is seen that most of the students in the province group encountered educational games for the first time within the scope of this research. It is seen that the students who encountered educational games in their lessons learned the subjects of Science, Turkish and English lessons through educational games. It is seen that the students who answered "Yes" to question 1 in the province experimental group learned the subjects of the Science lesson with educational games to a greater extent.

The statements of some students in the province experimental group who had previously encountered educational games in their lessons are given below.

> S_3: In science class at school, the teacher was taking someone to the blackboard. And others were telling their characteristics and I think I learned faster that way.
> S_6: Yes, we improved by playing games in English lessons. We learn English words better by playing hangman.

S_{24}: Yes, it happened. "Taboo" for words in Turkish lessons, and "What does it have?" for tasks of organelles in Science lessons, etc.

It is seen that almost all of the students in the district group encountered educational games in their lessons. In this group, it is seen that the students who encountered educational games in their lessons learned the subjects of Mathematics, Science, Turkish, English, and Religious Culture and Ethics lessons through educational games. It is seen that the students who answered "Yes" to question 1 in the district experimental group learned the subjects of the Mathematics lesson with educational games to a greater extent. The statements of the students in the district experimental group who had previously encountered educational games are given below:

S_1: I learned about digits in mathematics lessons thanks to the game I played.
S_{11}: Yes, it happened. In English, we had a vocabulary contest on the board and there were some words I didn't know and I learned them."
S_{16}: Yes. In math, we played with digits and angles. Thanks to the game, I was able to understand the subject.

The frequency distributions of the responses of the students in the province and district experimental groups to question 2 of the interview form are given in Table 16.

Table 16.
Frequency Distribution of Responses to Question 2 of the Interview Form

Question 2: How would you evaluate the educational games about household waste and recycling in terms of their suitability for your age group?	Province	District
	Frequency (f)	
Age Groups	23	19
Effective in creating positive thoughts towards the lesson/games	10	6
Subject/games are understandable	3	7
Informational	2	4
Facilitates learning	2	-
Can be used in all age groups	2	1
Suitable for Generation Z	2	2
Tools and equipment used	1	1
Pawn, bells, cards, riddles	1	-
Board game	-	1
Enabling effective learning	1	1
Not Suitable for the Age Group	6	-
Can be used in lower age groups	4	-
Games are hard to understand	1	-
Games are not a learning tool	1	-

According to Table 16, it is seen that the majority of the students in the province and district experimental groups found the games suitable for their age groups. The reason why educational games are found suitable for the age group is that they are effective in creating positive thoughts towards the lesson and games, that the subjects and games are understandable, informative, and suitable for use by all age groups as well as Generation Z, and are thought to facilitate effective learning. The reasons for not being suitable for the age group were that it was found suitable for use by lower age groups, there were difficulties in understanding the games and the game was not seen as a learning tool. The statements of some students in the province experimental group who found the educational games suitable for their age group are given below.

S_1: I think learning with games is more enjoyable and better. It is both memorable and fun. By the end, I understand the subject.
S_3: I think that the games played do not need to be suitable for any age group. Because the games we played were educational games suitable for all ages and they were all very fun.
S_{24}: Actually, I can evaluate it in a good way. Because it's normal for kids our age to like games like this in this new generation, and that's why we inevitably learn while we play. So it is suitable both in terms of game and education.

Only a few of the students in the province experimental group found the educational games unsuitable for their age group. The reason for this is that it is thought that educational games can be used for

lower age groups, that games are difficult to understand, and that games are not learning tools. The statements of some students in the province experimental group who did not find the educational games suitable for their age group are given below.

S$_6$: I think these games are not suitable for seventh graders. I think these games should be played by 5th or 6th graders.
S$_{11}$: I think it is quite below my age group, so children between the ages of 8-9 can play.
S$_{18}$: "It is childish because when I listen to the lesson, it is a lesson, it is compulsory, it is a subject, but the game is fun.

It is seen that all of the students in the district experimental group found the educational games used in the research appropriate for their age group. The statements of some students in the district experimental group who found the educational games suitable for their age group are given below.

S$_{10}$: I think it is very suitable, I learned many things. We learn while playing and have fun while learning.
S$_{13}$: "It is suitable because the lesson was more enjoyable.
S$_{18}$: It was suitable for our age. Because we always play, we can learn these subjects by playing games.

The frequency distributions of the responses of the students in the province and district experimental groups to question 3 of the interview form are given in Table 17.

Table 17.
Frequency Distribution of Responses to Question 3 of the Interview Form

Question 3: Did you have any difficulties in understanding the educational games on Household Waste and Recycling? If your answer is 'Yes', for which reason did you experience difficulties?	Province	District
	Frequency (f)	
No I did not experience any difficulty	20	16
Level of game		
Understandable	6	7
Impact on affective domain		
It was fun and good	6	1
Impact on the cognitive domain		
Reinforced knowledge	-	1
It was informative	-	1
Yes I had difficulties	9	3
Application Process		
I found the "I Got it!" game confusing/ hard to understand	2	3
Reflection game	2	-
It was a bit complicated	2	-
It was noisy	1	-
Time was insufficient in "Who Won the Cup?"	1	-

According to Table 17, it is seen that most of the students in the experimental group did not have any difficulty in understanding the educational games. A small number of students had difficulty in understanding educational games. It is also stated that the difficulties experienced are due to the environment or the nature of the game.

Some of the statements of the students in the province experimental group who did not have difficulty in understanding the educational games are given below:

S$_7$: No, I had no difficulty at all. Everything was very clear and obvious. I loved the games because they were clear and it was a lot of fun.
S$_{12}$: No, I had no difficulty. Not all the games were very good. The best was the last game we played, ring!.
S$_{19}$: It was very clear and obvious.

Some of the statements of the students who had difficulty in understanding educational games in the province experimental group are given below:

S_1: Yes, in the game I Got it! it was too complicated. When we ask the question, we come up with different answers and when we mix it up, we get indecisive and confuse the game.
S_8: Yes, in the reflection game, but I think because it was too noisy.
S_3: Yes, I had difficulty in some of them, but I think that the information I learned will be very useful for me after the games are over.

In the district experimental group, only one of the three students who had difficulty in understanding the educational games expressed the reason for their difficulty. The difficulty experienced by this student was due to the fact that the game "I Got it!" was found confusing by the student. Some of the statements of the students who did not have difficulty in understanding educational games in the district experimental group are given below:

S_2: No, it had a subject that I think everyone can understand.
S_{10}: No, I did not have any difficulty. The games are very enriching and informative.
S_{14}: No, I did not have any difficulty because it was easy and fun.

Some of the statements of the students who had difficulty in understanding educational games in the district experimental group are given below:

S_{16}: Yes, I had difficulties in understanding the game of I Got it!
S_{18}: Yes, the I Got it! game. It was hard to find the answers while playing the game.
S_{19}: Yes. I had a hard time understanding the I Got it! game.

The frequency distributions of the responses of the students in the province and district experimental groups to question 4 of the interview form are given in Table 18.

Table 18.
Frequency Distribution of Responses to Question 4 of the Interview Form

Question 4: Was it useful to use educational games about household waste and recycling? If so, what kind of effect did it have?	Province	District
	Frequency (f)	
Yes, it was useful	28	19
Impact on the cognitive domain		
Provided information	9	3
Institutions and organizations	2	-
Recyclable wastes	-	2
Waste management	1	-
Enabled effective learning	7	12
Made learning easier	6	4
Raised Awareness	1	-
Impact on affective domain		
Developed positive emotions towards the lesson/subject	11	5
Made learning fun	4	1
Saved the lesson/subject from being boring	3	2
Enabled learning in a different way	1	-
Improved concentration	-	1
Increased environmental awareness	1	-
No, it was useless.	1	-

According to Table 18, it is seen that the students in the province and district experimental groups found the use of educational games in teaching the subject of household wastes and recycling useful in cognitive and affective domains. Students found educational games cognitively effective in terms of informing, providing effective learning, and making learning easier, and emotionally effective in terms of developing positive feelings towards the lesson and the subject and increasing environmental awareness.

Some of the evaluations of the students in the province experimental group regarding the benefits of the educational games played within the scope of the research are given below:

> S_5: Yes, for example, I did not know that recyclable materials can be given to Mukhtar's office.
> S_{13}: Yes. I learned more in less time.
> S_{19}: Yes. I have become more conscious about this subject. My sensitivity to the environment has increased even more.
> S_{24}: Yes. Some parts of it I would definitely have to memorize and it is difficult to memorize. But it stayed in my mind after repeating it. So it was a great help.

It is seen that a student in the province experimental group did not find the educational games played within the scope of the research useful; however, he did not make any explanation on this issue. The evaluations of the students in the district group regarding the benefits of the educational games played within the scope of the research are given below:

> S_5: Yes. Maybe we couldn't understand it by writing, but we learned it through the game.
> S_{18}: Yes. I learned about recyclable waste through games.
> S_{19}: Yes, it did. I understood what recyclables are.

The frequency distributions of the answers given by the students in the province and district experimental groups to question 4 of the interview form are given in Table 19.

Table 19.
Frequency Distribution of Responses to Question 5 of the Interview Form

Question 5: What are your thoughts on the use of educational games in science lessons?	Province	District
	Frequency (f)	
Positive thoughts	26	19
Impact on affective domain		
The lesson/subject is fun and enjoyable	16	11
Increases motivation to study	4	-
Saves the lesson/subject from being boring	2	3
Helps to concentrate on the subject	1	-
Impact on the cognitive domain		
Facilitates learning	5	-
Enables effective learning	2	4
Informing	2	2
Raises awareness	1	-
It is better to use educational games together with traditional ways of learning	-	1
Applicability		
Can be included more	3	3
Can be used in other lessons	3	1
Can be used for other subjects	1	3
Negative thoughts	3	-
Games make the subject incomprehensible	2	-
It is better to teach with traditional ways of learning	1	-

According to Table 19, it is seen that the students in the province and district experimental group had positive opinions about the use of educational games in the Science lesson. It is seen that students find the use of educational games in Science lessons effective in terms of affective aspects as it provides positive development towards the lesson and the subject; and in terms of cognitive aspects as they find it more useful to facilitate learning, provide effective learning, inform, raise awareness and use educational games together with traditional learning methods.

It was determined that the students wanted more educational games to be included in the Science lesson and that they wanted to encounter educational games in other lessons and subjects other than

the Science lesson. The statements of some students in the province experimental group who had positive thoughts about the inclusion of educational games in the Science lesson are given below:

> S_2: Science lesson is very enjoyable but it is a difficult lesson to understand. When we enjoy the games, we want to play more and understand more.
> S_{11}: I think if it is played in difficult subjects, the subject can be understood faster and it provides a great motivation.
> S_{24}: Actually, science is a lesson that sometimes requires memorization, sometimes requires thinking, and sometimes requires both. The game is very good because it's good for thinking and intelligence, and it's good for sticking in our minds as we play.

In addition to the positive statements about the use of educational games in the Science lesson, negative thoughts were expressed by three students in the province experimental group. The reason for these negative statements is that they think that the subject is not understood with educational games and that it is better to teach the lesson with traditional learning methods.

The statements of the students in the province experimental group who had negative thoughts about the inclusion of educational games in the Science lesson are given below:

> S_{13}: It is fun to play games but I cannot learn very clearly. I need to ask some things, but I can't when I'm playing."
> S_{18}: Bad. I tried to understand the lesson and I couldn't.
> S_{29}: I think it would be better if it was a normal lesson.

The statements of some students in the district group who had positive thoughts about the inclusion of educational games in the Science lesson are given below:

> S_8: It was good, but it would be better if there was such a game for other lessons too.
> S_{11}: I think we should keep playing. It is good
> S_{15}: I learned the subject in a fun way. It should be in other subjects as well.

Discussion, Conclusion and Recommendations

When the pre-test and post-test scores of the province and district experiment group students on the household wastes and recycling knowledge test were analyzed, it was concluded that the educational games were effective in raising awareness on the subject of household wastes and recycling (Tables 4, 6, 9, 11). In reaching this conclusion, it is thought that the information and visuals in the educational games and the structure of the games that enable students to interact with their peers are effective in information and awareness. Similarly, Can (2010) examined the effect of science teaching with educational games on the academic achievement of 8th-grade students and concluded that teaching with educational games was more effective than traditional teaching methods. It was stated that the fact that students were active in educational games and interacted with their peers, that students liked educational games, that the subjects became fun with educational games, and that they appealed to the sensory organs could be effective in the emergence of this result. Güler (2011) concluded that the educational games used in teaching the subject of cells and organelles were more effective in increasing student achievement than the teaching carried out in line with the activities in the science curriculum. The reason for the increase in students' achievement was stated as the fact that teaching with educational games increased the motivation of the students and the lesson became more efficient due to motivation. Likewise, Kaya and Elgün (2015) found that the educational games used in the teaching of our planet Earth unit; Alıcı (2016) in the unit of cell division and heredity; Yıldız, et al. (2016) in the teaching of the circulatory system subject were more effective in increasing student achievement than the teaching carried out in line with the activities in the Science curriculum. Mariscal, et al. (2012) found that the educational card games used in the periodic table and elements subject had an educational effect even on students with low achievement and no interest in chemistry subjects. Rastegarpour and Marashi (2012) stated that educational cards and computer games are effective in learning abstract concepts. In the study conducted by Gülsoy and Uçgun (2013), it was concluded that educational games were effective in the development of students' vocabulary. In the study conducted by Liu and Chen (2013), it was determined that educational card games increased

students' knowledge. Rachman, et al. (2019) concluded that Android-based educational games used to explain fruits and vitamins were effective in understanding the types of vitamins in fruits. The results obtained from the studies support the results of the research conducted.

When the mean score change of the province and district experiment group students in the household wastes and recycling knowledge test is examined, it is seen that the pre-test and post-test mean score difference of the district experiment group students is higher than the mean score difference of the province experiment group students (Table 14). This shows that the teaching using educational games was more effective on the district experiment group students. Although they were in the same age group and at the same level of education, it was determined that more students in the district experiment group than in the provincial experiment group stated that educational games provided effective learning (Table 18) and that they wanted to learn with educational games in subjects other than household wastes and recycling (Table 19). In line with these statements about educational games used in the learning environment, it is thought that awareness about household waste and recycling is affected by students' cognitive and affective characteristics. Because cognitive and affective areas in learning are a part of education and are affected by each other (Biber, 2012). Besides, each student has a different learning style. Learning styles also vary due to the developmental characteristics and expectations of students (Eyinç & Engin, 2022).

It was determined that most of the students encountered educational games in many of the basic courses. It is seen that the courses in which educational games are encountered are Mathematics, Science, Turkish, English, and Religious Culture and Ethics Knowledge. In İnce's (2021) study, it was found that most of the students in the research group had previously encountered educational games in Mathematics, Science, Turkish, English, and Social Sciences lessons.

In the research, the students stated that they encountered educational games in the teaching of digits and angles in Mathematics, organelles and effort in Science, and vocabulary in Turkish and English. Among these results, it is noteworthy that they stated that they played educational games, especially in the teaching of digits and angles in Mathematics. Because the topic of digits is included in the 5th-grade "Numbers and Calculations" and the topic of angles is included in the 6th-grade "Geometry and Measurement" learning area. Considering that the applied students are studying in the 7th grade, the fact that they remember the lesson and the subject taught by playing educational games in the 5th and 6th grades shows how effective the educational game technique is on students. Because, as Uskan and Bozkuş (2019) stated, all senses of students are active in educational games. This situation ensures the internalization of knowledge, skills, and behaviors and the realization of permanent learning.

It is seen that the games played in the classroom environment are "What does it have?" in the Science lesson, "Taboo" in the Turkish and Religious Culture and Ethics lessons, and "Hangman" in the English lesson. It is seen that the educational games identified in the research and seen to be included in basic courses are also included in the literature. In the study of Genç, et al. (2012), "Taboo", which includes the concepts in the 6th, 7th, and 8th grade Science and Technology course curriculum, was prepared and students were allowed to play the game. Students were videotaped while playing the game. After the games, interviews were conducted to obtain students' opinions about the game. Based on the findings, it was stated that it is important for teachers to benefit from similar activities in determining misconceptions. Gürdal and Arslan (2011) stated in their study that educational games such as "Hangman", "What does it have?" and "Deriving words from the last letter" can be utilized while teaching Turkish words. In the research, S_3 student who encountered educational games in the science lesson in the province experiment group said, "In the science lesson at school, the teacher would take someone to the board. The others would say its characteristics and I think I learned faster in this way." In line with these statements, it is seen that the student encountered a cryptic game in the lesson. Karasan (2013) discussed educational games that can be used in the Religious Culture and Ethics lesson in 6 groups under the titles of memorization games, writing games, discussion games, drama-role games, communication games, and card puzzle games. While he included "Taboo" and "What does it have?" games under the title of communication games, he stated that the "Cipher text" game can be included under the title of card puzzle games.

It was determined that the educational games were suitable for the age groups of the students. It was stated by the students that the educational games were understandable, and informative, facilitating learning, and enabling effective learning. It was determined that the structure of the games and the materials used were suitable for Generation Z. In addition, it was seen from the statement of S_{18} student in the province experiment group, "It is childish because while listening to the lesson, it is a lesson, it is compulsory, it is a subject, but the game is fun" that educational games have an entertaining structure, but because of this feature, they cannot be a learning tool. However, educational games cannot be considered without educational activities (Dolunay & Karamustafaoğlu, 2021).

It was determined that students had no difficulty in understanding educational games. In line with the students' opinions, it was determined that the educational games used in the research were understandable, cognitive, and affective learning tools that had an impact on students. Kılıç and Karamustafaoğlu (2020) also took the opinion of teachers about the educational game they included in their research. Teachers found the educational game can be understandable and the instructional level of the game should be high. They also stated that the students approached the educational game with interest and found the educational game good in general. In line with the opinions received from the teachers, it was concluded that educational games are effective in gaining cognitive and affective skills in students. In addition, it was determined that there were students who had difficulty in understanding educational games. It is seen that the difficulties experienced are due to the environment or the game structure and duration. Such evaluations of educational games help to transform the negative aspects of the related subject into positive ones and to further improve the successful points (Akandere, 2013).

It is seen that students find the use of educational games about household waste and recycling useful. In line with the opinions of the students, it was determined that they had information about institutions and organizations, recyclable wastes, and waste control within the scope of household wastes and recycling through educational games. In line with the opinions of the students, it is seen that educational games are learning tools that facilitate learning, enable effective learning, and raise awareness. These features show that educational games are an effective learning tool in the cognitive field. It was determined that educational games make learning fun, save the lesson or subject from being boring, are seen as a different way of learning, and are effective in improving concentration and increasing environmental sensitivity. These features show that educational games are an effective learning tool in the affective domain. In the research conducted by Hazar and Altun (2018), in which the importance of educational games for the learner was discussed, the participants emphasized that they found educational games important in terms of providing permanent learning, making the lesson fun, and increasing motivation. Teachers' opinions on educational games are that educational games provide easier motivation for the lesson, concretize the subject, are effective in learning by having fun, and provide permanent learning (Ertuğrul & Karamustafaoğlu, 2021; Karamustafaoğlu & Coşgun, 2021). In addition, research shows that educational games are also effective in motivating science learning (Yıldız, et al., 2016; Yenice, et al., 2019). Educational games are effective in scientific concept learning (Al-Tarawneh, 2016). Due to the positive effects of educational games on cognitive and affective domains, educational games can be utilized in learning environments (Castellar, et al., 2014). Students become active and interact socially during the game. For this reason, the presence of entertainment, which is effective in student success, should not be ignored in learning environments (Gibbon, et al., 2017). Students also state that they learn by having fun with educational games and that they engage in cognitive activities such as thinking and predicting through games (Gençer & Karamustafaoğlu, 2014).

Students expressed that they would like educational games to be used in Science lessons and other lessons as well. In addition, it was determined that they wanted educational games to be included in subjects other than household waste and recycling. These expressions show that educational games can be applied in the Science lesson and other lessons other than it, as well as in subjects other than household waste and recycling. It is seen that educational games help to develop positive emotions towards the lesson or subject, increase motivation, save the lesson and subject from being boring, and help to improve concentration. These positive effects of educational games on students show that educational games affect students in the affective field. In addition, students stated that educational games facilitate learning, enable effective learning, inform, and raise awareness and that it would be

better to use educational games and traditional learning methods together. These statements of the students show that educational games affect students in the cognitive domain. In this case, it can be said that educational games used in Science lessons are an effective tool in cognitive and affective domains. Although positive opinions about the use of educational games in Science courses were dominant, a few students stated that the subject could not be understood with games and that it was better to use traditional learning methods. It is thought that the different opinions identified in the research are also due to individual differences in students. Because not all students in the class have the same characteristics, but each student has a different personality and world. For this reason, not every child may show the same interest and desire in a lesson with educational games (Akandere, 2013).

It was concluded that the lessons conducted with educational games positively affected the knowledge and awareness of the experimental group students about household waste and recycling. In this context, it is recommended to include educational games in the teaching of different subjects in the Science lesson or other lessons and to investigate the effect of educational games on students.

Educational games have led to the formation of positive feelings and thoughts towards the lesson, subject, and applied technique in students. For this reason, it is recommended to include educational games at various education levels.

In the research, it was determined that educational games made the subject comprehensible, enabled learning while having fun, and saved the lesson from being boring. Considering the advantages of educational games, it is recommended that educational games should be included more in the in-class activities of students.

Since the educational games used in the research are card games, they are also suitable for use outside the classroom without time and space limitations. For this reason, it is recommended that the educational games used in the research should also be used in out-of-class learning.

It is recommended that the educational games used in the research be transferred to the computer environment and made available to students through Web 2.0 tools.

Education on household waste and recycling has gained a visual and auditory structure through educational games. For this reason, it is recommended to investigate the effect of educational games on knowledge retention on household wastes and recycling.

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An Examination of the Views of Preschool Teachers on the use of Social Media for Professional Development

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Abstract

Teachers use social media actively and it is worth researching to learn about teachers' views on social media. The purpose of this study is to examine the views of preschool teachers on the use of social media for professional development. The research was designed with the case study approach as one of qualitative research methods. The participants of this study consisted of twenty-five preschool teachers. A semi-structured interview form was used to learn the opinions of the teachers. The interview form consisting of eight questions was applied face to face to preschool teachers in the spring term of the 2020-2021 academic year in Ankara. The data were analyzed by descriptive analysis technique. As a result of the data analysis, it was found that preschool teachers use social media platforms for professional development and benefit from these platforms effectively. Teachers emphasize that social media has an important contribution to their professional development, but they also state that one should be careful against disinformation. It is recommended that teachers are provided with media literacy training. Teachers should be conscious about acting in accordance with children's rights and ethical principles when using social media for professional purposes.

Keywords: Preschool teachers, professional development, social media

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Introduction

Social media has changed education and learning processes and has become an integral part of this process for all educational levels, including early childhood. In the literature, the role of social media in educational environments is defined as communication, cooperation, and providing information (Zhao, 2013). It is indicated that social media use in education facilitates the interaction between the teacher and the family (Fan & Yost, 2018) and enriches the learning experience (Epstein, 2013). Stansbury (2011) on the other hand, explains the use of social media at school by emphasizing the areas of connecting with other teachers, cooperative learning, intercultural communication, distance learning, and personal and professional development. Using social media means being aware of new teacher roles and new approaches to learning and teaching (Pineda Hoyos, 2014).

It is stated that the rate of social media use by all members of society, including teachers, has increased during the pandemic process, in which the entire world has been deeply affected (Digital, 2020). Teachers are also among the user profiles that actively use social media. On the other hand, with the compulsory closure of schools, distance education has started to be used. Therefore, during this period, teachers conducted educational work and student-parent communication via social media applications. In the process that started with the closure of schools on March 16, 2020, in Turkey, teachers and students employed the technology they had previously used in the education and training process compulsorily much more frequently. The Covid-19 pandemic has been effective in the increased use of digital devices, online resources, social media networks, and e-learning activities (Mulenga & Marban, 2020). Social media has become one of the significant resources from which teachers can benefit.

Some important issues should be emphasized in the relationship between education and social media. Sharing the faces of children in social media posts, violating the privacy of children, and the credibility of the information obtained through social media are on the table. Sharing children's faces and abusing children's privacy is a violation of children's rights. Marin, Carpenter, and Tur (2021) pointed out the concept of educational social media in their study and draw attention to the necessity of data privacy awareness among teachers. Media literacy education can prevent misinformation on social media. Social media creates a secondary world that is almost parallel to the world we live in. The documentary named Social Dilemma broadcast on the digital broadcasting platform Netflix begins with: "We've gone from the information age to the disinformation age" (Orlowski, 2020) This impressive statement puts forward the significant role of media literacy in the twenty-first century. Potter (2005) states that there is a fine line between the media world and the real world and points out the need for media literacy. Individuals expecting a social benefit tend to think that the message is credible when they believe the message that they get from social media can be used in real life. Thanks to its multi-dimensional messages, the media is capable of shaping individuals' perception of reality significantly. That is why besides all its advantages, one should be cautious and try to get the most benefit with the least harm.

In-service training processes in Turkey targeting schools and teachers follow top-down training direction. The professional exchange and development opportunities offered to teachers are frequently planned by the Ministry of National Education. Most training is executed by profiting from courses and seminars. Even though there are criteria for in-service training applications, inadequacies exist in the selection of applicants in terms of suitability, prioritization, and transparency (European Training Foundation, 2020). The majority of the in-service training planned for 2020 was canceled due to the pandemic or kept on going with distance education. It is known that the training planned for 2021 was also carried out through distance education (Ministry of National Education [MONE], 2021). There is no development-oriented and comprehensive evaluation or support system for teachers (İlğan, 2013). In order to receive some support from their experienced colleagues, teachers can benefit from social media platforms, and positively contribute to their professional development by asking questions to their colleagues and exchanging ideas. From time to time these contributions appear as colleague solidarity, which is expressed as the support of people working in the same profession for each other. Colleague solidarity of teachers on social media and their search for help is regarded as an important clue while determining the pre-service and in-service training needs of teachers (Ünüvar, Yavaşdemir,

& Tagay, 2018). Considering that learning is an active process, it requires teachers to update their professional knowledge, communicate with their colleagues, and share their knowledge and experiences with each other (National Association for The Education of Young Children [NAEYC], 2010). Reanalyzing teachers' levels of professional competence and professional development is regarded as a requirement. As a result of various elements hindering professional development, social media stands out as the main source of reference guides for teachers whose professional development is not sufficiently supported.

The literature review demonstrates that social media and education research are mostly directed at the use of social media tools in the classroom (Epstein, 2013; NAEYC, 2012). However, teachers' use of social media has the potential to turn into an important opportunity in early childhood education. Various resources explain in detail the contributions of social media tools to teacher education and professional development (NAEYC, 2012). Richardson & Mancabelli (2011) emphasized the importance of creating "Personal Learning Networks" in the professional development of teachers. It has been stated that prospective preschool teachers can develop a digital environment to share information with their colleagues and to be aware of current activities through e-mobile learning (Gözüm & Demir, 2022). Veziroğlu Çelik et al. (2018) stated in their research that preschool teachers use social media to find different activities and methods. Teachers engage in new forms of professional development made possible by the evolution of the internet. Teachers use social media for professional learning and information sharing (Bissessar, 2014; Manca & Ranieri, 2014; van Bommel & Liljekvist, 2015). The use of Twitter is encouraged, especially in pre-service teacher education programs. It is stated that pre-service teachers can be supported with Twitter in the subjects of field experience, emotions, cooperation, classroom, and relationships (Munoz, Pellegrini-Lafont, & Cramer, 2014). Teachers initiate and orchestrate their professional development on the Internet. However, studies on how preschool teachers use social media in their professional development seem to be insufficient. That is why the need for research on how social media contributes to preschool teachers in terms of professional development and whether it has a contribution has arisen. Within this context, the study aims to examine teachers' views regarding social media use for professional development purposes. In accordance with the aim of the study, answers were sought by asking the following research questions:

1. How do teachers use social media for professional development?
2. Which social media platforms do teachers use the most for professional development?
3. Which social media accounts do teachers follow for professional development?
4. From which aspects are teachers supported professionally when they follow social media?
5. What do teachers think about the reliability of the professional knowledge they get from social media?
6. How do teachers apply the knowledge they get from social media?
7. What do teachers think about the necessity of using social media for professional development?
8. What do teachers consider when sharing about their profession on social media?

Method

Research Design

This study used the qualitative method. As one of the qualitative research designs, the study was carried out based on the case study approach. The case study approach studies a current phenomenon in its real-life context (Yıldırım ve Şimşek, 2005). Yin (2003) defined the case study as exploratory, explanatory, and descriptive. The event and situations examined in case studies are limited to time and space in their natural context. This study was carried out during the pandemic period when social media was used extensively by teachers, and kindergartens were kept open during this period. The study is a case with this feature.

Participants

The study group of the research consisted of twenty-five preschool teachers chosen among preschool teachers working in public kindergartens in the Etimesgut district of Ankara province during the 2020-

2021 academic year. The sample group was determined by using purposeful sampling. Purposeful sampling is the deliberate classification of samples in line with the purpose of the research (Marshall & Rossman, 2014). In line with the purpose of the research, it was worked with preschool teachers, who were the only branch working face-to-face during the pandemic period.

Table 1.
Sociodemographic Information of Teachers

Variable		n
Gender	Woman	25
	Man	0
Age	20-24	4
	25-29	7
	30-34	4
	35-39	4
	40 and up	6
Education degree	Bachelor's	23
	Master's	2
Professional experience (year)	1-5	8
	6-10	7
	11-15	4
	16- 20	2
	21 and up	4
Daily time spent on social media	30 minutes or less	1
	30-60 minutes	5
	1-2 hours	9
	3-4 hours	8
	5-6 hours	2
	More than 6 hours	0
	Total	25

Table 1 demonstrates that 25 of the preschool teachers, in other words, all of them, are women. It is seen that 4 of the teachers are 20-24 years old, 7 of them are 25-29 years old, 4 of them are 30-34 years old, and 4 of them are 35-39 years old. All of the teachers hold a bachelor's degree, and only 2 of them have a master's degree. 8 of the teachers have a seniority of 1-5 years, 7 of them 6-10 years, 4 of them 11-15 years, 2 of them 16-20 years and 4 of them have a seniority of 21 years and above. The findings show that teachers spend between 1-2 hours and 3-4 hours on social media in a day. None of the teachers spend more than 6 hours a day on social media. 9 of the teachers spend 1-2 hours a day, 8 of them 3-4 hours a day, 5 of them 30-60 minutes a day, 2 of them spend 5-6 hours and 1 of them spends less than 30 minutes on social media.

Data Collection Tools

In the research, the "Information Form" was used to determine the sociodemographic characteristics of the teachers, and the "Semi-structured Interview Form" was used to assess the opinions of the teachers.

Information Form: It is a form developed by the researchers to determine the gender, age, education degree, professional experience, and time spent daily on social media of the teachers participating in the research. The form consists of five questions.

Semi-structured Interview Form: It is a form developed by researchers to determine teachers' views on the use of social media for professional development. While creating the form, the literature that includes teachers' social media usage habits and professional development resources was used. After the literature review, the questions of the Semi-Structured Interview Form were formed. The questions prepared for the interview form were first presented to six field experts working in the child development departments of universities for their opinions. Following the feedback received from the experts, the interview form was finalized, and the internal validity of the form was ensured. For example, in the first question form, it was planned to ask the teachers a question like "Do you include your students in the photos you use in your social media posts?" However, one of the experts stated

that this is a question about ethics rather than professional development. Therefore, this question was removed from the form. The final version of the form consisted of eight questions as follows:

1. How do you use social media for professional development?
2. Which social media platforms do you use most for professional development?
3. Which social media accounts do you follow for professional development?
4. How are you supported professionally while following social media?
5. What do you think about the reliability of the professional information you get from social media?
6. How do you apply the knowledge gained from social media?
7. What do you think about the necessity of using social media for your professional development?
8. What do you consider when sharing professional posts on social media?

Data Analysis

The interview form was applied to the teachers by the second researcher in the spring term of the 2020-2021 academic year. First of all, appointments were made by phone with the teachers and the meeting was set for Monday, March 8, 2021. The purpose of the research was explained and general information regarding questions was provided to the teachers on the day of the meeting. Individual and face-to-face interviews were conducted with each teacher. The teachers were provided to answer the interview form in detail. Audio recordings were used during the interview with the permission of the teachers. All interviews were completed between 8-12 March 2021. An interview took approximately 20 minutes with each participant. In order to protect participants' privacy, instead of using their names, codes were given to the participants. Interview forms were numbered from 1 to 25 and each of them was given the codes "T1", "T2" meaning "teacher 1", and "teacher 2".

Table 2.
As a result of content analysis, categories and subcategories

Categories	Subcategories
Using social media in terms of professional development	Activity examples, Video, Song, Education, Not using social media
Social media platforms used for professional development	Instagram, Pinterest, Whatsapp, Youtube, Facebook, Google, Telegram, Twitter
Followed social media accounts	okuloncesietkinlik, okuloncesi.cilginlik, once.okul.oncesi akademisyenanne, tcmeb, nalan_ogretmen, serapogretmen babaokulu_teacher
The aspects teachers are supported professionally when they follow social media	Theory and practice, Finding the activity, Learning about child development, Creativity, In the execution of official proceedings, Seminar and panel, Book recommendation
Thoughts on the credibility of professional information obtained from social media	Doubting the accuracy of the information, The information they receive from accounts they trust is correct, Not getting information, Having accurate information on Twitter
The status of using the information obtained through social media tools in the learning process	Increase in productivity, Increased interest, and motivation in children, Creativity, Suitable for children's developmental levels, Self-assessment
Thoughts regarding the necessity of using social media for professional development	To follow new developments, Ease of access to content, Communication speed, Too many alternatives, To understand the world of the new generation, Media literate, Taking a lot of time, Feeling inadequate, Making people lazy
Things they consider while professionally sharing on social media	Not sharing children's faces, Sharing the right information, Getting permission from parent and child, Suitable for children's age and developmental levels

The sociodemographic characteristics of the teachers are presented with frequency tables. The data obtained from the interview form were analyzed with the content analysis approach. A content analysis table was created from the categories and sub-categories for the answers given by the teachers to the questions. Content analysis is an analysis method that aims to reach concepts and relationships that can explain the collected data (Yıldırım & Şimşek, 2006). This method was applied to organize the concepts that emerged in the collected data within the framework of the research questions and to reveal the basic categories that could explain the data. The data was analyzed thoroughly and accordingly, categories were created. In order to ensure the reliability of the study, the data were analyzed independently by the two researchers and the compatibility percentage was calculated using the formula suggested by Miles and Huberman (2015). A compatibility percentage above 70% is considered reliable (Miles & Huberman, 2015). It is seen that the percentage of agreement between coders was 90%. Thus, it was determined that the level of compatibility between the coders was good and the reliability of the data analysis was ensured. Additionally, direct quotations from the data are presented in the results section with a descriptive approach. In qualitative research, while recording data using tape recorders, rich descriptions and inter-rater reliability ensure reliability and contribute to validity (Creswell, 2013).

Results

In this section, the views of preschool teachers on the use of social media for professional development are presented. As a result of the analysis of the data obtained from the questions directed to the teachers, the opinions of the teachers were gathered under the themes. The themes in question were created in the context of the questions in the interview form.

By examining the data obtained from the interviews, subcategories were formed from the sentences and words that are important within the framework of the purpose of the research. The opinions expressed by the teachers were first gathered under similar topics. Afterward, opinions were analyzed and those compatible with each other were categorized and subcategories were determined.

Category 1: Using Social Media in Terms of Professional Development

'How do teachers use social media for professional development?' The answers given to the question are given in Table 3.

Table 3.
Teachers' views on social media for professional development

Subcategories	n
Learning activity examples	11
Video	5
Song	5
Education	3
Not using social media	1

Nearly all of the preschool teachers participating in the research use social media for professional development. Looking at the use of social media for the professional development of preschool teachers, it is seen that they use social media primarily to look at examples of activities. Regarding this finding, a teacher states that (T8):

> Usually, I follow the websites where teacher groups are members. They have activity pools, and I follow them. The Ministry of National Education has a website called the General Directorate of Basic Education. I can find activities targeting preschool. They have activity pools. I look at these activity pools.

"Video" and "song" are indicated as second priority in the cases of using social media in the professional development of preschool teachers. Regarding this finding, a teacher states (T5): "I use social media mostly for videos and songs. As I believe they will make it more fun for the children."

Thirdly, preschool teachers use social media for "seminars" and "training". An example given by the teacher is: "There have been seminars carried out via internet because of the pandemic. I participated in almost all of these remote seminars."(T7)

Another teacher expresses that she does not use social media a lot except sharing information and knowledge by saying:

> I do not use social media, except WhatsApp. I use WhatsApp only for informing the parents, sending homework, and talking about the students during the pandemic. Except for this, I do not use social media. I use it for the content I choose for the children from Educational Informatics Network (EBA) and to inform the parents. I care about their education. (T10)

Category 2: Social Media Platforms Used for Professional Development and its Reasons

'Which social media platforms do teachers use the most for professional development?' The answers given to the question are given in Table 4.

Table.4
Social Media Platforms Used for Professional Development and its Reasons

Subcategories	n
Instagram	9
Pinterest	5
Whatsapp	4
Youtube	3
Facebook	1
Google	1
Telegram	1
Twitter	1

When we look at the social media platforms that preschool teachers use, it is determined that the majority of teachers use Instagram, and half of them use Pinterest, WhatsApp, and YouTube along with Instagram. Facebook, Google, Telegram, and Twitter are rarely used social media platforms by teachers. Hence, as social media platforms, preschool teachers use Instagram, Pinterest, WhatsApp, and YouTube the most for the purpose of professional development. When we look at the reasons why these platforms are preferred, some answers are given such as the fact that these platforms are more popular, the information is up-to-date and easily accessible, and the variety of activities is high. Regarding this, a teacher states (T3): "I use Instagram the most. Since it is more up-to-date and richer in content. We can easily access many local networks via Instagram. That is why, I prefer Instagram the most."Regarding this, another preschool teacher states (T13): "I use Instagram more and people are usually concentrated there. I mean it has become more popular. I prefer using Instagram as it contains a great number of activities."

About YouTube, another preschool teacher explains how they benefit from social media platforms in the process of learning by stating: "It works great for me at school. I click and open something from YouTube at school and children get an idea or they can concrete a subject while explaining. That is why I use YouTube the most."(T17)

The results show that preschool teachers using WhatsApp mostly use this platform to make exchange information with families. A small part of the working group stated that they do not use social media platforms too much for professional purposes.

Category 3: Followed Social Media Accounts

'Which social media accounts do teachers follow for professional development? The answers given to the question ' are given in Table 5. The majority of preschool teachers state that they follow Instagram and Pinterest as social media accounts. Some preschool teachers specify that they follow the YouTube and Telegram pages of these accounts along with Instagram and Pinterest.

When we look at the views of the preschool teachers regarding the accounts they follow, it is determined that the majority of them follow activity pages. When we look at the pages that are most closely followed by the teachers, it is seen that these pages are "okuloncesietkinlik, okuloncesi.cilginlik, once.okul.oncesi". It was determined that another majority of the teachers follow academicians and preschool teachers. The most closely followed page is the 'akademisyenanne' page. When we look at the preschool teachers followed, the most followed teacher accounts can be listed as

'nalan_ogretmen, serapogretmen, and babaokulu_teacher.' Some of the teachers follow the Ministry of National Education's Instagram page (tcmeb).

Another teacher does not specify the accounts she follows by saying: "There is no principal account. For example, there are some accounts opened abroad. I usually follow them but there is no certain answer to this account question. In general, I follow the accounts related to the profession group." (T8)

Table 5.
Followed Social Media Accounts

Subcategories	*n*
okuloncesietkinlik (instagram)	6
okuloncesi.cilginlik (instagram)	4
once.okul.oncesi (instagram)	4
akademisyenanne (instagram)	3
tcmeb (instagram)	3
nalan_ogretmen (instagram)	2
serapogretmen (instagram)	2
babaokulu_teacher (instagram)	1

Category 4: The aspects teachers are supported professionally when they follow social media

'Which aspects are teachers supported professionally when they follow social media?' The answers given to the question ' are given in Table 6.

Table 6.
The aspects teachers are supported professionally when they follow social media

Subcategories	n
Theory and practice	7
Find activity	6
Learn about child development	4
Creativity	4
In the execution of official proceedings	2
Seminar and panel	1
Book recommendation	1

The majority of preschool teachers indicate that they feel supported with regard to creativity in theory and practice, finding activities, and knowledge acquisition in child development. Regarding this matter, a teacher states (T15):

> As I said I try to follow academic topics. Such as scholarly articles. Most of the time, I try to follow children's development, their development levels, and surveys aiming at understanding these levels. Apart from these, I try to follow preschool activities, mind games, or informative games and activities that can further develop children and support their cognitive development.

Another group of preschool teachers states that social media support them in the functioning of official acts and in preparing a plan. Regarding this, a preschool teacher states (T5): "For official acts in particular, we might need to fill out some forms. I think it can be useful as we can pass to each other in similar acts."

Some preschool teachers also state that they saw their inadequacies on social media and completed these aspects with seminars and panels. Regarding this matter, a preschool teacher states (T7): "This is what usually happens in seminars. In the pages we follow, we look if there are new activities. To be honest, the seminars are really helpful for me. I mean, we think that we know so much but obviously, there are things we do not know. I watched and listened to some dialogues organized in the form of panels, particularly in our field."

Another preschool teacher states she is supported by getting book suggestions from social media and adds: "I just look at the activities, because I can't get such deep information from social media, but

there are books that are recommended. I can read them. Actually, I use the platform as an advertisement tool. I mean I want to see them by trying."(T4)

Category 5: Thoughts on the Credibility of Professional Information Obtained from Social Media

'What do teachers think about the credibility of the professional information they obtain from social media?' The answers given to the question ' are given in Table 7.

Table 7.
Thoughts on the Credibility of Professional Information Obtained from Social Media

Subcategories	n
Doubting the accuracy of information	11
The information they receive from accounts they trust is correct	9
Not getting information	4
Having accurate information on Twitter	1

Nearly all of the preschool teachers state that they are hesitant about the accuracy of the information they obtained from social media, however; they think that the information they get from the accounts they trust is credible. Regarding this matter, a preschool teacher states (T3):

> There might be a piece of information that is credible, but surely there might be which are not. In other words, I believe that I have already reached the credible information by following our well-equipped, really knowledgeable teachers who have achieved certain accomplishments in their field, and mistakes can of course occur on many pages.

In another aspect, the preschool teachers express that they only look at the activity examples from social media and do not generally get much information from it. Regarding this matter, a preschool teacher states (T4):

Sure, I do not use things that I am not sure about its credibility. Yet, as I say I prefer content regarding activity examples, poems, and games, rather than information-based content. They do not even have to be completely credible. If it fits my group, I use it.

Another preschool teacher states that there is more accurate information on Twitter :

> Some accounts are limited. The information shared on these accounts can be wrong. I usually prefer more formal accounts, for example for these topics I use Twitter. Because the platform is more formal. For example, some people may share false information about the Ministry of National Education. This is why I follow the official websites of the Ministry of National Education, and I follow them on Twitter because it is safer than Instagram. (T13)

Category 6: The Status of Using the Information Obtained Through Social Media Tools in the Learning Process

'How do teachers give place to the information they obtain from social media in the implementation processes?' The answers given to the question ' are given in Table 8.

Table 8.
The Status of Using the Information Obtained Through Social Media Tools in the Learning Process

Subcategories	n
Increase in productivity	10
Increased interest and motivation in children	6
Creativity	5
Suitable for children's developmental levels	3
Self-assessment	1

It is determined that the preschool teachers participating in the research tried to transfer the knowledge and activity ideas they obtained through social media platforms to the learning processes. Preschool teachers emphasize that when they use the knowledge and activity ideas, they have obtained through social media in the learning process, the efficiency in the process increases in parallel with the interest

and motivation of the children. About this, a preschool teacher (T22) explains the practices she has been doing as follows:

> I use them within the activities. I used it in classroom activities and live lessons. Wherever I need the plan of the day about the concepts that I would like to use. It can be a game, it can be a finger game, I combine it with my concepts and use it fluently in my activity.

It is determined that preschool teachers use social media to obtain different perspectives and creative activity ideas to make their learning experiences more effective and interesting. A preschool teacher on this subject states (T1): "I use them in the applications in class. When I see creative games by means of activities, different dramas, parkour games; I apply them in my classroom."

Another preschool teacher indicates that she employs activities by taking children's development levels into account by saying: "First of all, I use the ones that are suitable for the development levels of the children. This is how I use them. I mean according to the children's development levels."(T3)

Preschool teachers also mention self-criticism by comparing their behaviors with the information they get from social media by saying, "Considering the knowledge I have acquired from the articles or interviews, I try to ask myself and affirm it regarding how I behave. I try to self-criticize." (T5)

Category 7: Thoughts Regarding the Necessity of Using Social Media for Professional Development

'What do teachers think about the necessity of using social media for professional development?' The answers given to the question ' are given in Table 9.

Table 9.
Thoughts Regarding the Necessity of Using Social Media for Professional Development

Subcategories	n
To follow new developments	6
Ease of access to content	5
Speed	4
Too many alternatives	3
To understand the world of the new generation	2
Media literate	2
Take a lot of time	1
Feeling inadequate	1
Making people lazy	1

The views on whether using social media is necessary for their professional development are examined, all of the preschool teachers except one who participated in the research expressed positive opinions. More concretely, the self-development of preschool teachers is extremely important, and the continuity of the learning process should be ensured. At this point, teachers indicate that social media is an exceptionally useful source. The opinions of preschool teachers demonstrate that the use of social media has become absolutely important and has gained weight in terms of being able to follow the current developments, the easiness of accessing the contents, its speed and abundance of alternatives, and enabling communication and sharing. One of the teachers (T1) having this belief expresses:

> Yes, I think social media is necessary. We live in an information age. Profiting from social media and technology has positive impacts in every aspect. We can easily access the information. In the professional sense, it is a great blessing for us to have such an endless resource at our disposal at any time we want. I can find everything I am looking for and reach it in no time.

Another preschool teacher supporting this view states (T14):

> I think it is extremely important as we live in the internet age. Today, accessing the internet and smartphones is really easy. I find it positive. Because access is easy. We see more and more alternatives. At its simplest, we can make presentations to children in a way that addresses more senses of them by profiting from the internet. I find it necessary.

On the other hand, some preschool teachers like others, express that it is necessary to use social media tools, as they contribute to personal and professional development, and they explain that the reason behind this is to understand the new generation's world and to be able to communicate with them in addition to the curriculum. By emphasizing this view, a preschool teacher considering the use of social media is necessary states (T7): "Yes, definitely. Not only for our professional development, but it is also an environment that young people follow a lot, whether it is Facebook or Instagram. Perhaps, it is necessary to better understand and get to know them."

Another noteworthy aspect of preschool teachers' opinions is their statements that social media and using social media will contribute to individual and professional development if used appropriately and correctly. Teachers who support this opinion emphasized the importance of good media literacy in a teacher who uses social media. Regarding this matter, a preschool teacher states (T5): "I do not have a clear opinion on whether it should be completed or not. Of course, the more open we are to improving ourselves, the better, but as I previously stated, I believe we must filter and adapt. I believe we must be selective."

There are also preschool teachers who gave partially negative responses about the importance of social media in teacher self-development. Preschool teachers who have this opinion emphasize that these actions take a long time, the teacher may feel inadequate, and social media makes people lazy. At the same time, they stated that while social media is being used more due to the pandemic, face-to-face education is more beneficial. Regarding this matter, a preschool teacher states (T10):

> To be honest, I do not think it is necessary. There were no smartphones before. We used to send these things in small letters or, before the pandemic, in small meetings by arranging a suitable time for children and a suitable time for parents. But now, I cannot say we do not use smart technology. It also helped to make our job easier. It also made people a little lazy. They were having difficulty finding time. They are now studying from home. It seems to be better for them, but I believe it is better to face to face. We used to do small face-to-face training, but now we need a phone, there is nothing to do anymore.

Category 8: Things They Consider While Professional Sharing on Social Media

'Things They Consider While Professional Sharing on Social Media' are given in Table 10.

Table 10.
Things They Consider While Professional Sharing on Social Media

Subcategories	n
Not sharing	13
Not sharing children's faces	10
Sharing the right information	1
Getting permission from the parent and child	1

Preschool teachers who share or do not share stated that they did not think it was appropriate to share children's faces, and they emphasized the importance of sharing accurate information. Teachers stated that they make all efforts not to violate the children's rights. They also stated that they obtained permission from the parents and children before sharing the children's faces. Regarding this matter, a preschool teacher states (T18): "I make certain that the children's faces are not visible. Because we are not permitted to share photos without parental consent. As a result, if I take photos of their faces, I usually put emojis on them or try to visualize the activity without taking them"

Another preschool teacher thinks (T10): "As you have said, I am sharing after double-checking the accuracy of what I am about to share. Because teaching someone the wrong thing starts a chain reaction that cannot be reversed. It is critical to me that it is correct."

Discussion, Conclusion and Recommendation

According to the answers obtained from the first research question, teachers primarily use social media to find examples of activities, videos, and songs to receive training, or to attend seminars. According to the answers obtained from the fourth research question, it is understood that following social media provides teachers with theoretical and practical support in the fields of creativity, activity diversity,

child development, and education. Teachers can share their professional knowledge and experience with their colleagues and participate in educational discussions by working collaboratively with colleagues around the world, they can support their creativity, thus support the lifelong learning process (Carlson & Gadio, 2002). One of the most significant results of this study is that preschool teachers use social media for professional development and make contributions. Furthermore, most of the teachers agree that using social media for professional development is necessary, useful, and simple. Teachers can be said to use social media for professional development to improve themselves, follow innovations, be inspired in their profession, and access up-to-date, creative, and innovative content. The obtained results are consistent with the results of a study conducted by Dermentzi, Papagiannidis, Toro, and Yannopoulou (2016). According to the findings of the current study, social media is an effective way to stay in touch with other teachers. In another study, teachers reported that social media allowed them to stay up to date on developments in their fields (Tenopir, Volentine, & King, 2013, Veletsianos & Kimmons, 2013). According to McLoughlin, Brady, Lee, and Russell (2007), teachers use social media to overcome document and material deficiencies in their institutions, communicate with parents more easily, reach leaders in their fields more easily, and gain support to improve the quality of learning processes. Social platforms have the potential to provide significant socio-cultural opportunities through learning experiences such as interaction, feedback correction, group belonging, ease of access to information, content structuring, and ease of sharing content (Yokuş & Yanpar Yelken, 2019). Uyanık-Aktulun and Elmas (2019) emphasized the advantages of social media for preschool teachers, such as the ability to create personal learning networks, collaborate with colleagues, access rich content documentation, develop their creativity, and find career opportunities. All studies focusing on the role of social media in teacher professional development concluded that social media promotes teacher professional development (Ostashewski, Moisey, & Reid, 2011; Visser, Calvert Evering, & Barrett, 2014). Similar to the literature, it can be said that social media is a powerful source of professional development for teachers.

According to the answers obtained from the second research question, teachers use Instagram, Pinterest, WhatsApp, YouTube, Facebook, Google, Telegram, and Twitter. According to the answers obtained from the third research question, it is understood that teachers, follow the pages of preschool teachers, academicians, activity pages, and official accounts on Instagram. Similarly, teachers stated that they used Instagram the most, and it was seen that teachers followed the accounts on Instagram. In a study, it was emphasized that applications such as Facebook and Instagram can be used to support problem-solving and cooperative learning skills (Kıcı & Dilmen, 2014). In the study, it was determined that Instagram can be used to support learning, similar to the literature.

According to the answers obtained from the fifth research question; teachers doubt the accuracy of professional information obtained from social media and think that the information they receive from the accounts they trust is correct. However, it is understood that they rely on the accuracy of information obtained from accounts they trust without raising too many concerns. This complicates the use and dissemination of false information. While some of the teachers confirmed the accuracy of the information, they obtained from the media by asking others, it was discovered that some of them passed through their logic filter. Professional development for preschool teachers is actively pursued through the use of social media. However, the tendency of teachers to use content obtained from accounts they trust without questioning suggests that teachers need to be supported in media literacy. Tekin and Işıkoğlu Erdoğan (2020), in a study they conducted, revealed that preschool teachers have no idea about media literacy and that media literacy means controlled use of media by teachers and being selective. Similarly, Güneş and Toran (2022) discovered that preschool teachers needed assistance with technology literacy, using technological platforms, and creating digital content and that they were lacking technological pedagogical content knowledge proficiency. Gözüm, Metin, Uzun, and Karaca, (2022) emphasized that teachers' ICT use, competencies, and self-efficacy in the distance education process became a priority in early childhood education. Also, Gözüm and Demir (2021), drew attention to the relationship between technology, pedagogy, and content knowledge that teachers acquired in the pre-service period. Uyanık-Aktulun and Elmas (2019) also emphasized that preschool teachers and prospective teachers should keep technology literacy at the forefront of their education and professional lives and that they should be constantly supported by pre-service and in-service training programs developed by institutions. It is reported that power lies within media literacy in

today's digital era (Rogow, 2017). Furthermore, preschool teachers can be said to have responsibilities in the process of children becoming media literate. According to Donohue (2017), adults who are responsible for children are media consultants for children. It is concluded in this context that preschool teachers must be media literate as well as support the media literacy of children. Preschool teachers believe that it is critical to improving themselves, that the learning process should be continuous, and that social media is a great resource at this point, but they also believe that social media wastes a lot of time. This demonstrates the importance of media literacy training for teachers. Media literacy consists of six basic actions, the first of which is to access the media on purpose (Herdzina & Lauricella, 2020, Scheibe & Rogow, 2012). Teachers who understand how to use media tools purposefully can manage the time they devote to social media and improve their ability to avoid harm by reaping the benefits of social media. In the research, it can be said that teachers should be supported in terms of media literacy, similar to the literature.

According to the answers obtained from the sixth research question; teachers stated that the information they obtained through social media tools increased productivity and motivation in children, and supported creativity. It has been found that when preschool teachers incorporate social media into their implementation processes, it has a positive impact on both classroom environments and children. It has been determined that applications based on ideas obtained from social media are more creative, fun, and interesting and that the learning process is more efficient. It can be said that other resources that preschool teachers can use to enrich their implementation processes are limited. Uyanık-Aktulun and Elmas (2019) emphasized that by using social media posts, preschool teachers can create new arrangements in educational environments, design new materials, and provide different learning experiences for children. Similar to the literature, it can be said that social media will bring innovation to the learning environment.

According to the answers obtained from the seventh research question, teachers stated that thanks to social media, they follow new developments, provide easy access to content, social media is fast, offers them many alternatives and media literacy is important. In one study, teachers emphasized the possibility of social networks to access information, share information, access and interact with people (Tombuloğlu & İşman, 2014). Results from another study demonstrated that an individual's use of social media as professional learning spans understanding, networking, professional identity development, and transformative learning (King, 2011). In the research, it can be said that social media is an innovative, fast, and easily accessible learning resource, similar to the literature.

According to the answers obtained from the eighth research question, teachers stated that they attach importance to not sharing children's faces while sharing professionally on social media, obtaining permission from children and their families for sharing, and sharing accurate information. Some teachers stated that they did not share anything but were only followers. More than half of the preschool teachers said they do not share anything on social media and only use it for follow-up. Teachers are active media consumers, but they are not active content creators. Producing media content is one of the core actions of media literacy, and producing media content involves generating and expressing ideas through the media (Herdzina & Lauricella, 2020, Scheibe & Rogow, 2012). It can be said that teachers should be supported in their ability to create media content and connect that content to the larger world. The various results of the current study show the importance of supporting preschool teachers in media literacy.

Teachers who shared stated that they paid attention to the accuracy of the information they conveyed and that they generally shared activities and educational content for families. In particular, teachers emphasized that they are careful not to share children's faces and that they attach importance to children's rights. It can be said that teachers are conscious and sensitive in this regard. Teachers can create and share social media content for professional development purposes as long as children's privacy rights are respected. If the teacher share sharing of the photographs, sounds, and images of children on social media without consent, this means a violation of the child's personality rights and private life. Due to these violations, there are court decisions in Italy, Austria, and Turkey that punish the child's family or prohibit sharing (Serin, 2019). The Convention on the Rights of the Children aims to protect the child against the negative effects of mass media with Articles 13 and 17 (United Nations International Children's Emergency Fund, n.d.). The media contains contradictions as both a tool for

the child's free expression and a factor that can harm his mental, physical, and cultural development. It has been stated in a circular issued by the Ministry of National Education that it is a crime to make audio, text, photo, and video recordings of children and to illegally share them in various digital and printed media and that necessary measures will be taken to prevent these situations (MONE, 2017). Marin, Carpenter, and Tur (2021) stated that teachers who use social media for professional purposes lack knowledge of data privacy policies and regulations, and they drew attention to the data privacy and data literacy training needs of educational social media users.

Preschool teachers take responsibility for their professional development by searching social media about their interests, following various accounts, accessing media content, and engaging in lifelong learning. Teachers create a learning network by communicating with their colleagues using social media. Preschool teachers must raise the children's awareness of learning activities based on social platforms during this process. In order to make effective use of social platforms, preschool teachers need to be made aware of how they can use these platforms for professional development.

Preschool teachers can benefit from comprehensive and effective media literacy training to make their use of social media more efficient for professional development. These courses can be delivered via social media platforms. When using social media for professional purposes, teachers who create and share media content should be made aware of children's rights and ethical principles. If preschool teachers use social media correctly, it can be an excellent tool for information dissemination. It will also contribute to the promotion and appreciation of early childhood education services on a larger scale. Researchers can deepen their research on the relationship between social media and teachers' lifelong learning processes.

Limitations

This research is limited to the teachers working in the public kindergartens in the Ankara province in the spring term of the 2020-2021 academic year.

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Effectiveness of Virtual Reality Technology in Teaching Pedestrian Skills to Children with Intellectual Disabilities[1]

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Abstract

Pedestrian skills are important for children with intellectual disabilities to continue their daily lives independently. This study aims to determine the effectiveness of virtual reality in the acquisition and maintenance of pedestrian skills for children with intellectual disabilities. In addition, the effect of virtual reality on participants generalizing their pedestrian skills to real environments has also been examined. In the study, social validity data were collected from the participants and their mothers regarding the results of the study. Three intellectually disabled children between the ages of 11 and 15 participated in the study. In the study, a multiple probe design with an inter-participant probe trial, which is one of the single-subject research models, was used. It is seen that all participants learned pedestrian skills and continued the skills they learned one, three, and five weeks after the completion of the instruction. In addition, all participants were able to generalize their skills to the real environment (pedestrian crossing and illuminated pedestrian crossing). When the social validity data collected from the participants and their mothers were examined, it was revealed that teaching with virtual reality applications is interesting and fun, in addition, it can be used for different educational purposes.

Keywords: Pedestrian skills, using the crosswalk, using the illuminated crosswalk, virtual reality, children with intellectual disabilities.

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Introduction

Since ancient times, individuals with mental disabilities have been exposed to different practices and labels according to the needs of the society they live in, due to their characteristics or the difficulties they experience in daily life (Bryan, 1974). In the historical process, the definition of intellectual disability and the dynamics that make up the definition have changed in order to prevent the labeling of individuals with intellectual disabilities. In the 12th guideline published by the *American Association on Intellectual and Developmental Disabilities* (AAIDD) in 2010, the support services provided to the individual were highlighted and it was emphasized that the level of functioning of the individual would increase provided that adequate and appropriate support services are not permanent. The definition included the criterion of *'significant limitations in cognitive functions, limitations in adaptive skills, and the occurrence of this condition before the age of 18'.*

In the last guideline published by AAIDD in 2021, the definition was updated as *"significant limitations in cognitive functioning and adaptive skills that also affect conceptual, social and practical adaptation skills, and these limitations appear before the age of 22".* For adaptive behavior, in the 2021 guideline, the expression *'The sum of the conceptual, social, and practical skills learned and used by people in their daily lives'* is included. The definition and the change in the dynamics that make up the definition aim to provide appropriate support and training services, by preventing labeling (AAIDD, 2010).

The purpose of support and education services is to enable individuals with intellectual disabilities to function independently in their daily life, school, and work environments. Intellectually disabled individuals need frequent repetition, hints, or intensive training to learn many skills that their peers randomly learn in their daily life or school life (Friend, 2006). This situation makes the usage of scientifically based applications compulsory, which are effective and will provide the most benefit to the individual (Browder et al., 2020). A systematic evaluation process is required to determine the academic, self-care, language-communication, safety, and daily life skills needs of individuals with intellectual disabilities and to provide support services. The evaluation process is important for determining the skills needed by the individual and for the preparation of training programs for the individual (Wehmeyer et al., 2016; Turnbull et al., 2020). Individualized Education Programs (IEP), which will be prepared by taking into account the strengths of mentally handicapped individuals, will enable them to lead their lives independently. Teaching safety skills has vital importance in order to prevent risky situations and events that may be encountered during and after the transition to an independent life, and to protect the mentally retarded individual (Mechling, 2008).

Security skills are the skills that an individual needs to avoid possible harm, protect himself from the harm that occurs in sudden situations, or end the situation when faced with verbal or non-verbal negative behaviors and situations such as accidents, fire, kidnapping, and harassment (Clees & Gast, 1994; Jang, Mehta & Dixon, 2016). Difficulties in inference, reasoning, vision, communication, and motor skills or psychopathological situations cause intellectually disabled children not to realize that they may be harmed when they are exposed to dangerous situations and not be able to protect themselves from these situations. Such situations can result in intellectually disabled children being exposed to harassment, violence, or life-threatening situations in everyday environments such as home, school, or public places (Zirpoli, 1986; Gast et al.,1992; Levy and Packman, 2004). While individuals with normal development acquire these skills randomly along with maturation, cognitive development, and the situations they encounter in their daily lives, individuals with intellectual disabilities need support in the acquisition of these skills (Kim, 2010; Jang, Mehta, & Dixon, 2016). Studies show that individuals with disabilities learn to recognize, prevent and respond to potential emergencies and unsafe situations through systematic teaching (Matson, 1980; Haseltine &

Miltenberger, 1990; Mazzucchelli, 2001; Batu et al., 2004). However, it is seen that safety skills are not sufficiently included in children's IEPs due to some reasons stemming from families and teachers (thinking that they can be overcome with advice/protection, raising children overly dependent on the family, thinking that it is very difficult to learn these skills, insufficient knowledge about security skills, etc.) (Şirin, 2015). Pedestrian skills are one of the skills required for individuals with intellectual disabilities to lead their daily lives safely and to live independently in the community (Matson, 1980; Limbourg and Gerber, 1981; Katz et al. 2005). Individuals with mental disabilities who can walk safely on streets and avenues will be able to take an active role in society by functioning independently, such as doing their daily work, spending time with friends, and taking short trips in the city (Horner, Jones, & Williams, 1985; Mowafy & Pollack, 1995). However, there is a high risk for disabled people to take to the streets by relying on the experience and awareness of the drivers in order to teach in real environments. In particular, it is almost impossible to teach people with disabilities on roads with heavy traffic or at intersections (Matson, 1980).

Hundreds of thousands of traffic accidents occur every year in the world. Accordingly, pedestrians are also involved in traffic accidents and even lose their lives. In Turkey, the rate of death in pedestrian accidents is higher than in many European countries. A serious portion of fatal accidents occurs as a result of 'pedestrian collisions' and in 95% of these accidents, the drivers are at fault (Sungur et al., 2014). According to the data published by the Turkish Statistical Institute (TUIK), in 2020 there were 983,808 traffic accidents in the country. 150,275 of these accidents resulted in fatal injuries and 19.9% of those who lost their lives were pedestrians. 10.1% of the accidents resulting in injury occurred in traffic accidents involving pedestrians. In light of these data, many existing techniques and methods used for the teaching of pedestrian skills do not allow the repetitive applications needed for intellectually disabled children to cross the street safely. Virtual reality, on the other hand, allows practice repetitions in the skills to be taught, even in situations where teaching poses a risk (Schwebel & McClure, 2010). Adaptations to the street, pedestrian crossing, traffic light, and traffic density according to the cognitive characteristics of intellectually disabled children, provide the opportunity to increase the environmental reality (Josman et al., 2008; Wright & Wolery, 2011). Virtual reality applications eliminate all risks that may occur in the teaching of ethical and life-threatening skills. These applications can be easily applied in environments such as home and school and can be used safely in the teaching of critical skills such as fire, first aid, and pedestrian skills. When the literature is examined, it is seen that pedestrian skills are taught by using methods and environments such as video models, in-class adapted environments, public spaces (parking lots, closed roads, etc.), peer models, and question and answer (Page et al., 1976; Matson, 1980; Spears et al., 1981; Marchetti et al., 1983; Horner et al., 1985; Colins and Stinson, 1993; Branham et al., 1999; Batu et al., 2004). However, the techniques and methods used, do not provide the opportunity to adapt according to individual characteristics and frequent repetitions needed for the teaching of pedestrian skills. Virtual reality applications, on the other hand, eliminate all risks that may occur in the teaching of skills that carry ethical and vital risks. These applications can be easily applied in environments such as home and school and can be used safely in the teaching of critical skills such as fire, first aid, and pedestrian skills. Many security skills have been studied with different techniques and methods in the national and international literature, but the fact that these studies could not be taught in a realistic or real environment was included in the limitations of the research.

At this point, virtual reality applications can be designed with the images, and sounds of real environments and the people in those environments, without risk, and offer personalized experiences as close to reality. Therefore, this study will be a first in teaching pedestrian skills with virtual reality applications to intellectually disabled individuals and will make an important contribution to the literature.

Purpose

This research aims to determine the effects of virtual reality applications on teaching pedestrian skills to intellectually disabled children. Research questions for this general purpose are given below:

1.1. Are virtual reality applications effective in teaching children with intellectual disabilities the skill to cross the street using pedestrian crossing?

1.2. Are virtual reality applications effective in generalizing the ability of children with intellectual disabilities to cross the street using pedestrian crossing?

1.3. Can the behavior be maintained 1, 3, and 5 weeks after the end of teaching the skill of using pedestrian crossing to with intellectual disabilities children through virtual reality applications?

1.4. What are the views of parents and teachers on teaching children with mental disabilities the ability to cross the street using the pedestrian crossing with virtual reality applications?

2.1. Are virtual reality applications effective in teaching children with intellectual disabilities the skills to cross the street using the illuminated pedestrian crossing?

2.2. Are virtual reality applications effective in generalizing children with intellectual disabilities the skills to cross the street using the illuminated pedestrian crossing?

2.3. Can the behavior be maintained 1, 3, and 5 weeks after the end of teaching the skills to cross the street using the illuminated pedestrian crossing to children with intellectual disabilities through virtual reality applications?

2.4. What are the views of parents and teachers on teaching the skills to cross the street using the illuminated pedestrian crossing to children with intellectual disabilities with virtual reality applications?

Method

Research Model

In this study, the effectiveness of virtual reality applications in teaching pedestrian skills to mentally disabled children was examined. For this purpose, the multiple probe design with probe trials across participants, which is one of the single-subject research methods, was used. Experimental control in multiple probe designs is provided by a change in the data level or trend of the situation in which the application is made, no change in the data level or trends of the participants who have not yet been applied, and similarly, a similar change in the trend or level of the data occurs diachronically in the other participants as the application takes place (Tekin-İftar, 2012a). The dependent variable of this research is the increase in the acquisition level of pedestrian skills of children with intellectual disabilities. *The skills of crossing using the pedestrian crossing and crossing using the illuminated pedestrian crossing,* which are the pedestrian skills included in the study, were determined as a result of the literature review. *The skills of crossing the road using the overpass and crossing the road using the underpass*, which are among the other pedestrian skills planned to be studied, were excluded from the study's dependent variables, taking into account the city conditions in which the children live. Attention was paid to the fact that the dependent variables were independent from each other, but had functionally similar and close difficulty levels. For the analysis of pedestrian skills included in the study, expert opinion was obtained from two instructors who completed their Ph.D education in the field of special education.

Ethics Statement

Research ethics approval was obtained by Trakya University Social and Human Sciences Research Ethics Committee (Date: 20.10.2022/ Decision number: 08/03).

Table 1.
Crossing skill analysis using the pedestrian crossing

He/She comes to the pedestrian crossing.
He/she stops on the pavement before landing on the road.
He/she checks the road by looking to the left, then to the right, and again to the left.
If the vehicle is not coming or is too far away, He/she walks across the road.
When it reaches the middle of the road, He/she looks to the right again.
Walks quickly without running over the crosswalk lines.
He/she goes to the opposite sidewalk.

Table 2.
Crossing skill analysis using the illuminated pedestrian crossing

When coming to a pedestrian crossing with a pedestrian light, he/she stops two steps from the side of the road.
He/she looks at the traffic light.
If it is red, he/she waits.
When the green light is on, he/she looks to the left first and walks if the cars have stopped.
When he/she comes to the middle of the road, he/she looks to the right again.
He/she goes to the opposite sidewalk.

The independent variable of the research is the teaching application presented with virtual reality glasses. Virtual reality is defined as the technology that enables people to interact with these objects in the environment, as well as giving the feeling of being in a real environment in the minds of people with 3D pictures and animations created in the computer environment (Çavaş et al., 2004).

Participants

Participants in the study were determined as a result of interviews with teachers and their families. In the interviews, the prerequisite skills that the participants to take part in the research process should have were specified, and 3 participants who could take part in the study were determined in line with these skills. Some prerequisite skills were sought in the participants in the study. These prerequisite skills are: a) to be diagnosed with intellectual disability, b) to have no visual impairment, c) to have gross motor skills such as walking, running, jumping, and turning one's head left and right, d) to be able to correctly follow instructions that state two actions, e) during the virtual reality application, the participants know the concepts of place and direction and the colors in the traffic light so that they can position themselves in the virtual environment and feel the sense of direction, f) be able to direct the attention of the participants to the video images in the virtual reality glasses.

Table 3.
Characteristics of the students participating in the research

Student	Age	Gender	Diagnosis
Özge	15	Female	mental disability
Elif	14	Female	mental disability
Cemil	11	Male	mental disability

Setting

The applications were carried out in the drama hall and the researcher's room in the same building. The pilot application of the research was carried out in the special education and rehabilitation center where the participants attended. The starting level of the research, the implementation, and the follow-up sessions were held in the drama hall and the researcher's room. Generalization sessions were conducted in real environments, on roads closed to traffic with real pedestrian crossings and traffic lights.

Tools

For the virtual reality application, which is the independent variable of the research, Bobo VR Z4 and Bobo VR Z5 virtual reality glasses were used. The reason for choosing the glasses used is that they are light and have a built-in speaker system. The virtual reality glasses used offer an immersive viewing angle of up to 120 degrees. In addition, control devices that enable Bluetooth connection with smartphones or computers were purchased together with the glasses.

The virtual reality application, which includes the pedestrian skills to be taught, is the training application program prepared for pedestrian safety training called Crosswalk VR App 1. The application consists of three-dimensional spatial images required for users to cross the street and allows the implementation to be made without actually going out on the street. In order to process the responses of the participants in the Crosswalk VR App 1 application to the data recording form, the images must be transferred to the interface on the computer. Wi-Fi connection was sometimes used for this process, but there were problems in image transmission due to the variability in internet quality, and after a few implementations, the data was sent to the interface on the computer only with the help of data transfer cables.

Basically, this process is mandatory for the practitioner to see the environment seen by the participant, for the reactions to be recorded on the registration form, and for error corrections. This process was used to see and record the reactions of the participants while wearing the virtual reality glasses with the Crosswalk VR App 1 application. A program or interface through which images are transferred and the user can see participant reactions is essential for application reliability. For this process, a program which is called Vysor was purchased and used with its license. The Vysor program is used to send the image on the smartphone or computer to the desired vehicle with high resolution. The program also transfers the sound along with the image and allows the recording of data in real time. As explained in the previous paragraphs, a connection can be established with the help of Wi-Fi, a Web Port, or a data cable.

Table 4.
List of tools used in the research

Laptop	Virtual reality pedestrian app
Desktop	Data transfer cable x 2 (3 meters)
Camera	3D image transfer program - Vysor
Smartphone	Internet connection/Wi-Fi
Virtual reality glasses x 2	Initiation/implementation/monitoring data
Virtual reality controller x 2	forms

Pilot Study

A pilot study was conducted in order to determine the problems that may be experienced in the functioning of the dependent and independent variables, the tools and data forms to be used at the beginning, probe, teaching, and follow-up phases of the study, and to solve them beforehand. The pilot study was carried out with the teaching procedure and tools to be followed during the experiment. The study was carried out with a student who had the prerequisite skills of the students who would participate in the experiment process.

The pilot study was carried out in the special education and rehabilitation center where the determined student was educated. Permission for the study was obtained from the student's institution director, teacher, and parents. The study lasted two days, with a total of five beginning levels and five practice sessions. The laptop to be used during the application, virtual reality glasses, control devices, Crosswalk VR application, data cables, Vysor interface program, the responses of the participants when the virtual reality glasses are put on and off, and data collection forms were tested.

On the first day of the pilot study, there were technical problems in transferring data from the virtual reality glasses to the computer screen. This situation prevented the practitioner from properly processing student responses into the data recording form and systematically using the reinforcer schedule. In addition, the student had difficulty in establishing the relationship between the virtual

reality glasses and the control device. This situation was associated with not giving enough information to the student during the presentation of the materials. In the sessions on the second day, the problem of data transfer to the computer screen was solved with the help of data cables with a length of 3 meters and a data transfer capacity of 480 Megabits/second. The solution to the data transfer problem enabled the practitioner to collect data in accordance with the procedure and to use the reinforcer schedule within the specified criteria. In addition, allowing the participant to play the games downloaded from the Google App with the virtual reality glasses and controller at the beginning of the second day helped the participant to recognize the devices and eliminated the problems experienced during the application phase.

Experimental Process

The entire experimental process was carried out by the researcher through one-on-one teaching. Sessions were held within the scope of Covid-19 importance. Within the scope of social distance, mask, and hygiene rules, the practice environment was ventilated before and after the teaching sessions, the hands were disinfected before the students were taken to the practice environment and they were not allowed to remove their masks. After the teaching sessions, the hands of the students were disinfected and their masks were changed. The same disinfection processes were carried out for the materials used. In addition, students were not allowed to use public transportation vehicles on their arrival and departure, they were taken from their homes at the specified times with the knowledge of the families and left at the end of the application in the same way.

Before starting the research, verbal and written permission was obtained from the families of the participants regarding data collection and camera shooting. For the teaching of the dependent variable, three days a week, Friday, Saturday, and Sunday, were studied and three teaching sessions were held each day. The probe sessions were taken just before the fourth teaching session, after the three teaching sessions.
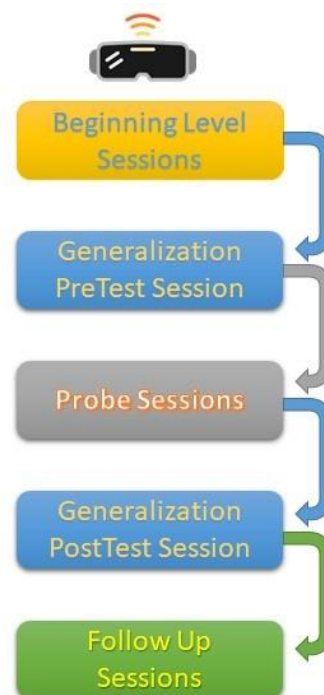

Figure 1. The Implementation Procedure to Be Repeated for Each Participant

After the first of the beginning level session were held with all three of the participants, the second and third sessions of the beginning level session were also taken with the first participant. After the beginning level session of the first participant was completed, a generalization pre-test session was held and then teaching sessions and intermittent probe sessions were started. Intermittent probe sessions were held after each of the three teaching sessions. After the first probe session, in which the first participant gave a 100% correct response, probe sessions were held for the other two participants.

When the first participant gave a 100% correct response in three consecutive sessions, the teaching sessions were terminated and a generalization post-test session was held. Follow-up sessions were held one, three, and five weeks after the generalization post-test sessions. The experimental process of the research continued from the first beginning level session to the last follow-up session for the first participant and lasted for three months.

Beginning Level and Intermittent Probe Sessions

After preparing the environment and tools for the beginning level and intermittent probe sessions, the sessions were held. Beginning level sessions were continued until stable data were obtained for three consecutive sessions in all participants. During the sessions, the participant's attention to the practice and the researcher was reinforced, but after the skill instruction was given, the reinforcer was not presented. At the beginning level and intermittent probe sessions, the Crosswalk VR application was opened to the participants through virtual reality glasses, and skill instruction was presented (Crosswalk). In this process, the single opportunity method was used and if the participant could not perform one of the skill steps, the trial was terminated and the next trial was started.

Teaching/Implementation Sessions

The participants were taken to the teaching sessions after all the necessary preparations were completed and the environment and equipment were ready. The attention-provoking stimulus was presented to the participants ('Hello Özge, are you ready to work with me today?', 'Cemil, are you ready to work with virtual reality glasses today?'). It is Reinforced when the student stated that he/she was ready verbally or with facial expressions ("Great, then let's put on the virtual reality glasses and get to work.'). After the virtual reality glasses were put on the participant properly, the image on the interface was checked from the computer (this process takes an average of six seconds) and the skill instruction was presented.

Generalization Sessions

In the study, generalization sessions were conducted to determine the level of generalization of the skills learned by the participants to different people, environments, and tools. Generalization sessions were held as pre-test generalization sessions after beginning level data were collected, and post-test generalization sessions after the teaching sessions were completed. The generalization data of the skills of *crossing using the pedestrian crossing and crossing using the illuminated pedestrian crossing*, which are the dependent variables of the study, were carried out in real pedestrian crossings and illuminated pedestrian crossings. One more adult attended the sessions to provide assistance and safety to the practitioner. In addition, the names in the study are not the real names of the participants.

Follow-up Sessions

After the participants completed the teaching sessions, follow-up sessions were held to determine to what extent they were able to demonstrate the skills they learned. Follow-up sessions were held one, three, and five weeks after the end of the instruction.

Inter-Observer Confidence Data

In the study, inter-observer reliability data, the "consensus / (consensus + disagreement) x 100" formula was used. Consensus and disagreement will be calculated together with the data recording forms to be filled in by the observers and the data collected by the researcher (Tekin-İftar and Kırcaali-İftar, 2012).

Inter-observer reliability data were collected and analyzed from 30% of all sessions regarding the beginning level, teaching, probe, generalization, and follow-up sessions conducted in the study. Inter-observer reliability data for all phases of the study are shown in Table 5.

Table 5.
Inter-observer reliability findings for all participants and stages regarding teaching pedestrian skills with virtual reality application

Participant	Beginning Level	Teaching	Probe	Follow-up	Overall Average
Özge	100%	100%	100%	100%	100%
Elif	100%	100%	100%	100%	100%
Cemil	100%	100%	100%	100%	100%

Social Validity Data

At the end of the study, social validity questionnaires prepared by the researcher were applied to the participants and their mothers. In the forms, questions about the dependent and independent variables were asked and the answers were recorded. There are nine closed-ended questions in both forms prepared for the participants and mothers, and they were asked to choose one of the options yes, no, or undecided in response to these questions.

Table 6.
Social validity data form for participants

Questions	f	Yes %	No %	Undecided %
1. Do you enjoy learning things using Virtual Reality glasses?	3	100	0	0
2. Did you enjoy learning pedestrian skills?	3	100	0	0
3. Did you enjoy learning to cross the street using the pedestrian crossing?	3	100	0	0
4. Did you enjoy learning to cross the street using a traffic light?	3	100	0	0
5. Would you like to participate in such a study again?	3	100	0	0
6. Do you want your teachers or parents to work with you with Virtual Reality glasses?	3	100	0	0
7. Can you cross the crosswalk on your own?	3	100	0	0
8. Can you cross by yourself using the traffic light?	3	100	0	0
9. Do you want your friends to learn what you learned?	3	100	0	0

Table 7.
Social validity data form for mothers

Questions	f	Yes %	No %	Undecided %
1. Do you think safety skills are important skills for your children?	2	100	0	0
2. Do you think pedestrian skills are important skills for your children?	2	100	0	0
3. Have you tried teaching your child pedestrian skills?	2	0	100	0
4. Do you like the use of Virtual Reality for teaching pedestrian skills to your child?	2	100	0	0
5. Have you ever used Virtual Reality applications for entertainment or trial purposes with your child?	2	0	100	0
6. Have you ever used Virtual Reality applications to teach your child?	2	0	100	0

Table 7 continuing

7. Have you ever thought that you can teach your child with Virtual Reality glasses?	2	0	100	0
8. Do you think Virtual Reality applications are effective in teaching pedestrian skills?	2	100	0	0
9. Would you prefer to use Virtual Reality applications to teach your children?	2	100	0	0

Findings

Figure 2 and Figure 3 show the graphics of the students participating in the study on teaching the skills of crossing using the pedestrian crossing and using the illuminated pedestrian crossing with a virtual reality application. Data for each student and skill are shown in a line chart. The horizontal axis in the line graph shows the number of sessions, and the vertical axis shows the correct response percentages of the participants. The line chart contains data for beginning, probe, and Follow-up sessions.

Findings on the teaching of crossing skills using the pedestrian crossing with virtual reality application
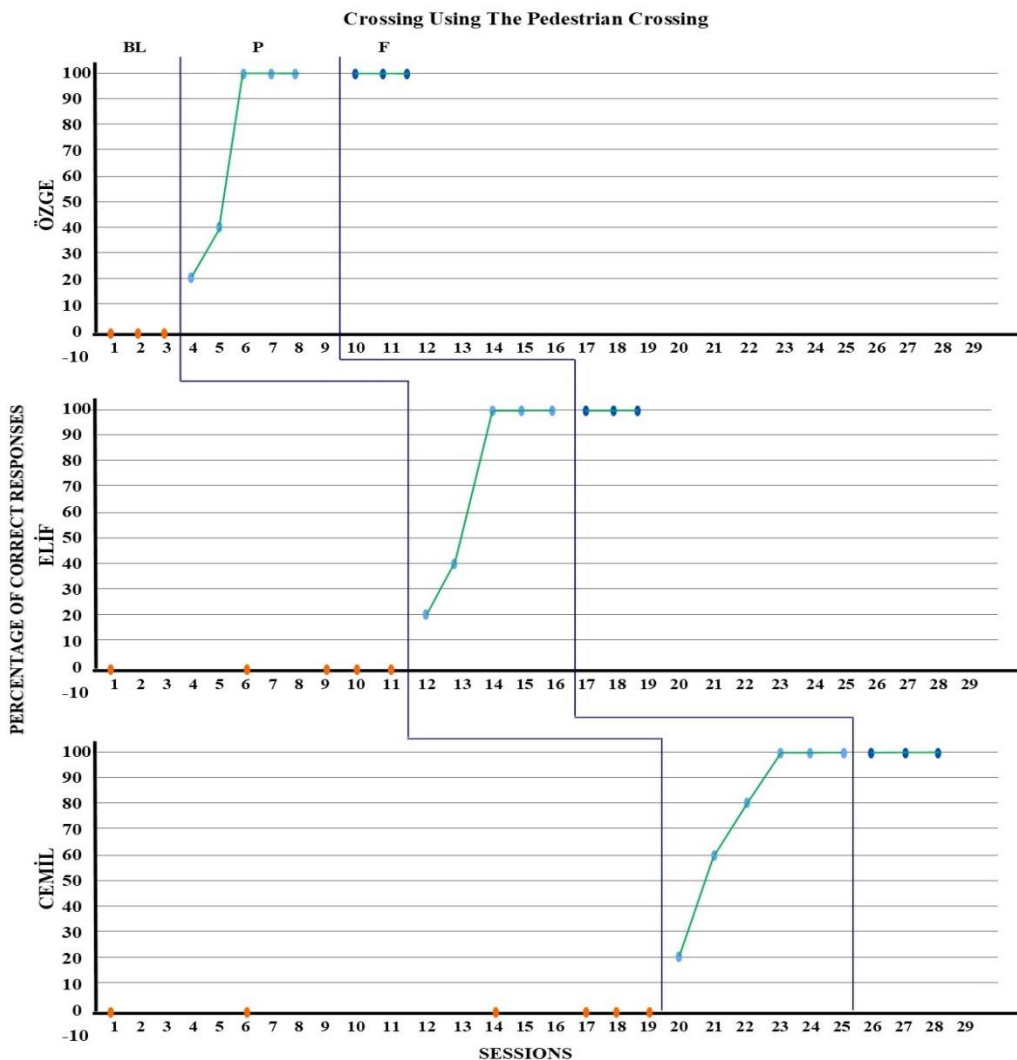

Figure 2. The correct response percentages in Özge, Elif, and Cemil crossing using the pedestrian crossing in the beginning level (BL), probe (P), and follow-up session (F).

The data obtained at the beginning level, probe, and follow-up phases regarding Özge's ability to cross the street using the pedestrian crossing are given in Figure 2. As seen in the graph, Özge's average

performance at the beginning level stage (0%, 0%, 0%) is 0%. After stable data were obtained at the beginning level stage, the implementation stage was started. In the first probe sessions taken during the implementation phase, 20% correct response percentage and 40% correct response percentage are seen in the second. In the third, fourth, and fifth probe sessions, it is seen that the 100% criterion was reached.

In the follow-up phase, when the criteria set in the implementation phase were met with the participant, it was examined whether the permanence effects of the teaching continued after 1, 3, and 5 weeks. It is seen that Özge continued to demonstrate the skill with 100% accuracy in all three follow-up sessions. This shows that the participant continues to exhibit the skill after the training is over.

The data show that Özge started to demonstrate her ability to cross the street using the pedestrian crossing with 100% accuracy at the end of six teaching sessions. Each point in the implementation phase represents three teaching sessions. 15 teaching sessions were held with Özge until the criterion was met and these sessions lasted for a total of 18.75 minutes.

The data obtained at the beginning level, probe, and follow-up phases regarding Elif's ability to cross the street using the pedestrian crossing are given in Figure 2. As seen in the graph, the average performance of Elif at the beginning level stage (0%, 0%, 0%, 0%) is 0%. When the criterion was met in the implementation phase with Özge, three more beginning-level sessions were held consecutively with Elif, the second participant, until stable data were obtained. After stable data were obtained at the beginning level stage, the implementation stage was started. Elif has a correct response rate of 20% in the first probe session and 40% in the second probe session. In the third, fourth, and fifth probe sessions, it was seen that Elif met the 100% criterion.

In the follow-up phase, when the criteria set in the implementation phase were met with the participant, it was examined whether the permanence effects of the teaching continued after 1, 3, and 5 weeks. It is seen that Elif continued to demonstrate the skill with 100% accuracy in all three follow-up sessions. This shows that the participant continues to exhibit the skill after the training is over.

The data show that Elif started to demonstrate her ability to cross the street using the pedestrian crossing with 100% accuracy at the end of six teaching sessions. Each point in the implementation phase represents three teaching sessions. 15 teaching sessions were held with Elif until the criterion was met and these sessions lasted for a total of 18.75 minutes.

The data obtained at the beginning level, probe, and follow-up phases regarding Cemil's ability to cross the street using the pedestrian crossing are given in Figure 2. As seen in the graph, the average performance of Cemil at the beginning level stage (0%, 0%, 0%, 0%, 0%) is 0%. When the criteria were met in the implementation phase with Elif, three more beginning-level sessions were held with Cemil, the third participant, in succession, until we obtained stable data. After stable data were obtained at the beginning level stage, the implementation stage was started. Cemil has a correct response percentage of 20% in the first, 60% in the second, and 80% in the third probe session taken during the implementation phase. In the fourth, fifth, and sixth probe sessions, it was seen that Cemil met the 100% criterion.

In the follow-up phase, when the criteria set in the implementation phase were met with the participant, it was examined whether the permanence effects of the teaching continued after 1, 3, and 5 weeks. It is seen that Cemil continued to demonstrate the skill with 100% accuracy in all three follow-up sessions. This shows that the participant continues to demonstrate the skill after the training is over.

The data show that Cemil started to demonstrate his ability to cross the street using the pedestrian crossing with 100% accuracy at the end of nine teaching sessions. Each point in the implementation phase represents three teaching sessions. 18 teaching sessions were held with Cemil until the criterion was met and these sessions lasted a total of 22.5 minutes.

Findings on teaching the skill to cross the street using the illuminated pedestrian crossing with virtual reality application
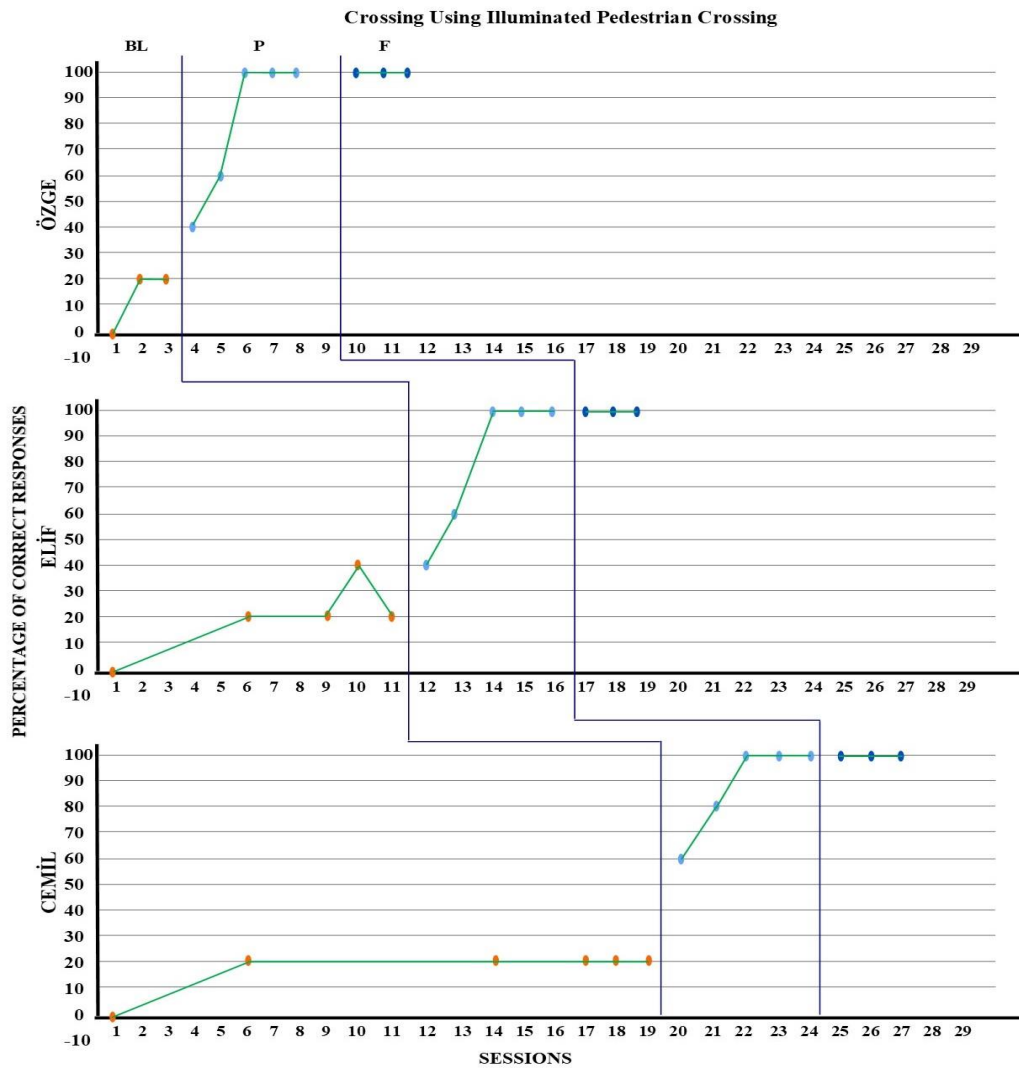

Figure 3. The correct response percentages in Özge, Elif, and Cemil crossing using an illuminated pedestrian crossing in the beginning level (BL), probe (P), and follow-up session (F).

The data obtained at the beginning level, probe, and follow-up phases regarding Özge's skill to cross the street using the illuminated pedestrian crossing are given in Figure 3. As seen in the graph, Özge's average performance at the beginning stage (0%, 20%, 20%) is 13.3%.

After stable data were obtained at the beginning stage, the implementation stage was started. In the first probe sessions taken during the implementation phase, 40% correct response percentage, in the second, 60% correct response percentage are observed. In the third, fourth, and fifth probe sessions, it is seen that the 100% criterion was reached.

In the follow-up phase, when the criteria set in the implementation phase were met with the participant, it was examined whether the permanence effects of the teaching continued after 1, 3, and 5 weeks. It is seen that Özge continued to demonstrate her skill to cross the street using the illuminated pedestrian crossing with 100% accuracy in all three follow-up sessions. This shows that the participant continues to demonstrate the skill after the training is over.

The data show that Özge started to demonstrate the skill to cross the street using the illuminated pedestrian crossing with 100% accuracy at the end of six teaching sessions. Each point in the implementation phase represents three teaching sessions. 15 teaching sessions were held with Özge until the criterion was met and these sessions lasted a total of 21 minutes.

The data obtained at the beginning level, probe, and follow-up phases regarding Elif's ability to cross the street using the pedestrian crossing are given in Figure 3. As seen in the graph, the average performance of Elif at the beginning level stage (0%, 20%, 20%, 40%, 20%) is 20%. When the criterion was met in the implementation phase with Özge, three more beginning-level sessions were held consecutively with Elif, the second participant, until stable data were obtained. After stable data were obtained at the beginning level stage, the implementation stage was started. Elif has an accurate response rate of 40% in the first probe session and 60% in the second probe session. In the third, fourth, and fifth probe sessions, it was seen that Elif met the 100% criterion.

In the follow-up phase, when the criteria set in the implementation phase were met with the participant, it was examined whether the permanence effects of the teaching continued after 1, 3, and 5 weeks. It is seen that Elif continued to demonstrate her skill to cross the street using the illuminated pedestrian crossing with 100% accuracy in all three follow-up sessions. This shows that the participant continues to demonstrate the skill after the training is over.

The data show that Elif started to demonstrate her ability to cross the street using the pedestrian crossing with 100% accuracy at the end of six teaching sessions. Each point in the implementation phase represents three teaching sessions. Until the criterion was met with Elif, 15 teaching sessions were held and these sessions lasted for a total of 21 minutes.

The data obtained at the beginning, probe, and follow-up phases regarding Cemil's skill to cross the street using the illuminated pedestrian crossing are given in Figure 3. As seen in the graph, the average performance of Cemil at the beginning stage (0%, 20%, 20%, 20%, 20%, 20%) is 16.7%. When the criteria were met in the implementation phase with Elif, three more beginning sessions were held with Cemil, the third participant, in succession, until we obtained stable data. After stable data were obtained at the beginning stage, the implementation stage was started. Cemil has an accurate response rate of 60% in the first probe session and 80% in the second probe session. In the third, fourth, and fifth probe sessions, it was seen that Cemil met the criterion of 100%.

In the follow-up phase, when the criteria set in the implementation phase were met with the participant, it was examined whether the permanence effects of the teaching continued after 1, 3, and 5 weeks. It is seen that Cemil continued to demonstrate his skill to cross the street using the illuminated pedestrian crossing with 100% accuracy in all three follow-up sessions. This shows that the participant continues to demonstrate the skill even after the training is over.

The data show that Cemil started to demonstrate his ability to cross the street using the pedestrian crossing with 100% accuracy at the end of nine teaching sessions. Each point in the implementation phase represents three teaching sessions. 15 teaching sessions were held with Cemil until the criterion was met, and these sessions lasted for a total of 21 minutes.

In this study, generalization sessions were conducted to determine the level of generalization of the skills learned by the participants to different people, environments, and tools. Generalization sessions were held as pre-test generalization sessions after introductory data were collected, and post-test generalization sessions after the teaching sessions were completed. The generalization data of the skills of *crossing using the pedestrian crossing and crossing using the illuminated pedestrian crossing*, which are the dependent variables of the study, were carried out in real pedestrian crossings and illuminated pedestrian crossings. One more adult attended the sessions to provide assistance and safety to the practitioner. In addition, the names in the study are not the real names of the participants.
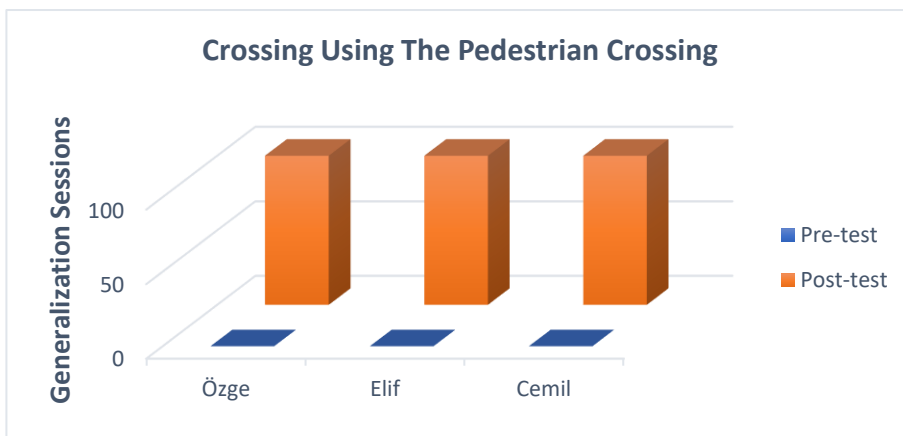
Figure 4. Generalization Percentages of Özge, Elif, And Cemil's Performances of Crossing Using The Pedestrian Crossing.
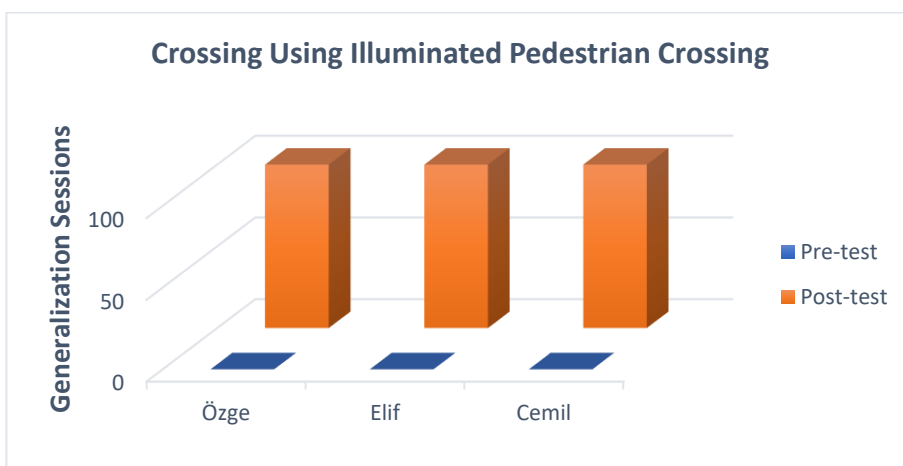

Figure 5. Generalization Percentages of Özge, Elif, And Cemil's Performances of Crossing Using The Illuminated Pedestrian Crossing

Discussion, Conclusion, And Recommendations

In this study, the effects of virtual reality applications on teaching pedestrian skills were determined. In addition, the effects of follow-up and generalization regarding dependent and independent variables were also determined in the study. Within the scope of the study, the skills of using pedestrian crossing and crossing using traffic lights were taught. One of the skills determined during the planning process of the study, *the ability to cross using the overpass*, was excluded from the skills to be studied by considering the conditions of the city of Edirne where the participants lived. The absence of an overpass in urban conditions eliminates the possibility of generalizing the skill and using it after the teaching is completed. For this reason, the researcher decided to exclude this skill from the study.

Research findings show that city simulation presented with virtual reality applications is effective in teaching the skills of crossing using the pedestrian crossing and crossing using traffic lights. Follow-up sessions held 1, 3, and 5 weeks after the teaching of the skills show that the skills are preserved. In addition, it is seen that the participants exhibited these skills with 100% accuracy in the real environment pedestrian crossing and illuminated pedestrian crossing in the environment generalization post-test sessions organized for pedestrian skills taught with virtual reality simulation. Within the scope of the study, the opinions of the participants and their mothers on the implementation and results were taken. Obtaining the opinions of the participants and determining their subjective opinions about the study within the studies carried out with individuals with special needs is one of the important and strong aspects of this research. The mothers stated that they were satisfied with the teaching of

pedestrian skills with the results of the study and the virtual reality application and that similar applications could be used for their children in the next teaching processes. The basis of the positive opinions of mothers about virtual reality technology is that they think that this technology is for gaming and they are unaware of its use for educational purposes. Participants, on the other hand, stated that they were impressed by the fact that virtual reality technology is an interesting and new technology and the feeling of being in the same place with the practitioner but in different environments. This situation has caused the technology used to be an extra source of motivation for teaching.

Most of the studies on teaching pedestrian skills or skill groups including pedestrian skills with virtual reality applications have been carried out with individuals with autism (Goldsmith, 2008; Josman, 2008; Saiano, 2015a; Saiano, 2015b; Tzanavari et al., 2015; Peng et al., 2018; Dixon et al. et al., 2019). On the other hand, Cherix and his friends (2020), taught the ability to cross the street in different conditions such as weather, driver attitudes, night and day in their experimental study with 15 intellectually disabled children, however, while teaching this skill, they examined the participants' passing times and how long they reacted to the situations they encountered while crossing, rather than their acquisition.

When the beginning level and generalization pre-test data of the first participant Özge's ability to cross the street using the pedestrian crossing are examined, it is seen that she gave 0% correct response in all sessions. During the pilot study, it was determined that the children should spend time with the materials and get used to the materials, and even though this process was run for all the participants, the reason why Özge did not respond correctly at the beginning level can be explained by the fact that she was not used to the virtual reality glasses and the feeling of reality she lived. After the beginning sessions were completed, the teaching phase was started, and when the three teaching sessions were completed, a probe session was held before the fourth teaching session. It is seen that Özge gave a 20% correct response in the first probe session. It was observed that Özge had difficulties in the steps *'She stops on the pavement before getting down to the road, she checks the road by looking first to the left, then to the right and then to the left'.* After Özge got off the pavement, she checked her left and right, thus preventing her from performing the skill. A similar situation occurred in the study of Tzanavari and his friends (2015), and students made a timing error while checking their left and right. Özge gave a 100% correct response in the third probe session and maintained this performance in the following two probe sessions. This efficacy data is similar to the results of other studies in the literature (Goldsmith, 2008; Josman, 2008; Saiano, 2015a; Tzanavari et al., 2015; Peng et al., 2018; Dixon et al., 2019). Teaching sessions with Özge and other participants consisted of five trials. The factors that may cause the sessions to be prolonged have been controlled beforehand since there are VR teaching sessions lasting 45 minutes in the literature (Saiano, 2015a), and wearing virtual reality glasses for a long time will tire the eyes of the children and negatively affect the experimental process of the study. The sessions did not last long, as the ability to cross the street using the pedestrian crossing occurred in the range of 8-15 seconds. In addition, 60 minutes was put between each teaching session in all skills to prevent the carrier effect. It was observed that the skills continued in the follow-up sessions, which were held 1, 3, and 5 weeks after the stable data were obtained in the probe sessions, similar to other studies in the literature (Tzanavari et al., 2015; Dixon et al., 2019). When the Generalization Pre-Test and Post-Test data are examined in Figure 4, it is seen that Özge generalizes the skill she learned with the VR application to the real environment.

When Özge's skill to cross the street using the illuminated pedestrian crossing lights beginning data is examined, it is seen that she gave 0% correct response in the first session and 20% correct response in the next two sessions. When Özge's beginning data in the first skill were examined, it was seen that she gave 0% correct response, but she gave 20% correct response in the second and third beginning sessions of the second skill. This situation shows that Özge carries the knowledge she gained in teaching the skill of crossing using the pedestrian crossing to the skill to cross the street using the illuminated pedestrian crossing, and that is, there is a carrier effect. However, this effect is low. In the Generalization Pre-Test session Figure 5, it is seen that Özge gave 0% correct response. After the beginning level sessions were completed, the teaching phase was started. It is seen that Özge responded correctly to 40% in the first probe session and 60% in the second probe session. It has been

observed that Özge has difficulties in the skill level of "If it's red, wait; When it turns green, first look to the left. If the cars have stopped, look to the right when she reaches the middle of the road". Özge tried to cross the street without paying attention to the traffic lights or tried to cross at the red light. Özge gave a 100% correct response in the third probe session and maintained this performance in the following two probe sessions. This efficacy data is similar to the results of other studies in the literature. It was observed that the skills continued in the follow-up sessions, which were held 1, 3, and 5 weeks after stable data were obtained in the probe sessions, similar to other studies in the literature (Tzanavari et al., 2015; Dixon et al., 2019). When the Generalization of the Pre-Test and Post-Test data are examined in Figure 5, it is seen that Özge generalizes her skill to cross the street using the illuminated pedestrian crossing she learned through the VR application to the real environment.

The first beginning level of the second participant, Elif's ability to cross the street using the pedestrian crossing, is a collective probe session with all participants. The second probe session is the second full probe session due to the first probe session in which Özge responded 100% correctly. A total of five probe sessions, together with the three beginning sessions, were held with Elif before starting the teaching, and she gave 0% correct response in these sessions. The 0% correct response rate in these sessions can be explained by the fact that she is not used to the virtual reality glasses and the feeling of reality she experiences, in the same way as Özge. When the teaching session with Elif is started, it is seen that she gave a 20% correct response in the first probe session. It was observed that Elif had difficulties with the first participant Özge, in the skill step, *'stop on the pavement before getting down on the road, check the road by looking first to the left, then to the right and then to the left'.* Elif gave a 100% correct response in the third probe session and maintained this performance in the following two probe sessions. This efficacy data is similar to the results of the previous participant and other studies in the literature. In the follow-up sessions held 1, 3, and 5 weeks after the stable data were obtained in the probe sessions, it was observed that the skills continued, similar to the previous participant and other studies in the literature. When Generalization the Pre-Test and Post-Test data are examined in Figure 4, it is seen that Elif generalizes the skill she learned with the VR application to the real environment.

The first beginning level of Elif's skill to cross the street using the illuminated pedestrian crossing is a collective probe session with all participants. The second probe session is the second full probe session due to the first probe session in which Özge responded 100% correctly. When the beginning data of Elif are examined, it is seen that she gave 0% correct response in the first session, and 20%, 20%, 40%, and 20% correct response in the following sessions, respectively. The 0% beginning data in the first session can be explained as the effect of the information in the teaching of the ability to adapt to the new skill and the data in the following sessions, using the pedestrian crossing, carried over to this skill. Similar to the first participant Özge, it is seen that Elif gave a correct response of 40% in the first probe session and 60% in the second probe session. It has been observed that Elif has difficulties in the steps of *"When green lights up, look left first if the cars have stopped, walk, look right when comes to the middle of the road".* Elif tried to cross the street when the traffic light turned green, but she did not turn to her left and check that the cars had stopped. Elif gave a 100% correct response in the third probe session and maintained this performance in the following two probe sessions. This efficacy data is similar to the results of the first participant Özge and other studies in the literature. In the follow-up sessions held 1, 3, and 5 weeks after the stable data were obtained in the probe sessions, it was observed that the skills continued, similar to the first participant Özge and other studies in the literature. When Generalization the Pre-Test and Post-Test data are examined in Figure 5, it is seen that Elif generalizes her skill to cross the street using the illuminated pedestrian crossing that she learned with the VR application.

The first beginning level of the third participant, Cemil's ability to cross the street using the pedestrian crossing, is a collective probe session with all participants. The second probe session is the collective probe session held because of the first probe session where Özge responded 100% correctly and the third probe session was the first probe session where Elif responded 100% correctly. A total of six probe sessions were held with Cemil, with three beginning sessions taken before the teaching. Cemil gave 0% correct response in all of these sessions. The 0% correct response rate in these sessions can be explained by the fact that he is not accustomed to the virtual reality glasses and the feeling of reality

he experiences, the same as the other two participants. When the teaching session with Cemil was started, it was seen that he gave a 20% correct response in the first probe session. It was observed that Cemil had difficulties in the steps of *" stop on the pavement before getting down on the road, check the road by looking first to the left, then to the right and then to the left, and when reaching the middle of the road, look to the right again".* Unlike the other participants, Cemil gave a 100% correct response in the fourth probe session and continued this performance in the next two probe sessions. To meet the criteria, Cemil received three more teaching sessions, i.e. one probe session, than the other participants. This efficacy data is similar to the results of previous participants and other studies in the literature. In the follow-up sessions held 1, 3, and 5 weeks after the stable data were obtained in the probe sessions, it was observed that the skills continued, similar to the previous participants and other studies in the literature. When Generalization the Pre-Test and Post-Test data are examined in Figure 4, it is seen that Cemil generalizes the skill he learned with the VR application to the real environment.

The first beginning level of Cemil's skill to cross the street using illuminated pedestrian crossing is a full probe session with all participants. The second probe session is the collective probe session held because of the first probe session where Özge responded 100% correctly and the third probe session was the first probe session where Elif responded 100% correctly. A total of six probe sessions were held with Cemil, with three beginning sessions taken before the teaching. It is seen that Cemil gave a 0% correct response in the first beginning session and gave 20%, 20%, 20%, and 20% correct responses in the following sessions, respectively. When the beginning data on Cemil's skill to cross the street using illuminated pedestrian crossing are examined, it is seen that there is not any transport effect from the other probes. It is seen that Cemil, unlike the other participants, gave a 60% correct response in the first probe session. Although this situation creates the suspicion of immediate effect, an 80% correct response percentage in the next session can be interpreted as no immediate effect. However, the knowledge that Cemil gained in the ability to cross the street using the pedestrian crossing may have been transferred to this skill and an acceleration that increased from 16.7% to 60% correct response, which was the average of the beginning sessions, could be observed. It was observed that Cemil had difficulties in the last step of the skill analysis, *'when reaching the middle of the road, look to the right'.* Cemil correctly performed the part of the last step of the skill, *'When the green light comes on, look to the left first and walk if the cars have stopped',* but in the second part of the step, *'look to the right when reaching the middle of the road',* he crossed the road without checking the cars. Similar to other participants, Cemil gave a 100% correct response in the third probe session and continued this performance in the following two probe sessions. This efficacy data is similar to the results of other participants and other studies in the literature. In the follow-up sessions held 1, 3, and 5 weeks after the stable data were obtained in the probe sessions, it was observed that the skills continued, similar to the other participants and other studies in the literature. When Generalization the Pre-Test and Post-Test data are examined in Figure 5, it is seen that Cemil generalizes the skill to cross the street using the illuminated pedestrian crossing he learned with the VR application to the real environment.

As a result, virtual reality application is effective in gaining pedestrian skills for intellectually disabled children and maintaining them for 1, 3, and 5 weeks after the end of education. In addition, it was emphasized that it is important to generalize the skills to the real environment in all of the studies in which pedestrian skills are taught with virtual reality applications (Goldsmith, 2008; Josman, 2008; Saiano, 2015; Tzanavari et al., 2015; Peng et al., 2018; Dixon et al., 2019). In some studies, generalizations could not be made in real environments due to the vital risks and ethical concerns that may be experienced in traffic (Goldsmith, 2008; Tzanavari et al., 2015). Goldsmith (2008) stated in his study that these skills can be taught with virtual reality applications, but at the generalization stage, the participants could not generalize the skills to the real environment. One of the important data that this study adds to the literature is that pedestrian skills taught with virtual reality applications have been generalized to real environments with a 100% correct response. The present study shows that life-threatening safety skills such as pedestrian skills can be taught to individuals with special needs with virtual reality applications and can be generalized to real environments.

According to the results of the study, suggestions for future studies are listed below.

1. Studies can be carried out with more heterogeneous participant groups regarding the teaching of pedestrian skills with virtual reality applications.

2. While determining the pedestrian skills to be taught with virtual reality applications, the skills of using overpasses and underpasses can be included in the studies.

3. In addition, skills related to traveling and urban transportation can be practiced with different disability groups.

4. With the virtual reality application, pedestrian skills can be studied by creating conditions involving drivers with different seasons, lights, and driving profiles.

5. In addition, similar studies in which social validity data are collected can be carried out with participants, families, and teachers.

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Doğan Cüceloğlu's Philosophy of Education in Context of His Speeches and Writing Works

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Abstract

Educational philosophies direct the education of societies and, therefore, their future. Research has been carried out to determine the educational philosophy of many educators worldwide and in Turkey. However, no research revealing Doğan Cüceloğlu's philosophy of education, who recently passed away, one of the academicians of our country has been found. This study aims to determine the educational philosophy of Turkish psychologist and academician Doğan Cüceloğlu, who has tried to make sense of education and psychology together throughout his life. The current research is a qualitatively conducted grounded theory study. Doğan Cüceloğlu's speeches and writing on education were carried out in the light of the data collected by the document analysis method. Data were collected by examining the books, articles, interviews, conversations, social media accounts, speeches, and TV programs he wrote and analyzed by coding. "Why, what, and how to teach?" were answered by making inferences from Doğan Cüceloğlu's sentences. As a result of the research, it was understood that in terms of the purpose of education, Doğan Cüceloğlu's educational philosophy is existentialism; in terms of the content of education, it is existentialism; in terms of method of education, it is progressivism and existentialism. It has been determined that Doğan Cüceloğlu's perspective on education generally reflects existential understanding.

Keywords: Doğan Cüceloğlu, education, educational philosophy, grounded theory, existentialism, Doğan Cüceloğlu's educational philosophy.

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Introduction

Philosophies produced to solve education problems are called educational philosophy (Noddings, 2008). The main educational philosophies, in order of their emergence, are as follows: perennialism, essentialism, progressivism, reconstructionism, and existentialism (Beatty, Leigh & Dean, 2009). People and societies make important educational decisions, and the realization of these decisions is shaped according to these educational philosophies (Ornstein, 1990).

When the studies on the philosophy of education are examined, it is seen that some research is carried out to reveal the philosophical and political views of the people in the field of education. Some of these are as follows: The study titled "Mehmet Akif Ersoy's philosophy of education (A qualitative analysis in the context of his speeches and works)" by Baysülen (2016), the thesis titled "Ismet İnönü's philosophy of education (A qualitative analysis in the light of his speeches and writings)" by Yılmaz (2015), the study named "An Evaluation of Nurettin Topçu's understanding of education in terms of philosophical approaches" by Uslukaya (2018), Akdağ's (2005) master's thesis titled "Hilmi Ziya Ülken's educational philosophy", the thesis study "A comparative research on the educational ideas of Nurettin Topçu and Mümtaz Turhan" by Acar (2011), the study named "Hasan Ali Yücel's philosophy of education and his contributions to Turkish national education" by Taşkesen (2006), master's thesis named "Johann Friedrich Herbart's philosophy of education" by Sağdıç (2019), the study titled "John Wilson's philosophy of education and his contributions to religious education" by Uluağaç (2018), Öktem's (2014) thesis research on "Rousseau's understanding of education and its reflections on today", the study titled "Emrullah Efendi's educational philosophy policies and practices 1908-1914 as a minister of education" by İpek (2002), a research named "Atatürk's Philosophy of Education (In the Light of What Atatürk Said and Wrote") by Toprakçı (2011). In some of the listed studies, while the educational philosophies of the research subjects were revealed, data were collected in the light of their writing; some are based on works written about them. Looking at the methods of these studies, it can be said that Doğan Cüceloğlu's view of education and educational philosophy can be defined in the light of his own published works, recorded interviews, and conversations.

It has been observed that there is no study in the literature about Doğan Cüceloğlu's views on education or his philosophy of education. The researchers agreed on the necessity of investigating the educational philosophy of Doğan Cüceloğlu, an academic expert in psychology. With this research, Doğan Cüceloğlu's views on education were examined, and his educational philosophy was tried to be revealed. Such an effort may be important in guiding those who shape the Turkish education system policy by ensuring that Doğan Cüceloğlu's views on education, the education system, education policies, and education philosophy are known. Such an effort may be important in guiding those who shape the Turkish education system policy by ensuring that Doğan Cüceloğlu's views on education, the education system, education policies, and education philosophy are known. In addition, his advice to teachers about education can reach more people by providing a better understanding of the works of Doğan Cüceloğlu, who passed away recently. It is thought that this research will be important in revealing Doğan Cüceloğlu's education philosophy and shed light on both the theorists working to create an educational philosophy and policy and the teachers who actively influence education at every stage of education.

This research aims to reveal the educational philosophy of Doğan Cüceloğlu in the light of his works (books and articles he wrote) about education, conversations, speeches, interviews, and seminars about education. In addition, this research aims to answer the following questions:

1. What are the frequently used words in Doğan Cüceloğlu's works and speeches that reveal his educational philosophy?
1.1. "Why should we teach?" - What are the words frequently used in the expressions in the objectives dimension?
1.2. "What should we teach?" - What are the words frequently used in the expressions in the content dimension?
1.3. "How should we teach?" - What are the words frequently used in the expressions in the method dimension?

2. What is the educational philosophy embodied in answering the questions that reveal Doğan Cüceloğlu's philosophy of education?
2.1. "Why should we teach?" – What is the educational philosophy of Doğan Cüceloğlu that emerged regarding purposes?
2.2. "What should we teach?" – What is the educational philosophy of Doğan Cüceloğlu that emerged regarding content?
2.3. "How should we teach?" – What is the educational philosophy of Doğan Cüceloğlu that emerged in terms of method?
3. What is the educational philosophy embodied in the light of Doğan Cüceloğlu's works and speeches?

Background of the Study

Carr (2004), who examined the relationship between education and philosophy, suggested that education should have a philosophical basis. According to Peters, Tesar, and Locke (2014), the philosophy of education is the study of philosophy, which is generally carried out to raise educational goals, methods, problems, and questions about education. On the other hand, Siegel, Harvey, and Callan (2008) defined the concept of "philosophy of education" as a branch of applied philosophy that deals with the nature and aims of education and philosophical problems arising from educational theory and practice. According to Ergün (2009), the educational philosophies of societies are among the main elements that shape the country's education policy and direct educational practices.

The philosophy of education, which can be defined in different ways by different scientists, examines the problems in education in general and tries to explain the concepts and ideas that shape education. Educational philosophers analyze and clarify the concepts and questions underlying education. The main questions that education philosophy seeks to answer are: "What should be the aims of education?", "Who should be educated?", "Should education differ according to natural abilities and interests?", "What role should the state play in education (Noddings, 2018)?". Philosophy of education can have different meanings in the context of the relationship of philosophy with an education based on various perspectives. The approaches to seeking answers to the questions of the philosophy of education have also been shaped by these differences and have led to different views (Toprakçı, 2011). In this sense, the leading educational philosophy trends in the literature on which the majority agree are perennialism, essentialism, reconstructionism, progressivism, and existentialism (Ornstein, Levine, Gutek, & Vocke, 2016).

Perennialists think that the main reason for students to be educated is to understand the great ideas that have emerged from Western civilizations. According to perennials, these views are necessary to overcome problems (Mosier, 1951). In addition, western philosophy works for this purpose in every era. Perennialists emphasize conveying universal principles to students as they are; since human nature is static. Human beings have logic, so the quality of the power of thought needs to be increased. The first aim of education is to bring human intelligence to the highest level. The great victories and ideas humankind has achieved since its existence are issues that should be emphasized in education. While teaching these subjects, it is preferred to use methods that force students' minds. Students studying with the perpetual education curriculum are asked to examine the sublime works of art and literature. The main topics to be taught are shaped around unchanging facts (Cohen, 1999).

According to essentialism, a community's basic ideas and shared culture should be taught to everyone, especially at the primary school level. To achieve this, teachers use their authority in the classroom. In essentialism, the curriculum is subject-centered (Sahin, 2018). According to Sahu (2002), in essentialism, the student must be disciplined to ensure learning takes place. In addition, education should not be given according to the interest or desires of the student. The center of education in essentialism is a curriculum that requires much effort. Education should aim to raise citizens who will benefit society and should be open to all children (Şahin, 2018).

Britannica (2019) states that the philosophy of progressivism in education is a movement that reacted to the so-called narrowness and formalism of traditional education in Europe and the United States in the late 19th century. One of the main goals of progressivism is to educate the child as a "whole"

(Blake, Smeyers, Smith, & Standish, 2008) – that is, to see the student as a "whole" individual, physically, emotionally, and intellectually. In progressivism, the school is designed as a laboratory for the student. Children learn by doing and experiencing. Creativity and crafts are essential in the curriculum, and children are encouraged to do experiments and think independently. According to American philosopher John Dewey (2019), the most influential theorist of progressivism, a class should be a democracy in the microcosm.

According to Cohen (1999), the philosophy of reconstructionism is a thought that focuses on social problems and creates a society based on the existing social structure. Educators who advocate this philosophical trend focus on a curriculum emphasizing social reform as education's goal. The subjects taught in school are, in general, social problems. The courses aim to enable students to take actions that will enable them to overcome social problems such as famine, international terrorism, and wars.

Apart from these four main educational philosophies, the existential philosophy of education also has an important place. Existentialism focuses on human existence. According to existential philosophy, which rejects absolute and universal ideas, the individual creates reality himself. The task of schools is to assist the student in self-discovery (Tan, 2006). Existentialism always focuses on the individual. The message of this philosophy, in general, is not directed to the individual being considered but to the "individual trying to define what makes her/him human" (Morris and Troutner, 1966). Therefore, in the existentialist view, the question of being should precede the question of knowledge while carrying out philosophical research. Self-aware individuals understand their existence in terms of their experience of themselves and their situation (Flew, 1979). The goals of existential philosophy are for the individual to be aware of his essence, to understand the reason for his existence, to be loyal to his own belief and the values he has created, to choose freely as he wishes, and to create his truths. These goals should not be ignored in education (Rumianowska, 2020).

All countries make arrangements in their education systems according to the necessity of time. These arrangements are made according to society's social and economic conditions. In the Ottoman Empire, education policy was organized by foundations until the Tanzimat period. This situation started to change in the Tanzimat period, and the government regulated the education policy in the Republican period. The cultural and educational policy in the Republican period caused differences in the philosophical foundations of the education curriculum. Since the establishment of the Republic of Turkey, many changes have been made in the education system (Gömleksiz & Kan, 2005).

When the Republic of Turkey was newly established, it tried to establish a new education system by inheriting its old cultural tradition. Although the influence of the perennials and essentialism philosophies in the Ottoman period continued, the new Turkey adopted a pragmatist, progressive, and reconstructive philosophical trend in education. Efforts were made to shift from teacher-centered education to student-centered education, and educational technologies were rapidly adapted to education. While all these were being realized, progressivism indirectly and sometimes directly affected the Turkish education system. Like other developed and developing countries, Turkey has tried to develop education in this direction while inviting scientists such as John Dewey, a pragmatist, to the country and getting beneficial opinions from them. The Turkish education system has also begun to be restructured in line with the ideas of J. Dewey (Kesgin, 2015). With the Village Institutes practice in the 1940s, the philosophical movement of reconstructivism in education was adequate, but this system did not affect the general philosophy of education since it lasted for a short time (Hesapçıoğlu, 2009). Ulubey and Aykaç (2017), in a study that aimed to determine which educational philosophies were reflected in the primary school programs developed between 1926 and 2005, concluded that Turkey's educational philosophy is a mixture of perennials and progressivism, as a result of their research findings.

Doğan Cüceloğlu

Doğan Cüceloğlu, who has carried out many studies in the field of psychology, was also a renowned academician in media psychology. During his lifetime, he has published non-fiction books in psychology and education, has been a radio and TV presenter, and has organized many conferences and seminars on the importance of education in individual development. He continued his studies on

society, people, and life until the last days of his life. He repeatedly emphasized the importance of education in his works. He stated that the role of education should not be denied in reaching an advanced society level and in the process of self-discovery (Savaşçı, 1999; Öğretmenim Bir Bakar Mısın – Öğretmen'in Gücü, 2018; Öğretmen Olmak – Bir Can'a Dokunmak, 2013). The fact that he is an academician and psychologist who is an expert in his field, his productivity, his love of the nation, and the importance he gives to education made the author of the present article think that he has thoughts based on an educational philosophy worth examining. As a result of these reasons, it was decided to examine Doğan Cüceloğlu's thoughts on education. It is thought that determining his educational philosophy will contribute to the literature.

Method

This research was designed with the theory-building approach, one of the qualitative research designs. The document analysis method was used in the research. In the theory-building approach, also called grounded theory, which is frequently used in qualitative research, data are collected in a planned manner and compared simultaneously; then, a theory based on this data is produced with an inductive method (Noble & Mitchell, 2016). In theory-building studies, from the beginning of the research process, the researcher codes the data, compares the data and codes, and collects more data. The process continues like this. Finally, a grounded theory of the subject under study emerges. This theory, which emerged with factual data, is presented in an explanatory way (Charmaz & Belgrave, 2015).

In document analysis studies, printed and electronic resources are evaluated by examination (Bowen, 2009). The published works of Doğan Cüceloğlu and the programs he participated in were analyzed by document analysis technique. In order to reveal Doğan Cüceloğlu's philosophy of education, a tool called "Educational Philosophies Definitions Chart" was created by the researcher by making use of the educational philosophy determination tool used by Toprakçı (2011) in his article. In Table 1, the questions of "Why," "What," and "How" have been tried to be answered in the context of five educational philosophies (perennialism, essentialism, progressivism, reconstructionism, and existentialism) in order to define educational philosophies.

Table 1.
Educational Philosophies Definitions Chart

	Perennialism	Essentialism	Progressivism	Reconstructionism	Existentialism
Why?	*for humanity *to reach the creator *to obey the laws of the universe	*to adopt the main cultural elements *to raise good citizens	*to adapt to changing life conditions *to evolve and move forward	*to ensure democracy *for revolutionary transformation	*to liberate *to develop the potential *to discover one's essence
What?	*great works *basic morals *universal issues	*experiences of our elders *cultural values of society	*curriculum created by taking interests into account	*real-life problems *Science	*Empathy *critical thinking *spiritual values
How?	*through discipline *using the deductive method	*by using books *by using the rote method	*learning by doing and experiencing *with collaboration and research	*using technology *using democratic techniques	* by raising awareness * allowing them to choose their truth

Data Collection

Data collection was carried out with the document analysis method. After the "Educational Philosophies Definitions Chart" was created, in the context of educational philosophies in Table 5, the following questions were asked by the researcher to give answers on behalf of the reason, content, and method of teaching, respectively: "Why should we teach?", "What should we teach?" and "How should we teach?". While searching for these answers, the following works, which are also mentioned in the limitations of the research, were taken into account such as Doğan Cüceloğlu's books, speeches, and articles published on the internet. All these works belong to him and can be considered a direct source. Since Doğan Cüceloğlu did not have direct answers to the questions asked to define the philosophy of education, the expressions bearing the nature of indirect answers were sought in the works.

Data Analysis

In the present study, content analysis was carried out with the data collected by the document review method. After searching for answers to the questions of educational philosophies in the works written by Doğan Cüceloğlu, open coding was done by the researcher during the data analysis. The keywords in the answers to the questions of educational philosophies from the first-hand sources of Doğan Cüceloğlu were matched with the codes allocated to the themes. After collecting the necessary data for the research and coding, themes were created by the researcher using the questions of "Why," "What," and "How" related to the education philosophy of education in order to clarify the research findings and make them easier to read. After the coding, the frequencies of the expressions compatible with the codes were analyzed, and the number of answers given to the questions of educational philosophies was shown in a table. The collected data were interpreted by using the "Educational Philosophies Definitions Chart" created by the researcher.

Validity and Reliability

What determines the value of research is its precision. Validity and reliability must be taken into account in order to ensure the precision of the research (Creswell, 2003). Validity determines whether research measures what it is supposed to measure and the accuracy rate of study results (Bashir, Afzal & Azeem, 2008). In order to ensure validity, the findings were interpreted separately by ensuring that the research questions were handled one by one. Then, the answers to all questions were interpreted and integrated to determine Doğan Cüceloğlu's education philosophy. The research findings were interpreted by comparing them with their counterparts in the literature.

Stenbacka (2001) argues that reliability is essential in quantitative research; however, she says that the issue of reliability is not important in qualitative research since it is about measurement. She draws attention to how insignificant reliability is in determining qualitative research quality. Lincoln and Guba (1985) suggested using "consistency" for qualitative research instead of the term reliability used in quantitative research. They say that when measuring the reliability of research results is impossible, it is more important for data interpretations to contain consistent statements. In this study, which was designed with theory building, the confirmation of a faculty member and a researcher was applied to examine the consistency of the data. Direct citations to be used in qualitative research are raw data sources. Detailing the qualitative data by giving direct quotations provides the research to gain depth (Labuschagne, 2003). In order to provide depth and increase consistency in the research, the collected data were exemplified by quoting directly from the sources.

Limitations

This study is limited to the books published under the names of "Öğretmenim Bir Bakar Mısın?" (2018), "Öğretmen Olmak: Bir Can'a Dokunmak" (2019), and "Savaşçı" (2005); his Twitter account, the works that contain Doğan Cüceloğlu's published articles (Table 2), his speeches and conversations (Table 3), his seminars and interviews (Table 4).

Table 2.
Doğan Cüceloğlu's published articles*

Name of the Article	Publication Date
Karnedeki Notun Anlamı (The Meaning of the Grade on the School Report)	13.06.2015
Öğretmen Olmak: Bir Cana Dokunmak (Being a Teacher: Touching a Life)	16.05.2015
İyi Öğretmen ve Etki Alanı (The Good Teachers and their Influence)	02.05.2015
Öğretmen Soruyor: Ben Nerede Yanlış Yaptım? (Teacher Asks: Where Did I Go Wrong?)	29.04.2015
Çocuklarımız, Sınav ve Gerçekler (Our Children, Exams and Facts)	08.04.2015
Kıyaslanan Çocuk (The Child Compared to others)	14.10.2012
Yeni Müdür Konuştu (The New School Principal Speaks)	12.08.2012
Öğretmen Var, Öğretmen Var (Some Teachers are Good, Some are Bad)	01.04.2012
Kendi Egosuna ya da Öğrenciye... (To Their Own Egos or the Student...)	11.03.2012
Yanlış ve Hata (Mistakes and Errors)	04.03.2012
Bir Öğretmenin Gözlemleri (A Teacher's Observations)	17.07.2009
	-

www.dogancuceloglu.net

Table 3.
Doğan Cüceloğlu's Speeches and Conversations about Education*

Name of the Speech	Publication Date
Değişim Süreci İçerisinde Eğitim (Education in the Process of Change)	09.01.2017
Eğitim Bireye Ne Kazandırmalı? (What Should Education Gain Individuals?)	16.06.2016
Nasıl Bir Toplum Oluşturmak İstiyoruz (What Kind of Society do We Want to Create?)	29.03.2016
Özgür Bolat ile Eğitim ve Aile Üzerine Bir Sohbet (Conversation with Özgür Bolat on Education and Family)	28.03.2016
Eğitim ve Öğretimde Başarı – İbrahim Taşel ile Sohbet (Success in Education and Training – Conversation with İbrahim Taşel)	28.03.2016
Öğretmenin öğrenme yolculuğu nasıldır? - İrfan Erdoğan ile Sohbet (What is the teacher's learning journey like? –Conversation with Irfan Erdogan)	28.03.2016
Hayata Hazır Gençler Yetiştirmek - Cihat Şener ile Sohbet (Raising Young People Ready for Life – Conversation with Cihat Şener)	28.03.2016
Aydınlık bir gelecek için neler yapmalıyız? - Cihat Şener ile Sohbet (What should we do for a bright future? – Conversation with Cihat Şener)	28.03.2016
Eğitim bir araç mı yoksa amaç mıdır? (Is Education a Tool or the goal?)	28.03.2016
Öğretmen-Öğrenci İlişkisi: Çocuğun gözüne bakıp 'Merhaba' demek (Teacher-Student Relationship: Looking into the child's eyes and saying 'Hello')	28.03.2016
Hüseyin Özcan ile Eğitim Üzerine Bir Sohbet (Conversation on Education with Hüseyin Özcan)	29.02.2016
İyi bir öğretmen nasıl olunur? - İbrahim Taşel ile Sohbet (How to be a good teacher? – Conversation with İbrahim Taşel)	29.02.2016

* *https://www.youtube.com/@DoganCucelogluOfficial*

Table 4.
Doğan Cüceloğlu's Seminars and Interviews about Education*

Name of the Seminar	Publication Date
Doğan Cüceloğlu'nun Değerler Bilincine Yaklaşımı / Başarının Anahtarı / A Para (Doğan Cüceloğlu's Approach to Awareness of Values / The Key to Success / A Para)	24.02.2021
Prof. Dr. Doğan Cüceloğlu ile Mesleki Çalışma Dönemi Webinar Etkinliği "Öğretmenim Bir Bakar Mısın?" (Teachers' Professional Working Term Webinar Event "Teacher, Can You Take A Look?")	29.06.2020
2018-2019 Akademik Yılı Açılış Konuşması (2018-2019 Academic Year Opening Speech)	18.09.2018
Ezgi Aşık'ın Söyleşisi (Inteview with Ezgi Aşık)	16.02.2019

www.google.com/search/doğan-cüceloğlu

Findings

While researching Doğan Cüceloğlu's philosophy of education, the coding process performed by the researcher and the table indicating the frequency levels were taken into consideration to solve the research questions. The findings of the study were presented in a way that the dominant educational philosophy would be indicated, taking into account the answers given to the questions of educational philosophies and the sums of the answers given for each question according to the degree of frequency. In Table 5, the frequencies of the answers given to the questions of fundamental questions of educational philosophies in the works of Cüceloğlu are given.

Table 5.
The Structure of the Dimensions of the Philosophy of Education became concrete in the context of what Doğan Cüceloğlu wrote and said

	Why should we teach?	What should we teach?	How should we teach?	TOTAL
Perennialism	2	0	0	2
Essentialism	2	1	0	3
Progressivism	4	2	5	11
Reconstructionism	5	0	0	5
Existentialism	19	9	6	34
TOTAL	32	12	11	55

Three main themes were created from the document review data. These can be listed as follows: "Why should we teach?" - What are the words that are frequently used in the expressions in the objectives dimension?", "What should we teach? - What are the words frequently used in the expressions in the content dimension?" and "How should we teach? - What are the words frequently used in the expressions in the process dimension?". The codes of these four themes and the expressions from which the codes were taken are given below in order.

Theme 1. "Why should we teach?" - What are the words that are frequently used in the expressions in the objectives dimension?

What Doğan Cüceloğlu said and wrote in the context of the purpose of education was analyzed according to five main educational philosophy trends, and the following findings were reached: A total of 2 expressions were found following the purpose of the perpetual education philosophy: "For the future of the world" and "For raising generations who can contribute to the culture of the world." In the reference source "Hüseyin Özcan ile Eğitim Üzerine Bir Sohbet, "the following sentence can be

given as an example: "Our education should raise people who can contribute to world culture, understand it, and communicate with it.". A total of 2 expressions were found following the purpose of the essentialist education philosophy: "Raising good citizens" and "incorporating the values of our culture into our education." The following statement by Cüceloğlu in the "Ezgi Aşık'ın Söyleşisi" is one of the examples: "One of the main purposes of education should be to raise good citizens.". A total of 4 expressions have been found in Doğan Cüceloğlu's writings and discourses, which are suitable for his progressive education philosophy; these expressions have formed two codes: "for the development of people" and "to enable them to adapt to living conditions." The following statement in his article titled "Öğretmen-Öğrenci İlişkisi: Çocuğun gözüne bakıp 'Merhaba' demek" is one of the expressions in which the codes are accessed: "Education should prepare the child strongly for life." A total of 5 expressions were obtained from Doğan Cüceloğlu's words following the purpose of the reconstructive education philosophy. These phrases are grouped under the following codes: "for revolution" and "for reconstruction." The phrase he said in his book "Öğretmen Olmak, Bir Can'a Dokunmak" is one of the expressions taken into account while creating these codes: "Education exists as a tool of social change in Turkey.". A total of 19 expressions were found in what Doğan Cüceloğlu said and wrote following the purpose of the existential philosophy of education. These expressions formed the codes of "to liberate," "to develop one's potential," and "to realize oneself." For example, the sentence "Every person has only one innate purpose: to realize herself" (p.57) in the book Savaşçı exemplifies these statements.

Theme 2. "What should we teach?" - What are the words frequently used in the expressions in the content dimension?

What Doğan Cüceloğlu said and wrote in the context of the content of education was analyzed according to five educational philosophies, and the following findings were reached: No expression can be associated with the content approach of the perennials in what Doğan Cüceloğlu wrote and said. One statement was found in what essentialism said about the content of education. The following statement he shared on his personal Twitter account is the expression that constitutes the "social values" code: "I see the future of a society in the values that live in the family and the educational environment." A total of 2 statements were found regarding the content approach of the philosophy of progressive education: "It will enable the child to use his current talent more efficiently..." and "People's tendencies are different..." (Çocuklarımız, Sınav ve Gerçekler) can be associated with the philosophy of progressivism. Regarding the reconstructivist philosophy of education content approach, no findings were found in Doğan Cüceloğlu's works that could be associated with this philosophy. A total of 9 expressions were found following the content of the existential philosophy of education, and these expressions led to the formation of the following codes: "spiritual values," "empathy," and "critical thinking." The following statements in his works can be associated with the content approach of the existential philosophy of education: "I care about values more than knowledge.", "Science and technology are based on values." (Öğretmen Olmak: Bir Can'a Dokunmak), "Values are the basis of a meaningful life.", "Values are indispensable." (Nasıl bir Toplum Oluşturmak İstiyoruz?) Cüceloğlu's following sentences in his book "Öğretmenim, Bir Bakar Mısın?" can be given as an example: "Behind being productive in science and technology, there are values at the core of scientific thought. Teachers should keep the values underlying scientific thinking alive in the classroom.".

Theme 3. "How should we teach?" - What are the words frequently used in the expressions in the method dimension?

In Cüceloğlu's writings and statements, no expression refers to what perennials and essentialist philosophies say about the method of education. A total of 5 expressions were found following the method approach of the philosophy of progressivism. The following statements in his works "Yanlış ve Hata" and "Öğretmen Olmak" are associated with the method of progressive philosophy: "Providing the opportunity for students to observe, ask questions, do research, "participate the student," "educational experiences such as walks, school painting, garden cleaning," "encourage asking new and quality questions.", "interactive lessons." These expressions enabled the codes of "living by doing," "collaborating" and "using research method" to be reached. The phrase "A teacher who sees the knowledge and the source as a potential in himself/herself teaches a lesson based on

interaction," said by Cüceloğlu at the Becoming a Teacher seminar, is one of the data collected in the research. In Cüceloğlu's writings and statements, no expression could be associated with the method approach of the reconstructive philosophy of education. A total of 6 expressions were found that fit the method approach of the existential philosophy of education. The following statements in his works (His Twitter account and Öğretmenim, Bir Bakar Mısın?) coincide with the content approach of this educational philosophy: "Real education transforms knowledge into consciousness.", "Helping the student discover his life," "making the children realize they are their most important witness." The obtained statements created the following codes: "by giving the person the opportunity to choose his truth" and "by making the person conscious." An example is the following statement from his Twitter account: "Teachers should aim to help their students discover and build the meaning of their own lives.".

Discussion, Conclusion, and Suggestions

In this part of the research, the questions sought answers are discussed by comparing the inferences from the findings and the literature. "What is Doğan Cüceloğlu's philosophy of education?" Based on what Cüceloğlu wrote and said, an answer was sought with the inferences made by the researcher.

1. "Why should we teach?" – What is the educational philosophy of Doğan Cüceloğlu that emerged regarding purposes?

Based on what Doğan Cüceloğlu said and wrote, some of his words about what the purpose of education should be have been reached. Below, the results obtained by deducing from the findings obtained in the current research are presented with a discussion.

According to the philosophy of perennials, education aims to enable students to use their intelligence best (Howick, 1980). It will be possible to ensure that universal principles and traditions are permanent by raising individuals who think rationally and critically. Thanks to education, world culture will develop (Link, 2008). In short, the primary purpose of education is to raise people who will benefit all humanity (Ergün, Oral, & Yazar, 2018). The following statements in Doğan Cüceloğlu's words supported these views: "We must educate people for the future of the world." and "We must raise people who can contribute to world culture.".

According to the philosophy of essentialism, education should ensure that society remains as it is. Education should not change society. Instead of changing people's behavior in education, the focus should be on making them become good experts on basic issues (Howick, 1980). According to the essentialists, the main purpose of education is to transfer knowledge and culture to future generations as they are (Yayla, 2009). According to the philosophy of essentialism, education aims to adopt the main cultural elements and to raise good citizens (Ergün et al., 2018). The following statements in Cüceloğlu's words coincide with the answers given by the essentialist education philosophy to the question of what should be the purpose of education: "We need to raise good citizens." and "We must incorporate the values of our culture into education." Therefore, from his statements, it is concluded that he has views following essentialist philosophy.

The philosophy of progressivism aims to prevent the reasons that may prevent change and development and to do this with education (Keskin and Şahin, 2018). Progressives regard education as life itself. They oppose absoluteness and dogmatism. (Gutek, 2005). They argue that students' social and academic development in interaction with each other is the main purpose of education (Dewey, 2019; Gutek, 2005). It is seen that the following statements of Cüceloğlu coincide with the aims of the philosophy of progressivism and support these ideas: "Education should ensure the development of human beings." and "We must educate the student in order to improve."

The philosophy of reconstructionism aims to make a revolutionary transformation with education so that society becomes better than it is (Ergün et al., 2018). According to the philosophy of reconstructionism, the education system, which is seen not only as life but also as the "future" (Dewey, 1923), should restructure the society (Zırhlıoğlu & Yayla, 2016). Reconstructionists have adopted the view that it is possible to improve people's living conditions through education (Cohen & Gelbrich, 1999). It has been revealed that the following words in Cüceloğlu's works support the views

of this educational philosophy: "Social change is necessary.", "Creating another future is possible with education." and "Sustainable social change is possible through education."

The existential philosophy of education puts the person at the highest level and emphasizes how valuable the individual is. It says that existentialism, freedom, choice, and responsibility should be emphasized in the context of education (Wang, 1988). Existentialism aims to increase one's own individual awareness and moral development. Education should make people happy, and happiness is possible by enabling people to be self-aware, make their own choices, and take responsibility for their actions (Kooli, 2019). The following statements of Cüceloğlu support the views of the philosophy of existentialism: "Students need to discover the importance of self-witnesses," "It is necessary to look at the existence of human beings," "There is a need for education that develops the potential of human beings." The existential philosophy of education requires that the student also discover his freedom and accept that he is responsible for setting the limits of his freedom (Suiçmez, 2009). The following statements in Cüceloğlu's works and words seem to support this argument: "Education is necessary to raise free people.", "Education is important in the journey of self-discovery." and "It is necessary to set the student free."

When the research findings were compared with the relevant literature review, it was concluded that Doğan Cüceloğlu's philosophy of education, which emerged in terms of purposes, was existentialism.

2. "What should we teach?" – What is the educational philosophy of Doğan Cüceloğlu that emerged regarding content?

Based on what Doğan Cüceloğlu said and wrote, some statements about the content of education should have been reached. Below, the results obtained by deducing from the findings obtained in the current research are presented with a discussion.

In the philosophy of perennials, the accurate information that has been going on since the beginning of history in the temporal and spatial sense should be reflected in the content of education. Perennialism, which aims at the learner's cognitive development, suggests that great works created by great people should be included in the curriculum. Raising intellectual people can only be achieved by teaching permanent knowledge (In Tan, Wong, Chua, & Kang, 2006). The curriculum is designed to teach the values and knowledge that exist in society (Kooli, 2019). It was concluded that Doğan Cüceloğlu disapproved of the perpetual curriculum since it was not seen that he advocated such a content approach in his works.

Essentialism argues that taking care of people's differences is unnecessary and says that every person is essentially the same (Holma, 2007), and therefore a single subject-centered curriculum should be applied. The focus of the teaching curriculum is the culture and history of the society (Kooli, 2019). Essentialists emphasize that the unchanging customs of society from past to present should be taught to students (In Tan et al., 2006). Based on what Doğan Cüceloğlu said, it was revealed that he did not have a statement showing that he found a curriculum that describes the unchanging traditions and customs of the society appropriate. Therefore, it is seen that there is no evidence that Cüceloğlu defends the essentialist philosophy in terms of content.

According to Labaree (2005), progressivism is an educational philosophy that was influenced by the philosophy of pragmatism. Therefore, it is emphasized to create a curriculum suitable for student's interests and abilities that can benefit them (Sadker et al., 2008). We can say that Cüceloğlu agrees that people are different from each other. He defends the necessity of maximizing the existing talent of the student in his works. However, since there is not enough data on this subject to satisfying the researcher, it has been revealed that progressivism in the content dimension of the philosophy of education is not the dominant philosophy of Cüceloğlu.

In the understanding of reconstructivism created against the philosophy of progressivism, the fact that progressivism and other educational philosophies make the status stronger politically is criticized. It is stated that teachers and students are essential in social empowerment. Reform is possible only if the school is seen as a social institution. In the philosophy of reconstructionism, a curriculum consisting of subjects that require students to find solutions to social problems is applied (In Tan et al., 2006). In

Cüceloğlu's works, expressions supporting the importance given to the school and the teacher by the reconstruction philosophy have been encountered. It is also stated that social welfare can be achieved through the school institution. However, no statement exists that the content should be realized to solve life's problems. Therefore, there is no evidence that he supports this philosophy in the context of education content.

According to Koirala (2011), the philosophy of existentialism rejects the teaching of subjects that do not consider human wants, needs, and the conditions in which humans are found. According to existential thinkers, man creates reality himself. Therefore, the subjects that should be given priority in the curriculum are literature, music, and art (Malik & Akhter, 2013). The main subject that should be taught to students in existentialism is how to be free (Cevizci, 2010). In existential philosophy, the essence of man and the subjective knowledge he has created is more important than the objective knowledge taught worldwide. At the same time, social and human sciences are predominant over the positive sciences. Creating an ethical human being, putting values before absolute knowledge, the fact that there are moral values under scientific thought, and the importance to be given to human values for humanity to have a bright future are expressions frequently encountered in Cüceloğlu's works. In the philosophy of existentialism, which argues that the lessons should be human-oriented, affective issues are emphasized (Wang, 1988). Derslerin insana yönelik olması gerektiğini öne süren varoluşçuluk felsefesinde duyuşsal ağırlıklı konuların üzerinde durulmaktadır (Wang, 1988). The following statements, reached from the works of Cüceloğlu, which were examined in order to answer the question "What should we teach," support the view of the philosophy of existentialism: "I care more about values than knowledge." and "Values are indispensable." Cüceloğlu, who repeated many times that man should discover his essence, has been found to advocate that human values should be included in the content of education. At the same time, he openly said that humanities should be given more importance than positive sciences. For this reason, it was revealed that Doğan Cüceloğlu was influenced by existential philosophy regarding content.

3. "How should we teach?" – What is the educational philosophy of Doğan Cüceloğlu that emerged in terms of method?

Based on what Doğan Cüceloğlu said and wrote, some expressions he used about what the method of education should be have been reached. Below, the results obtained by deducing from the findings obtained in the current research are presented with a discussion.

In the philosophy of perennials, it is not essential for education that the individuals in the society have their characteristics. Mistakes are not forgiven, and those who make mistakes are sanctioned. Maintaining order in the classroom where the teacher's activity is in question is possible with strict and prescriptive teaching (Tuncel, 2004; Erden, 2007). It is not seen that Cüceloğlu advocates a strict education in his works and speeches. There are statements that he does not recommend the punishment method because it will cause adverse reactions. For these reasons, it has been concluded that his educational philosophy is not perennial in the method dimension.

In the philosophy of essentialism, as in perennials, the teacher is the leader in the teaching environment. Memorization and expression techniques are used in education (Lynch, 2016). The teacher explains, and the student memorizes the information to absorb it (In Tan et al., 2006). The student has to do everything the teacher says and give correct and complete answers to the questions. Therefore, the perennialism philosophy supports an oppressive teaching method (Zırhlıoğlu & Yahya, 2016). There was no expression in Doğan Cüceloğlu's works showing that he defended the methods proposed by essentialism. Therefore, it was revealed that he disagreed with the philosophy of essentialism.

In progressivism, which opposes the views of perennial and essentialist philosophy, the center of the education system is the student, not the teacher. The teacher is in a position to guide the student (Kooli, 2019). According to the philosophy of progressivism, the primary goal is for the student to solve a problem (Radu, 2011). For this reason, the student needs to be active throughout the learning process. A progressive teacher should use the scientific method in the classroom and encourage students to ask questions and do research (Cohen, 1999). Doğan Cüceloğlu says that learning by doing

and research methods should be used in the classroom that the student's being active during the lesson will increase learning, that the student should be encouraged to ask questions, that an interactive lesson will positively affect the learning process, the importance of experiences in education and all of these are opportunities. It turns out that he has a positive view of progressive philosophy on how teaching should be in terms of method.

Cohen (1999) says that the philosophy of reconstructionism can be used to improve people's living conditions. To achieve this, worldly problems must be brought to the classroom. The aim of reconstructive philosophy can be achieved by using democratic methods such as questioning and discussion. Although Cüceloğlu sees education as a tool of social change, he does not have any statement about the approaches offered by reconstructive philosophy as an education method. Therefore, it is concluded that Cüceloğlu does not support this philosophy in the context of the method of education.

The philosophy of existentialism in education says that the student should grow up free and responsible. The courses prepared by considering the value of humans make it necessary to determine a method with existential philosophy (Wang, 1988). Teachers and students determine the subject and method together (Sadker & Zittleman, 2018). In order to develop student freedom both during the lesson and in his own life, the teacher should use methods that will provide this in the teaching process (Duman, 2010). The role of the educator in existential philosophy is to enable the student to discover their essence and make their own choices (Koirala, 2011; Kooli, 2019). Cüceloğlu, in his works and speeches, states that real education is to transform knowledge into consciousness, that one's awareness should be increased, and that the student should discover the meaning of life; He also says that the teacher should help the student in this awareness process of the student. Cüceloğlu argues that the education system aims to make the child realize that he is the most important witness and that it is necessary to use the education method advocated by the philosophy of existentialism in order to achieve this goal; it turns out that he accepts this philosophical approach in terms of method. It is seen that Doğan Cüceloğlu's ideas on how education should be carried out in an educational environment are the same as progressive and existential philosophies.

4. What is the educational philosophy of Doğan Cüceloğlu embodied in the light of his works and speeches?

In the context of what he said and wrote, it can be included that Doğan Cüceloğlu's philosophy of education is existentialism in terms of the purposes of education. Again, based on his statements, it turns out that existentialism is the approach that reflects Doğan Cüceloğlu's perspective on education in terms of the content of education. What he said and wrote about the method of education is in line with the philosophies of progressionalism and existentialism. When Doğan Cüceloğlu's works and speeches are examined, it is seen that his words mostly contain expressions that are close to the ideas put forward by the philosophy of existentialism. It can be said that Doğan Cüceloğlu evaluates education from the perspective of "existentialist" philosophy in general, based on what he said and wrote about the aims, content, and method of education.

In the current study, which aims to determine the education philosophy of Doğan Cüceloğlu, when the data are evaluated as a whole, it has been concluded that his view of education coincides with the "existentialism" education philosophy. Researchers can examine Doğan Cüceloğlu's perspective on education in the context of educational philosophies and carry out a study by reaching other works by Doğan Cüceloğlu which are not used in this study. In addition, since he passed away, interviews with family members or friends can be conducted with prior permission. Thus, more comprehensive research can be carried out.

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A Descriptive Overview of Dynamic Assessment

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Abstract

Dynamic assessment (DA), deriving from the Vygotskian Sociocultural theoretical approach, has attracted considerable attention from researchers in the fields of psychology and general education, but it is still regarded as a novel approach within the field of second language acquisition. DA can be defined as an approach not only focusing on assessment as its name suggests but also aiming to instruct learners through hints or prompts, which are forms of mediation within the framework of sociocultural theory. With the increasing number of studies on DA in the field of second language teaching, DA seems to have promising effects on language teaching and learning processes. This study aims to provide a brief overview of what DA is by addressing the theoretical framework of DA, the fundamental principles of DA, its principal components, the criticisms leveled at DA, and the advantages DA offers. The data was collected through the literature review method (Machi & McEvoy, 2016). As a result of the literature review, it was found that although DA has been criticized in some ways, it has been found useful in not only uncovering success in past learning but also furthering it by discovering the underlying reasons for poor performance and intervening to improve it through dialogic interaction. It can be suggested that DA can be used effectively in formal language learning environments to reveal learners' abilities at a certain time, to promote their growth, and to predict their future potential.

Keywords: Sociocultural Theory, dynamic assessment, zone of proximal development, mediated learning.

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Introduction

Being an essential component of teaching, assessment has attracted substantial attention from second language researchers due to the powerful interface between these two components as both aim to contribute to learners' progress (Alderson, 2005). Assessment, in general terms, is defined by Russell and Airasian (2012, p.3) as "the process of collecting, synthesizing, and interpreting information to aid in classroom decision-making". Accordingly, teachers make use of assessment to make important decisions about students, instruction, classroom management, etc. It is essential that teachers know what is already known by learners, what has been learned as a result of the instructional period, and learners' strengths and weaknesses, which enables teachers to plan instruction that is attuned to learner needs, to provide guidance for the points to be improved, and to provide learners with feedback (Alderson, 2005). This illustrates how important assessment is for an effective language teaching program.

One of the primary goals of assessment is to inform all stakeholders. For one thing, looking at assessment results, both teachers and learners get an idea of the existing abilities of learners and the abilities that need to or can be improved. What is more, teachers and program developers receive feedback on the effectiveness of the instructional program. However, what is critical here is that in addition to its role as a performance indicator for learners, teachers, and program developers, assessment is also, intentionally or unintentionally, the driving force behind the teaching and learning process, which indicates its washback effect on teaching and learning (Hughes, 2003).

There are different types of assessment used for a variety of purposes like formal/informal, formative/summative, implicit/explicit, self/other, etc. (CoE,2001). Teachers usually make use of these assessment types in their teaching contexts by employing different assessment tools such as exams, unit tests, quizzes, graded assignments, oral interviews, portfolios, journals, and observations in classrooms depending on their purposes. Hence, the assessment covers obtaining not only quantitative indicators of learner performance but also qualitative ones like observation (Oosterhof, 2003). However, with the increasing attention to learner-centered teaching approaches that place importance on learner agency and self-regulation skills in the learning process, assessment types applied in classrooms have been changing. Today, assessment practices that support the learning process with a more learner-centered, dynamic, and collaborative approach have been more appealing within the context of teaching and learning (Jones, 2014).

Theoretical Base of DA

One type of assessment focusing on continuous learner assessment and development through a collaborative practice is DA. With its long history, DA has attracted the attention of researchers in different fields like psychology and general education (Poehner, 2005). As for the founder of DA, which derived from the Vygotskian theory of mind and was established by Feuerstein in a project on the learning potential of low-achievers, both Vygotsky and Feuerstein are regarded as the father of DA (Lidz, 2004). Thus, DA is basically grounded in Vygotsky's theory of mind, that is Sociocultural theory of mind (henceforth SCT). In order to achieve a thorough understanding of what DA is and how it works, it is essential to first develop an understanding of its underlying theory.

Having its origins in the works of Vygotsky, SCT aims to explore the higher mental activities of people such as memory, planning, execution and monitoring, and social settings. Although SCT is mainly associated with the ideas of Vygotsky as its base, his colleagues and former students Alexander Romanovich Luria and Alexei Nikolaevich Leontiev made substantial contributions to the development of SCT. Indeed, Vygotsky and his two colleagues were known as the "troika" of the Vygotskian School (Wertsch, 1985, p.9). It was the efforts of Luria and Leontiev that contributed to the development of Vygotskian ideas even after his death.

According to Wertsch (1985), intellectual and cultural circumstances of the time resulting from the Russian Revolution of 1917 enabled Vygotsky to develop all his innovative ideas since Vygotsky and intellectuals like Vygotsky were devoted to creating a new society based on socialist principles, which associates Vygotskian theory and Marxist principles. What is more, Vygotsky was also interested in

finding solutions to practical problems in the USSR. His main studies were on massive literacy, cultural differences among the people of the future Soviet, and the absence of services given to mentally retarded people to which the problem of defectology was later added (Wertsch, 1985). Vygotsky mainly worked on disadvantaged children with impaired hearing ability or learning disabilities. These two goals can be claimed to lay the foundations of the Vygotskian theory. Wertsch (1985) outlined the base of Vygotsky's theory of mind around the three interrelated tenets: "It relies on a genetic or developmental method, mental processes in the individual have their origin in social processes and mental processes can be understood only if we understand the tools and signs that mediate them" (pp. 14-15). Thus, it can be stated that the theory emphasizes the social nature of higher cognitive processes which can only be developed through the use of mediational tools and signs in social interaction and tracked using genetic analysis. Wertsch (1985) views one's social and intellectual settings as inseparable phenomena that could be tied through semiotic means.

SCT has received broad recognition since it brought an innovative perspective on child learning and development. Diverging from naturist, behaviorist, and constructivist theories with respect to how learning occurs, the theory posits that children's learning and development result from adult mediation, which indicates the involvement of children in age-appropriate activities during which adults provide support to promote their development (Lidz, 2017). SCT aims to provide an understanding of the role of the environment in the learning process. According to Vygotsky (1978), higher mental functions are rooted in social interaction because Vygotsky views learning as a collaborative process in which more capable peers help less capable ones demonstrate a higher level of cognitive functioning (Elliot, Lauchlan & Stringer, 1996). SCT argues that "humans utilize existing tools and create new **cultural artifacts** that allow them to **regulate**, or more fully monitor and control, their material and symbolic activity" (Lantolf, Poehner, & Thorne, 2020, p. 223, emphasis in original). This means that mental development does not occur on its own, rather it is realized in a social environment that offers interaction through cultural artifacts or other individuals. What is more, SCT does not stress learners' past learning which represents their zone of actual development (ZAD), but their possible future learning which represents their ZPD, which is the core concept of SCT. While Vygotsky originally developed his theory for the development of children, it is used to explain the second language acquisition processes as well. From the framework of SCT, the acquisition of a second language is not only mastering the linguistic properties of another language; it is beyond linguistic boundaries. It involves social interaction which improves one's understanding of the language through forms of mediation, which functions as a bridge from the interpersonal to the intrapersonal layer of internalization (Lantolf et al., 2020).

Importance of ZPD within the framework of SCT

Within the framework of SCT, knowledge is in constant change through collaboration and interaction in the social environment, and therefore the ZPD is not a fixed feature of an individual, which can be altered through the use of interaction with the social environment and mediation. Vygotsky (1978) defines the ZPD as "the distance between the actual developmental level [of a person or group] as determined by independent problem-solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (p.86). Haywood (2012) explored the notion of ZPD based on the questions of "what is" or "what could be". That is, it is the gap between what one can do at present independently and what one can possibly do with the guidance of a more capable individual through interaction.

Vygotsky views development in two levels: actual and proximal. According to him, an individual can have two types of developmental areas, the zone of actual development (ZAD) and the zone of potential development. The former refers to one's already attained mental abilities whereas the latter indicates the potential maturity of these abilities with the assistance of a more competent individual (Lantolf &Pavlenko, 1995). For Vygotsky, what a child can possibly do in the future is more important than what the child can do at present since Vygotsky is development-oriented and believes in the continuous transformation of cognitive functions. He gives importance to the possible cognitive functions of the child because they are the true representatives of the child's abilities. What is highlighted in the notion

of ZPD is the interaction between the ZAD and the ZPD. Vygotsky maintains that to understand one's level of mental functioning, we must have an idea of both one's ZAD and ZPD since the former is the reflection of the latter within the framework of this theory. To achieve the transition from the ZAD to the ZPD, the person must be mediated, which unites the cognitive and social areas for development to occur. Thus, this notion lays the foundation of the Vygotskian theory, which underscores the co-construction of knowledge in the social setting that one lives in through collaboration or interaction with another party. Thus, the ZPD is a developmental, interactive, and social construct (Sternberg& Grigorenko, 2002). According to Vygotsky (1981, p. 163), "any mental function is distributed between two individuals (e.g., novice and expert) as intermental activity; it later becomes intramental activity as it is appropriated by the novice in the zone of proximal development" (cited in Lantolf & Pavlenko, 1995).

Vygotsky regards the individualistic nature of a child as critical for development and believes that no two individuals can be treated in the same way. Although they could seem to have similar abilities when superficially looked at, their level of true development can only be unearthed through the use of mediation because it allows seeing the future potential of the child (Poehner, 2005). The following quote demonstrates how Vygotsky views the unique cognitive maturity of two children:

> Imagine that we have examined two children and have determined that the mental age of both is seven years. This means that both children solve tasks accessible to seven-year-old. However, when we attempt to push these children further in carrying out the tests, there turns out to be an essential difference between them. With the help of leading questions, examples, and demonstrations, one of them easily solves test items taken from two years above the child's level of [actual] development. The other solves test items that are only a half-year above his or her level of [actual] development. (Vygotsky, 1956, p. 446-47, cited in Wertsch, 1985).

As revealed, despite the equal look of the two children, they are indeed very different in terms of what they can achieve when the appropriate amount of support is given. Then, it is evident that achieving the ZPD is dependent on the presence of mediation, which is therefore another essential ingredient of Vygotskian thinking.

The Role of Mediation in Achieving Potential

Closely associated with the ZPD, mediation is considered vital to attain higher cognitive functions since the human mind, according to Vygotsky, consists of lower mental processes like attention and memory which are biologically endowed and similar to those of other species that also give automatic responses (Lantolf et al., 2020). Echoing the views of Arievitch (2017), Lantolf et al. (2020) argue that what makes humans unique is their consciousness which leads to attention to relevant features of a situation, further planning, rational thinking, and risk evaluation of actions before carrying them out. In order to achieve higher mental processes one needs mediation, which is defined by Lantolf and Thorne (2006) as a "process through which humans deploy culturally constructed artifacts, concepts, and activities to regulate the material world or their own and each other's social and mental activity" (p.79). That is, human mental functioning is organized by three basic cultural factors, which are "activities (e.g. education, play, work), artifacts (e.g. physical tools, books, weapons, eating utensils, and computers), and symbolic tools (e.g. language, numbers, diagrams, charts, and art)" (Lantolf, 1995, p. 69). It is argued that humans do not directly interact with the world but use different kinds of mediation. To explain the role of mediation in enhancing the abilities of humans, Lantolf and Thone (2006) present the example of the action of digging as in the following:

> If we want to dig a hole in the ground in order to plant a tree, it is possible, following the behaviour of other species, to simply use our hands. However, modern humans rarely engage in such nonmediated activity; instead, we mediate the digging process through the use of a shovel, which allows us to make more efficient use of our physical energy and to dig a more precise hole. We can be even more efficient and expend less physical energy if we use a mechanical digging device such as a backhoe. Notice that the object of our activity remains the

same whether we dig with our hands or with a tool, but the action of digging itself changes its appearance when we shift from hands to a shovel or a backhoe. (p. 199)

Accordingly, higher mental processes of individuals are mediated through mediating agents of different natures including objects, physical tools, or another human being (Kozulin, 2003). According to SCT, it is essential to mediate learners to help them develop cognitively and internalize learning mechanisms (Tzuriel, 2011), which allows us to get a thorough understanding of one's matured and maturing abilities. Regarding this, Poehner (2005) maintains that it is possible to trace one's cognitive development by means of mediation since it mirrors one's potential future cognitive functions. Within the framework of SCT, language is the most powerful mediating agent, which humans use to mediate their connection to the environment, to one another, and themselves (Lantolf et. al, 2020). What this means is that people use language as a mediating tool to organize their functioning within the social circle and within themselves through inner speech, which is defined by Lantolf et al. (2020) as "the inward or self-directed use of language as a symbolic tool for cognitive regulation" (p. 227). Using language, more competent individuals help those who need other-regulation to achieve higher mental functioning through interaction. The one who assumes the role of mediator in interaction can employ various mediational techniques while assessing learners' ZPDs like asking a question, request for clarification, modeling, explanations, etc. In the case of inner speech, one can use language to organize his or her thinking by talking to himself or herself, which puts the person in the roles of the learner and the mediator at the same time.

Internalization

Another core element of Vygotsky's Sociocultural Theory is internalization. According to Yaroshevsky (1989, p. 230), "internalization accounts for the organic connection between social communication and mental activity and is the mechanism through which we gain control over our brains, the biological organ of thinking" (cited in Lantolf & Thorne). Vygotsky believes that the precondition for development is social learning, and every function in development appears on two levels, initially on the interpersonal level- between people and later on the intrapersonal level- within the individual (Lantolf & Thorne, 2006). Initially, a learner may need the support of a more capable person like a teacher, parent, or peer to complete tasks that are within their ZPD. Over time, the learner can eventually develop his or her ability to perform these tasks alone thanks to the interactions with this teacher, parent, or peer, which is referred to as internalization (Gal'perin, 1992). Accordingly, higher mental processes occur in the social circle at first and then are internalized and finally become an intrapersonal function of the individual who can carry out complex tasks without showing a need for mediation (Lantolf et al., 2020). That is, a learner's development can be tracked from other-regulation to self-regulation, which shows the path of internalization. However, internalization does not refer to just learning material very well and leaving it in the mind. A learning material or an ability can only be internalized on the condition that this recently acquired ability or material is tried in new contexts independently (Ableeva, 2010). DA aims to help learners internalize what has been taught through mediation and use that new knowledge in a different domain independently.

What is Dynamic Assessment?

Grounded in the notion of the ZPD, DA proposes an alternative or complementary approach to static standardized tests by fusing instruction and assessment into a single activity during which learners are given some level of support attuned to their needs with the purpose of developing their cognitive functions which could become internalized by the learners in the future (Lidz & Gindis, 2003). Lantolf and Poehner (2004, p. 50) define DA as a "procedure for simultaneously assessing and promoting development that takes account of the individual's (or groups') zone of proximal development". Thus, it can be asserted that DA prioritizes potential for growth with assistance over solo performance. Although DA was grounded on the principles of the Vygotskian theory of mind, it was not formally established by Vygotsky himself (Poehner & Lantolf, 2005). It was developed by Feuerstein who was interested in promoting the learning potential of disadvantaged children who had brain impairment and therefore performed poorly on traditional tests and as a result were categorized as low achievers in the 1950s (Anton, 2009). To reduce these educational inequalities for these children and improve their

cognitive functioning through the application of an intervention program called instrumental enrichment program, Feuerstein proposed the theory of structural cognitive modifiability and mediated learning experience (MLE) for disadvantaged children by stating that one's level of mental functioning could be modified depending on the nature and amount of mediated learning experiences he/she received. Hence, his theory seems to underscore the role of mediation in learning enhancement.

Looking at the general framework of his theory, it is suggested that Vygotskian SCT and Feuerstein's MLE share common grounds in their approach to promoting higher mental processes in individuals. Similar to SCT, Feuerstein's theory assigns great roles to the human mediator who provides mediation to the individual in varying quantity and quality to transform his or her attained abilities. DA was also introduced by one of Vygotsky's influential colleagues, A.R. Luria (1961) in a paper that contrasted static and dynamic approaches to assessment.

Although it was initially proposed for the development of children, DA is now applied in psychological and educational research with different groups of learners. DA puts the potential growth of learners at the center of the approach, which is commensurate with the notion of the ZPD within the framework of SCT. Learners' potential growth is promoted through interventions that emerge in the cooperative dialogue between the mediator and the learners when they come across a difficulty leading to performance breakdowns (Poehner, Davin, & Lantolf; 2017). Although it is viewed as an approach to assessment, DA aims to trigger the transformation of individuals' cognitive abilities using intervention, which indicates another focus besides assessment, which is instruction. From a Vygotskian stance, an assessment not only diagnoses attained abilities, but also attempts to foster development based on the diagnosis (Anton, 2009). In parallel with SCT, DA argues that an assessment that is focused on an individual's present abilities demonstrated through independent performance ignores what the individual can do with assistance, which is the true representation of their scope of mental functioning. That is, DA helps gauge the extent of one's cognitive functioning by opening a window to their potential cognitive abilities. It is not possible for static assessment to provide this kind of information since the only purpose of static assessment is to reveal what one can do at present, not to anticipate his or her future capacity. How does DA provide a more complete picture of one's abilities? It is through interaction with the social environment, which is the source of mediation for individuals to achieve higher mental capacities.

DA applications mainly differ in terms of how mediation is offered, that is, whether mediation is provided based on a priori set of moves or in a flexible manner. There are two fundamental approaches to DA, namely interventionist and interactionist. In interventionist DA, the most well-known proponent of which is M. Budoff, learners are provided hints or prompts from a list with predetermined moves usually with the purpose of increasing the validity and reliability of the procedure (Lantolf & Poehner, 2004). What is important in interventionist DA is the quantification of the process concerning the help provided. Because the process offers a more valid and reliable interpretation, interventionist DA is used widely in the fields of general education (Budoff, 1987; Guthke, 1992). During the dialogic interaction, the mediator uses a list of mediational prompts or hints which are prepared beforehand and offered to learners in a fixed order. This approach allows the mediator to manage interactions more efficiently and statistically analyze the level of development each learner has attained (Lantolf & Poehner, 2004).

The second approach to DA is referred to as interactionist DA. As its name suggests, in interactionist DA, which has no concerns for validity or reliability, mediational strategies are offered based on the dialogic interaction in a more flexible manner, rather than strictly following a list (Poehner, 2005). That is, the mediator does not use a pre-determined set of moves since it is against the nature of its basic tenet, which is achieving an extensive understanding of what the learner can do at a given point and how that ability can be promoted through the provision of contingent feedback attuned to learners' emergent needs during dialogic interaction. The most important proponents of this approach are Feuerstein and his colleagues. The main purpose of the interactionist approach to DA is not to quantify learner growth or make a comparison between learners based on scores obtained from a list of predetermined prompts but to foster learners' cognitive development through mediation which focuses on the need of the individual determined by his or her responsiveness, not on a priori list. In

interactionist DA, collaborative act and interaction are central concepts, which help the mediator to diagnose one's needs and provide immediate feedback attuned to his or her needs (Ableeva, 2010).

Basic tenets of DA

1. *DA embraces a unified understanding of instruction and assessment.*

The integration of instruction and assessment into a single process is associated with DA's purpose of seeing the actual to realize the possibilities. That is, since the important thing is the possible cognitive maturity individuals can reach with support, it is not enough to only diagnose the attained abilities, it is also essential to further develop these abilities by eradicating the gaps in their actual knowledge and potential knowledge (Linds & Gindis, 2003). This central focus of the approach is addressed by Bronnfenbrenner (1977, p.528) in an excerpt taken from a conversation with Leontiev, a colleague of Vygotsky, as follows: "American researchers are constantly seeking to discover how the child came to be what he is; we in the USSR are striving to discover not how the child came to be what he is, but how he can become what he not yet is.' (cited in Poehner, 2005).

2. *DA is change-focused.*

As its name suggests, DA gives importance to the dynamic nature of one's abilities by viewing them not as fixed traits that one possesses but as constantly changing. Therefore, it aims to transform learners' already matured abilities to further foster their development in order to reach their potential through mediation. In line with SCT, which envisages the transformation of both mind and environment through interaction, DA is primarily concerned with learners' ZPDs.

3. *DA is realized through collaboration and interaction.*

In DA, a learner's performance entails the joint contribution of the mediator and the learner to create meaning through ongoing negotiation. As suggested by SCT, the social environment plays an essential role in helping learners achieve their proximal capacities, which also indicates the central role of collaboration and interaction in DA. Learners need the assistance of more capable individuals to extend their attained level of cognitive functioning (Elliot, Lauchlan & Stringer, 1996; Ableeva, 2010)

4. *DA views mediation and reciprocity as integral components of the teaching and learning process.*

DA prioritizes the further growth of learners' mental functioning through the involvement of the social environment which forms the basic source of mediation for learners. If we consider language, which is accepted as the most powerful mediating tool (Lantolf et al., 2020) as the mediating agent, learner development can be outlined based on the quality and quantity of mediation provided to learners and their reciprocity to these mediations. Since interaction involves at least two parties and learners are also the active shapers of the interaction (Poehner, 2005), their reciprocity gives essential information about the extent of their ZPDs. Vygotsky stresses the critical role of responsiveness to mediation in order to grasp cognitive functions as it reflects one's future performance (Poehner, 2005b).

5. *DA considers transcendence (transferring an ability) a necessity for independent functioning.*

Feuerstein et al., (1979, p.92) assert that "true development *transcends* any specific task, and the results of development should be visible in a variety of ways under differing conditions" (cited in Poehner, 2005). The term transcendence, which can be defined as expanding the scope of ability to a more challenging context (Ableeva, 2010), is conceptualized in Feuerstein's MLE (Feuerstein, Rand & Hoffman, 1979) and is also called transfer in Brown's Graduated Prompt Approach (Brown & Ferrara 1985). According to Vygotsky, development is not limited to the completion of a difficult task, but it is the application of an attained ability in newer contexts other than the one in which that ability has been learned (Poehner, 2005). Transcendence of mental ability is essential to reveal if the ability has been internalized or not.

How does dynamic assessment differ from the non-dynamic assessment?

Evaluation of students' learning has always been an integral part of the educational field to shed light on the effectiveness of the learning and teaching process. According to Gould (1996), assessment emerged as a domain that attracted researchers and educators in the 19th century, and widespread practices of assessment began in the 20th century (as cited in Poehner, 2008). Herman and Golan (1991) stress that the proponents of testing advocate the use of testing for educational purposes based on a variety of arguments like holding schools and teachers more responsible for students' learning, designing classroom instruction based on tests results, and providing meaningful standards to which schools, teachers, and students can adhere. Standardized tests have always been the most popular forms of assessment, and they aim to reveal how successful learners are with respect to their past learnings and to find out to what extent program goals have been met through the standardization of the process of test administration and analysis of the results.

Standardized assessments regard assessment and instruction as two separate practices and prioritize assessment, which 100% contradicts the underlying principle of DA, which views assessment and instruction as two inseparable gears of the wheel. Next, traditionally in standardized static tests, learners are evaluated on the basis of their solo performance which is assessed at the end of the learning process (be it a chapter, a unit, or an academic term) to reveal what the learner knows or is capable of doing independently during the testing time. However, DA does not confine itself to certain subjects as it is in nondynamic assessment. What is more, learners' independent performance is considered vital for the effectiveness of standardized tests, which perceive any external assistance provided to the learner as a threat to the reliability of the whole testing procedure since it is not the learner's solo performance that is assessed in case of assistance but the performance jointly constructed by both the learner and the helper. What matters in static tests is the outcome. For this reason, what causes learners to perform poorly or if their performance could be augmented are not relevant to the assessment goals. This view of assessment is totally not commensurate with that of DA, which has no interest in the final product of learners. What DA is indeed concerned with is diagnosing learners' abilities through interaction and mediation and providing the necessary assistance to the learners to foster their abilities. DA doesn't regard receiving external help as a threat to the testing conditions because it does not recognize any other assessment practices as a sufficient way to illustrate learners' true development. Additionally, standardized tests do not ensure equal treatment for learners, because they aim to measure what learners know at a certain time and to categorize learners based on the results. Usually, standardized tests cannot address learners with attention to their individual traits. However, since DA is realized with individual learners considering their responsiveness, it can treat individuals separately, mediate them to the extent they require, and promote their development. This is especially essential for disadvantaged learners who perform poorly on standardized tests due to an impairment they have, their deprived sociocultural background, etc. (Ascher, 1990; Lidz & Pena, 2009). In brief, while standardized tests have offered many benefits since their introduction, their reliability and validity are still questioned (Herman & Golan, 1991). Despite their evident differences, it must be clearly noted that DA didn't emerge to completely replace static assessment (Anton, 2009) because there are also situations that require the use of standardized static tests due to several reasons such as being time-saving, easier preparation, and practical administration procedures (Ascher, 1990).

Criticisms against DA

Although DA has been applied for nearly a hundred years, it has not brought about any widespread pedagogical changes, which is also the case even in the field of special education where a substantial amount of research on DA has been conducted (Poehner, 2008). This may be partially true because of the criticism directed to DA by researchers in mainstream psychology, which is grounded on different theoretical frames and makes use of distinct explanatory constructs and research methodologies from the ones favored in SCT. According to Poehner (2008), psychometric tests give importance to measurement and quantification. Gould (1996) asserts that the cognitive abilities of learners are treated as discrete traits that individuals have in different amounts and regarded as stable and predictable traits of learners which can be measured just like their height or weight. On the other hand, DA asserts that human cognition is dynamic in nature and modifiable through intervention, so psychometric tests cannot provide a thorough analysis of one's mental functions by measuring them at a given time

(Poehner, 2008). However, this leads to one of the harshest criticisms leveled at DA by the proponents of psychometrics tests in that interacting with the learners during the assessment and providing assistance to them so that their performance could be enhanced jeopardize the reliability of the testing procedure (Lidz, 1991; Poehner, 2005; Poehner & Lantolf, 2005). If learners are provided assistance during testing, it makes it impossible to correctly interpret their abilities because they are in constant change. In psychometric counterparts of DA, tests are developed so rigorously that they do not cause learners to learn from the items due to any given clues and as a result perform better on subsequent items (Elliot, Lauchlan, & Stringer, 1996). Thus, one of the concerns against DA is that DA researchers fail to ensure the critical test theory constructs like generalizability, validity, and reliability of their procedures. Due to these criticisms, some DA researchers following an interventionist approach have incorporated traditional testing constructs into their procedures by making their procedures more standardized, which could enable them to conduct statistical analyses on the learners' mediated performance (Guthke, 1992). This criticism is leveled particularly at interactionist DA because there is no standardization in its procedures. However, those leveling criticisms of DA miss an essential point about DA, which is that the critical test theory constructs like validity and reliability are not among the goals of DA because of its theoretical orientation. Inspired by Vygotskian thinking, DA attaches greater importance to both diagnosing actual cognitive abilities and developing maturing abilities than psychometric properties of a test and the process of test administration (Poehner & Lantolf, 2004). Within the framework of DA, development does not refer to the completion of a task successfully, but to transforming one's abilities through mediation in interaction. According to Lidz and Gindis (2003), "Traditional standardized assessment follows the child's cognitive performance to the point of 'failure' in independent functioning, whereas DA in the Vygotskian tradition leads the child to the point of achievement of success in joint or shared activity" (p.103).

An additional reason why DA is criticized is that the measurement process has too much ambiguity, which means that it is very difficult to discern the mediator's contributions to students' performance; so, it is impossible to measure one's abilities reliably. (Poehner, 2008). In response to this criticism, supporters of DA assert that DA aims not to measure one's abilities in isolation but to interpret individuals' existing abilities and project the abilities that may emerge and promote the already attained ones to reach the possible abilities through mediation in dialogic interaction. What is more, Vygotsky views development not as an individual act, but as a co-constructed act (Poehner & Infante, 2016). DA posits that one's performance cannot be interpreted in isolation and that the social environment is not considered the only setting for development, but the leading source of development (Poehner, 2008).

Another criticism against DA results from its novelty. In contrast to its counterparts that have a disintegrated approach to assessment and instruction, DA unites instruction and assessment. This causes it to be radically different from others and therefore more difficult for scholars who follow the mainstream research tradition to understand how to apply DA procedures within their setting. Studies conducted on DA, especially interactionist DA, usually fail to illustrate the procedures followed in the study comprehensively. Protocols followed in mediator-learner interactions are not given in detail in many studies, which results in more criticisms from researchers in the non-dynamic assessment tradition.

Furthermore, the tendency to conduct research on the DA of individual learners makes it time-consuming (Anton, 2009). Many classroom settings around the world comprise between 20-30 learners in a class on average, so DA is not considered very practical for testing purposes by some circles. What is more, standardized static tests are relatively easier to administer and score. However, what is imposed in DA is the detailed qualitative analysis of each learner's development, which makes it difficult to be employed for testing purposes in class settings.

Finally, since DA does not have as a long history as traditional testing, DA needs to prove its advantages over static assessment (Sternberg & Grigorenko, 2002, as cited in Anton, 2009). Although it has been used in psychology and general education for quite a long time, it is still not enough to make certain assertions about the effectiveness of DA in different contexts with respect to the field of SLA.

Advantages of DA

There has been some research conducted on DA in the fields of education and psychology for several decades to reveal its contributions to the learning process. Initially, DA integrates the two key elements in learning, which are teaching and assessment. They are not treated as separate processes, as in static tests. In addition, unlike nondynamic tests, which usually assign a score to each individual as an indicator of how well he/she has performed in the test, DA prevents teachers from overestimating and underestimating learners' abilities (Poehner, 2008). It can be put forward that DA can be applied not only to identify the difficulties that learners come across in the learning process, but also to specify the extent and source of the difficulties, and that DA can help learners to overcome the difficulties met through intervention. According to Poehner (2008), assessments should be *prognostic* rather than simply *diagnostic*, which allows us to go beyond simply acknowledging that learners are challenged and forces us to examine *how* individuals approach certain types of problems and *where* these difficulties emerge (p. 114, italics in original). This helps teachers to design remedial learning plans for each individual to promote their development (Anton, 2009). This is especially beneficial for underprivileged learners like those with low socioeconomic backgrounds or those who have a kind of learning disability. In traditional, standardized tests, the abilities of these learners are often underestimated with no concern for the underlying reasons (Budoff, 1968). However, DA aims to provide a richer account of the abilities of individuals through social interaction and mediation (Poehner, 2005). DA allows tracking learners' development via analysis of the quality and quantity of mediation offered to learners and their responsiveness (Anton, 2009), which makes it easy to identify the changes occurring in their performance.

A final advantage of DA is that it can be used to predict the extent of one's future development. Learners' ZPDs are estimated based on their responsiveness to mediational moves. That is, the more responsive learners are to mediation, the larger ZPDs they are expected to have. This can give teachers an idea while planning their lessons. In addition, DA helps learners become more self-regulated and autonomous by assigning them responsibility in the process. By receiving mediating moves, one can move from object regulation and other-regulation to self-regulation over time (Lantolf & Thorne, 1996; Poehner, 2005).

Conclusion and implications

This study attempted to provide an overview of what DA is by addressing its theoretical base, relevant constructs, basic principles, differences with nondynamic assessment, criticisms directed to it, and its advantages for the field of SLA. The review of the literature on DA suggests that it can yield positive effects on language teaching and learning processes since it aims not only to uncover success in past learning but also to further it by revealing the underlying reasons for learners' poor performance and intervening to help learners overcome the problems they have encountered to achieve better performance. DA, as it proposes, ensures teachers are more aware of their learners' strengths and weaknesses and shape their teaching based on their diagnosis of the learners' needs as a result of the dialogic interaction they have with the learners. This approach may indeed be very useful within the language teaching and learning context because learners must develop their abilities in terms of multiple aspects for different language skills, which makes it essential to gauge the extent of one's abilities and offer appropriate mediation to promote his/her development. Hence, considering its potential contributions, it is suggested that language teachers make use of DA; however, as it is still a novel approach, teachers should be trained on how to apply DA in their teaching through pre-service training and in-service training. In addition, teacher education departments at universities can offer courses or workshops on DA so that their students who are future teachers can be aware of this alternative assessment for classroom use.

Although DA has been applied in developmental and educational research for a long time, there is still a further need to explore it in detail with respect to SLA research (Poehner, 2005). The studies conducted on DA have yielded promising effects for its use in the field of language teaching and learning. However, due to its being a relatively novel practice for the field of SLA, the number of studies conducted on the use of DA in the field of SLA is still limited. Therefore, more research is

warranted on the applications of DA in different contexts. For one thing, employing DA practices to expand the ZPD of an entire class has been underexplored, so DA can be applied in classroom contexts and the efficiency of the approach can be reported. Additionally, comparative studies can be conducted on the interventionist and interactionist approaches for DA to unearth the impact of each on developing different language skills.

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