OSMANGAZİ JOURNAL OF EDUCATIONAL RESEARCH

OJER

OJER: http://ojer.ogu.edu.tr

Osmangazi Journal of Educational Research is published by Institute of Education in Eskisehir Osmangazi University, Türkiye

OSMANGAZİ JOURNAL OF EDUCATIONAL RESEARCH

(OJER)

Volume 11, Number 1, Spring 2024

Correspondence Address

OJER Dergisi, Eskişehir Osmangazi Üniversitesi, Eğitim Bilimleri Enstitüsü, Meşelik Yerleşkesi, Eğitim Fakültesi Yeni Binası B Blok Kat.4, 26480 Eskişehir/Türkiye

E-mail: ojer@ogu.edu.tr Tel: +902222393750 /ext. 6300

Fax: +90 222 239 82 05

Contents

Volume 11, Number 1, Spring 2024

Articles

Editorial Commission

Editor-In-Chief

M. Zafer BALBAĞ, Ph.D.
Eskişehir Osmangazi University, TÜRKİYE
E-mail: zbalbag@ogu.edu.tr
Tel: +90-222-239 3750 (ext. 6300)
Fax: +90-222-239 82 05
Postal Address: Eskişehir Osmangazi Üniversitesi, Eğitim Bilimleri Enstitüsü, Meşelik Yerleşkesi 26480 Eskişehir / TÜRKİYE

Editor-In-Chief Assistant

Emre EV ÇİMEN, Ph.D.
Eskişehir Osmangazi University, TÜRKİYE
E-mail: evcimen@ogu.edu.tr
Tel: +90-222-239 3750 (ext. 6302)
Fax: +90-222-239 82 05
Postal Address: Eskişehir Osmangazi Üniversitesi, Eğitim Bilimleri Enstitüsü, Meşelik Yerleşkesi 26480 Eskişehir / TÜRKİYE

Editorial Assistants

Z. Melis DEMİR, Ph.D.
Eskişehir Osmangazi University, TÜRKİYE
E-mail: zmelisdemir@gmail.com
Tel: +90-222-239 3750 (ext.6812)
Postal Address: Eskişehir Osmangazi Üniversitesi, Eğitim Fakültesi, Meşelik Yerleşkesi 26480 Eskişehir / TÜRKİYE

Elif TUNÇEL, Researcher
Eskişehir Osmangazi University, TÜRKİYE
E-mail: eliftuncel@gmail.com
Tel: +90-222-239 3750 (ext.6837)
Postal Address: Eskişehir Osmangazi Üniversitesi, Eğitim Fakültesi, Meşelik Yerleşkesi 26480 Eskişehir / TÜRKİYE

Gözde TEKBAŞ, Researcher
Eskişehir Osmangazi University, TÜRKİYE
E-mail: gozde.tekbas@ogu.edu.tr
Tel: +90-222-239 3750 (ext.6754)
Postal Address: Eskişehir Osmangazi Üniversitesi, Eğitim Fakültesi, Meşelik Yerleşkesi 26480 Eskişehir / TÜRKİYE

Merve YAVUZ, Researcher
Eskişehir Osmangazi University, TÜRKİYE
E-mail: merve.yavuz@ogu.edu.tr
Tel: +90-222-239 3750 (ext.6782)
Postal Address: Eskişehir Osmangazi Üniversitesi, Eğitim Fakültesi, Meşelik Yerleşkesi 26480 Eskişehir / TÜRKİYE

Proofreaders

Emine EREN GEZEN, Ph.D.
Eskişehir Osmangazi University, TÜRKİYE
E-mail: egezen@ogu.edu.tr
Tel: +90-222-239 3750 (ext.6853)
Postal Address: Eskişehir Osmangazi Üniversitesi, Yabancı Diller Eğitimi Bölümü, Meşelik Yerleşkesi 26480 Eskişehir / TÜRKİYE

Editorial Board

Reviewer List for Volume 11, Number 1, Spring 2024

Nurhan Atalay, Ph.D.	Niğde Ömer Halisdemir University, TÜRKİYE
Gültekin Atalik, Ph.D.	Amasya University, TÜRKİYE
Cengiz Hakan Aydın, Ph.D.	Anadolu University, TÜRKİYE
Osman Bağdat, Ph.D.	Anadolu University, TÜRKİYE
Ümran Demir, Ph.D.	Alanya Alaaddin Keykubat University, TÜRKİYE
Deniz Gülmez, Ph.D.	Necmettin Erbakan University, TÜRKİYE
Nejla Gültepe, Ph.D.	Eskişehir Osmangazi University, TÜRKİYE
Tuğba Horzum, Ph.D.	Necmettin Erbakan University, TÜRKİYE

**Reviewer List is alphabetically ordered by last names*

Reviewer List for Volume 11, Number 1, Spring 2024

Feriha Hande İdil, Ph.D.	Ministry of National Education, TÜRKİYE
Tevfik İşleyen, Ph.D.	Atatürk University, TÜRKİYE
Eren Kesim, Ph.D.	Anadolu University, TÜRKİYE
Himmet Korkmaz, Ph.D.	Ordu University, TÜRKİYE
Ebru Saka, Ph.D.	Kafkas University, TÜRKİYE
Mehmet Sandal, Ph.D.	Manisa Celal Bayar University, TÜRKİYE
Neslihan Şahin, Ph.D.	Sinop University, TÜRKİYE
Özge Yiğitcan Nayir, Ph.D.	Başkent University, TÜRKİYE

**Reviewer List is alphabetically ordered by last names*

Osmangazi Journal of Educational Research (OJER) is published by the Institute of Education of Eskisehir Osmangazi University, Türkiye.

OJER is an online, open-access, international, scholarly, peer-reviewed journal offering scholarly research articles on various topics in all areas of educational sciences.

All submitted manuscripts must be original, previously unpublished and not under consideration for publication in any type of publication outlet.

OJER is being published twice a year.

"Victory belongs to those who can say victory is mine.
Success belongs to those who start by saying "I will succeed" and finally say "I did."

(Mustafa Kemal ATATÜRK)

Dear Readers,

The main purpose of education is to process, develop, specialize and enable as a useful producer the inherent talents in humans. Education covers both theoretical knowledge and practical skills and contributes to individuals' personal development, professional competence and social adaptation. Education is the driving force of individual success and social development; and in this context, research that shapes education is the basis of educational practices and policies. As Henri Poincaré stated, "Science is built of facts, just as a house is built of bricks. But collecting facts is not science. Just like a cluster of bricks doesn't mean a house." With his words, he emphasizes that science has a certain systematic and methodology. Educational research is an academic discipline that studies educational systems, methods and processes. These studies use a variety of methods and theories to understand teaching and learning processes, evaluate educational policies, and improve the achievement of teachers and students. Educational research includes research conducted in many fields and subjects in order to understand the dynamic structure of education systems, develop teaching strategies and increase student success. These studies on innovations, problems and opportunities in the field of education provide researchers, practitioners and policy makers; It provides important information that will contribute to shaping the educational environments of the future. Improving the quality of education requires constant review of not only teaching methods but also educational policies.

With this motivation, **OJER (Osmangazi Journal of Educational Research)** aims to contribute to educational research and facilitate the sharing of educational knowledge. OJER is published twice a year in English by Eskişehir Osmangazi University Institute of Educational Sciences. It is an online, open accessed, international, peer-reviewed journal that offers scientific research articles in all fields of educational sciences. Qualitative and quantitative mixed method researches and compilation studies in many fields whose subject is education and training; research results from theory to practice are included. Our goal is to promote researches that are original, creative, enlightened and that shape the future of education with emphasis on ethical values.

In this issue of **OJER**, there are important studies that will contribute to the field. We would like to express our gratitude to the researchers, the reviewer referees, the editorial board, the journal secretariat and our readers who examined our journal and reached us via e-mail. In this issue of **OJER** of Spring 2024, 7 studies are presented, as introduced below:

The 1st article of this issue is entitled "Investigating Students' Problem Solving Achievements, the Modeling Steps reached and Modeler Types in the Process of Mathematical Modeling Activities" written by Özlem ÇELİKKOL, and Aytaç KURTULUŞ. The aim of this study is to identify the effect of mathematical modeling activities applied as action plans on the development of students' achievement in solving algebraic verbal problems, as well as to investigate the mathematical modeling competencies they use during these activities and the modeling steps they reach. Moreover, the types of mathematical modelers that the students demonstrated during this application process were examined in the study. The study was conducted as an action research with a total of 15 7th grade students in rural areas. The data were collected through observations, researcher and student diaries, as well as interviews conducted with students. As a result of the study, it was confirmed that students' mathematical modeling competencies were related to competencies such as general mathematical knowledge or verbal comprehension, and it was also revealed that students' mathematical knowledge competence could be examined in more detail. It was also found that students could achieve competencies through group work and their success in solving the verbal algebraic problems generally improved based on their mathematical modeling competencies.

The 2nd article of this issue is entitled "Examining Occupation Fields of Programs According to Artificial Intelligence: Anadolu University Open Education System Case" written by Sefa Emre ÖNCÜ, and İrfan SÜRAL. Anadolu University's Open Education System (OES) accommodates over one million students and has incorporated an AI-based Virtual Assistant for non-academic support since 2022. While OES offers abundant information about its programs on its website, there is a notable absence of support services providing job recommendations related to students' chosen programs. This gap in student support extends to the post-graduation phase, with the Virtual Assistant lacking a concept for guiding students in finding employment opportunities. Recognizing the need for comprehensive assistance, this study sought to leverage AI capabilities to offer job

recommendations by extracting information from the objectives of 63 OES programs. The initial inquiry involved requesting AI-generated job recommendations based on the stated objectives of these programs. Subsequently, the Virtual Assistant was tasked with providing insights into the occupation fields associated with OES programs. Analysis of the AI's responses, along with the classification of occupations according to the International Standards of Classifications of Occupations (ISCO) and the International Standard Classification of Education (ISCED), forms the core of this study. Contrary to trends observed in most European countries, the predominant number of graduates in Türkiye emerges from business and management fields. However, the correlation between graduation rates and subsequent job placements appears suboptimal within the labor force and employment landscape. The study advocates for the integration of AI in offering job recommendations, incorporating graduation and employment rates. This approach enables students to seek guidance on suitable programs aligned with their skills, fostering a more informed decision-making process. The study underscores the potential for higher education institutes to share employment and labor force data.

The 3rd article of this issue is entitled "Comparison of the Effect of Teachers Speaking Only English in English Language Teaching on Students' Anxiety According to Gender and Graduation Status: A Quantitative Research" written by Kamil YAR, and Fatih ÇEMREK. This casual comparative study investigated the impact of exclusive English Language instruction by teachers on students' anxiety levels in the context of English language learning, with a particular focus on the students' graduation status. The research was conducted with 450 university students enrolled in English language programs at two private educational institutions in Eskişehir. The participants were attending English speaking lessons delivered by both local and foreign instructors. The findings revealed that the exclusive use of English by teachers during second language instruction did not significantly impact students' anxiety level based on gender. However, a noteworthy distinction emerged between university graduates and non-graduates, suggesting that anxiety levels were lower among the former group.

The 4th article of this issue is entitled "Examination of Elementary School Mathematics Teachers' Mathematical Modelling Attitudes in Terms of Various Variables" written by Esra ALTINTAŞ, Şükrü İLGÜN, and İsmail SOYTETİR. This study aims to examine elementary mathematics teachers' attitudes towards mathematical modelling in

terms of various variables. The current study is particularly important as it is one of the few ones in our country to investigate this type of work, focusing on the attitudes of elementary mathematics teachers towards mathematical modelling across all sub-dimensions. A survey model, one of the quantitative research methods, was used, and the sample of the study consisted of 102 elementary mathematics teachers working at official secondary schools and official imam hatip secondary schools in Aydın province. The research revealed that elementary mathematics teachers exhibit a low level of attitude towards mathematical modelling. Although their motivation sub-dimension towards mathematical modelling was high, the real-life sub-dimension was moderate, while the constructivism and understanding sub-dimensions were low. However, it was found that the sub-dimension and overall scores of the mathematical modelling attitude scale of elementary mathematics teachers did not differ according to gender, faculty of graduation, age, and professional experience, but they did differ according to level of education.

The 5th article of this issue is entitled "Teacher Disappointments from Teacher's Perspective" written by Semiha ŞAHİN, Ömer DEMİR, and Yavuz Kamil ŞEVİK. The principal aim of this paper is to gain a comprehensive understanding of teachers' encounters with disappointment, specifically focusing on their daily experiences in school settings. By employing a qualitative research methodology, this investigation adopts a phenomenological framework. The application of thematic analysis enabled an in-depth exploration of teachers' experiences in relation to the phenomenon of disappointment. The analysis was rooted in data collected through semi-structured interviews with 28 teachers from schools in İzmir, Türkiye. The findings of the research reveal that the primary sources of teachers' disappointments include the education system, educational administrators, parents, students, the teaching profession, and colleagues. These key themes were meticulously examined in the study, and both the positive and negative impacts of disappointments on teachers were also deliberated.

The 6th article of this issue is entitled "Differentiated Instruction in the World and Türkiye through Studies" written by Zeynep Ecem ALKIN, and Burcu ANILAN. In this study; to reveal the change process of differentiated instruction approach from past to present, studies published in English and Turkish languages were examined according to various variables and it was aimed to compare them according to foreign and domestic perspectives. The research data consisted of Turkish and English articles published on

differentiated instruction approaches between 2006 and 2023. The data were obtained from reliable sources by searching the Google Scholar database for Turkish articles and the Web of Science database for English studies. As a result of document analysis, it was found that more teacher-oriented and process-planning studies were conducted in English, while more student-oriented process-planning was observed in Turkish studies. Based on these results, it is recommended that researchers conduct studies with groups such as parents and administrators to observe the effects of the process on different data groups.

The 7th article of this issue is entitled "Investigation of Middle School Students' Attitudes towards Mathematics Course in the Context of Different Variables (Eskişehir-Türkiye Case)" written by Emin ÖZEN, and Funda ÇIRAY ÖZKARA. This study aims to investigate middle school students' attitudes towards mathematics lessons in the light of various variables. A quantitative cross-sectional survey approach was used in the design of the study. It was tried to understand how these variables affect students' attitudes towards mathematics. Various variables such as gender, grade level, school type, technology use, use of concrete materials/activities in lessons and use of Education Information Network (EBA), an online platform for distance education, were taken into consideration. According to the findings, students' attitudes towards mathematics lessons are positively affected by educational policies, curriculum designs and the creation of concrete materials and activities in the classroom. In particular, a detrimental change was observed in the attitudes of students who used EBA less. The perspective provided by this study is crucial for understanding middle school students' attitudes about mathematics in learning environments. It is also recommended that the study be extended to cover more samples and regions, as the findings can serve as a basis for further research.

See you in the next issue…

"Stay with Science, Stay with Us"

M. Zafer BALBAĞ, Ph.D.
Editor In Chief
Director of Institute of Education
Eskişehir Osmangazi University, Türkiye

Osmangazi Journal of Educational Research **Volume 11(1), Spring 2024**

RESEARCH Open Access

Suggested Citation: Çelikkol, Ö., & Kurtuluş, A. (2024). Investigating students' problem solving achievements, the modeling steps reached and modeler types in the process of mathematical modeling activities. *Osmangazi Journal of Educational Research, 11*(1), 1-38.

Submitted: 01/10/2023 **Revised:** 13/02/2024 **Accepted:** 08/06/2024 **DOI:** 10.59409/ojer.1369551

Investigating Students' Problem Solving Achievements, the Modeling Steps reached and Modeler Types in the Process of Mathematical Modeling Activities

***Özlem Çelikkol , **Aytaç Kurtuluş**

Abstract. The aim of this study is to identify the effect of mathematical modeling activities applied as action plans on the development of students' achievement in solving algebraic verbal problems, as well as to investigate the mathematical modeling competencies they use during these mathematical modeling activities and the modeling steps they reach. Moreover, the types of mathematical modelers that the students demonstrated during this application process were examined in the study. The study was conducted as an action research with a total of 15 7th grade students in rural areas. It was aimed to reveal the mathematical modeling competencies that students achieved during mathematical modeling activities through observations, researcher and student diaries, as well as interviews conducted with students. Content analysis was implemented to analyze the data. During the study, the mathematical modeling competencies demonstrated by the students in each mathematical modeling activity and the mathematical modeling steps they reached were identified. As a result of the study, it was confirmed that students' mathematical modeling competencies were related to competencies such as general mathematical knowledge or verbal comprehension, and it was also revealed that students' mathematical knowledge competence could be examined in more detail. It was also observed that students could achieve competencies through group work and it was found that students' success in solving the verbal algebraic problems generally improved based on their mathematical modeling competencies.

Keywords. Mathematical modelling, modelling competencies, modeller types, problem solving.

* Teacher Ministry of Education, Erzincan, Türkiye

e-mail: zlemclkkl2423@gmail.com

** Prof. Dr. Eskisehir Osmangazi University, Faculty of Educatıon, Eskisehir, Türkiye

e-mail: agunaydi@ogu.edu.tr

Note: This article is presented as part of the master thesis.

Problem solving skill is a skill that we encounter not only in mathematics but in every field especially in this day age. In general sense, problems are the questions whose solutions are not known in advance and do not have a clear solution (MoNE, 2018). What makes the problem different is that it includes special circumstances that have not been encountered previously. Situations such as financial crises, earthquakes, negativities generated by population growth, and unplanned urbanization can indeed be considered as problems. Particularly in the present century, more complex problems are encountered that require knowledge and information from more than one discipline to solve. While knowledge of engineering field is required to solve a problem in the field of medicine, applying mathematical knowledge in the software world can be represented as an example of such situations. Zawojewski and Lesh (2003) stated that the experts in application fields where mathematics, science and technology were used intensively, such as engineering, medicine and business management, indicated that problem solving constantly changed significantly over the past 20 years.

Muller and Burkhardt (2007) stated that it was of great importance in mathematics curricula to teach students the basic skills that they would encounter in their lives or work during their school years. In this sense, mathematics education should be provided with the methods best-suited for this purpose. In this context, the interaction of future generations with problems related to real life, appropriate to their own level, rather than disconnected from the problems of daily life, turn out to be all the more important. It is a common target of mathematics educators to enable students to interpret real-world problems with figures and equations (Nemirovsky, 1996). Furthermore, as emphasized in the mathematics curriculum, "problem solving skills" should be considered within the scope of non-routine problems and just routine problems should not be satisfied with (MoNE, 2013). Non-routine problem situations can often be regarded as real-world problems. In order to address these problems at school, mathematical modeling based on real-world problems rather than classical problem solving can be debated. What differentiates the mathematical modeling problems from the routine verbal problems is that they are the problems that involve mathematization skills related to daily life, rather than being a problem that depends on the results found as a result of a few operations.

Mathematical Modeling and Problem Solving

Broadly speaking, even though models are simply representations of how an event works, they are conceptual systems that allow the definition of structures by explaining the elements,

relationships between these elements, and operations with some representations (Lesh, Carmona & Post, 2002). Therefore, based on this definition, it is possible to say that models are relational and connectional structures created using signs and symbols based on situations or events. While the normal problem-solving procedure proceeds in a linear way between those given and those goals as illustrated in Figure 1, the modeling approach proceeds cyclically by dividing the problem into stages.

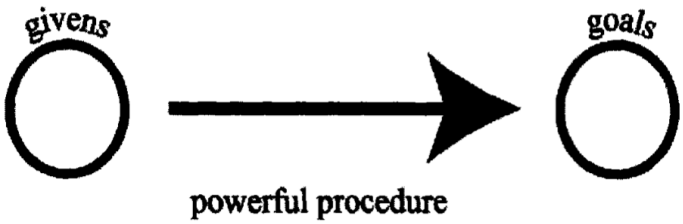


Figure 1. Information- Processing Perspective in Problem Solving (Zawojevski & Lesh, 2003).

Mathematical models are formed by establishing mathematical structures, connections and relationships over a real situation and transferring this real situation or problem to the mathematical world (Berry & Houston, 1995; Lesh & Doerr, 2003). Mathematical models are the reflection of a real situation or problem in the world of mathematics. With the connectional, relational and structural model obtained through this reflection, the problem at hand is resolved, verified and explained. This cycle generates the mathematical modelling.

According to Blume (1989, p. 93) mathematical modeling is "transforming a problem situation into its reflection in the mathematical world, where it can be worked on more appropriately than the real world and continuing this cycle." Furthermore, according to the Ministry of National Education (2013), mathematical modeling is a method that enables one to easily see the relationships between problems in life and to express, classify and generalize these relationships using mathematical language.

Blum and Ferri (2009) stated that the mathematical modeling cycle was important for students,

- Since it was important for students to help them understand the world better,
- Since it supported mathematical learning (Motivation, concept formation, comprehension, support),

- Since it contributed to the development of various mathematical competencies and appropriate attitudes,
- Since it contributed to the convenient definition of mathematics.

Blum and Ferri (2009) explicated the modeling cycle as illustrated in Figure 2. As far as this figure is concerned, they referred to a cycle that started from a problem situation in the real world and ended with transferring this situation to the mathematical world by applying the mathematical knowledge and skills; in other words, a cycle consisting of modeling, interpreting, evaluating it and explaining the results.

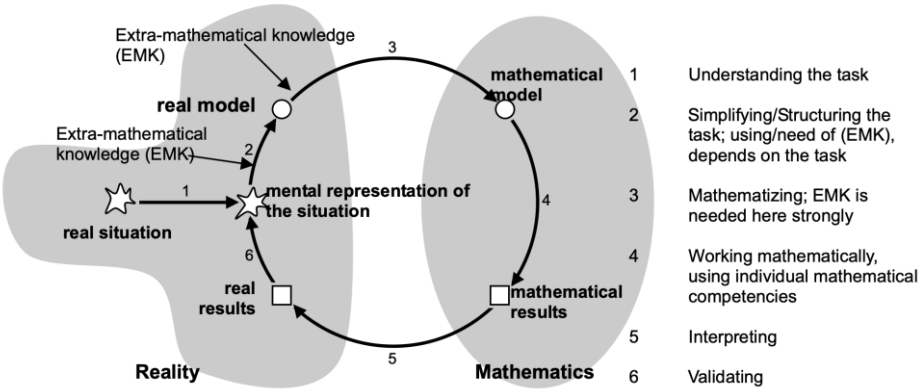


Figure 2. Mathematical Modeling Cycle in cognitive perspective (Blum & Ferri, 2009; Ferri, 2006).

At the outset, the problem situation must be comprehended by the problem solver, this is the construction of the situation model. After the problem is simplified and structured, a model that is more appropriate to the real situation of the problem is created. Particularly, the problem solver should be able to define what is worth spending time on (Blum & Ferri, 2009). After a model of the problem situation is created, it is essential to use the mathematical knowledge to ensure the transition of this real-world problem to the mathematical world. In a problem situation that has been made mathematical, mathematical results are obtained by using mathematical relations and information. Subsequently, after the obtained results are interpreted and verified, it is expected to check the real-world outputs of these mathematical results. At the very end, students are supposed to present all the results they have obtained, again using the same situation model they have started with. According to Ferri (2006), it is very important that the presentation phase takes place in revealing the details of the real-life problem that remains in mind in the next stage after the interpretation of the results.

Similarly, Silver et al. (1993) stated that there were four main stages of solving word problems. In these four stages, the first stage was understanding the structure of the mathematical problem, understanding the information given and completing the missing information; in the second stage, the appropriate process for solving the given verbal problem, planning the process, creating a mathematical plan; implementation of the solution plan created in the third stage; the fourth stage was to explain the accuracy of the answer and what it meant with both content and real situations. When all these mathematical modeling steps are considered, it is possible to say that these steps overlap with the problem solving process. There are similarities between the solutions of verbal problems and mathematical modeling activities and competencies needed when solving problems with the mathematical modeling approach, these competencies vary depending on each stage in the mathematical modelling cycle.

Mathematical Modeling Competence

Mischo and Maaß (2012) revealed that the mathematical modeling competencies were the skills that students should use when solving problems with mathematical modeling. They revealed the impact of mathematical modeling skill's field or domain competencies and ideas and specified the necessary skills for each modeling step. As far as the skills listed in Table 1 are concerned, there are skills that students should exhibit in each of the modeling steps. These personal factors can be overcome with skills corresponding to the Mathematical Modeling steps. They stated that these personal factors were related to the modeling steps. Given Table 1, it is indicated that in order to understand the model, one should initially have verbal comprehension skills and that this personal feature is effective in getting through this step.

Table 1.

Modeling Process and Personal Factors Acknowledged to be Relevant

All steps	**Personal factors considered to be related**
Step 1: Creating the model situation	Verbal comprehension outline, understanding and explaining the text
Step 2: Building a real model	Establishing logical general knowledge and representations, modeling outline and linking the general knowledge
Step 3: Creating a mathematical model	Mathematical competence
Step 4: Finding a solution with a mathematical model	Mathematical competence
Step 5: Interpreting the mathematical solution	Mathematical competence and verbal comprehension
Step 6: Verification	General information

Maaß (2006) quoted the mathematical modeling competencies from Kaiser and Blum (1997, p. 9) and defined a list of competencies as follows. As seen in Table 1, the competences concerning each of the steps in the mathematical modeling process have been revealed, and in Table 2, the modeling competencies that must be laid out in the mathematical modeling process are indicated. This list is presented in Table 2.

Table 2.

Mathematical Modeling Competencies

1. Competence to understand the real situation and build a model based on reality	• Competence to make assumptions for the problem and simplify the situation. • Competence to identify quantities that affect the situation, name them and identify the relevant variables. • Competence to establishing the connection between the variables • Competence to search for accessible information, distinguishing between the relevant and irrelevant
2. Competence to create the mathematical models from real models	• Competence to mathematize the relevant quantities and the relationships between them • If necessary, competence to simplify the relationships and connections between quantities and reduce their complexity with numbers. • Competence to choose the appropriate mathematical representations and present the situations as Figures
3. Competence to solve the mathematical problems with this mathematical model	• Competence to divide the problem into smaller parts, establish relationships with similar problems • Competence to use heuristic strategies such as rephrasing and examining the problem, vary the quantities or appropriate data. • Competence to use mathematical knowledge to solve the problem.
4. Competence to interpret the mathematical results in real situations	• Competence to interpret the mathematical results in non-mathematical contexts, • Competence to generalize the solutions developed for a specific situation • Competence to examine or talk about the solution using appropriate mathematical language.
5. Competence to validate the solution	• Competence to critically check the solution found and make reflections • Competence to revisit some parts of the model or repeat the entire modeling process, if the solution does not fit the situation, • Competence to reflect on other ways to solve the problem if solutions can be developed differently • Competence to question the model in general.

All of these competencies comprise students' behaviors and problem-solving approaches in the mathematical modeling activities. These competencies, which are structured similarly to the

characteristics of being a good problem solver, are also considered in mathematical modeling activities. Eventually, the competence that students should have is the competence to see the relationship of mathematics with daily life, which can be considered as the point that mathematical modeling activities aim to reach in the end.

The mathematical modeling process dealt with in the study was first compiled from the studies of Berry and Houston (1995) and Blum and Ferri (2009). The mapping of the essential competencies in the mathematical modeling steps was made based on the studies of Mischo and Maaß (2012) and Maaß (2006). While the mathematical competencies are examined in three sections; Algebraic expression (establishing an equation), Operational (solving the equation) and interpreting the solution; the general knowledge is examined in two sections: Daily life knowledge and General mathematics knowledge. Similarly, while verbal comprehension competence represents understanding the problem, the competence to verify and explain the solution to the problem was also investigated within the scope of verbal expression competence.

Modeler Types

Students' behavioral patterns in mathematical modeling activities were also considered as the modeler types. Kaiser and Maaß (2007) referred to four different modeler types in their study, and the scheme identified by Maaß (2006) regarding these modeler types is illustrated in Figure 3. This figure presents us the clues about the behavior of students in mathematical modeling activities. The modeler types based on the attitudes towards modeling activities and attitudes towards mathematics are as follows;

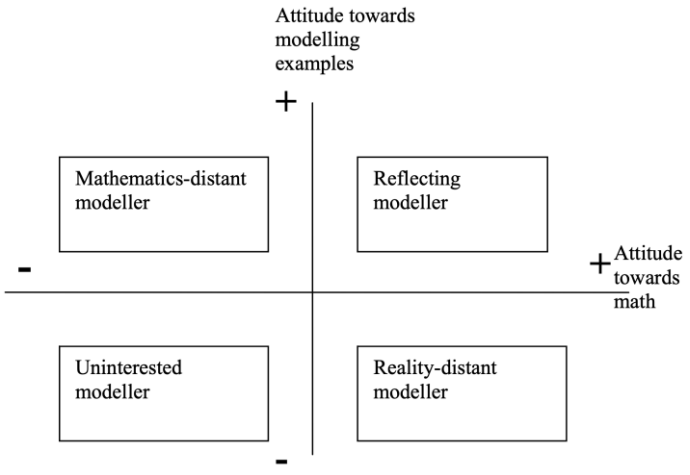


Figure 3. Modeler types based on the modeling competencies (Maaß, 2006).

Reality-distant modeler. Although they have positive attitudes towards mathematics, they are distanced in connection with reality. As an effective consequence, they build a barrier, mainly due to their lack of competence in solving problems related to the mathematical content, where they have problems with the structure of real models, their validation and, in part, the interpretation of the results.

Mathematics-distant modeler. These modeler students clearly grant the real-world problems a chance and exhibit low success in mathematics classes. These students are very enthusiastic about modeling examples. They can build real models and validate the solutions very well, too. There are flows in establishing mathematical models, finding mathematical solutions to them, and interpreting the complex solutions.

Reflecting modeler. They have positive attitudes towards the modeling examples as well as mathematics itself. They demonstrate appropriate achievement in mathematics. It is very difficult to find flaws in the modeling process.

Uninterested modeler. They are neither concerned with the real world nor with mathematics itself. There are errors in their mathematical proficiencies. When solving the modeling problems, problems arise in every modeling process.

The competencies that modelers demonstrate in mathematical modeling activities are also significant in the formation of mathematical modeler types. Furthermore, the competencies demonstrated by students in mathematical modeling steps differ in each mathematical modeling step. All these need to be addressed as a whole.

Purpose and Significance of the Study

The purpose of the study is to identify the effect of mathematical modeling activities implemented to improve students' achievement in solving verbal problems and thus to augment their success in solving the verbal problems. In the study, it is very important to investigate the progress of the 7th grade student group in solving the algebraic verbal problems that they previously had difficulties with and to identify to what extent and how these difficulties were overcome. When the studies conducted with mathematical modeling activities were reviewed, it was clear seen that the study groups of those studies, especially nationally conducted ones were generally composed of teachers and teacher candidates (Aydın Güç, 2015; Bal & Doğanay, 2014; Tuna et al., 2013; Güder, 2013; Karalı, 2013; Şen). Zeytun, 2013; Ural & Ülper, 2013; Tekin Dede &Yılmaz, 2013; Hıdıroğlu, 2012; Çiltaş, 2011; Ünveren, 2010; Korkmaz, 2010). In addition to

these studies mathematical modeling studies have increased in recent years, especially with secondary school students (İnan Tutkun & Didiş Kabar, 2018; Yıldırım & Işık, 2013; Muşlu& Çiltaş, 2016; Özgen & Şeker, 2021; Çavuş Erdem & Gürbüz, 2018; Kalaycı, 2017).

The international studies, on the other hand, includes the mathematical modeling studies including primary school level (English, 2002; English & Waters, 2005). It was clearly observed that those studies generally attempted to identify the effects of mathematical modeling activities on the students' mathematics achievement and attitudes towards mathematics (Olkun et al., 2009). Furthermore, some other studies, on the other hand, focused on the solution of these mathematical modeling activities of the students. In these studies, students' behaviors in one or more mathematical modeling activities were comprehensively investigated. Nevertheless, previous studies either only investigated its effects on the quantities such as achievement and attitude quantitatively and experimentally or focused on the solution of mathematical modeling activities. In this sense, the present study makes the research distinctive by identifying the mathematical modeling competencies that students demonstrate during the mathematical modeling activities. When the difficulties in algebraic verbal problems obtained from the researcher's observations and the literature (Akgün, 2009; Aydın & Özmen, 2012; Dede, 2004; Llinares & Roig, 2008; Sezgin Memnun, 2014; Soylu, 2008;) were compared with the class, it was found that the points to be solved were; 1) Students tried to find a solution without understanding the problem, 2) Students had difficulty in identifying the unknown and establishing equations; the students failed to mathematize a problem, 3) Students operated with unknowns and knowns while solving the equation they created, 4) Students did not perceive the solution they found as a realistic solution and did not interpret or verify their solutions, 5) Students failed to explain the solution they found. The reason why mathematical modeling was chosen to solve these identified problems was that many studies confirmed that mathematical modeling activities had a positive effect on teaching problem solving (Olkun et al., 2009; Kal, 2013; English, 2002; English & Watters, 2005; English & Sriraman, 2010). It was indicated by many researchers that mathematical modeling activities were effective in teaching mathematics and especially in problem solving (Mousoulides et al., 2008; English & Doerr, 2003; Reusser & Stebler, 1997; Lester & Kehle, 2003; Işık & Yıldırım, 2014; Kal, 2013; Sandalcı, 2013). This study is significant in terms of not only improving a situation that requires intervention in teaching, but also identifying the effects of mathematical modeling activities on students in solving the algebraic verbal problems. In this sense, answers to the following questions were sought in the study;

1) How do mathematical modeling activities impact the verbal problem solving success of the 7th grade students?

2) What are the mathematical modeling steps that 7th grade students reach during the mathematical modeling activities?

3) How do the mathematical modeling competencies of 7th grade students develop during the mathematical modeling activities?

4) What are the modeler types demonstrated by the 7th grade students during mathematical modeling activities?

Method

Research Model

Since the purpose of this study was to improve students' verbal problem solving success and identify the effect of mathematical modeling steps on this process, it was implemented through the method of action research. The general purpose of action research is to ensure a development and change action in which active elements are brought together in the process, based on the existing situation where a solution or change is required, and evaluate the functionality of this action (İnan, 2011).

Prior to the study, the action process in Table 3 was conducted to establish the current situation of the students and aim for a change to improve the success of the students in solving the verbal problems due to the low achievement of the students in solving the verbal problems.

In this sense, in order to overcome the difficulties that the students experienced, especially the points where they had particular difficulty were identified through observation and this was repeated in a cycle after each action plan. In other words, the content of the mathematical modeling activity, which was the other action plan, was established accordingly, based on the observations made after each action plan was implemented and the data obtained from the student diaries. While implementing this action plan, the action committee met at each stage and the difficulties that could be encountered or the results to be achieved for each action plan were discussed and the actions were taken after these stages.

Table 3.

Procedure of the Study

Problem Statement (Preliminary diagnosis)	**Data Collection**	**Data Analysis**	**Action Plan-1**	**Action Plan-2**	**Action Plan-3**	**Action Plan-4**	**Evaluation**
Identifying the current situation of students	Monitoring the students and examining their notebooks	Action planning with the data obtained from the students	Planning and implementation of the "Apple Tree"	Planning and implementation of the "Speed Problem"	Planning and implementation of the "Giant's Foot"	Planning and implementation of the "Onion Seed"	Examining student development Post-test
Literature review	Literature review	Deciding on and structuring other activities through student observation in each activity	Identifying students' missing competencies as a result of the interviews about the problem	Identifying students' missing competencies as a result of the interviews about the problem	Identifying students' missing competencies as a result of the interviews about the problem	Identifying students' missing competencies as a result of the interviews about the problem	Conducting semi-structured interviews with the students as a result of the application
Pre-test							

Study Group

The study group consisted of a total of 15 7th grade students studying in a rural area in Ankara province. The problem situation in this group was observed by one of the researchers who was also a mathematics teacher, leading to the selection of this study group. All these students were in the same class.

Therefore, the students' levels were identified as a result of the achievement test and they were allowed to take part in mathematical modeling activities in groups of 3 students. The levels students were in were High (H), Medium (M) and Low (L). In creating the levels pre-test were considered. According to the pre-testing conducted in three levels, 6 students were classified as high, 7 students were classified as middle, and 2 students were classified as low. The students were then divided heterogeneously and homogeneously into groups of three, depending on their friendship. The students in five groups were placed as H1H2H3, H5H6M3, H4M1L2, M2M5M6 and M4M7L1.

Data Collection Tools

There was an achievement test administered to the students in an attempt obtain quantitative data. This achievement test was administered to the students before and after the research process. The content of the achievement test consisted of 10 open-ended questions based on solving the algebraic verbal problems. The test was prepared in order to identify the effect of mathematical modeling activities on problem solving success, considering the 7th grade problem solving achievements. The solution time of the achievement test was 100 minutes, allowing 10 minutes for each question.

Basically, the reason for this was to enable the students to understand and solve the problems without time limits. Opinions of two experts were taken for content validity, and the achievement test was finalized in line with the recommendations. Such a tool had to be implemented in order to quantitatively identify the effect of the application on the students' problem-solving success. The reliability of this open-ended test was calculated with the formula Consensus / (Consensus + Dissensus) *100, which calculates reliability based on the items of disagreement and agreement stated by Miles and Huberman (1994), and it was found that the reliability was 0.84. The scores students achieved from this test were classified as low, medium and high, and the students were coded and divided into groups accordingly.

Four mathematical modeling activities, two of which are researchers and two of which are adapted from different researchers, were carried out with the students for 6 weeks. Each activity was practiced for about 3 lesson hours.

In addition to the researcher's diary, student diaries and worksheets, the semi-structured interviews with students during and after mathematical modeling activities constituted the data collection tools of the study. Structured observation was conducted in the study. Before the structured observation, the solution process of the students in the mathematical modeling activities was observed in the context of the mathematical modeling competencies previously established by Mischo and Maaß (2012), which the students had to meet, as well as the mathematical modeling steps defined by Blum and Ferri (2006). The reason for choosing this observation method was that it provided reliability and validity in collecting the data (Büyüköztürk et al., 2010).

The researcher's diary consisted of recording students' in-group and individual behaviors and solutions during each activity, both in audio and text format. Furthermore, the student diaries were a resource that contained individual students' solutions and thoughts about activities, both for

themselves and as a group. Similarly, through the semi-structured interviews, it was aimed to identify which paths the students followed in the activities, which mathematical connections, relationships and symbols they used and why they used them. By conducting semi-structured interviews, rich data was provided for the study and students' attention was drawn on the subject. In the semi-structured interviews, questions were asked to identify the solution keys that students followed in mathematical modeling activities. Asking these questions also contributed to reliability in terms of verifying the activity solutions in the student diaries. Furthermore, as a requirement of action research, semi-structured interviews were conducted with the students in an attempt to establish the activities to be implemented to control the progress of the students, and the modeling activities were reviewed accordingly. Through continuous interviews, the students' way of handling the problems was analyzed and the problems were arranged accordingly.

Process

Four mathematical modeling activities, lasting a total of 6 weeks, were held with the students. Students worked with their groups for the activities and made presentations to other groups at the end of each activity. Two of the four mathematical modeling activities were developed by the researchers and the other two were adapted from the previous mathematical modeling studies. Approximately 120 minutes were spent on each activity. In classrooms where mathematical modeling activities were applied, students were divided into groups of at least three people in order to understand and interpret real situations, develop a model and evaluate with their classmates, and the teacher guided them in the process of generating their own knowledge (Türker Biber & Yetkin Özdemir, 2015; English & Sriraman, 2010; Lesh & Lehrer, 2003). Hence, mathematical modeling activities were carried out by working groups of 3 students.

All the mathematical modeling activities were planned during the application process and planned in line with the mathematical knowledge and interests of the students. Four activities were implemented. During and at the end of the activity, students' progress in the mathematical modeling steps was recorded as audios. Furthermore, in each activity, the researcher's diary, observation and student diaries revealed the steps that the students had difficulty with, and the plan and content of the next activity were planned accordingly, by observing and interviewing the students. Throughout their mathematical modeling activities, students kept diaries, and after each activity, student diaries were gathered, scrutinized, and sent back to them. The four mathematical modeling activities illustrated in Table 6 were prepared or adapted based on the mathematical modeling approach.

Table 6.

Mathematical Modeling Activities İmplemented with the Students

Implementation	Purpose	Duration
Apple Tree Problem	The purpose of this activity was to make students feel that a problem situation did not always contain numerical data and develop the skills of developing a hypothesis and testing it.	3 lesson hours
Speed Problem	The purpose of this activity was to enable the students to establish the speed, distance and time variables in the problem situations.	3 lesson hours
Giant's Foot	It is an activity aimed at improving students' skills in identifying the unknowns, especially in problems involving the concept of ratio, and finding these variables by establishing the ratios.	3 lesson hours
Onion Seed	It was observed that students had difficulty especially in profit and loss problems. Moreover, onion farming was carried out in the region where the students lived and their families were also interested in agriculture. It was intended to be an activity related to daily life that included both profit and loss and drew the attention of students.	3 lesson hours

In mathematical modeling activities, both individual and group interviews were conducted with the students, how the activities would be done, the students' interest in the subject of the activity, and the weaknesses encountered in other activities were recorded. In this sense, the results of each event were shared with the action committee and it was decided how the following event should be. The action committee consisted of researchers and two mathematics teachers who have master of mathematics education science. During the activities, the students' ability to reach the mathematical modeling steps and the mathematical modeling competencies they demonstrated in the activities were also examined and the findings were recorded and interpreted.

Data Analysis

The analysis of observation data in the study was conducted using content analysis. The content analysis framework for observation data was deliberated within the framework of mathematical modeling competencies. There are basically two processes in content analysis, which are used especially in the analysis of data obtained from observations and interviews. The first of these is to identify the categories before starting the analysis and shape these categories based on the previously obtained information, theories and experiences. The second is being more familiar with the subject thanks to the data collected and new categories emerge as the analysis continues (Büyüköztürk et al., 2010).

In the literature review, the steps identified by Blum and Ferri (2009) were established as understanding the problem, making assumptions, mathematizing, solving the problem, interpreting the solution, verifying the solution and explaining-predicting-presenting. It was decided to examine the students according to these steps in mathematical modeling. Secondly, the data arranged by transcribing the audio recordings were analyzed in line with the framework established above. This analysis was implemented in order to identify at what stage of modeling the students were in the activities and what competencies they could use. In the second step, the diversification of mathematical knowledge, which was one of the mathematical modeling competencies used by students in mathematical modeling activities, was established through the observation-interviews and the student diaries examined after each activity, and the mathematical modeling step and the mathematical modeling competencies essential for this were matched again, as is the case in Table 4 below, and this new theme was also taken into consideration in the analysis of the data.

Table 4.

Mathematical Modeling Steps in the Problem Solving Process and the Required Competencies

Mathematical Modeling Steps	**Competencies and Personal Factors to be Used in the Step**
1. Understanding the Problem: The real-life problem or situation can be understood by the solver, and the important data is established through selection.	**Verbal comprehension:** Understanding and making sense of the problem when it is read. Competence to understand the real situation.
2.Making Assumptions: Searching the data in the problem situation; mathematical relationships, establishing connections and creating a simple verbal model for solving the problem.	**General Knowledge (General mathematics knowledge):** Identifying the variables in the problem statement using mathematical knowledge, expressing the purpose verbally in the form of a simple sentence.
3.Mathematizing: Turning the established verbal model into a mathematical model by representing the variables assigned in the problem situation such as symbols and shapes.	**Mathematical (Expressing Algebraically - Establishing an Equation):** Building a model using variables. Competence in building models based on reality and competence in creating mathematical models from real models.
4. Solving the Problem: Solving the established mathematical model with the data in the situation or problem. Going back and re-examining the variables so that assumptions can be made again, and making improvements.	**Mathematical Competence (Operational - Solving the Equation):** Substituting the numerical values using the model constructed by establishing the variables, solving the equation constructed with the general mathematical knowledge. Competence to solve the mathematical problems with this mathematical model.
5. Interpreting the Solution: Putting the solution into words to see to what extent the achieved result matches the original problem situation.	**Verbal comprehension and ability to express, Mathematical competence (Interpreting the Solution):** Explaining the result verbally by associating it with mathematics. Competence to interpret the mathematical results in real situations.

6. Verifying the Solution: Using the obtained mathematical model on other suitable data. Again, at this step, one can return to the assumption step to make retrospective corrections.	**General Knowledge (General mathematical knowledge):** Reaching the common results by substituting different values into the created model. Do not use mathematical knowledge while doing this. Solution Validation Competence
7. Explanation, Reporting: The solver makes a general presentation about the solution. They can prepare posters and presentations.	**Ability to oneself express verbally, General knowledge (Daily life knowledge):** Ability to express oneself using general mathematical knowledge to explain the operations performed.

Furthermore, the indicators in Table 5 suggested by Maaß (2006) were utilized to identify the students' mathematical modeler types.

Table 5.

Indicators of mathematical modeler types

Modeler types	**Indicators**
Distanced from reality	They exhibit a positive attitude towards mathematics and a negative attitude towards modeling activities.
Modeler with Distanced from Mathematics	They are enthusiastic in the modeling activities, but their attitude towards mathematics is negative.
Reflective Modeler	They exhibit positive attitudes towards both mathematics and mathematical modeling activities.
Uninterested Modeler	They have a positive attitude towards neither mathematics nor mathematical modeling activities.

Results

Findings and interpretations were obtained at the activity level and on a group basis.

The Effect of Mathematical Modeling on Algebraic Verbal Problem Solving Achievement

A pre-test and post-test were administered to the students in the study group. After the implementation, a post-test was conducted to identify the students' competence in order to solve the problems after performing mathematical modeling activities. By conducting dependent groups T-test, it was aimed to identify the effect of mathematical modeling activities on the students' achievement in solving the algebraic verbal problems.

Comparison of the averages of the tests performed before and after the mathematical modeling activities is as follows:

Table 7.

Pre-test and Post-test T-test and Dependent Sample Statistics

	Average	N	Standard deviation	t	p
Pre-test	24.33	15	20.607	-5.02	0.0001
Post-test	50.93	15	32.103		

As is clear in Table 7, it is possible to say that there was a significant difference between the pre-test and post-test score averages because the p/2 value obtained as a result of the dependent sample T-test was smaller than the 0.05 significance value (p = .0001). As far as the results obtained here are concerned, it was found that students' achievement in solving the algebraic verbal problems differed positively with the mathematical modeling activities.

Mathematical Modeling Competencies Exhibited by the Students in the Mathematical Modeling Activities

Modeling steps were examined when mathematics students participated in mathematical modeling activities. These four mathematical modeling activities are prepared according to the mathematical knowledge and connections that students have had difficulties in the previous activity.

Mathematical modeling steps reached by the students in the apple tree activity. The apple tree activity, unlike the verbal problems students encountered previously, was an activity that did not include specific quantity values and encouraged the students to use variables. In this problem, students were expected to make a mathematical solution by taking into account the values such as root, trunk and crown width. Figure 4 illustrates the mathematical modeling steps that students reached in solving this activity.

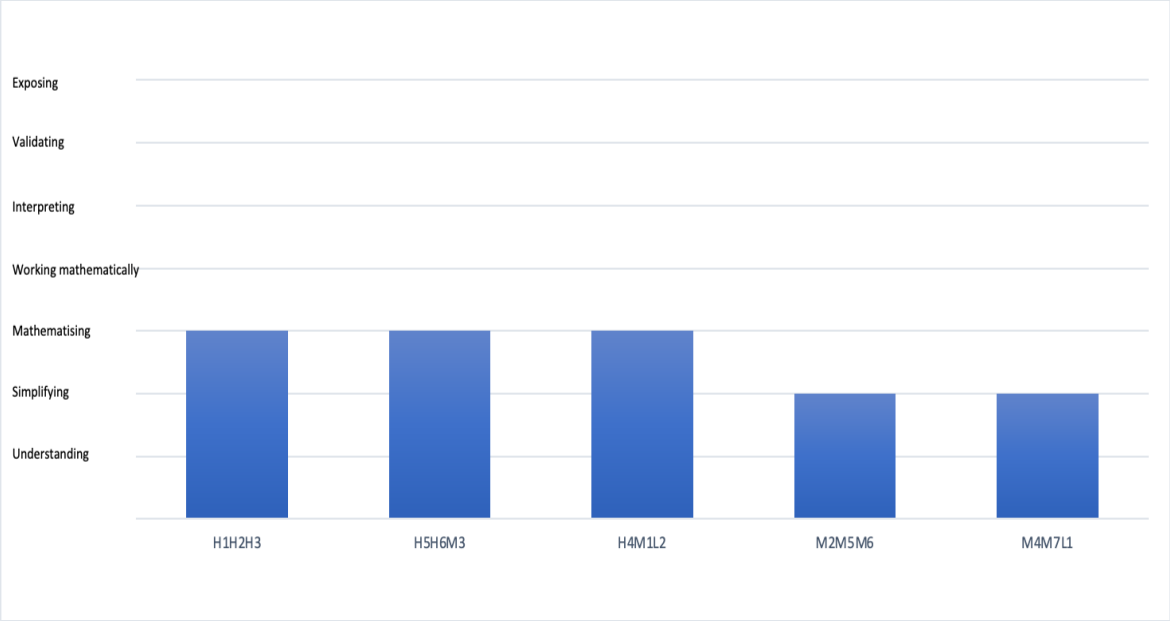


Figure 4. Mathematical Modeling Steps Reached by the Student Groups in the Apple Tree Problem.

As the Figure 4 illustrates, none of the student groups managed to reach the final stage of the problem. Below are the students' solutions and explanations:

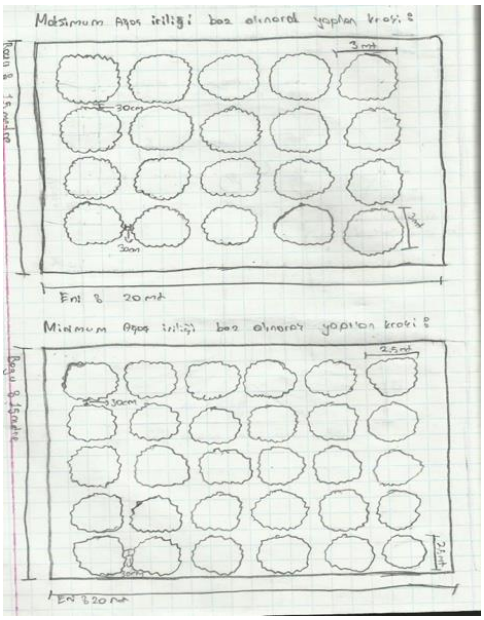


Figure 5. Drawing of the H1H2H3 Group regarding the Apple Tree Problem.

In Figure 5, which was a joint drawing of the students, the students tried to create a model to test their assumptions by drawing two different gardens on the assumption that trees could be large or small in daily life, as presented in the problem. The following conversation also demonstrates how students used the variables in this mathematization process:

"H3: The length between them also varies, but it depends on its length.

H1: I found the area, sir. It was 300 square meters. I called it n. Then I found the area of the tree, I said it was 9 square meters. I called it x. Something came out, but there are 20 at most here.

H3: The distance would be n/x, as I just said

A: What do you mean by n?

H1: n the area.

H3: Yes.

H3: Maybe we can actually figure out how many trees will fit.

H1: No, no, we should develop a formula that includes the distance, not how many trees will fit."

As far as Figure 5 above and the students' explanations are concerned, it is clear that the students tried to find out how many trees could fit in a certain area and realized that they needed to create a model using the variables in order to do this. It was stated that the students considered the area of the garden with the variable "n" and chose to represent the distance between them with the variable "x". It was pointed out that the students reached the mathematization stage, but when working with these variables, they thought that they obtained the number of trees as a result of estimating the area to the distance. With H1's warning, even though the students wanted to develop a model for finding distance, they were not successful. Therefore, the H1H2H3 group progressed to the "mathematising" stage.

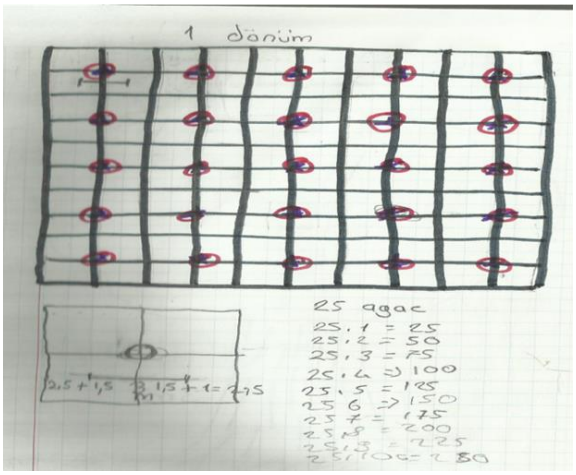


Figure 6. A Model of the Apple Tree Problem from the Worksheet of the M4M7L1 Student Group.

Considering Figure 6 above, it is clear that the M4M7L1 group tried to understand and simplify the problem from the drawing they made to place the trees in a certain area for the

problem. It is possible to say that the students at this stage tried to calculate hypothetically how many trees could fit on 1 acre of land. However, it seems that they failed to mathematize the solution to the problem.

Mathematical modeling steps reached by the students in the speed activity. A Mathematical Modeling actvity was given to the students in the second week. Students' problem solving processes were examined on a group basis. The Mathematical Modeling steps that the student groups reached in solving the Speed problem were identified as illustrated in Figure 7.

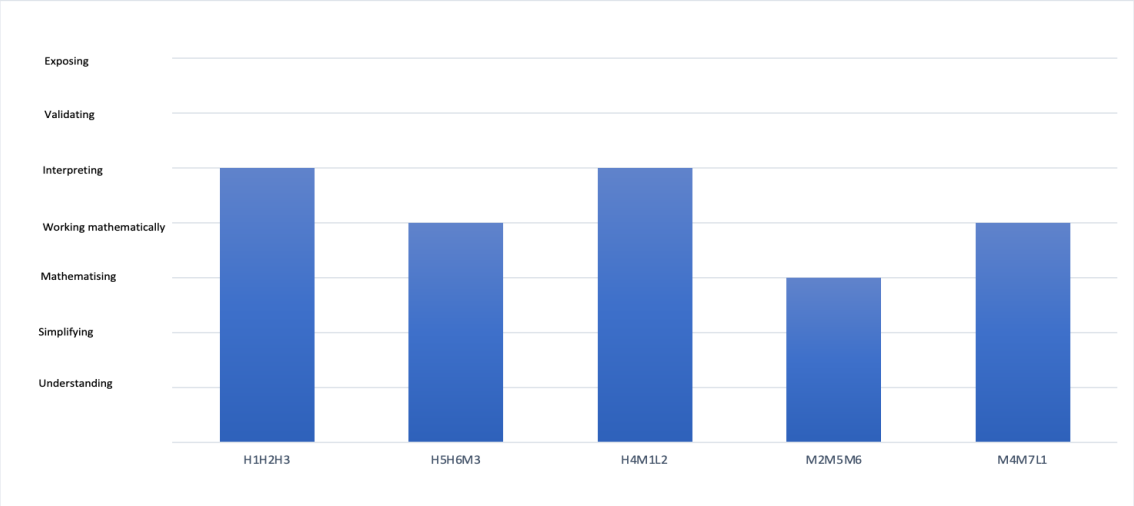
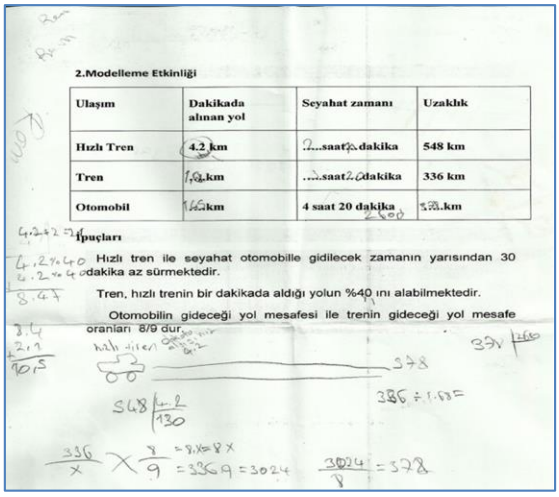


Figure 7. Mathematical Modeling Steps Reached by the Student Groups in the Speed Activity.

As Figure 7 illustrates, it is possible to say that the student groups reached higher levels of mathematical modeling in the Speed Activity. The details regarding the solutions of the student groups are presented below:


2.Modelleme Etkinliği

Ulaşım	Dakikada alınan yol	Seyahat zamanı	Uzaklık
Hızlı Tren	4.2 km	2 saat 2 dakika	548 km
Tren	1,9 km	3 saat 2 dakika	336 km
Otomobil	1,4 km	4 saat 20 dakika	328 km

İpuçları

Hızlı tren ile seyahat otomobille gidilecek zamanın yarısından 30 dakika az sürmektedir.

Tren, hızlı trenin bir dakikada aldığı yolun %40 ını alabilmektedir.

Otomobilin gideceği yol mesafesi ile trenin gideceği yol mesafe oranları 8/9 dur.

Figure 8. Solution for the Activity from M3's Worksheet.

The solution made by the H5H6M3 group for the Speed Activity is presented in Figure 8. It is clear that the group tried to fill in the missing parts by using ratios, while aiming to create a model by establishing an equation. Nevertheless, it was found that the students did not use the same model to verify the model. Therefore, it is possible to say that the students only reached as far as the problem-solving/mathematical working stage.

Mathematical modeling steps reached by the students in the giant's foot activity. The giant's foot activity was given to students. The main mathematical concept to be used in solving the problem is ratio–proportion. The Mathematical Modeling Steps reached by the Student Groups in solving the Giant's Foot problem are illustrated in Figure 9 on a group basis:

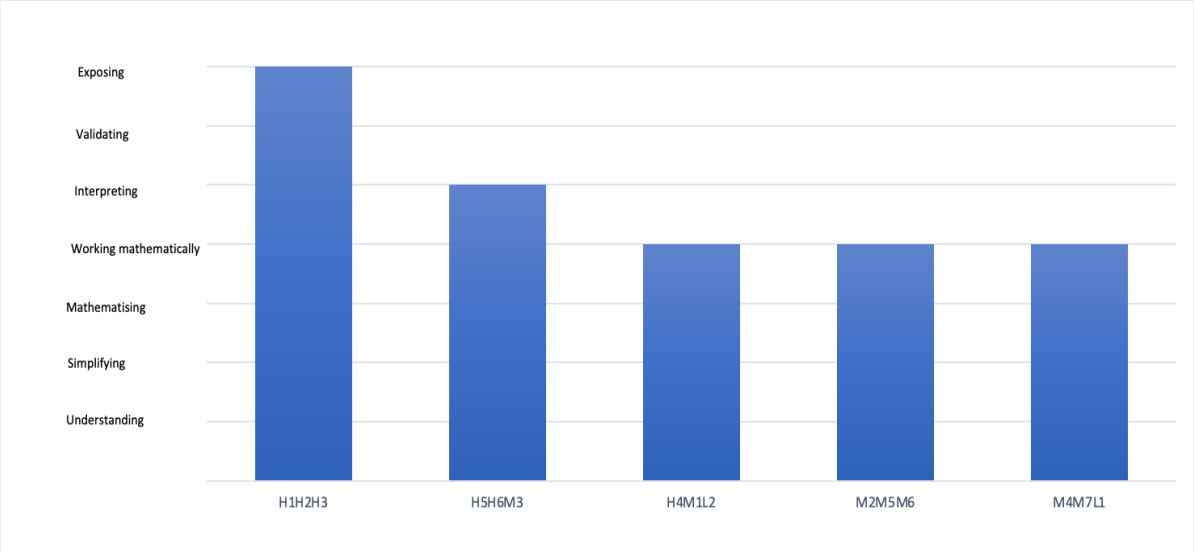


Figure 9. Mathematical Modeling Steps Reached by the Student Groups in the Giant's Foot Problem.

As far as Figure 9 is concerned, it is clear that student groups were able to reach higher levels of mathematical modeling compared to the previous activities. It is evident that especially the H1H2H3 student group was able to reach the highest level of mathematical modeling step. Considering that they could only progress as far as the mathematization step in the Apple Tree Activity, it is possible to say that the group exhibited improvement in terms of progress in mathematical modeling steps. It is possible to generalize this situation for other groups as well; in this problem, the groups reached at least the Problem Solving stage. Some of the solutions offered by the groups are listed below:

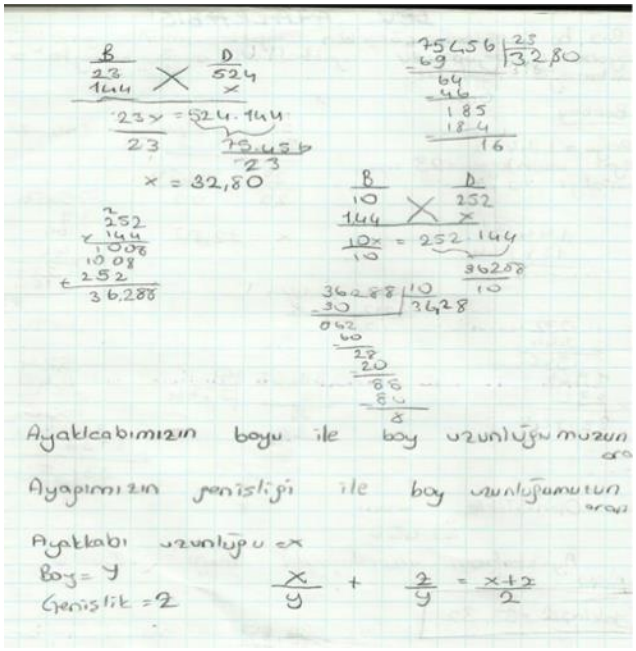


Figure 10. A Section from H3 Student's Diary regarding the Solution of the Problem.

Figure 10 illustrates a section from H3's diary regarding the solution of the problem. The students aimed to develop a model in order to solve the problem by trying to estimate the quantities given in the problem with such data as actual arm and foot length. The solution of the other students in the group, H1 and H3, shown in Figure 11 below, supports this:

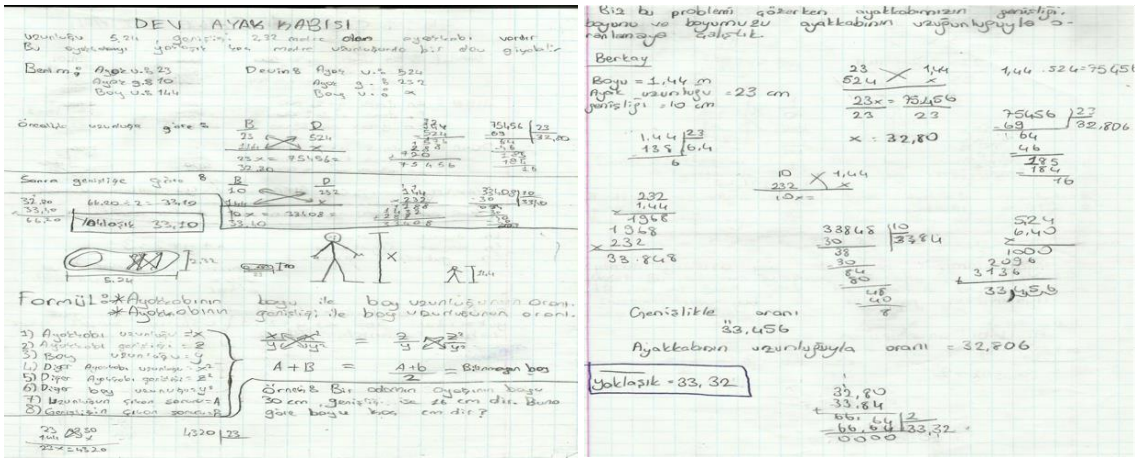


Figure 11. A Section from the Diaries of H1 and H3 on the Solution of the Problem.

As is clear in Figure 11, it is evident that the students developed mathematical models to calculate the variables by establishing a proportional connection between the real data and the data of the problem. Furthermore, it is clear to see that they reached the stage of calculating the giant's height by verifying the model they created to solve the problem situation in the activity for their

own body and foot lengths. Finally, the students explained to their friends how they made this calculation and reached the last mathematical modeling step for the solution of the activity.

The H5H6M3 group's approach to the problem was slightly different. While solving the problem, the students started from the area of the shoe. They calculated the ratio between the area of the giant shoe and the foot of one of the group members.

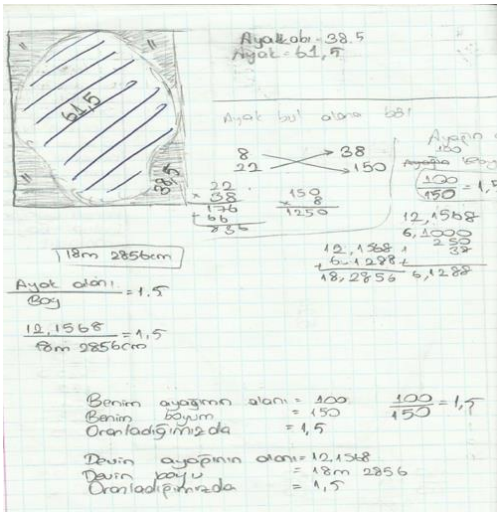


Figure 12. H6's Solution for the Giant's Foot Activity.

As is illustrated in Figure 12, the students first reached the result that the ratio of foot area to foot height was 1,5; but when asked how they calculated this area, they stated that they contemplated that it could be roughly like this.

By trying to create a model, they reached the stage of validating the model with their own foot measurements, stating that they took the giant's foot area as the product of the giant's foot width and height. Figure 13 illustrates a section from H5's diary regarding the solution of the problem:

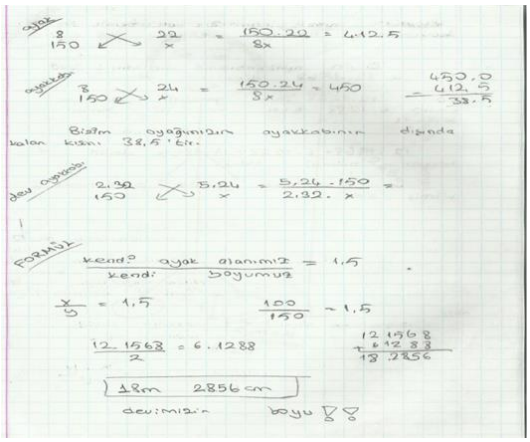


Figure 13. H5's Explanation for the Giant's Foot Activity.

According to this solution in Figure 13, it is evident that H5 tried to develop a method that demonstrated that height was related to the foot area, based on the height and foot length of herself and her group friends.

Mathematical modeling steps reached by the students in the onion seed activity. The last mathematical modeling activity was prepared by the researcher. The basis for preparing this mathematical modeling activity was that onion farming was done in the application area and the application area was in a rural area. By preparing a mathematical modeling activity in this way, it was aimed to attract the attention of the students and increased their motivation and desires. In this mathematical modeling activity, students needed to find the most suitable seed by using the existing data and table and following the mathematical modeling steps. The mathematical concepts that student groups used extensively in this problem were ratio-proportion, profit-loss, and creating a mathematical model using the algebraic expressions. Figure 14 illustrates the mathematical modeling steps that the student groups reached in this activity:

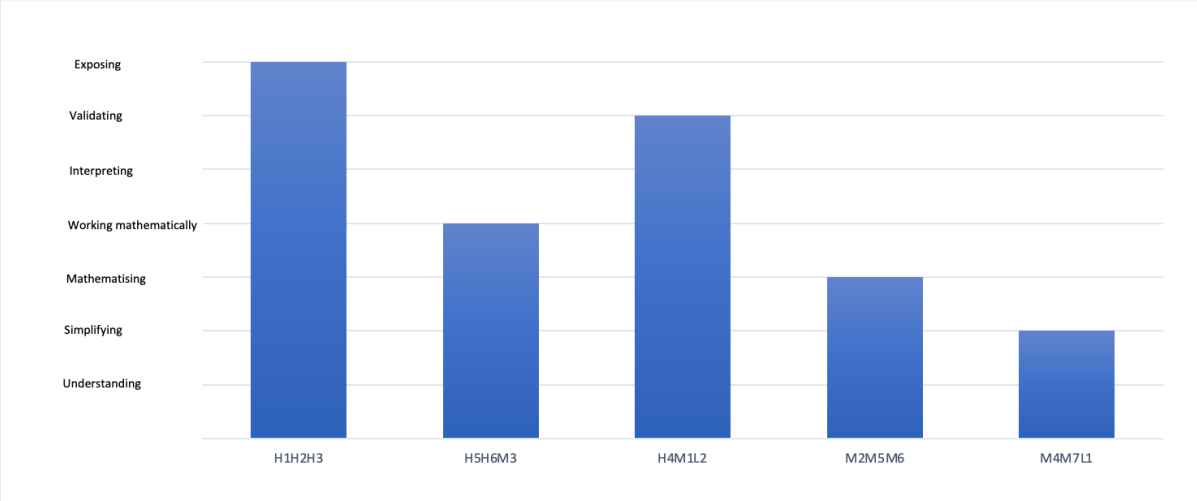


Figure 14. Mathematical Modeling Steps Reached by the Student Groups in the Onion Seed Problem.

As is seen in Figure 14, H1H2H3 student group reached the solution by completing all mathematical modeling steps. Nevertheless, it is clear that the M4M7L1 group was able to progress as far as the stage of simplifying the problem. Even though they could not reach a solution, it was observed that the M4M7L1 Group actively worked on this event. A section of the in-group discussions that the students had to solve the activity is below:

"*M7: In order to be able to solve this problem, we must first find out size of the area to plant the seeds and calculate which seed is good.*

L1: Yes, one by one, okay, let's start with the Yakut first.

M7: Let's first equalize the grams and get started.

M4: When 500 grams is 120 liras, 250 grams is equal to double, that's what we get. So if 500 grams is 120, wouldn't 1000 grams be 240?"

It is apparent from the students' conversations that they grasped the problem and tried to structure the problem by making assumptions for the solution.

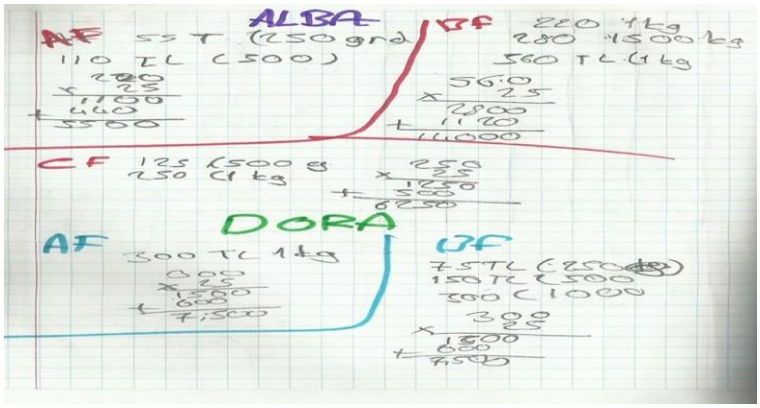


Figure 15. A section from L1's diary regarding the solution of the activity.

As clear in Figure 15 regarding the solution in L1's diary, the students tried to calculate the cost for a specific area by assigning variables using the abbreviations for each seed. Nevertheless, even though the students tried to do mathematization in this process, they had difficulty in the mathematical operation stage.

H1H2H3 student group created two different models for this activity.

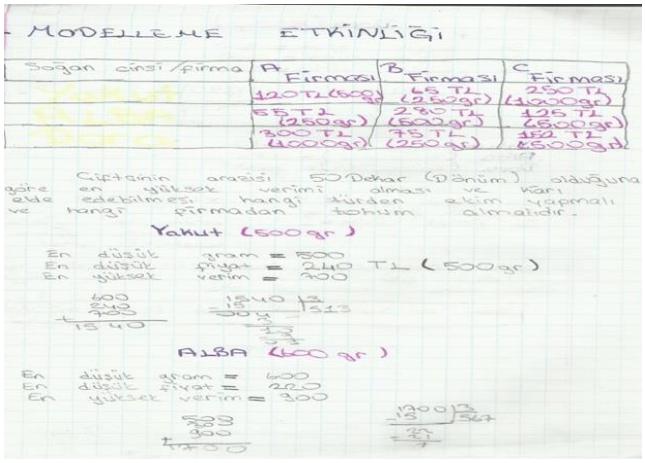


Figure 16. A Visual of Group H1H2H3's Effort to Synchronize the Units Attempting to Solve the Problem.

Figure 16 illustrates that the students tried to create a model that took into account the minimum number of grams of each seed type to be planted per acre, the lowest price and the highest harvest amount per acre, by making assumptions about the solution of the problem. Students' explanations regarding the problem situation are as follows:

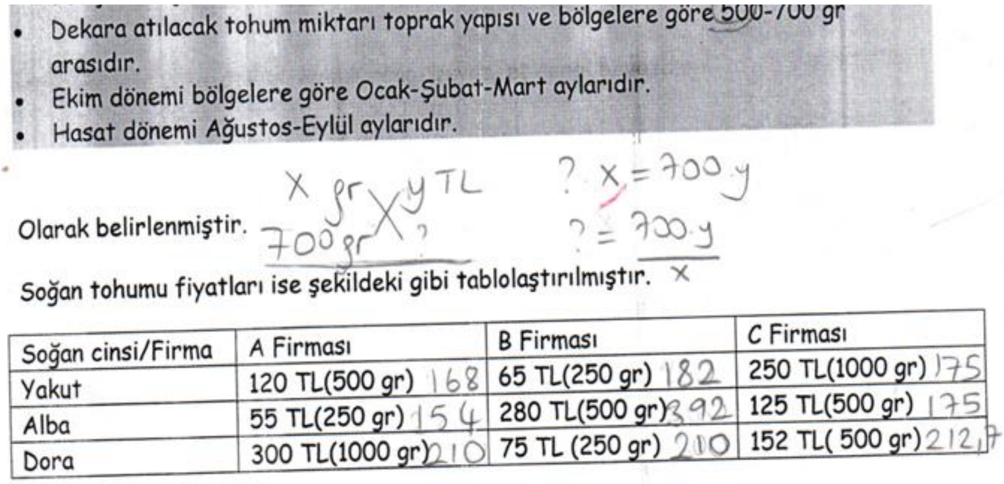
"H1: Alba is 650, Dora is 520, but since the one with the lower price is the more useful one, we will swap the two.

H3: How about this? If we call the lowest gram x...

H1: But how about something like this? The lowest gram of this is x, which is low, this is 500, and this becomes 600. Now, if the gram is low, the usefulness will increase even more, right? We can buy more grams for less money. Let's say you bought 6000 grams for 1 lira, you buy 5000 grams here.

H2: It would be better if we could find out how many grams are used per acre."

This conversation between the students is an indication that the students used the variable "x" and were at a stage of mathematization.



- Dekara atılacak tohum miktarı toprak yapısı ve bölgelere göre 500-700 gr arasıdır.
- Ekim dönemi bölgelere göre Ocak-Şubat-Mart aylarıdır.
- Hasat dönemi Ağustos-Eylül aylarıdır.

Olarak belirlenmiştir.

Soğan tohumu fiyatları ise şekildeki gibi tablolaştırılmıştır.

Soğan cinsi/Firma	A Firması	B Firması	C Firması
Yakut	120 TL(500 gr) 168	65 TL(250 gr) 182	250 TL(1000 gr) 175
Alba	55 TL(250 gr) 154	280 TL(500 gr) 392	125 TL(500 gr) 175
Dora	300 TL(1000 gr) 210	75 TL (250 gr) 210	152 TL(500 gr) 212,7

Figure 17. Model and Calculations Developed by the Group from H2's Worksheet.

As is clear in Figure 17, the students developed a mathematical model in order to solve the problem situation and calculated the seed costs required for 1 acre with the help of this model.

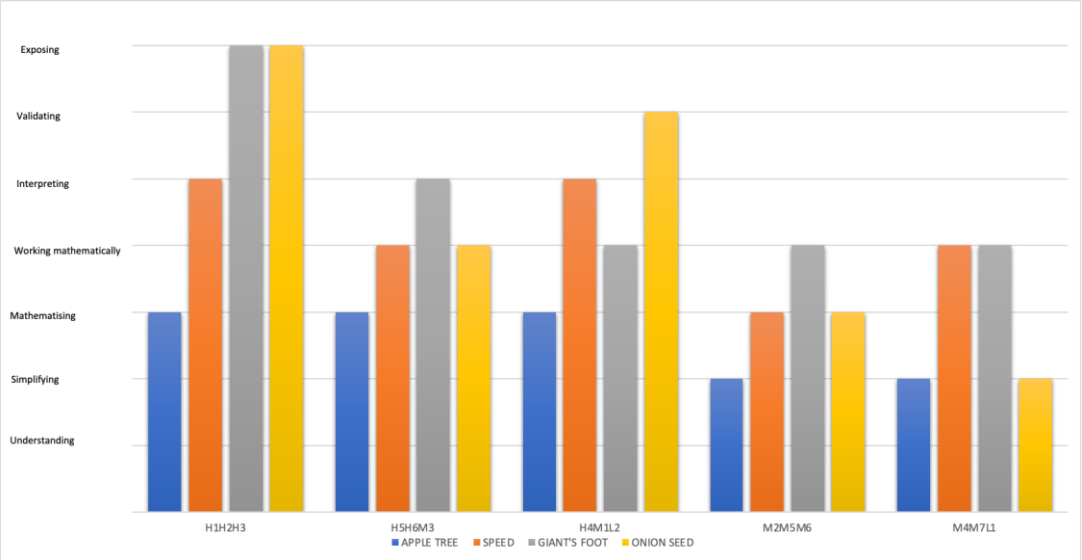


Figure 18. Mathematical Modeling Steps Reached by the Student Groups during the Implementation Process of the Activities.

Figure 18 illustrates that the mathematical modeling steps that the student groups reached throughout the activities in the implementation process. The mathematical modeling step that the student groups reached in the first activity, the Apple Tree Activity, was the mathematising. A group of homogeneous and high-achieving students, such as H1H2H3, continuously progressed through the stages of mathematical modeling and was able to reach the final stage. On the other hand, the M2M5M6 group was a homogeneous group with medium level success, but the highest level this group could achieve was the "problem solving". The H4M1L2 group, as a heterogeneous group with students from all levels, reached higher levels and made progress in general.

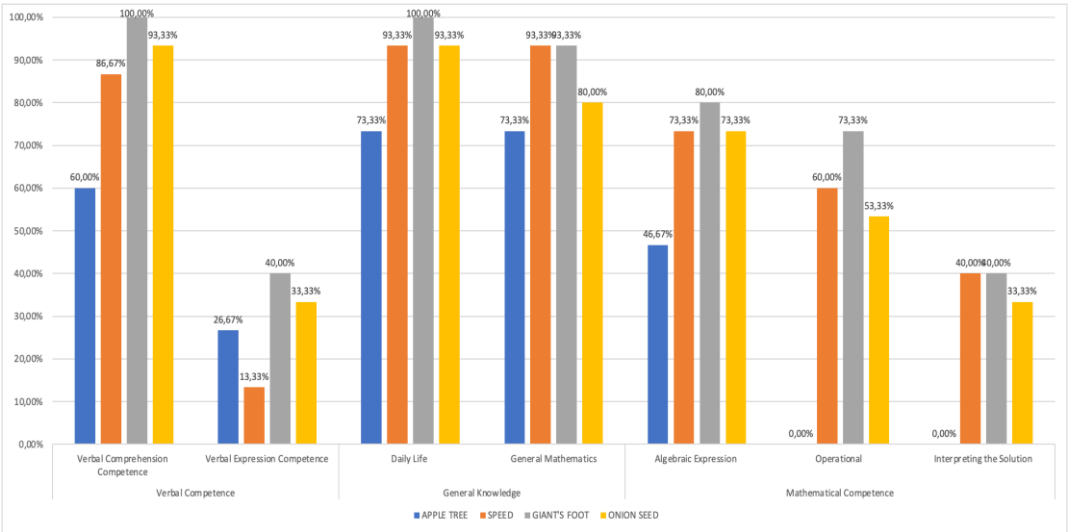


Figure 19. Percentages of the Students Achieving Mathematical Competence during the Application.

As far as Figure 19 is concerned, the mathematical competencies of the 15 students who participated in the application during the solution of the four mathematical modeling activities improved as the activities progressed. It was found that some competencies were displayed by every student in some problems. For instance, while the Verbal Comprehension Competence was demonstrated by each and every student in the Giant's Foot Activity, it is possible to say that no student exhibited the Procedural and Solution Interpretation competencies in the first activity, the Apple Tree Activity. It is clear that the development of students' Verbal Expression and Solution Interpretation competencies progressed less during the activities compared to the other competencies.

The data obtained from the semi-structured interviews conducted during the students' mathematical modeling activities and after the activity, the researcher's diary, and the transcript of the student diaries were analyzed and coded. As a result of this coding, the students' mathematical modeler types were established as illustrated in Table 8.

Table 8.

Classification of the Students According to the Mathematical Modeler Types

	Distanced from reality	**Distanced from Mathematics Modeler**	**Reflective Modeler**	**Uninterested Modeler**
Students	M3, M4	M2, M6, M7	H1, H2, H3, H4, H5, H6, M1, L1	M5, L2

As is illustrated in Figure 19 and Table 8, according to the mathematical modeling competencies of the students revealed in the mathematical modeling activities, it was found that most of the students were reflective modelers at the end of the application. It was further revealed that while the students with medium and low levels in mathematics were generally distanced from reality and distanced from mathematics, the students with high problem-solving achievement were in the reflective modeler type.

Discussion and Conclusion

The purpose of this study was specified as the application of mathematical modeling activities on algebraic verbal problems at the 7th grade level and identifying the effects of the application. With this idea underlying the study, the effect of the difficulties experienced by the students in solving the algebraic verbal problems on the problem solving situations of students during and after

the application of mathematical modeling activities was investigated. Some particular results were achieved in the light of the results obtained both during and at the end of the application.

As far as the quantitative findings are concerned, it was revealed that the achievement of the students in solving the algebraic verbal problems in the pre-test and post-test was statistically significantly different. It is possible to say that this difference was realized positively with the post-test average. This result is similar to the results obtained by Işık and Yıldırım (2014) in their study with 5th grade students. Furthermore, it was also revealed that the students' pre-test averages were quite low (=24.33). This particular result is parallel to the idea stated by Llinares and Roig (2008) that students had difficulty in understanding the mathematical structure in verbal problems and that this was due to the lack of comprehending the question in the interviews, the operation steps not progressing smoothly, and the weaknesses in the operational dimension in lower level students. The interviews conducted with the students during the application further revealed that it was seen that the students expressed that they had difficulty in performing some of the mathematical operations.

The level of progress of the students in the modeling steps reached in the process of mathematical modeling activities has increased gradually. Similar to Tekin Dede (2015), it was determined that the mathematical modeling competencies shown by the students in the first activity were low and therefore they did not progress in the mathematical modeling steps. This is because students cannot have experience with mathematical modeling activities have been mentioned in many studies (English, 2009; Korkmaz, 2010; Özgen & Şeker, 2021; Deniz & Akgün, 2018, Sarı Uzun et. al, 2023). Although it was seen in fewer groups in later activities, especially in the first activity Apple Tree activity, it was also seen in similar studies that students struggled because there was no numerical data and tried to proceed mathematically without understanding the problem (Çoksöyler & Bozkurt, 2021; Canbazoğlu Albayrak & Tarım, 2023). In general, it was seen that students had problems in activities, understanding the problem, making assumptions by simplifying the problem, expressing it in mathematical language and working mathematically, solving problems and interpreting it in a way that is suitable for real life. However, as the activities increased, it was found that they could overcome these difficulties and reach to the upper steps (Sandalcı, 2013; Şahin, 2014). It was determined that the percentage of mathematical competences reached by the students during the mathematical modeling activities increased. For instance, during the first of the activities Apple Tree Activity, the verbal expression competencies of the students were 26.67%, while this last activity increased to 33.33 %. In addition, it has been determined that the competencies that the students have never shown can occur as the activities continue. This result

shows that mathematical competences can also be improved during mathematical modeling activities. As stated by Altun (2020), mathematical modeling activities are useful in teaching mathematical competences.

Many researchers previously emphasized the importance of students working collaboratively in groups in mathematical modeling activities (Türker Biber & Yetkin Özdemir, 2015; English & Sriraman, 2010; Lesh & Lehrer, 2003; Blum & Leiß, 2007) and the benefit of working in groups was also highlighted by the students in the study, both during the activities and in the interviews held afterwards. Even though it is a special case, the fact that not all students were at the same level may make it easier to develop daily life knowledge, general mathematical knowledge, such as general algebraic expression (establishing equations), operational (equation solving), mathematical competencies such as interpreting the solution, and verbal competencies such as verbal expression and verbal comprehension. It was observed or expressed by the students that during the application, the students positively considered working cooperatively in groups and even managed to improve some of their competencies through in-group interactions. This situation is parallel to the view in Korkmaz's (2010) study that group activities were significant in terms of knowledge sharing.

In the study, the problem solving achievement level as a group in the pre-test and post-test increased the most in the H4M1L2 group. Nevertheless, the same increase was not observed in the M2M5M6 group. The fact that the students' levels were very close caused them not to be able to help one another sufficiently in the problem solving process. It is simply because a student's weakness in one competence was also observed in another one. In other words, since the students in the group did not exhibit the same competence, they approached the solution of the problem in a similar way and failed to overcome their weaknesses and share the knowledge and information among themselves. That is the reason why the group failed to progress very far. Similarly, this group had the least intra-group interaction in the activities and was able to rise to as high as the level of problem solving in the mathematical modeling steps. It is possible to say that the reason for this may be that the students were at the same level and therefore had similar mathematical modeling competencies. Therefore, it is possible to say that working cooperatively in groups in mathematical modeling activities provided a positive environment for students' problem-solving achievement, but it is possible to say that better results would be achieved if the groups consisted of heterogeneous students in terms of achievement level as much as possible.

As far as the results obtained from the application process are concerned, it was found that the students who displayed mathematical modeling competencies were more favorable for the Reflective Modeler type, one of the mathematical modeling types, while the students who did not complete the modeling steps in the modeling activities were more of the modeler types who were distanced from reality or distanced from mathematics. It is possible to say that knowledge and attitudes about both the real world and mathematics are very significant for the students to demonstrate their modeling competencies in mathematical modeling activities and complete the modeling steps.

It was found that during the application of the four mathematical modeling activities discussed in the study, students were able to climb up the top modeling steps from the first problem to the last problem. In general, it was observed that students were able to reach the highest level of mathematization in the first problem.

It is possible to conclude that mathematical modeling activities helped the students make connections between the real world and mathematics. It is also possible to add that as the activities progressed, the students achieved the mathematical modeling competencies. It was also observed that in mathematical modeling problems, students began to approach the problem from different perspectives rather than from a single perspective.

The results show that mathematical modeling activities also lead to the development of mathematical competences, the success of verbal algebraic problem solving increases, so mathematics teaching can be supported by including these applications in mathematics courses.

About Authors

First Author: Özlem Çelikkol is a teacher at Ministry of Education in Erzincan, Turkey.

Second Author: Aytaç Kurtuluş is a member of Eskişehir Osmangazi University. She works at the Faculty of Education. She is currently working at the Mathematics and Science Education Department.

Conflict of Interest

"It has been reported by the authors that there is no conflict of interest."

Funding

"No funding was received."

Ethical Standards

The study was carried out within the framework of the Helsinki Declarations. The data does not require any ethical permission.

ORCID

Özlem Çelikkol https://orcid.org/0000-0002-8504-0102

Aytaç Kurtuluş https://orcid.org/0000-0003-2397-3510

References

Akgün, L. (2009). 8. Sınıf öğrencilerinin sözel problemler ve değişken kavramı arasında ilişki kurabilme becerileri. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, *5*(2), 275-284.

Aydın Güç, F. (2015). *Matematiksel modelleme yeterliklerinin geliştirilmesine yönelik tasarlanan öğrenme ortamlarında öğretmen adaylarının matematiksel modelleme yeterliklerinin değerlendirilmesi* (Yayımlanmamış Doktora Tezi), Karadeniz Teknik Üniversitesi, Trabzon.

Aydın, F., & Özmen, Z. M. (2012). *8. Sınıf öğrencilerinin sözel problemlerde verilenler ile istenilenler arasındaki ilişkiyi belirleyebilme becerileri*. Sözlü bildiri. X. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, 27-30 Haziran 2012, Niğde Üniversitesi, Niğde.

Bal, A. P., & Doğanay, A. (2014). Sınıf Öğretmenliği adaylarının matematiksel modelleme sürecini anlamalarını geliştirmeye yönelik bir eylem araştırması. *Kuram ve Uygulamada Eğitim Bilimleri*, *14*(4), 1363-1384.

Barbosa, J. C. (2006). Mathematical modelling in classroom: a socio-critical and discursive perspective. *ZDM Mathematics Education*, *38*(3), 293-301. Doi: https://doi.org/10.1007/BF02652812

Berry, J., & Houston, K. (1995). *Mathematical Modelling*. London, Gulf Professional Publishing.

Blum, W., & Ferri, R.B. (2009). Mathematical modelling: Can it be taught and learnt? *Journal of Mathematical Modelling and Application*, 1(1), 45-58.

Blum, W., & Leiß, D. (2007). Deal with modelling problems. *Mathematical modelling: Education, engineering and economics-ICTMA, 12*, 222.

Blume, G. W., & Heid, M. K. (1989). New directions for mathematics instruction. 1989 Yearbook.

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2010). *Bilimsel araştırma yöntemleri*, Pegem Akademi Yayınları: Ankara. ISBN 978-9944- 919-28-9

Canbazoğlu, H. B., & Tarım, K. (2023). İlkokul dönemi öğrencilerinin bilişsel matematiksel modelleme yeterlikleri. *SDU International Journal of Educational Studies*, *10*(1), 1-21.

Çiltaş, A. (2011). *Dizi ve seriler konusunun matematiksel modelleme yoluyla öğretiminin ilköğretim matematik öğretmeni adaylarının öğrenme ve modelleme becerileri üzerine etkisi* (Yayımlanmamış Doktora Tezi), Atatürk Üniversitesi, Erzurum.

Çiltaş, A., & Işık, A. (2013). Matematiksel modelleme yoluyla öğretimin ilköğretim matematik öğretmeni adaylarının modelleme becerileri üzerine etkisi. *Kuram ve Uygulamada Eğitim Bilimleri*, *13*(2), 1177-1194.

Çoksöyler, A., & Bozkurt, G. (2021). Bilişsel perspektif bağlamında matematiksel modelleme süreci: Altıncı sınıf öğrencilerinin deneyimleri. *Dokuz Eylül Üniversitesi Buca Eğitim Fakültesi Dergisi*, (52), 480-502.

Crouch, R., & Haines, C. (2004). Mathematical modelling: transitions between the real world and the mathematical model. *International Journal of Mathematical Education in Science and Technology*, *35*(2), 197-206. Doi: https://doi.org/10.1080/00207390310001638322

Dede, Y. (2004). Öğrencilerin cebirsel sözel problemleri denklem olarak yazarken kullandıkları çözüm stratejilerinin belirlenmesi. *Eğitim Bilimleri ve Uygulama*, *3(6), 175- 192*.

Deniz, D., & Akgün, L. (2018). Matematiksel modellemenin matematik öğretmeni adaylarının matematik, matematiğin öğretimi ve öğrenimine yönelik inançları üzerindeki etkisinin incelenmesi. *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi*, *6*(STEMES'18), 19-25.

English, L. D. (2002). Development of 10-year-olds' mathematical modelling. In L. D., English (Eds.), *International PME Conference*, University of East Anglia, Norwich.

English, L. D. (2009). Promoting interdisciplinarity through mathematical modelling. *ZDM*, *41*, 161-181.

English, L. D., & Doerr, H. M. (2003). Perspective-taking in middle school mathematical modelling: A teacher case study. *International Group for the Psychology of Mathematics Education*, *2*, 357-364.

English, L., & Sriraman, B. (2010). Problem solving for 21st century. In B. Sriraman, L. English (Eds.), *Theories of Mathematics Education, Advances in Mathematics Education* (pp. 263-290), Doi: 10.1007/978-3-642-00742-2_27, Springer-Verlag Berlin Heidelberg.

English, Lyn D. and Watters, James J. (2005) Mathematical modelling with 9-year-olds. In Chick, Helen L. and Vincent, Jill L., Eds. Proceedings of the 29th Annual Conference of the International Group for the Psychology of Mathematics Education 2(1), pages pp. 297-304, Melbourne, Australia. Accessed from: http://eprints.qut.edu.au/archive/00003515

Erbaş, A. K., Ketil, M., Çetinkaya, B., Çakıroğlu, E., Alacacı, C., & Baş, S. (2014). Matematik eğitiminde matematiksel modelleme: Temel kavramlar ve farklı yaklaşımlar. *Kuram ve Uygulamada Eğitim Bilimleri, 14*(4), 1607-1627. Doi: 10.12738/estp.2014.4.2039

Erdem, Z. Ç., & Gürbüz, R. (2018). Matematik modelleme etkinliklerine dayalı öğrenme ortamında yedinci sınıf öğrencilerinin alan ölçme bilgi ve becerilerinin incelenmesi. *Adıyaman University Journal of Educational Sciences*, *8*(2), 86-115.

Eric, C. C. M. (2010). Tracing primary 6 students' model development within the mathematical modelling process. *Journal of Mathematical Modelling and Application, 1*(3), 40-57.

Ferri, R. B. (2006). Theoretical and empirical differentiations of phases in the modelling process. *ZDM*, *38*, 86-95. Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2010). *Bilimsel Araştırma Yöntemleri,* Pegem Akademi Yayınları: Ankara. ISBN 978-9944- 919-28-9

Güder, Y. (2013). *Ortaokul matematik öğretmenlerinin matematiksel modellemeye ilişkin görüşleri* (Yayımlanmamış Yüksek Lisans Tezi), Fırat Üniversitesi, Elazığ.

Ikeda, T., & Stephens, M. (2001). The effects of students' discussion in mathematical modelling. In *Modelling and mathematics education* (pp. 381-390). Woodhead Publishing. Doi: https://doi.org/10.1533/9780857099655.5.381

İnan, G. 2011). Eylem araştırması: Eğitimde değişimin yaratılmasında öğretmenin gücü. *Celal Bayar Üniversitesi Sosyal Bilimler Dergisi*, *9*(02), 481-486.

Kaiser, G., & Maaß, K. (2007). Modelling in lower secondary mathematics classroom—problems and opportunities. *Modelling and Applications in Mathematics Education: The 14th ICMI Study*, 99-108. Doi: 10.1007/978-0-387-29822-1_8

Kal, F.M. (2013). *Matematiksel modelleme etkinliklerinin ilköğretim 6. sınıf öğrencilerinin matematik problemi çözme tutumlarına etkisi* (Yayınlanmamış Yüksek Lisans Tezi), Kocaeli Üniversitesi, Kocaeli.

Kalaycı, Ö. (2017). *Ortaokul 7. sınıf öğrencilerinin bilişsel ve üst bilişsel matematiksel modelleme yeterliklerinin incelenmesi (Yayımlanmış Yüksek Lisans Tezi). Bartın Üniversitesi Eğitim Bilimleri Enstitüsü, Bartın.*

Kang, O., & Noh, J. (2012, July). Teaching mathematical modelling in school mathematics. In *12th International Congress on Mathematical Education* (pp. 8-15).

Karalı, D. (2013). *İlköğretim matematik öğretmen adaylarının matematiksel modelleme hakkındaki görüşlerinin ortaya çıkarılması* (Yayımlanmamış Yüksek Lisans Tezi), Abant İzzet Baysal Üniversitesi, Bolu.

Korkmaz, E. (2010). *İlköğretim matematik ve sınıf öğretmeni adaylarının matematiksel modellemeye yönelik görüşleri ve matematiksel modelleme yeterlikleri* (Yayımlanmamış Doktora Tezi), Balıkesir Üniversitesi, Balıkesir.

Lesh, R., & Doerr, H. M. (2003). Foundations of a models and modeling perspective on mathematics teaching, learning, and problem solving. In *Beyond constructivism* (pp. 3-33). Routledge.

Lesh, R., & Zawojewski, J. (2007). Problem solving and modeling, In F. K., Lester, Jr. (Eds.), *Second Handbook of Research on Mathematics Teaching and Learning: A Project of the National Council of Teachers of Mathematics* (pp.763-804). Charlotte, NC: Information Age Publishing.

Lesh, R., & Zawojewski, J. S. (2007). Second handbook of research on mathematics teaching and learning, chapter Problem solving and modeling. *Problem solving and modeling, 763, 804*.

Lesh, R., Carmona, G., & Post, T. (2002, October). Models and modeling, In: *Proceedings of the Annual Meeting [of the] North American Chapter of the International Group for the Psychology of Mathematics Education*, *1*(4), Athens: PME.

Lester, F. K., Jr., & Kehle, P.E. (2003). From problem solving to modeling: the evolution of thinking about research on complex mathematical activity, In R. Lesh, & H. M., Doerr (Eds.), *Beyond constructivism: Models and modeling perspectives on mathematics problem solving, learning, and teaching* (pp. 501-518). Mahwah, NJ: Lawrence Erlbaum Associates.

Llinares, S., & Roig, A. I. (2008). Secondary school students' construction and use of mathematical models in solving word problems. *International Journal of Science and Mathematics Education*, *6*, 505-532. Doi: 10.1007/s10763-006-9055-6

Maaß, K. (2006). What are modelling competencies? *ZDM*, *38*(2), 113-142. Doi: 10.1007/BF02655885

Memnun, D. S. (2014). Beşinci ve altıncı sınıf öğrencilerinin sözel problemleri çözme konusundaki yetersizlikleri ve problem çözümlerindeki hataları. *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, *5*(2), 158-175.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Sage.

Milli Eğitim Bakanlığı Talim ve Terbiye Kurulu Başkanlığı. (2013). *Ortaokul matematik öğretim programı*. Ankara.

Milli Eğitim Bakanlığı Talim ve Terbiye Kurulu Başkanlığı. (2018). *Ortaokul matematik öğretim programı*. Ankara.

Mischo, C., & Maaß, K. (2012). Which personal factors affect mathematical modelling? The effect of abilities, domain specific and cross domain-competences and beliefs on performance in mathematical modelling. *Journal of Mathematical Modelling and Application*, *1*(7), 2-19.

Mousoulides, N. G., Christou, C., & Sriraman, B. (2008). A modeling perspective on the teaching and learning of mathematical problem solving. *Mathematical Thinking and Learning*, 10, 293–304. Doi:10.1080/10986060802218132.

Muller, E., & Burkhardt, H. (2007). Applications and modelling for mathematics—overview. In W., Blum, P. L., Galbraith, H. W., Henn, & M., Niss (Eds.), *Modelling and Applications in Mathematics Education: The 14th ICMI Study* (pp.267-274). Springer US.

Muşlu, M., & Çiltaş, A. (2016). Doğal sayılarda işlemler konusunun öğretiminde matematiksel modelleme yönteminin öğrenci başarısına etkisi. *Bayburt Eğitim Fakültesi Dergisi*, *11*(2), 329-341.

Nemirovsky, R. (1996). Mathematical narratives, modeling, and algebra. In N. Bernarz, C. Kieran, & L. Lee (Eds.), *Approaches to Algebra* (pp. 197-220). Springer Netherlands.

Olkun, S., Şahin, Ö., Akkurt, Z., Dikkartın, F. T., & Gülbağcı, H. (2009). Modelleme yoluyla problem çözme ve genelleme: İlköğretim Öğrencileriyle Bir Çalışma. *Eğitim ve Bilim,* 34(151), 65-73.

Özgen, K., & Şeker, İ. (2021). 6. Sınıf öğrencilerinin farkli matematiksel modelleme problemlerindeki beceri gelişimlerinin incelenmesi. *Milli Eğitim Dergisi*, *50*(230), 329-358.

Özgen, K., & Şeker, İ. (2021). 6. Sınıf öğrencilerinin farklı matematiksel modelleme problemlerindeki beceri gelişimlerinin incelenmesi. *Milli Eğitim Dergisi*, *50*(230), 329-358.

Reusser, K., & Stebler, R. (1997). Every word problem has a solution—The social rationality of mathematical modeling in schools. *Learning and instruction*, *7*(4), 309-327. Doi: 10.1016/S0959-4752(97)00014-5

Sandalcı, Y. (2013). Matematiksel modelleme ile cebir öğretiminin öğrencilerin akademik başarılarına ve matematiği günlük yaşamla ilişkilendirmelerine etkisi. *(Yayımlanmış Yüksek Lisans Tezi). Recep Tayyip Erdoğan Üniversitesi. Sosyal Bilimler Enstitüsü, Rize.*

Silver, E. A., Shapiro, L. J., & Deutsch, A. (1993). Sense making and the solution of division problems involving remainders: An examination of middle school students' solution processes and their interpretations of solutions. *Journal for Research in Mathematics Education*, *24*(2), 117-135. Doi: 10.5951/jresematheduc.24.2.0117

Soylu, Y. (2008). 7. Sınıf Öğrencilerinin cebirsel ifadeleri ve harf sembollerini (değişkenleri) yorumlamaları ve bu yorumlamada yapılan hatalar, *Selçuk Üniversitesi Ahmet Keleşoğlu Eğitim Fakültesi Dergisi, Sayı: 25, 237 -248.*

Şahin, N. (2014). İlkokul 4. sınıf öğrencilerinin model oluşturma etkinlikleri üzerindeki düşünme süreçleri. *(Yayımlanmış Yüksek Lisans Tezi). Ondokuz Mayıs Üniversitesi, Eğitim Bilimleri Enstitüsü, Samsun.*

Şen Zeytun, A. (2013), *Öğretmen adaylarının matematiksel modelleme süreçlerinin ve bu sürece etki eden faktörlere ilişkin görüşlerinin incelenmesi* (Yayımlanmamış Doktora Tezi), Orta Doğu Teknik Üniversitesi, Ankara.

Tekin Dede, A. (2015). Matematik derslerinde öğrencilerin modelleme yeterliklerinin geliştirilmesi: bir eylem araştırması. (*Yayınlanmış doktora tezi). Dokuz Eylül Üniversitesi, Eğitim Bilimleri Enstitüsü, İzmir*.

Tekin Dede, A., & Yılmaz, S. (2013). İlköğretim matematik öğretmeni adaylarının modelleme yeterliliklerinin incelenmesi. *Turkish Journal of Computer and Mathematics Education, 4*(3), 185-206.

Tomal, D. R. (2003). *Action Research for Educators: A Scarecroweducation Book*, Inc.Lanham, Maryland, and Oxford: The Scarecrow Press.

Tuna, A., Biber, A. Ç., & Yurt, N. (2013). Matematik Öğretmeni adaylarının matematiksel modelleme becerileri. *Gazi Üniversitesi Eğitim Fakültesi Dergisi*, *33*(1), 129-146.

Türker Biber, B., & Yetkin Özdemir, İ. E. (2015). Matematik öğretiminde matematiksel modelleme yaklaşımı. *Cito Eğitim: Kuram ve Uygulama*, 27, 39-50.

Tutkun, M. İ., & Kabar, M. G. D. (2018). Ortaokullarda matematiksel modelleme: 7. sınıf öğrencilerinin "hava durumu" modelleme problemi ile deneyimi. *Adıyaman University Journal of Educational Sciences*, *8*(2), 23-52.

Ünveren, E. N. (2010). *İlköğretim matematik öğretmen adaylarının ispata yönelik tutumlarının matematiksel modelleme sürecinde incelenmesi* (Yayımlanmamış Yüksek Lisans Tezi), *Balıkesir Üniversitesi, Balıkesir*.

Ural, A., & Ülper, H. (2013). İlköğretim Matematik Öğretmeni adaylarının matematiksel modelleme ile okuduğunu anlama becerileri arasındaki ilişkinin değerlendirilmesi. *Kuramsal Eğitimbilim Dergisi*, *6*(2), 214-241.

Uzun, H., Ergene, Ö., & Masal, E. (2023). İlköğretim beşinci sınıf öğrencilerinin matematiksel modelleme süreçlerinin incelenmesi: Matematik Köyü'ne gidiyoruz etkinliği. *Kocaeli Üniversitesi Eğitim Dergisi*, *6*(2), 494-521.

Verschaffel, L., De Corte, E., & Vierstraete, H. (1999). Upper elementary school pupils' difficulties in modeling and solving nonstandard additive word problems involving ordinal numbers. *Journal for Research in Mathematics Education, 30* (3), 265-285. Doi:10.2307/749836

Yenilmez, K., & Teke, M. (2008). Yenilenen matematik programının öğrencilerin cebirsel düşünme düzeylerine etkisi. *İnönü Üniversitesi Eğitim Fakültesi Dergisi*, 9(15), 229-246.

Yenilmez, K., & Yılmaz, S. (2013). İlköğretim ikinci kademe öğrencilerinin problem çözmedeki kavram yanılgıları. *Sakarya Üniversitesi Eğitim Fakültesi Dergisi*, (15), 75-97. Retrieved From https://Dergipark.Org.Tr/En/Pub/Sakaefd/Issue/11211/133890

Yıldırım, Z. & Işık, A. (2015). The effects of mathematical modelling activities to academic achievement of the fifth grade students in mathematics course. *Kastamonu Eğitim Dergisi, 23*(2), 581-600. Retrieved from https://dergipark.org.tr/en/pub/kefdergi/issue/22599/241432

Yıldırım, Z., & Işık, A. (2015). Matematiksel modelleme etkinliklerinin 5. sınıf öğrencilerinin matematik dersindeki akademik başarılarına etkisi. *Kastamonu Eğitim Dergisi*, *23*(2), 581-600.

Yoon, C., Dreyfus, T., & Thomas, M. O. J. (2010). How high is the tramping track? Mathematising and applying in a calculus model-eliciting activity. *Mathematics Education Research Journal*, *22*(1), 141-157. Doi: 10.1007/BF03217571

Zawojewski, J. (2010). Problem solving versus modeling, R. Lesh et al. (Eds.), *Modeling Students' Mathematical Modeling Competencies* (pp.237-243). Springer US. Doi: 10.1007/978-1-4419-0561-1_20.

Zawojevski, J., & Lesh, R. (2003). A models and modeling perspective on problem solving, In R. Lesh, H. Doerr (Eds.), *Beyond constructivism: Models and modeling perspectives on mathematics problem solving, learning, and teaching* (pp. 501-518). Mahwah, NJ: Lawrence Erlbaum Associates.

Zbiek, R. M., & Conner, A. (2006). Beyond motivation: exploring mathematical modeling as a context for deepening students' understandings of curricular mathematics. *Educational Studies in mathematics*, *63*, 89-112. Doi: 10.1007/s10649-005-9002-4

Zollman, A. (2010). Commentary on Problem Solving for the 21st Century, In L. English (Eds.), *Theories of Mathematics Education: Advances in Mathematics Education* (pp.297-301). Springer-Verlag Berlin Heidelberg. Doi: 10.1007/978-3-642- 00742-2_27.

Osmangazi Journal of Educational Research **Volume 11(1), Spring 2024**

RESEARCH Open Access

Suggested Citation: Süral, İ., & Öncü, S. E., (2024). Examining occupation fields of programs according to artificial intelligence: Anadolu university open education system case. *Osmangazi Journal of Educational Research, 11*(1), 39-72.

Submitted: 19/12/2023 **Revised:** 18/03/2024 **Accepted:** 08/06/2024 **DOI:** 10.59409/ojer.1407007

Examining Occupation Fields of Programs According to Artificial Intelligence: Anadolu University Open Education System Case

***Sefa Emre Öncü, **İrfan Süral**

Abstract. Anadolu University's Open Education System (OES) accommodates over one million students and has incorporated an AI-based Virtual Assistant for non-academic support since 2022. While OES offers abundant information about its programs on its website, there is a notable absence of support services providing job recommendations related to students' chosen programs. This gap in student support extends to the post-graduation phase, with the Virtual Assistant lacking a concept for guiding students in finding employment opportunities. Recognizing the need for comprehensive assistance, this study sought to leverage AI capabilities to offer job recommendations by extracting information from the objectives of 63 OES programs. The initial inquiry involved requesting AI-generated job recommendations based on the stated objectives of these programs. Subsequently, the Virtual Assistant was tasked with providing insights into the occupation fields associated with OES programs. Analysis of the AI's responses, along with the classification of occupations according to the International Standards of Classifications of Occupations (ISCO) and the International Standard Classification of Education (ISCED), forms the core of this study. Contrary to trends observed in most European countries, the predominant number of graduates in Türkiye emerges from business and management fields. However, the correlation between graduation rates and subsequent job placements appears suboptimal within the labor force and employment landscape. The study advocates for the integration of AI in offering job recommendations, incorporating graduation and employment rates. This approach enables students to seek guidance on suitable programs aligned with their skills, fostering a more informed decision-making process. The study underscores the potential for higher education institutes to share employment and labor force data.

Keywords: Higher education, open education, student support, artificial intelligence.

*** (Responsible Author)** Master Student, Eskisehir Osmangazi University, Institute of Education, Eskisehir, Türkiye

e-mail: sefaemreoncu@gmail.com

** Assoc. Prof. Dr., Eskisehir Osmangazi University, Faculty of Education, Eskisehir, Türkiye

e-mail: isural@ogu.edu.tr

Artificial intelligence, which has a broad range of applications in today's world, essentially refers to a machine's ability to exhibit behaviors resembling human intelligence. Through machine learning, artificial intelligence obtains insights from data, providing exceptional opportunities for analysis, mapping, and prediction in fields such as language, finance, medicine, space, science, and more. Although tracing the origins of artificial intelligence is not easy, the concept was first encountered in Asimov's work "Runaround," written in 1942 (Haenlein & Kaplan, 2019). In real life, artificial intelligence emerged in 1945 when Vannevar Bush proposed a system to enhance human knowledge and understanding. This was followed by Alan Turing, who wrote an article on the capabilities of machines to simulate human beings and perform intelligent actions such as playing chess in 1950 (Negnevitsky, 2005). It is difficult to pinpoint the beginning of AI, the discipline. The Dartmouth Summer Project assumed the first event about AI in 1956 (Kline, 2011). In literature, different institutions worldwide have used AI for a long time.

AI is used for job automation, education, business, communication, etc. The first generation of AI was a rule-based model, the second generation was an optimal model for statistics, and the third generation has a brain model with an improving recognition performance (Zhai et al., 2021). Notably, the prominence of AI gained momentum with the establishment of OpenAI in 2015. The transformative impact continued with the introduction of ChatGPT-3 in 2020, marking a milestone in optimized language models (Fitria, 2023). Integrating AI in education has revolutionized the learning landscape, providing personalized learning experiences and unique opportunities for each student (Süral, 2008). As the latest and widely recognized technology in education, AI has been consistently adopted by higher education institutions since its initial development. Notable institutions, such as Anadolu University, a mega university boasting over one million students in the Open Education System (OES), harness the power of AI for learning, registration, and student support (Bozkurt, 2013).

Since 2022, OES has been utilizing an AI-based Virtual Assistant to address student inquiries for support. Additionally, higher education institutions globally have embraced the integration of AI-based chatbots for student assistance. AI supports various areas, including registration, course selection, examinations, and graduation information. The continuum of student support extends from pre-registration to post-graduation in higher education institutions. Notably, open education students can effortlessly register for a program online. Despite the student's responsibility for choosing a program, institutions play a crucial role in furnishing information about programs and courses. If students refrain from seeking help from professionals or need more adequate program information,

there is a risk of dropout. Furthermore, the challenge of securing employment commensurate with their skills may arise even after graduation.

In the realm of literature, the concept of student support, as outlined by Tait (2000), encompasses various facets, including course materials support and the creation of conditions for emotional support, work commitment, motivation, and components support. Following the holistic model Simpson (2012) presented, learner support is organized into academic and non-academic assistance categories. Thorpe (2002) further elaborates on this by breaking down learner support systems into phases – pre-study, during, and after learning. Armed with these insights, it becomes apparent that offering job recommendations based on program objectives after learning and during pre-study is an integral aspect of student support. Moreover, recognizing that some students may require individualized job suggestions even before the registration stage highlights the personalized nature of this support.

Job recommendations are seamlessly woven into various job search assistance modules uncovered in the literature review. Wegmann (1979) delved into a Job Search Assistance program in the USA, renowned for its high success rate in aiding individuals in securing employment. Building on this, Cottier et al. explored the impacts of a job search assistance program on overall employment outcomes. Adding a different perspective, Tovar (2014) asserts that support services, particularly those involving significant interactions with counselors during program selection, are crucial in influencing students' academic success. According to the findings, Xiong et al. (2011) found that a job research assistant is one of the students seeking specific services. Whereas Holmegaard (2014) et al., Korkut-Owen et al. (2013), and Aydemir (2018), the process of choosing what to study in higher education and their research job preferences was one of the choosing factors. Besides, some researchers have studied job search modules with AI. Verma et al. (2022) investigated skill requirements in artificial intelligence and machine learning job advertisements, revealing that skills acquired in higher education could be instrumental in the hiring process.

Kingchang et al. (2024) state that AI-based chatbots can also be used as tools that offer suggestions on education. Hou et al. (2024) examined the demands of learners enrolled in Computer Programming in the productive AI-based ChatGPT application; they found that the application yields better results only when learners write messages clearly and understandably. Melina et al. (2023) conducted a study on a web-based information system with database modeling and design that will help to identify and report students' activities and achievements in student affairs. Institutions must

understand that they can effectively implement AI technology (Kim et al., 2022). Higher education institutions should research and assimilate AI-based technologies for teaching, learning, student support, and administration. Dunn et al. (2021) state that it is vital for the staff working in student affairs in a higher education institution to spend all their time with students seeking support and that staff with leadership qualities should try to solve the problems experienced by students. However, it is impossible for centralized open education institutions such as Anadolu University, called Giga universities, to deal with students one-on-one regarding human resources. Learners who experience inadequacy in support services from the beginning and even realize that the program they enrolled in is far from their skills may fail academically or even drop out. In this context, higher education administrators should clearly state the program's aims before learners enroll and clarify in which field and occupational group those who enroll can work upon graduation. However, artificial intelligence-based support systems can provide this information in institutions such as open and distance education institutions, where the number of learners and employees could be higher. Within the scope of the Bologna Process and National Qualifications Framework for Higher Education, higher education institutions in Türkiye determine the aims, outcomes, curriculum, and ECTS credits of the program in specific standards and publish them on their websites. Although some higher education institutions include program objectives and future information, ISCO or ISCED standards are not related to the vocational fields of the programs.

There are established standards in determining the professional fields for programs in higher education institutions. Anadolu University, for instance, now mandates the identification of appropriate codes from the International Standards of Classifications of Occupations (ISCO) and the International Standard Classification of Education (ISCED) when proposing new programs. These standards play a crucial role in statistical processes, guiding the determination of program registration quotas and their associated employment areas. The initial occupational classification, originating in Europe in the 1940s, includes well-known systems like ISCO (Ganzeboom & Treiman, 1996). The main standardized occupational classification used in the USA, Europe, and other countries is the ISCO classification. Widely recognized, the ISCO classification is a critical standard in the USA, Europe, and globally. Its development by the International Labor Office (ILO) dates back to 1958, with the 1988 revision aiming to establish itself as the international standard for occupational classification (Kromhout, 2003). The last version of ISCO-08 is categorized as a four-digit code. ISCO is classified as a four-digit code. The first digit is the major group, the second is the sub-major

group, the third is the minor group, and the fourth is the unit group (Züll, 2016). The codes of Major ISCO-08 are listed as follows:

1. Managers
2. Professionals
3. Technicians and Associate Professionals
4. Clerical Support Workers
5. Services and Sales Workers
6. Skilled Agricultural, Forestry and Fishery Workers
7. Craft and Related Trades Workers
8. Plant and Machine Operators and Assemblers
9. Elementary Occupations
00. Armed Forces Occupations

The standard used to determine which professional fields the programs in higher education institutions are included in is ISCED. UNESCO designed it in the 1970s to provide statistics on education for robustness and, despite its limitations, as a qualification period (Chhinzer & Russo, 2018). The main aim was to create a statistical preview of study programs following primary, secondary, and higher education. Following the Bologna process in higher education, ISCED took a new form, and a new application was published in 2011 (Silvestru et al., 2018). The last Broad ISCED codes are the same as the ISCO digit system. The first two digits show broad fields. The late version of ISCED, what is called ISCED-F, is expressed below (ISCED).

00. Generic programs and qualifications
01. Education
02. Arts and humanities
03. Social sciences, journalism, and information
04. Business, administration, and law
05. Natural sciences, mathematics, and statistics
06. Information and Communication Technologies (ICTs)
07. Engineering, manufacturing, and construction
08. Agriculture, forestry, fisheries and veterinary
09. Health and welfare
10. Services

In 1997, the Lisbon Recognition Convention was signed, aligning with the Convention on the Recognition of Documents Related to Higher Education in European Countries, signifying a collective decision to acknowledge education obtained from European nations. In tandem with the Bologna Declaration, standards were established as part of the Bologna Process, encompassing the recognition of secondary education degrees, higher education, learner mobility, lifelong learning, and European Credit Transfer (ECTS) for course counting (Kehm, 2010). One of the main topics of the Bologna process is lifelong learning and student mobility (Zgaga, 2006). Türkiye also set standards in this context by creating the Core Competencies Framework in 2015 (Baykal, 2017). Higher education institutions offering education through the open education system extend accessible and distance learning opportunities to those pursuing lifelong learning. However, it is worth noting that while students enrolling in the Open Education System or other higher education institutions aim for lifelong learning, one of their crucial career goals after graduation is to secure a job related to their enrolled program. The European Union Commission, as part of the Bologna Process, conveyed six essential messages in their Lifelong Learning studies, emphasizing "New skills for everyone, more investment in human resources, bringing learning home, evaluating learning, rethinking guidance and consultation, innovations in teaching and learning" (Kaya, 2016). The Open Education System, which serves lifelong learning in Türkiye, allows students enrolled in a higher education institution to enroll in a program and thus develop their skills in different fields.

After graduating from a higher education institution, finding a job related to your field comes with various scenarios. Meanwhile, the job market and employment data in a particular field can offer insights to both students and institutions (Rahmat et al., 2012). It is essential to note that job trends and opportunities can fluctuate over time and across different locations. Consequently, individuals entering higher education to secure employment are encouraged to anticipate the professional landscape they might encounter post-graduation from their enrolled program (Stiwne & Alves, 2010). Recognizing that this can be a complex matter, especially for recent high school graduates, higher education institutions must extend support to students after they graduate (Tait, 2010). Higher education institutions that provide face-to-face education can provide this service at a higher rate in practice than institutions that open education (Öztürk, 2018). As exemplified by the Anadolu University Open Education System in Turkiye, open education institutions have proactively developed support services and integrated new technologies. To this end, artificial intelligence-supported Virtual Assistants and chatbots address prospective students' inquiries before officially registering, complementing human-based academic or non-academic support. Despite the widespread

association of artificial intelligence with chatbots or virtual assistants, it plays diverse roles, from driving cars to engaging in creative endeavors like music and painting. Artificial intelligence strives to deliver swift and accurate responses based on available datasets. In the current landscape, AI can amalgamate vast amounts of data and provide precise recommendations tailored to users' needs.

It is essential for Giga Universities such as Anadolu University, which has more than one million learners enrolled in the Open Education System, to provide instant and accurate support to learners. Learners who enroll in a program online need an advisor to measure whether the program suits them adequately. However, they can only understand the program's suitability within a few semesters. In addition, the program's objectives and outcomes may differ from the learner's skills and professional ability. At this point, artificial intelligence-supported applications can show which occupational groups the programs cover. In this field, the learners can find a job after graduation, and the employment status of the field to the learners before they enroll. This data can be meaningful for learners who register with the concern of finding a job. The administrators of the higher education institution can also determine the quotas of the existing programs by considering the employment and graduation data and deciding in which field the programs should be opened. At this point, artificial intelligence-based support systems are important for employees, managers, and learners. With the support of artificial intelligence, learners who enroll in the program from the right occupational group will be more likely to show academic success as they study in their field of interest. They will be expected to show high performance in their possible future job as they will be more likely to find a job in the relevant field when they graduate. However, learners who are not guided correctly can be expected to be unhappy or underperform in their jobs even if they graduate and find a job in the field they graduated from.

This study deals with the data that will emerge in the case of using an artificial intelligence-based support system that will recommend a program according to the profession and give an idea by sharing employment data related to the occupational field before enrolling in the program to learners who cannot access enough information on open and distance education websites and cannot get instant information due to the limited number of staff. Artificial intelligence-based support systems can share the information in this study with learners instantly and quickly. According to this study, higher education administrators may decide they do not need an AI-based support system.

In this context, the questions were proposed for the research:

1. Can AI recommend jobs based on OES program objectives? If it can, what jobs are recommended by AI?
2. How can AI classify the OES programs based on occupation fields?
3. What are OES's graduation and employment rates based on AI's occupation fields?
4. How can graduation rates be compared based on occupation fields?

Method

This study's research model, data collection tools, process, and data analysis are explained under the headings below.

Research Model

A case study design was used for the research in which the qualitative research method was adopted. The data collected through document analysis were analyzed using frequency and descriptive analysis (Karadağ, 2010). In a case study, the approach used for data analysis may differ. Some case studies involve the analysis of more than one unit within the situation, while others report the entire situation. A good case study research must describe the situation (Creswell, 2013). Document analysis is conducted through interviews, observations, interviews, and analysis of documents. Specifically, document analysis was employed, presenting situational themes according to Yin (2009). As highlighted by Yıldırım & Şimşek (1999), document analysis can be considered a research method. To ensure a systematic approach, this research followed the steps. Document analysis involves meticulously examining extant documents or records as a data source. This process involves the analysis of written materials that contain information pertinent to the subjects under investigation. Employed to garner data essential for the study's objectives, this method facilitates the extraction of findings from the analyzed data.

Moreover, document analysis allows for deriving generalizations and interpretations by synthesizing data gleaned from the scrutiny of verbal, printed, and other material forms that encapsulate information on the intended research topics. This study applied the descriptive analysis technique to assess the data collected. This approach permits the reorganization of research findings in alignment with the investigative problems or their presentation through various dimensions, considering different aspects.

Bowen (2009) highlights five specific functions of documents in research: providing contextual data, suggesting research questions and observations, offering supplementary data, enabling tracking

of change and development, and serving to verify findings or corroborate evidence from other sources. These functions underscore the versatility of document analysis in enriching the understanding of research topics by offering historical insights, informing the research process, and contributing to the robustness of qualitative analysis. This statement underscores the importance of accurately reflecting participants' perspectives in research findings. The methodologies employed, particularly document and thematic content analysis, are lauded for their systematic approach to data organization and interpretation. This precision facilitates crafting recommendations that resonate with the participants' core beliefs, values, and attitudes. By providing a structured model for data analysis, these methods are invaluable in thematic analysis and fostering interdisciplinary collaboration, making them ideal for projects that span multiple fields of study. For instance, in a health and social sciences project, such a methodological approach can ensure that policy recommendations align with patient experiences and expectations, thus enhancing the applicability and impact of research outcomes (Armstrong, 2021).

Data Collection Tools

For this purpose, program outcomes on the website were transferred to a database individually. Sixty-three program objectives available on the OES website were gathered and compiled into a database using Google Spreadsheets. The integration of GPT-3.5 with Spreadsheets allowed for direct interactions, prompting GPT to provide three job recommendations based on the program objectives listed on the OES website. GPT delivered three job suggestions and detailed job descriptions, all recorded on Spreadsheets. The job recommendations for each program were cross-referenced with the corresponding ISCO and ISCED codes. Subsequently, the registration and graduation statistics for the programs were compared with employment statistics from TÜİK and OECD.

Process

This study seeks to analyze AI's job recommendations, as depicted in Figure 1. To initiate the analyses, we compiled 63 program objectives from the OES website, creating a database on Google Spreadsheets. Leveraging the integration of OpenAI's GPT-3.5 with Spreadsheets, we engaged GPT to provide three job recommendations based on the program objectives listed on the OES website. GPT generated three job suggestions and detailed descriptions, all meticulously documented on Spreadsheets. The job recommendations for each program were cross-referenced with the corresponding ISCO and ISCED codes to ensure alignment. Subsequently, we compared the registration and graduation statistics of the programs with employment data from TÜİK.

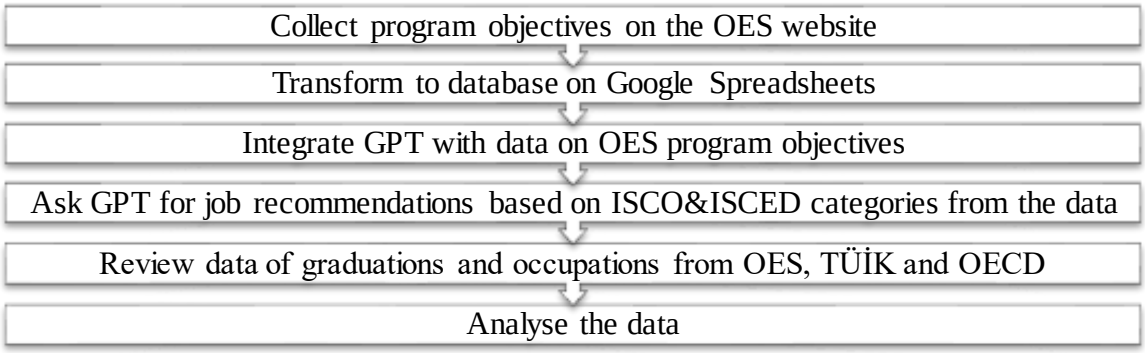


Figure 1. Steps in the Study.

In this research, we exemplify how artificial intelligence was incorporated, illustrating the process in Figure 2. The model depicted in this figure outlines the professions recommended by AI based on the objectives of the Call Center Services program and aligns these suggestions with occupation fields by ISCO and ISCED standards.

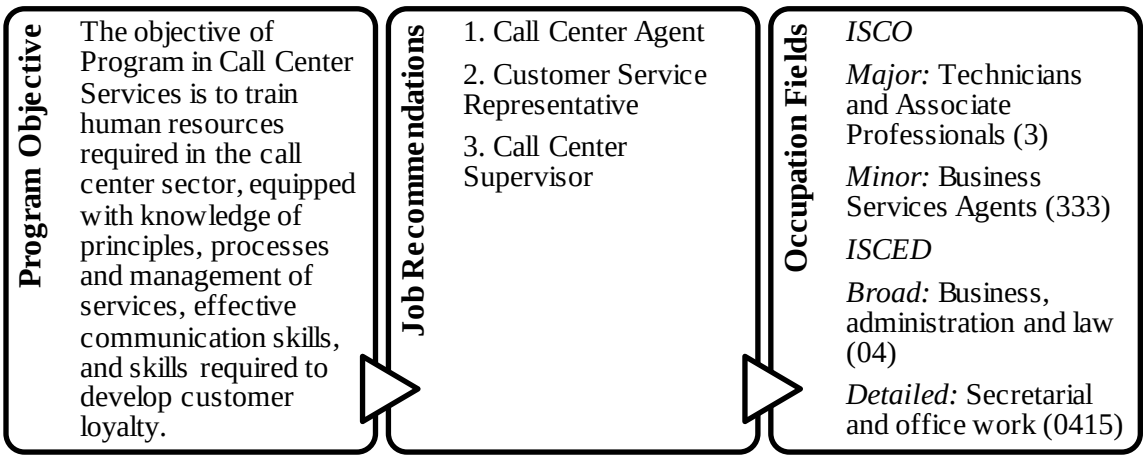


Figure 2. An Example of a Program's Classification: Call Center Services Program.

Data Analysis

This research examined AI's job recommendations based on document analysis from OES's program objectives. Then, AI classified programs in ISCED and ISCO categories; after the classification, OES compared graduation and employment rates based on TÜİK and OECD. After collecting all the data needed through artificial intelligence, the documents were analyzed descriptively according to the research questions. In summary, the data obtained in the study were analyzed on the question, "If there was an artificial intelligence-based support system, how would the program occupational fields be shown?".

Results

This research's findings were listed with headings per the research questions in this section.

Findings on Job Recommendations

When we sought job recommendations from AI based on program objectives, it provided 189 distinct job suggestions, 160 of which were unique. Notably, twenty-one jobs had a frequency greater than two. The frequency of employment with more than two is shown in Table 1.

Table 1.

AI's job recommendations from program objectives (Frequency is more than two)

Job Recommendation	f
Financial Analyst	4
Public Relations Specialist	4
Event Planner	3
Policy Analyst	3
Social Media Manager	3
Social Worker	3
Business Analyst	2
Diplomat	2
Entrepreneur	2
Health Services Manager	2
Healthcare Consultant	2
Hospital Administrator	2
Hotel Manager	2
Human Resources Manager	2
Interfaith Dialogue Facilitator	2
International Organization Officer	2
International Trade Specialist	2
Marketing Manager	2
Policy Advisor	2
Supply Chain Analyst	2
Travel Consultant	2

Based on the insights from Table 1, it is notable that the top-recommended positions include Financial Analyst and Public Relations Specialist. The Financial Analyst role emerged as a top suggestion for programs like Accounting and Taxation, Banking and Insurance, Economics (English), and Securities and Capital Markets. On the other hand, the Public Relations Specialist position was prominent in recommendations for Media and Communication, Political Science and Public

Administration, Public Relations and Advertising, and Public Relations and Publicity programs. The roles of Event Planner, Policy Analyst, Social Media Manager, and Social Worker are closely in second place, each recommended for three programs. Interestingly, the data indicates that among the fifteen jobs considered, their program frequency is consistently two.

Findings on the Classification of Programs Based on Occupation Fields

In this study, we utilized ISCO and ISCED occupation fields. AI played a crucial role in classifying each program in OES according to its objectives. Then, the findings were analyzed.

Table 2.

Occupation Categories of OES Based on ISCO

Occupation	**f**	**%**
2. Professionals	24	38.10
3. Technicians and Associate Professionals	19	30.16
1. Managers	13	20.63
9. Elementary Occupations	4	6.35
5. Services and Sales Workers	3	4.76
Total	*63*	*100*

Table 2 presents the data regarding the classification of programs into ISCO categories. The data highlights that AI suggested five occupations for all OES programs despite ISCO encompassing ten major occupation categories. These ISCO occupation fields, listed from most to least, include technical and associate professionals, managers, elementary occupations, and services and sales workers.

Table 3.

Occupation Categories of OES Based on ISCED

Occupation	**f**	**%**
04. Business, Administration and Law	27	42.86
10. Services	8	12.70
02. Arts and Humanities	7	11.11
09. Health and Welfare	6	9.53
03. Social Sciences, Journalism and Information	5	7.94
06. Information and Communication Technologies (ICTs)	4	6.35
08. Agriculture, Forestry, Fisheries and Veterinary	2	3.17
01. Education	2	3.17
07. Engineering, Manufacturing and Construction	2	3.17
Total	*63*	*100*

Similar to ISCO, ISCED comprises ten major occupation categories, though the types differ. Table 4 presents the occupation fields and the frequency of programs. The data from this table reveals that AI classified OES programs into nine ISCED occupations. Business, administration, and law comprise 42.86% of the occupations, while agriculture, forestry, fisheries, veterinary, education, engineering, manufacturing, and construction collectively account for only 3.17%.

Findings on Graduation and Employment Rates Based on Occupation Fields

Understanding the classification of occupation fields provides insights into employment trends. Table 4 illustrates the number of graduated students in OES and the employment of occupations in Türkiye based on ISCED areas over the years (Anadolu Üniversitesi, TÜİK).

Table 4.

OES Graduations and Employment of Occupation in Türkiye

Year	Occupation	Graduated Students in OES	Employment of Occupation in Türkiye
2020	Managers	73.454	1.468
	Professionals	114.592	3.235
	Technicians and Associate Professionals	54.369	1.628
	Services and Sales Workers	676	5.179
	Elementary Occupations	7.127	3.881
2021	Managers	79.905	1.565
	Professionals	121.650	3.513
	Technicians and Associate Professionals	63.582	1.819
	Services and Sales Workers	2.139	5.370
	Elementary Occupations	8.822	4.462
2022	Managers	29.912	1.677
	Professionals	44.196	3.730
	Technicians and Associate Professionals	29.194	1.991
	Services and Sales Workers	1.042	5.957
	Elementary Occupations	4.011	4.711

Analyzing Table 4 reveals that the most graduated students fall under the professionals category, with the most employed individuals in the services and sales workers field. Interestingly, even though services and sales workers are the most engaged, they consistently have the lowest number of graduated students each year in Table 4. Notably, the overall graduation rate in OES saw a significant decline in 2022, with only the services and sales workers field experiencing an increase in the number of graduated students compared to 2020 and 2021.

Comparing the number of graduated students from OES with the number of employed individuals in Türkiye based on ISCO fields provides insights into the ratio of graduates to employed individuals. While the data merges two different sets of information, it does not specify how many graduated OES students were employed. This nuanced perspective is comparatively presented in Figure 3 (Anadolu Üniversitesi, TÜİK).

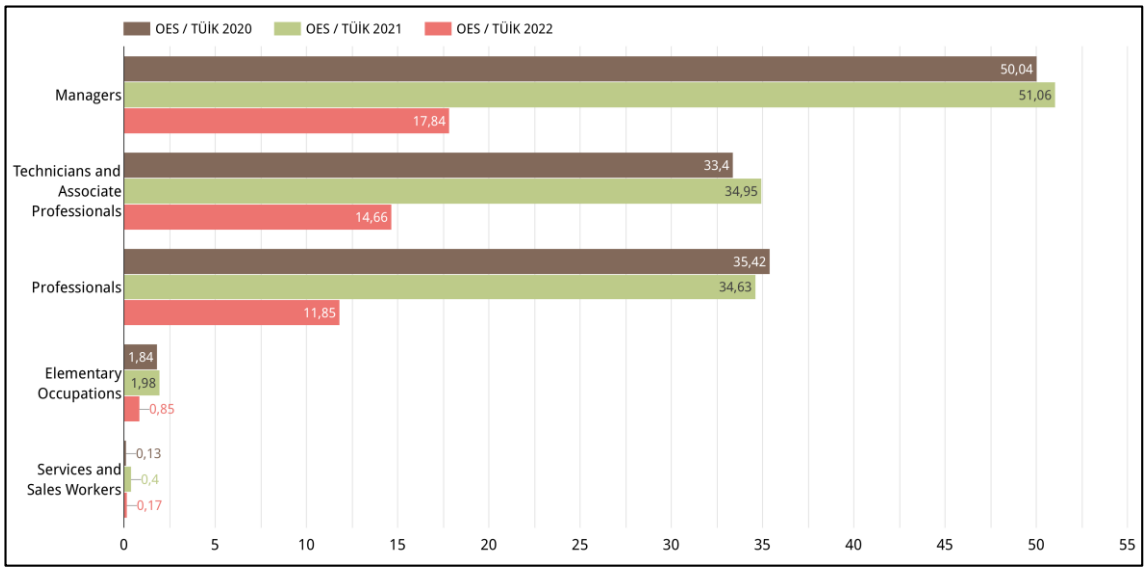


Figure 3. Comparison of OES and TÜİK.

Figure 3 provides a glimpse into the dynamics of employment in different fields. Notably, in the managerial domain, the number of graduated students was nearly 50 times more than those employed in 2020 and 2021, but this ratio dropped to almost 15 in 2022. Over the years, managers consistently held the highest coefficients. While the coefficient of technicians and associate professionals increased in 2021, it declined in 2022. Professionals, on the other hand, have witnessed a decrease since 2021.

Examining the comparison between the number of graduated students in OES and the employment of occupations, the chart indicates that services and sales workers consistently had the lowest coefficients across all years. Interestingly, unlike other fields, the number of people finding jobs in services and sales workers exceeded the number of graduates. For a detailed overview of the number of graduating students from OES and the Labor Force Status of Graduates in Türkiye based on the occupation fields of ISCED, refer to Table 5 spanning from 2020 to 2022 (Anadolu Üniversitesi; TÜİK)

Table 5.

OES Graduations and the Labour Force Status in Türkiye

Year	Occupation	Graduated Students in OES	The Labour Force Status of Graduates in Türkiye
2020	Education	3.121	1.103
	Arts and Humanities	39.922	592
	Social Sciences, Journalism and Information	14.859	565
	Business, Administration and Law	134.410	2.280
	Information and Communication Technologies	7.228	107
	Engineering, Manufacturing and Construction	1.810	1.273
	Agriculture, Forestry, Fisheries and Veterinary	6.884	190
	Health and Welfare	31.160	596
	Services	10.824	318
2021	Education	3.256	1.195
	Arts and Humanities	42.060	659
	Social Sciences, Journalism and Information	13.653	630
	Business, Administration and Law	139.082	2.497
	Information and Communication Technologies	10.283	105
	Engineering, Manufacturing and Construction	2.596	1.374
	Agriculture, Forestry, Fisheries and Veterinary	10.022	206
	Health and Welfare	34.303	696
	Services	20.843	348
2022	Education	2.063	1.269
	Arts and Humanities	12.126	695
	Social Sciences, Journalism and Information	6.620	659
	Business, Administration and Law	52.526	2.653
	Information and Communication Technologies	6.525	123
	Engineering, Manufacturing and Construction	957	1.471
	Agriculture, Forestry, Fisheries and Veterinary	3.898	215
	Health and Welfare	12.321	747
	Services	11.319	384

Analyzing Table 5 shows that business, administration, and law consistently recorded the highest numbers in graduation and the labor force across all the years. However, its graduation numbers dipped in 2022. On the flip side, even though engineering, manufacturing, and construction consistently had the lowest graduation numbers, they secured the second-highest position based on the labor force.

Figure 4 highlights the ratio of OES students graduating to the labor force in different fields. Notably, in the managerial domain, the number of graduated students was nearly 50 times more than those employed in 2020 and 2021, but this ratio dropped to almost 15 in 2022. Over the years, managers consistently held the highest coefficients. Conversely, services and sales workers consistently held the lowest coefficients.

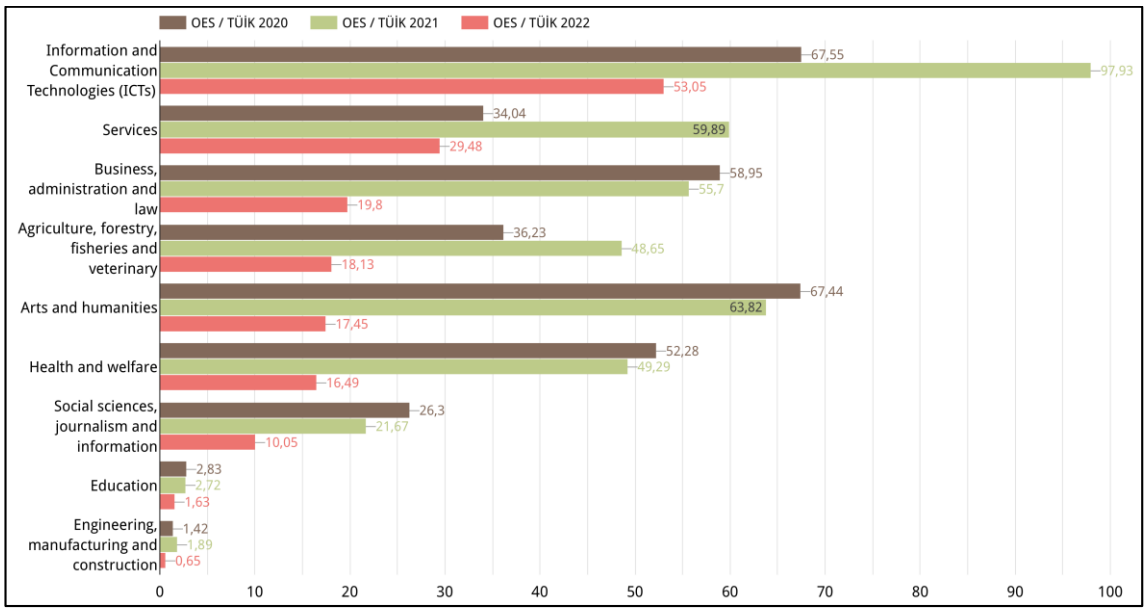


Figure 4. OES vs. TÜİK (ISCED).

Findings on the Comparison of graduation Rates Based on Occupation Fields

In this study, we delved into the variation in the number of graduate students in higher education, focusing on the occupation fields of ISCED. To achieve this, we examined the data for France, Germany, Italy, Türkiye, and the United Kingdom in 2021, as outlined in Table 6 OECD).

Table 6

Occupation Stats

Occupation	France	Germany	Italy	Türkiye	UK
Education	6.672	42.549	23.481	52.400	13.306
Arts and humanities	46.523	24.531	49.884	82.689	84.664
Social sciences, journalism, and i.	31.101	25.949	42.529	103.434	72.813
Business, administration and law	98.740	113.387	42.218	139.116	92.606
Natural sciences, mathematics and s.	29.856	18.859	17.890	15.660	51.984
Information and Communication Tech.	10.687	20.412	3.767	7.684	18.201
Engineering, manufacturing and c.	20.953	96.987	32.139	84.358	39.953
Agriculture, forestry, fisheries and vet.	1.547	6.345	5.512	6.151	3.641
Health and welfare	41.695	22.055	24.679	38.010	67.371
Services	16.654	15.362	12.412	23.849	0
Generic programs and qualifications	0	0	0	0	3.248
Field unspecified	804	2.296	265	0	0

According to Table 6, business, administration and law had the highest numbers in all countries except Italy. Arts and humanities were the first fields in Italy. Considering the number of students graduating from all higher education institutions in Türkiye, engineering, manufacturing and construction were the second. The results show that agriculture, forestry, fisheries, and veterinary had the lowest numbers in Türkiye. When the weakest figures were examined except 'field unspecified,' the lowest numbers were identical for each country except Italy. Agriculture, forestry, fisheries, and veterinary had the most insufficient numbers in France, Germany, and the United Kingdom, like Türkiye. Information and communication technology was the most downfield in Italy. The chart of these findings is shown in Figure 5.

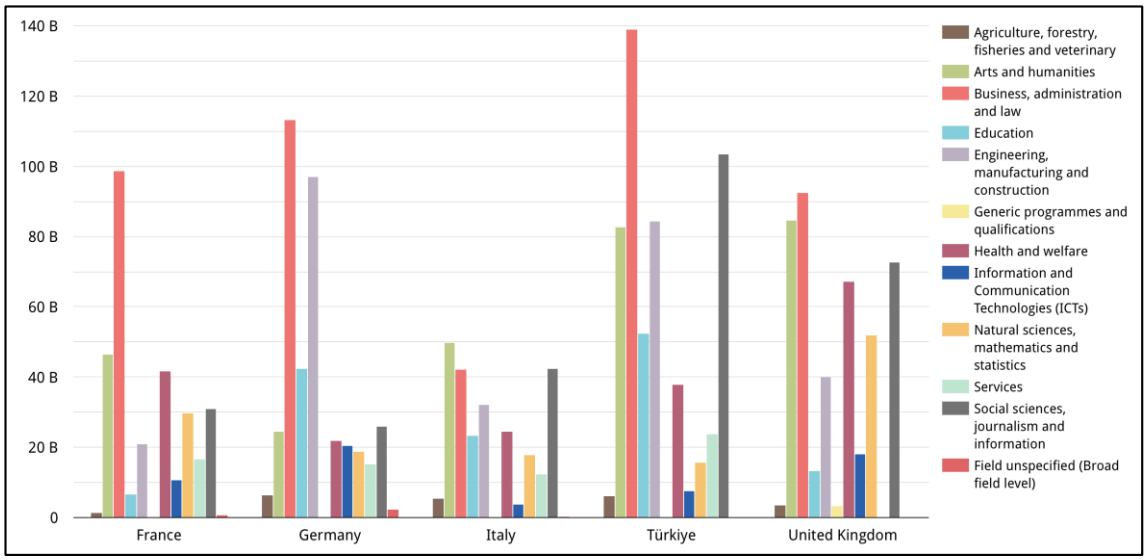


Figure 5. Graduates by Fields (OECD, 2021).

The data from TÜİK's The Labour Force Status of Graduates in Türkiye in 2021 and OECD's data from higher education graduates by fields in Türkiye in 2021 were compared in Figure 6 (TÜİK, OECD). According to the comparison result in this figure, students graduating from agriculture, forestry, fisheries and veterinary (3.35%) had the highest employment potential. This is followed by education (2.28%), health and welfare (1.83%), business, administration and law (1.79%), engineering, manufacturing, and construction (1.63%), services (1.46%), information and communication technologies (1.37%), art and humanities (0.80%), social sciences, journalism and information (0.61%) respectively. According to the comparison of 2021 data, forestry, fisheries, and veterinary were more than five times to social sciences, journalism, and information.

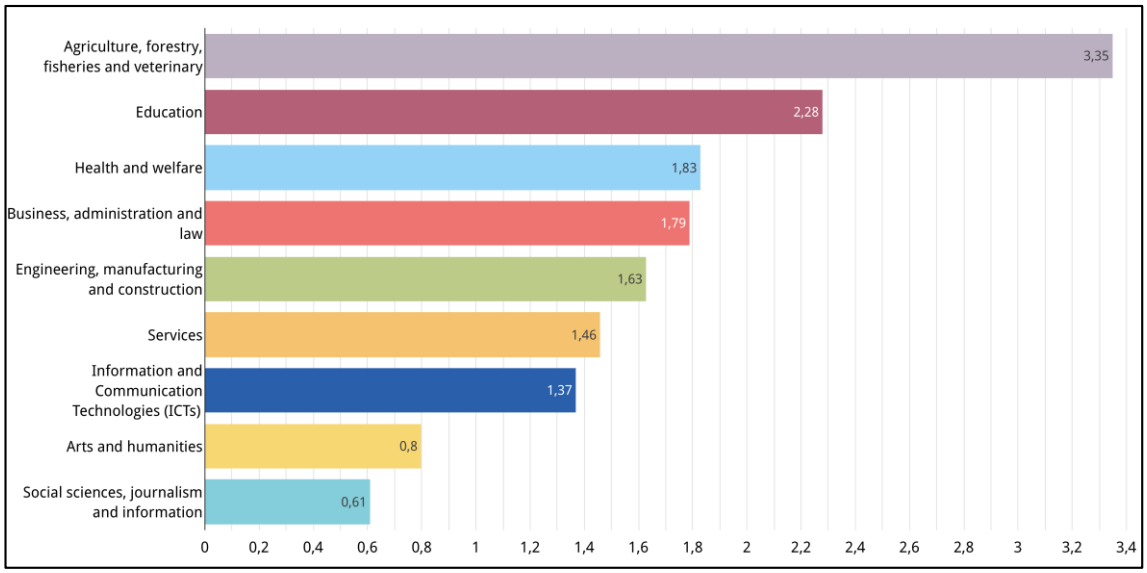


Figure 6. TÜİK & OECD Türkiye Percentage (%) Rates 2021.

Discussion and Conclusion

As efforts persist to integrate artificial intelligence into applications like chatbots and virtual assistants, several higher education institutions leverage it to enhance student support systems. Given GPT's versatility across various domains, this study initially explored the feasibility of generating professional suggestions based on the program outputs on the Anadolu University Open Education System website. Despite GPT consistently providing accurate responses post the implementation of artificial intelligence-supported GPT 3,5; it is crucial to acknowledge the potential for occasional inaccuracies. In today's landscape of AI-supported student support systems, users still exhibit a preference for interactions with humans. However, it is anticipated that virtual assistants equipped to scour the entire internet swiftly will respond and conduct analyses for the user (Babori et al., 2019).

Like other artificial intelligence applications, GPT can be a recommender in different branches. Liu et al. (2023) studied "Is ChatGPT a Good Recommender?". They conclude that for the study, "Despite GPT's limitations, it outperforms state-of-the-art methods in human evaluation for explainable recommendation tasks, highlighting its potential to generate explanations and summaries." Through the GPT plug-in integrated into the Google Sheets application, artificial intelligence made three career suggestions quickly and easily based on the information from 63 programs. Moreover, while doing this, he made statements about professions. According to the programs and their outputs, artificial intelligence made the most recommendations for Business, Administration, and Law. Considering that these recommendations were made for Accounting and Taxation, Banking and Insurance, Economics (English), and Securities and Capital Markets Programs, it can be said that artificial intelligence operates reasonably.

After making a program recommendation, the artificial intelligence was asked to classify the Open Education System programs according to ISCED and ISCO codes. Artificial intelligence has classified all programs according to the desired standards. However, it should be remembered that this is not done by field experts but rather among the categories specified according to the classification feature of artificial intelligence. According to the professional classification of artificial intelligence in ISCO, most programs in OES are in the field of professionals.

In Wan et al.'s (2023) research focusing on ISCO for automating the coding of job descriptions derived from a general population study, various automated job coding tools were employed to assess their coding performance. The findings indicated a low absolute consensus in job coding across all three instruments. Beyond underscoring the significance of conducting study-specific evaluations

before employing coding tools, their research highlights the pressing need for enhanced and evaluated automated coding tools.

Based on ISCED, the predominant program category is in business, administration, and law. These findings suggest a higher concentration of business administration, economics, and management programs. However, it is crucial to note that the significance lies in the quantity of programs and whether the occupational areas align with the country's needs. In the subsequent stage of our research, we delve into the discussion about programs in terms of employment and workforce, considering occupational fields. The intricate relationship between the employability-development opportunities provided by higher education institutions and graduates' work is further complicated by the influential role played by employers. Ultimately, employers play a pivotal role in translating a graduate's employability into a tangible job opportunity (Harvey, 2001).

Ortiz (2008) delved into the Spanish case of classifying occupational fields based on ISCED and highlighted a notable limitation—the apparent absence of a clear distinction between lower and upper university degrees. As indicated by the study findings, considering that around 40% of Spanish university graduates hold lower university degrees, it becomes pertinent to examine the job-finding scenario after graduation through economic and sociological lenses. Similarly, the statistical information does not encompass graduation levels in our research.

An interesting trend emerges when scrutinizing the graduation figures of students in OES programs and correlating them with employment numbers in ISCO professional fields. While a significant portion of OES graduates falls into the professional field, there are other areas with the highest employment rate. Despite appearances suggesting a substantial presence in the services and sales workers' field, the number of OES graduates could be a lot higher. Even though only three programs in OES are categorized under services and sales workers, administrators of higher education institutions should carefully assess these findings. The lower number of graduates or a potential lack of demand in a field with higher employment opportunities within OES, which offers abundant second university chances, could be explored. This sheds light on the importance of students' job readiness post-graduation. Additionally, the readiness of individuals engaged in lifelong learning, contributing to knowledge and academic enhancement, is crucial in their job search endeavors (Ng et al., 2022).

Examining the graduation figures of students in OES programs based on job statuses in ISCED professional fields reveals a distinct pattern. The field of business, administration, and law

significantly outpaces others in producing graduates, a trend that gains meaning when considering the corresponding number of programs offered. Similarly, business, administration, and law boast high employment rates in professional realms. However, a closer inspection of the data, comparing graduation and employment figures, reveals a noteworthy disparity. In specific years, the number of students graduating in the managerial field is nearly 50 times higher than those securing employment in this domain. Managers consistently hold the highest coefficients across all years, while service and sales employees consistently have the lowest. Even though these statistics may not unequivocally demonstrate that OES graduates are successfully finding employment, as mentioned earlier, they yield crucial insights for juxtaposing graduation and employment dynamics. While education actively contributes to individual self-improvement and enhances employability by preparing individuals for the job market, the contemporary landscape suggests that being a university graduate is gradually losing its conventional role in securing a profession. The employability of diplomas appears to be experiencing a gradual decline in today's context (Gönültaş Çelik, 2019).

Can (2019) suggests that the graduation numbers from OES should be considered in relation to the enrollment figures. In Can's study, while the total number of undergraduate students in open and distance education in Türkiye from 2013 to 2018 closely rivaled the number in formal education, the count of graduate students was higher in formal education, indicating that graduation rates in open and distance education tend to be relatively lower compared to formal education. According to the research conducted by Akoğlan Kozak & Dalkıraoğlu (2013) on careers with 2901 associate and undergraduate students who graduated from Anadolu University, students were not given sufficient guidance in their career decisions, they made their career decisions according to traditional patterns, financial concerns took precedence over career opportunities, and pursuing a master's degree was an important issue. It was concluded that they saw it as a career opportunity.

Except for Italy, business, administration, and law boast the highest graduation rates in higher education institutions across France, Germany, Türkiye, and the United Kingdom. Italy, on the other hand, stands out in its focus on the arts and humanities. Countries generally tailor their higher education planning to meet their needs and facilitate job opportunities for graduates in relevant fields. Consequently, the areas in demand for employment may vary from one country to another. However, higher education institutions producing graduates in fields unrelated to current needs could potentially lead to issues like unemployment. According to OECD data, an analysis of employment numbers in Türkiye based on fields suggests that agriculture, forestry, fisheries, and veterinary program graduates

are more likely to find employment. Conversely, graduates in social sciences, journalism, and information appear to face lower employment prospects in Türkiye, as indicated by these results.

Tarvid's (2015) study of over education in Europe shows that administrative services have the highest risk. In contrast, the most and the least affected industries differ considerably. So, institutes must control enrollment to graduation rates in terms of employability. The differences in graduate employability might be related to the country's economic capacity or specificities (Ilieva-Trichkova & Boyadjieva, 2017). Weligamage et al. (2014) claim in their study that higher education institutes may conduct employers' skill requirement surveys to identify employers' actual skills. Also, government organizations investigate to determine this skill requirement. Businesses should cooperate with educators to review and redevelop their curriculum and change delivery methodology to support the development of these skills and attributes.

Higher education institutes widely employ AI for their chatbots and virtual assistants, primarily in a text-based format. However, this study demonstrates the broader potential of AI in providing student support, encompassing the revelation of occupation fields related to OES programs, insights into employment scenarios, and an understanding of the labor force landscape. As numerous institutions deploy algorithms capable of delivering personalized predictions, it underscores the evolving responsibilities of higher education institutions in the realm of education.

Recommendations

In this study, we delved into the professions suggested by artificial intelligence and their alignment with the professional fields categorized in ISCO and ISCED classes. This analysis was based on the program outputs available on the website of 63 programs offered through the Anadolu University Open Education System. GPT efficiently addressed all inquiries and shared the requested data throughout the study. However, it is important to note that GPT's highly accurate responses do not guarantee 100% reliability. Institutions are encouraged to leverage artificial intelligence to streamline processes, but caution is warranted, assuming that responses may not be flawless. Particularly in official transactions, experts should verify data provided by artificial intelligence to ensure accuracy. Therefore, the limitations of this research lie in the responses provided by artificial intelligence, and the study's data should be assessed within this context. Future research could explore the accuracy of artificial intelligence responses, especially in areas involving determining professional standards and seeking expert opinions.

Higher education institutions should adopt internationally standardized platforms to disseminate information about their programs, going beyond conventional course lists, objectives, and outcomes presented in information packages aligned with the Bologna Process. Institutions can augment their disclosures to enhance precision by specifying their programs' ISCED and ISCO professional fields. Additionally, leveraging artificial intelligence, chatbots, and virtual assistants fueled by web data can provide workforce insights and employment opportunities linked to specific professional domains. While prioritizing data privacy, these systems can give students personalized information about their prospective employment outcomes based on their chosen profession before enrollment. Although statistical agencies furnish such data, the complexity of analysis poses challenges for students. However, well-trained artificial intelligence-supported student support systems can swiftly and accurately guide students, offering program recommendations aligned with career aspirations. Furthermore, they can provide virtual counseling during registration by accessing real-time employment status data from relevant statistical institutions. Developing a robust support system that factors in professional data is crucial, especially for open education system students undertaking remote registration and studentship procedures, thus bridging the gap for those distanced from the formal enrollment system.

Enhancing student support in higher education, particularly in distance learning, requires a more human-centered approach. Integrating GPT into a Virtual Assistant can prove beneficial, offering personalized recommendations to students even without navigating a website or dashboard. By accurately analyzing individual student characteristics, AI can suggest programs aligned with their interests during registration. This AI-driven student support could evolve into a form of professional counseling, guiding students on registration and graduation decisions in the future.

While institutions offering distance higher education, like the open education system, share extensive information on their websites, students often need help accessing the specific information they need. Issues such as navigating the web and using technology can lead to delays or the inability to find relevant information. Due to these challenges, some students might enroll in programs without adequate knowledge, resulting in potential academic struggles, especially in courses aligned with their program's requirements. Those facing program-related issues may discontinue their education, impacting their academic journey. Even after graduation, students may encounter challenges finding jobs in their professional field, potentially prompting them to explore opportunities outside their expertise.

Establishing and maintaining an up-to-date database containing ISCED and ISCO codes for all institutions and programs is crucial. Beyond solely employing these codes for statistical analyses on professions, they should be readily shared with students and institutions. Sharing professional fields within programs based on international standards is essential for maintaining quality standards, facilitating student mobility, and streamlining equivalence procedures. In institutions delivering education through open education systems with a high volume of students, sharing ISCED and ISCO codes via web services is imperative.

Higher education institutions must regularly assess workforce and employment data within the professional domains of their programs to determine appropriate quotas. When contemplating introducing new programs, it is essential to consider statistical institution data aligned with ISCED and ISCO standards, focusing on areas with a professional demand. Furthermore, researchers can conduct various studies utilizing statistics from educational institutions or countries. As this research specifically addresses open education activities in Türkiye and Anadolu University, within the context of the Bologna Process, comparisons were limited to a selection of European countries.

Until the hypothetical scenario of artificial intelligence completely taking over jobs, akin to depictions in dystopian movies or TV shows, why not leverage artificial intelligence for career guidance? AI has the potential to provide valuable insights into future job prospects, all for the benefit of individuals. This study seeks to understand the optimal utilization of artificial intelligence in this context.

About Authors

First Author: Sefa Emre Öncü works at Anadolu University. He graduated from the Management of Higher Education master's program at Eskişehir Osmangazi University in 2024.

Second Author: İrfan Süral has been an Associate Professor in the Faculty of Education at Eskişehir Osmangazi University. He received B.S. and M.S. degrees in the Electrical and Electronics Engineering Department and a Ph.D. in the Distance Education Program of the Social Sciences Institute of Anadolu University.

Conflict of Interest

The authors have reported that there is no conflict of interest.

Funding

No funding was received.

Ethical Standards

The study was carried out within the framework of the Helsinki Declarations. The data does not require any ethical permission.

ORCID

Sefa Emre Önci https://orcid.org/0009-0008-2314-4628

İrfan Süral http://orcid.org/0000-0003-2232-9483

References

Akoğlan Kozak, M., & Dalkıranoğlu, T. (2013). Mezun öğrencilerin kariyer algılamaları: Anadolu üniversitesi örneği. *Anadolu Üniversitesi Sosyal Bilimler Dergisi, 13*(1), 41-52.

Armstrong, C. (2021). Key methods used in qualitative document analysis. *SSRN*. https://ssrn.com/abstract=3996213

Aydemir, L. (2018). Üniversite öğrencilerinin meslek tercihlerini belirleyen faktörlere yönelik bir inceleme. *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi*, *6*(5), 713–723. https://doi.org/10.18506/ANEMON.378084

Babori, A., Zaid, A., & Fihri Fassi, H. (2019). Research on MOOCs in major referred journals. *The International Review of Research in Open and Distributed Learning*, *20*(3). https://doi.org/10.19173/IRRODL.V20I4.4385

Baykal, M. (2017). Türkiye yeterlilikler çerçevesi(TYÇ)'nin öğrenci değerlendirme programı (PISA) açısından değerlendirilmesi. *Yeditepe Üniversitesi Eğitim Fakültesi Dergisi*, *6*(8), 69–79. https://dergipark.org.tr/en/pub/edu7/issue/36504/414111

Bozkurt, A. (2013). Mega üniversitelerde öğrenci destek hizmetleri. *Akademik Bilişim 2013 –XV. Akademik Bilişim Konferansı Bildirileri*.

Can, E. (2019). Açık ve uzaktan yükseköğretim mezunları üzerine bir değerlendirme. *Açıköğretim Uygulamaları ve Araştırmaları Dergisi*, *5*(3), 81–105. https://dergipark.org.tr/en/pub/auad/issue/50201/645988

Chhinzer, N., & Russo, A. M. (2018). An exploration of employer perceptions of graduate student employability. *Education + Training*, *60*(1), 104–120. https://doi.org/10.1108/ET-06-2016-0111

Creswell, J. W. (2013). *Qualitative ınquiry and research design*. SAGE.

Dunn, A. L., Briers, G. E., Moore, L. L., Odom, S. F., & Bailey, K. J. (2021). The places and spaces student affairs practitioners should learn and practice leadership educator competencies. *Journal of Leadership Education*, 66–85. https://doi.org/10.12806/V20/I4/R6

Fitria, T. N. (2023). Artificial intelligence (AI) technology in OpenAI ChatGPT application: A review of ChatGPT in writing English essay. *ELT Forum: Journal of English Language Teaching*, *12*(1), 44–58. https://doi.org/10.15294/ELT.V12I1.64069

Ganzeboom, H. B. G., & Treiman, Donald. J. (1996). Internationally comparable measures of occupational status for the 1988 ınternational standard classification of occupations. *Socıal Scıence Research*, *25*(10), 201–239.

Gönültaş Çelik, M. (2019). İşgücü piyasasının bir sorun alanı olarak uyumsuz eşleşme. *Yönetim ve Çalışma Dergisi*, *3*(2), 223–241. https://web.s.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=0&sid=daf7d37e-e10c-46be-a99b-1687107f1d62%40redis

Haenlein, M., & Kaplan, A. (2019). A brief history of artificial intelligence: On the past, present, and future of artificial intelligence. *California Management Review*, *61*(4), 5–14. https://doi.org/10.1177/0008125619864925/FORMAT/EPUB

Harvey, L. (2001). Defining and measuring employability. *Quality in Higher Education*, *7*(2), 97–109. https://doi.org/10.1080/13538320120059990

Holmegaard, H. T., Ulriksen, L. M., & Madsen, L. M. (2014). The process of choosing what to study: a longitudinal study of upper secondary students' ıdentity work

when choosing higher education, *58*(1), 21–40. https://doi.org/10.1080/00313831.2012.696212

Hou, I., Metille, S., Li, Z., Man, O., Zastudil, C., & MacNeil, S. (2024). *The effects of generative AI on computing students' help-seeking preferences*. https://doi.org/https://doi.org/10.1145/3636243.3636248

Ilieva-Trichkova, P., & Boyadjieva, P. (2017). *Labour and social transformation in central and eastern europe* (V. Delteil & V. Kirov, Eds.).

Karadağ, E. (2010). Eğitim bilimleri doktora tezlerinde kullanılan araştırma modelleri: nitelik düzeyleri ve analitik hata tipleri 1. *Educational Administration: Theory and Practice*, *16*(1), 49–71.

Karadağ, E., & Yücel, C. (2017). Türkiye üniversite memnuniyet araştırması [TÜMA-2017]: Rapor Özeti. *Yükseköğretim Dergisi*, *7*(2), 132–144. https://doi.org/10.2399/yod.17.016

Kaya, H. E. (2016). *Yaşam boyu yetişkin eğitimi*. Nobel Akademik Yayıncılık.

Kehm, B. M. (2010). *Quality in european higher education: the ınfluence of the bologna process, change: The magazine of higher learning*. *42*(3), 40–46. https://doi.org/10.1080/00091381003704677

Kim, J. H., Kim, M., Kwak, D. W., & Lee, S. (2022). Home-tutoring services assisted with technology: Investigating the role of artificial ıntelligence using a randomized field experiment. *Journal of Marketing Research*, *59*(1), 79–96. https://doi.org/10.1177/00222437211050351/ASSET/IMAGES/LARGE/10.1177_00222437211050351-FIG6.JPEG

Kingchang, T., Chatwattana, P., & Wannapiroon, P. (2024). Artificial ıntelligence chatbot platform: AI chatbot platform for educational recommendations in higher education. *International Journal of Information and Education Technology*, *14*(1). https://doi.org/10.18178/ijiet.2024.14.1.2021

Kline, R. R. (2011). Cybernetics, automata studies, and the dartmouth conference on artificial ıntelligence. *IEEE Annals of the History of Computing*, *33*(4), 5–16. https://doi.org/10.1109/MAHC.2010.44

Korkut-Owen, F., Kepir, D. D., Özdemir, S., Ulaş, Ö., & Yilmaz, O. (2013). Üniversite öğrencilerinin bölüm seçme nedenleri. *Mersin University Journal of the Faculty of Education*, *8*(3), 135–151. https://doi.org/10.17860/EFD.87701

Kromhout, H. (2003). Options for analysis labour statistics The use of occupation and industry classifications in general population studies. *International Journal of Epidemiology*, *32*, 419–428. https://doi.org/10.1093/ije/dyg080

Liu, J., Liu, C., Zhou, P., Kong, H., Lv, R., Zhou, K., & Zhang, Y. (2023). Is ChatGPT a good recommender? A preliminary study. *The 1st Workshop on Recommendation with Generative Models, October 21â•fi25, 2023, Birmingham, United Kingdom*, *1*. https://doi.org/10.1145/nnnnnnn.nnnnnnn

Melina, M., Putra, E. K., Hadiana, A. I., & Kusumaningtyas, V. A. (2023). Web-based information system the offices bureau of student affairs with database modeling and design. *Sıxth Internatıonal Conference Of Mathematıcal Scıences (ICMS 2022)*, *2879*(1), 030002. https://doi.org/10.1063/5.0129003/2915880

Negnevitsky, M. (2005). *Artificial ıntellige* (2nd ed.). Pearson Education.

Ng, B., Lee, A. N., & Chua, B. L. (2022). *Preparing graduates for future workplace: development and validation of work readiness assessment ınventory (WRAI)*. 13–35. https://doi.org/10.1007/978-3-031-05716-8_2

Ortiz, L. (2008). Evaluation of the ISCED-97 for the Spanish system of education. *The International Standard Classification of Education (ISCED-97*, *15*, 125–248.

Öztürk, Ö. (2018). Açıköğretim programlarına kayıt yaptıran ve yaptırmayan öğrencilerin açıköğretim sistemine yönelik görüşleri. *AUAd*, 157–170. https://dergipark.org.tr/en/download/article-file/465604

Rahmat, M., Ahmad, K., Idris, S., & Zainal, N. F. A. (2012). Relationship between Employability and Graduates' Skill. *Procedia - Social and Behavioral Sciences*, *59*, 591–597. https://doi.org/10.1016/J.SBSPRO.2012.09.318

Silvestru, C.-I., Ion, V., Botez (Constantin), C., & Icociu, V.-C. (2018). ISCED Classification Influence on E-Learning Education Systems. *Informatica Economica*, *22*(4), 80–88. https://doi.org/10.12948/issn14531305/22.4.2018.07

Simpson, O. (2012). *Supporting Students for Success in Online and Distance Education* (3rd ed.). Routledge.

Stiwne, E. E., & Alves, M. G. (2010). Higher education and employability of graduates: Will Bologna make a difference? *European Educational Research Journal*, *9*(1), 32–44. https://doi.org/10.2304/EERJ.2010.9.1.32

Süral, İ. (2008). *Yeni teknolojiler ışığında uzaktan eğitimde açıklık, uzaktanlık ve öğrenme*. XIII. Türkiye'de Internet Konferansı Bildirileri, 22-23 Aralık, Orta Doğu Teknik Üniversitesi, Ankara.

Tait, A. (2010). Planning student support for open and distance learning. *Open Learning: The Journal of Open, Distance and e-Learning*, *5*(3), 287–299. https://doi.org/10.1080/713688410

Tarvid, A. (2015). The role of ındustry in the prevalence of overeducation in Europe. *Procedia Economics and Finance*, *30*, 876–884. https://doi.org/10.1016/S2212-5671(15)01337-4

Thorpe, M. (2002). Rethinking learner support: the challenge of collaborative online learning. *Open Learning*, *17*(2), 105–119. https://doi.org/10.1080/02680510220146887A

Verma, A., Lamsal, K., & Verma, P. (2022). An investigation of skill requirements in artificial intelligence and machine learning job advertisements. *Industry and Higher Education*, *36*(1), 63–73. https://doi.org/10.1177/0950422221990990/ASSET/IMAGES/LARGE/10.1177_0950422221990990-FIG3.JPEG

Wan, W., Ge, C. B., Friesen, M. C., Locke, S. J., Russ, D. E., Burstyn, I., Baker, C. J. O., Adisesh, A., Lan, Q., Rothman, N., Huss, A., Van Tongeren, M., Vermeulen, R., & Peters, S. (2023). Automated Coding of Job Descriptions From a General Population Study: Overview of Existing Tools, Their Application and Comparison. *Annals of Work Exposures and Health*, *67*(5), 663–672. https://doi.org/10.1093/ANNWEH/WXAD002

Wegmann, R. G. (1979). *Job search assistance: A Review*.

Weligamage, S., & Samudrika Weligamage, S. (2014). *Graduates' Employability Skills: Evidence from Literature Review Graduates" Employability Skills: Evidence from Literature Review*. 115. https://www.researchgate.net/publication/266014502

Xiong, S., & Lee, S. E. (2011). Hmong Students in Higher Education and Academic Support Programs by Soua Xiong and Song E Hmong Students in Higher Education and Academic Support Programs. *Lee, Hmong Studies Journal*, *12*, 1–20.

Yin, R. K. (2009). *Case Study Research: Design and Methods* (4th ed.). SAGE.

Zgaga, P. (2006). Looking out: The Bologna Process in a Global Setting. *Norwegian Ministry of Education and Research*.

Zhai, X., Chu, X., Chai, C. S., Jong, M. S. Y., Istenic, A., Spector, M., Liu, J. B., Yuan, J., & Li, Y. (2021). A Review of Artificial Intelligence (AI) in Education from 2010 to 2020. *Complexity, 2021*. https://doi.org/10.1155/2021/8812542

Züll, C. (2016). *The Coding of Occupations*. https://doi.org/10.15465/gesis-sg_en_019

Attachment

Job Recommendations, ISCO, and ISCED Fields of OES Programs According to AI

Program	Job Recommendations	ISCO No.	ISCO Field	ISCED No.	ISCED Field
Accounting and Taxation	Tax Accountant, Financial Analyst, Auditor	121	Business Services and Administration Managers	0411	Accounting and taxation
Agriculture Technology	Agricultural Technician, Greenhouse Manager, Agricultural Product Quality Control Specialist	921	Agricultural, Forestry and Fishery Labourers	0811	Crop and livestock production
Aviation Management	Aviation Marketing Manager, Aviation Financial Analyst, Aviation Safety Manager	143	Other Services Managers	0413	Management and administration
Banking and Insurance	Bank Manager, Insurance Underwriter, Financial Analyst	241	Finance Professionals	0413	Management and administration
Brand Communication	Brand Manager, Marketing Communications Specialist, Public Relations Manager	243	Sales, Marketing and Public Relations Professionals	0414	Marketing and advertising
Business Administration	Entrepreneur, Business Analyst, Marketing Manager	121	Business Services and Administration Managers	0413	Management and administration
Business Administration (English)	Business Analyst, Marketing Manager, Entrepreneur	121	Business Services and Administration Managers	0413	Management and administration
Business Management	Business Development Manager, Entrepreneurship Educator, Innovation Consultant	121	Business Services and Administration Managers	0413	Management and administration
Call Center Services	Call Center Agent, Customer Service Representative, Call Center Supervisor	333	Business Services Agents	0415	Secretarial and office work
Child Development	Child Development Specialist, Early Childhood Educator, Child Life Specialist	234	Primary School and Early Childhood Teachers	0922	Child care and youth services
Civil Air Transport Management	Airport Operations Manager, Airline Operations Coordinator, Cargo Operations Supervisor	933	Transport and Storage Labourers	1041	Transport services
Communication Design	Graphic Designer, Designer, Branding Specialist	343	Artistic, Cultural and Culinary Associate Professionals	0212	Fashion, interior and industrial design

Program	Job Recommendations	ISCO No.	ISCO Field	ISCED No.	ISCED Field
Computer Programming	Software Engineer, Web Developer, Data Analyst	351	Information and Communications Technology Operations and User Support Technicians	0611	Computer use
Culinary Arts	Chef, Food and Beverage Manager, Culinary Instructor	343	Artistic, Cultural and Culinary Associate Professionals	1013	Hotel, restaurants and catering
Cultural Heritage and Tourism	Cultural Heritage Manager, Tourism Development Officer, Tour Guide	343	Artistic, Cultural and Culinary Associate Professionals	1015	Travel, tourism and leisure
Disability Care and Rehabilitation	Disability Support Worker, Rehabilitation Therapist, Special Education Teacher	325	Other Health Associate Professionals	0921	Care of the elderly and of disabled adults
Economics	Economic Analyst, Policy Advisor, Market Researcher	241	Finance Professionals	0311	Economics
Economics (English)	Economist, Financial Analyst, Policy Analyst	331	Financial and Mathematical Associate Professionals	0311	Economics
Elderly Care	Elderly Care Program Coordinator, Elderly Care Trainer, Elderly Care Service Provider	226	Other Health Professionals	0921	Care of the elderly and of disabled adults
Electric Power Generation, Transmission and Distribution	Electrical Engineer, Power System Operator, Energy Analyst	215	Electrotechnology Engineers	0713	Electricity and energy
Emergency and Disaster Management	Emergency Management Specialist, Disaster Recovery Coordinator, Crisis Communication Manager	226	Other Health Professionals	1032	Protection of persons and property
Foreign Trade	International Trade Specialist, Customs Broker, International Business Consultant	333	Business Services Agents	0413	Management and administration
Geographic Information Systems	GIS Analyst, GIS Technician, GIS Specialist	252	Database and Network Professionals	0612	Database and network design and administration
Healthcare Management	Hospital Administrator, Healthcare Consultant, Health Services Manager	143	Other Services Managers	0413	Management and administration
History	Online History Educator, Historical Researcher, Curriculum Developer	231	University and Higher Education Teachers	0114	Teacher training with subject specialization

Program	Job Recommendations	ISCO No.	ISCO Field	ISCED No.	ISCED Field
Home Economics	Home Economics Teacher, Family and Consumer Sciences Educator, Home Economics Consultant	235	Other Teaching Professionals	0114	Teacher training with subject specialization
Human Resources Management	Human Resources Manager, HR Consultant, Talent Acquisition Specialist	121	Business Services and Administration Managers	0413	Management and administration
International Trade and Logistics	Logistics Manager, International Trade Specialist, Supply Chain Analyst	933	Transport and Storage Labourers	0413	Management and administration
Labor Economics and Industrial Relations	Labor Economist, Human Resources Manager, Labor Relations Specialist	263	Social and Religious Professionals	0413	Management and administration
Laboratory and Veterinary Assistance Services	Veterinary Laboratory Technician, Veterinary Clinical Assistant, Animal Breeding Technician	324	Veterinary Technicians and Assistants	0841	Veterinary
Local Governments	Local Government Administrator, Community Development Specialist, Urban Planner	335	Government regulatory associate professionals	0731	Architecture and town planning
Logistics	Logistics Coordinator, Supply Chain Analyst, Warehouse Manager	933	Transport and Storage Labourers	0413	Management and administration
Management Information Systems	Systems Analyst, Database Administrator, IT Project Manager	133	Information and Communications Technology Services Managers	0611	Computer use
Management of Healthcare Organizations	Hospital Administrator, Healthcare Consultant, Health Services Manager	143	Other Services Managers	0912	Medicine
Media and Communication	Media Journalist, Public Relations Specialist, Social Media Manager	133	Information and Communications Technology Services Managers	0321	Journalism and reporting
Medical Documentation and Secretary Training	Medical Documentation Specialist, Medical Secretary, Healthcare Administrative Assistant	334	Administrative and Specialized Secretaries	0415	Secretarial and office work
Occupational Health and Safety	Occupational Health and Safety Technician, Safety Coordinator, Environmental Health and Safety Specialist	325	Other Health Associate Professionals	1022	Occupational health and safety
Office Management and	Executive Assistant, Office Manager, Administrative Assistant	334	Administrative and Specialized Secretaries	0415	Secretarial and office work

Program	Job Recommendations	ISCO No.	ISCO Field	ISCED No.	ISCED Field
Executive Assistant Training					
Philosophy	Philosophy Professor, Ethicist, Writer or Journalist	264	Authors, Journalists and Linguists	0223	Philosophy and ethics
Photography and Camera Operation	Photographer, Camera Operator, Photo Editor	343	Artistic, Cultural and Culinary Associate Professionals	0211	Audio-visual techniques and media production
Political Science and Public Administration	Government Policy Analyst, Nonprofit Program Manager, Public Relations Specialist	335	Government regulatory associate professionals	0413	Management and administration
Political Science and Public Administration (English)	Political Analyst, Public Policy Advisor, International Relations Specialist	335	Government regulatory associate professionals	0312	Political sciences and civics
Program in International Relations	Diplomat, International Organization Officer, Coordinator	235	Other Teaching Professionals	0413	Management and administration
Program in International Relations (English)	Diplomat, International Organization Officer, Program Manager	231	University and Higher Education Teachers	0413	Management and administration
Public Finance	Public Finance Analyst, Budget Manager, Policy Advisor	241	Finance Professionals	0413	Management and administration
Public Relations and Advertising	Public Relations Specialist, Advertising Account Executive, Social Media Manager	243	Sales, Marketing and Public Relations Professionals	0414	Marketing and advertising
Public Relations and Publicity	Public Relations Specialist, Communications Coordinator, Media Relations Manager	243	Sales, Marketing, and Public Relations Professionals	0414	Marketing and advertising
Radio and Television Program Production	Radio and Television Program Producer, Broadcast Journalist, Media Production Coordinator	351	Information and Communications Technology Operations and User Support Technicians	0211	Audio-visual techniques and media production
Real Estate Management	Real Estate Appraiser, Real Estate Marketing Specialist, Property Manager	121	Business Services and Administration Managers	0413	Management and administration
Retailing and Store Management	Store Manager, Visual Merchandiser, E-commerce Specialist	524	Other Sales Workers	0416	Wholesale and retail sales
Securities and Capital Markets	Financial Analyst, Stockbroker, Investment Banker	241	Finance Professionals	0412	Finance, banking and insurance

Program	Job Recommendations	ISCO No.	ISCO Field	ISCED No.	ISCED Field
Social Media Management	Social Media Manager, Content Creator, Digital Marketing Specialist	524	Other Sales Workers	0414	Marketing and advertising
Social Services	Social Worker, Case Manager, Community Outreach Coordinator	226	Other Health Professionals	0923	Social work and counselling
Social Work	Social Worker, Community Organizer, Policy Analyst	325	Other Health Associate Professionals	0923	Social work and counselling
Sociology	Social Researcher, Social Worker, Policy Analyst	263	Social and Religious Professionals	0314	Sociology and cultural studies
Sports Management	Sports Facility Manager, Sports Marketing Coordinator, Sports Event Planner	342	Sports and Fitness Workers	0413	Management and administration
Theology	Theology Teacher/Professor, Interfaith Dialogue Facilitator, Religious Counselor	263	Social and Religious Professionals	0221	Religion and theology
Theology (Arabic)	Interfaith Dialogue Facilitator, Religious Educator, Chaplain	263	Social and Religious Professionals	0221	Religion and theology
Tourism and Hotel Management	Hotel Manager, Event Planner, Travel Consultant	143	Other Services Managers	1015	Travel, tourism and leisure
Tourism and Travel Services	Travel Agent, Tour Operator, Event Planner	511	Travel Attendants, Conductors and Guides	1015	Travel, tourism and leisure
Tourism Management	Hotel Manager, Event Planner, Travel Consultant	231	University and Higher Education Teachers	1015	Travel, tourism and leisure
Turkish Language and Literature	Turkish Language and Literature Teacher, Researcher in Turkish Language and Literature, Editor or Content Writer	264	Authors, Journalists and Linguists	0231	Language acquisition
Web Design and Coding	Web Designer, Front-end Developer, Full-stack Developer	133	Information and Communications Technology Services Managers	0611	Computer use

Osmangazi Journal of Educational Research **Volume 11(1), Spring 2024**

RESEARCH Open Access

Suggested Citation: Yar, K., & Çemrek, F., (2024). Comparison of the effect of teachers speaking only english in english language teaching on students' anxiety according to gender and graduation status: a quantitative research. *Osmangazi Journal of Educational Research., 11*(1), 73-94.

Submitted: 08/03/2024 **Revised:** 28/05/2024 **Accepted:** 21/07/2024 **DOI:** 10.59409/ojer.1440405

Comparison of the Effect of Teachers Speaking Only English in English Language Teaching on Students' Anxiety According to Gender and Graduation Status: A Quantitative Research

*** Kamil Yar, ** Fatih Çemrek**

Abstract. This casual comparative study investigated the impact of exclusive English Language instruction by teachers on students' anxiety levels in the context of English language learning, with a particular focus on the students' graduation status. The research was conducted among 450 participants enrolled in English language programs at two private educational institutions in Eskişehir. All participants were university students, undergoing English speaking lessons delivered by both local and foreign instructors. Data collection employed the English Speaking Anxiety Scale, and the statistical analysis was executed using SPSS software. Descriptive statistics, including mean, standard deviation, t-test, and one-way analysis of variance (ANOVA), were employed to analyse the acquired data. The findings revealed that the exclusive use of English by teachers during second language instruction did not significantly impact students' anxiety level based on gender. However, a noteworthy distinction emerged between university graduates and non-graduates, suggesting that anxiety levels were lower among the former group.

Keywords: English speaking anxiety, teacher's speaking, teacher's role.

***** Postgraduate Student, Eskişehir Osmangazi University, Faculty of Education, Eskişehir, Türkiye

e-mail: mehmetkamilyar@gmail.com

**** (Responsible Author)** Assoc. Prof. Dr., Eskişehir Osmangazi University, Faculty of Science, Eskişehir, Türkiye

e-mail: fcemrek@ogu.edu.tr

In the context of globalization, the imperative for individuals to employ a universal language for cross-border communication is steadily escalating. In this milieu, the significance of English, presently spoken and instructed as either a native language or a secondary language in numerous countries, is progressively growing. It is noteworthy that approximately 1 billion individuals worldwide are conversant in English, with the language serving as the official medium of communication in 67 countries and being adopted as a secondary language in 27 countries (Nishanthi, 2018).

Given the extensive utilization of English, undertaking foreign language courses emerges as a strategic advantage for individuals aspiring to navigate life in English-speaking countries or seeking employment in multinational corporations. These courses not only target the enhancement of communication proficiency but also facilitate networking opportunities with professionals across diverse domains, underscoring the compelling rationale for English language study. In contrast to public educational institutions, private language courses offering English instruction often feature native English-speaking instructors who are highly sought after by students due to their linguistic expertise.

Medgyes (1994), an influential scholar in this field, asserts that instructors with English as their native language enjoy certain advantages, particularly in terms of language proficiency and self-assurance. On the other hand, educators from different linguistic backgrounds may possess distinct strengths, such as a comprehensive understanding of the local educational system and the ability to anticipate challenges that students might encounter. Within this framework, the acquisition of a foreign language may necessitate English instruction delivered by a teacher who is either a native English speaker or possesses advanced proficiency in English, even if it is not their native language.

Literature Review

Horwitz (1996; cited in Öztürk, 2016) describes anxiety as an unpleasant state marked by subjective feelings of pressure and nervousness, along with the activation or arousal of the nervous system. Based on this, student anxiety in foreign language learning can be defined as the experience of pressure, reluctance, and apprehension towards language learning. Language anxiety is the feeling of tension and apprehension specifically associated with second language contexts, including speaking, listening, and learning (MacIntyre, 1999). Among the primary responsibilities of educators is the incorporation of methods and activities geared towards alleviating students' anxiety levels throughout the language instruction process. Notably, speaking activities have been identified as potent triggers of anxiety among students in the pre-university educational phase (Baş, 2014).

The anxiety levels of both students and teachers in the classroom environment should be taken into consideration. For instance, İpek (2006) notes that high teacher anxiety negatively impacts teaching effectiveness. Similarly, Howirtz (1996) points out a negative relationship between foreign language teaching and teacher anxiety, indicating that high anxiety can hinder the effective presentation of the target language and adversely affect teaching practice. Similarly, various studies have demonstrated a strong relationship between student anxiety and language acquisition (Krahnke & Krashen, 1983; Ohata, 2005; Li, 2016; Hardacre & Güvendir, 2020).

Anxiety in learning a foreign language is not limited to productive skills like speaking and writing; teacher-related concerns also play a significant role. Merç (2011) highlighted that anxiety may stem from factors such as classroom management, teaching procedures, and observations during lessons. Unlike traditional teaching, which centres the teacher as the absolute authority, student-centred education expects students to actively participate and be emotionally prepared for the upcoming content. With the adoption of novel and student-centred approaches in education, minimizing student anxiety has become a priority for both institutions and course instructors. In these approaches, teachers are expected to guide students, serve as role models, and foster autonomous learning abilities rather than merely being authority figures. Thus, a teacher's knowledge of the content to be taught alone is insufficient for creating an effective educational process and enhancing student motivation and performance. Factors such as a teacher's cultural orientation, organizational behaviours, and resource utilization also impact students' interests, motivation, performance, and leadership skills (Siddiqui & Ahamed, 2020). To manage an effective teaching process, instructors must first address and minimize their own professional anxieties and concerns while guiding large class groups. Within the domain of English speaking, it has been observed that the teacher's role, coupled with the proficiency of students in the foreign language, contributes to heightened nervousness during speaking exercises (Merzifonlu, 2014). Furthermore, research findings indicate positive student reception to the utilization of the native language in English language instruction (Tamimi Sa'd & Qadermazi, 2015). Nevertheless, a prevailing perception in recent years within the realm of English language teaching advocates for the exclusive use of English by teachers.

Speech Anxiety in Language Classes

It is well-known that speaking activities in foreign language classes are one of the primary sources of anxiety for students (Worde, 2003). Creating a less stressful classroom environment is regarded as a crucial strategy for reducing student anxiety (Ekizer, 2021). To achieve this, educators must carefully consider their teaching methods, pedagogical approaches, use of the target language,

and the design of classroom activities. In essence, they need to cultivate an optimal learning environment that minimizes anxiety and maximizes student comfort and engagement.

It can be anticipated that the anxiety levels of native English-speaking teachers, exclusively utilizing English in the classroom, may exhibit variations when considering different age groups, particularly within the age range under investigation. Students who are consistently exposed to English instruction during primary education tend to engage more actively in later-stage English education. However, as individuals in the youth and adult age groups commence English education at a later stage, there is an observed increase in the auditory acclimatization to the sounds of their native language. Consequently, distinguishing unfamiliar phonetic elements and attempting their pronunciation becomes progressively challenging (Gaonac'h, 2006).

Indeed, this perspective aligns with the Acquisition Threshold (Critical Age) Hypothesis, initially proposed by Lenneberg (1967), a seminal figure in theories and approaches to foreign language learning, and subsequently supported by Krashen (1982). This approach underscores the importance of adhering to the principle of early age language acquisition to prevent delays in language learning. Consequently, the current research is designed to comprehensively assess the anxiety levels and attitudes of students who commence English education beyond the critical period stipulated by the Acquisition Threshold, notably after the post-high school period.

Research Significance and Objectives

Despite numerous studies and practices in the literature addressing various anxiety situations in foreign language learning, no studies have been identified that specifically investigate the comparative impact of the instructional approach mandating exclusive English communication by teachers on the anxiety and stress levels between university students and graduates during their English language education. Consequently, this study distinguishes itself from other inquiries into anxiety and attitudes pertaining to students' English-speaking skills.

The research seeks to contrast the anxiety levels experienced by students when instructors solely use English in the delivery of English language education, considering their status as university students or graduates. Additionally, the investigation aims to scrutinize the influence of the teacher's consistent use of English during English language instruction on students' anxiety. The ultimate goal is to compare the anxiety levels of students, irrespective of their university enrolment status, in response to English instruction conducted entirely in a foreign language and to derive conclusions regarding the extent of this impact.

The primary objective of this study is to examine the impact of exclusive English-language instruction by teachers on students' anxiety levels during the process of learning English. Within this framework, the research aims to assess and comprehend students' attitudes through the administration of a scale, with a specific focus on addressing the following research questions:

1. To what extent does the exclusive use of English in English lessons impact students' anxiety levels?

2. Does a significant difference exist in the anxiety levels of university students as compared to graduate students undergoing English language learning?

3. Is there a discernible difference in English speaking anxiety between genders in the context of English language instruction?

Method

Research Design

In this study, the chosen quantitative research method is the causal comparison model. This model, falling under the broader category of quantitative research methods, is employed to measure students' anxiety levels in English-speaking classes. The causal comparison study model is designed to identify and analyse the factors influencing the causes of an existing or naturally occurring situation or event, as well as the consequences resulting from a particular effect (Büyüköztürk et al., 2008).

Participants

The population under investigation for this study comprises 852 students enrolled in two private educational institutions affiliated with the Ministry of National Education in Eskisehir, where English language education is provided. A sample group for scale application was selected using the random sampling method, a form of Probability Sampling Methods. Initially, 450 students were selected for the sample. However, only 317 students were available during the survey. Out of these, 4 students did not sign the voluntary participation form, resulting in a final sample size of 313 students. In this method, each potential combination of elements in the universe has an equal likelihood of being included in the sample, ensuring an unbiased selection process (Kerlinger et al., 1999). The students participating in the study are enrolled in general English courses at the specified private educational institutions, representing diverse programs and age groups, thereby contributing to the broad inclusivity of the research participants. Table 1 presents the demographic information of the students who participated in the study.

Table 1.

Demographic Information of the Participants

		Frequency	Percent	Valid Percent	Cumulative Percent
Gender	Female	122	39.0	39.0	39.0
	Male	191	61.0	61.0	100.0
	Total	313	100.0	100.0	

Data Collection Tools

For this study, demographic information such as education level, age, and gender will be collected from the participants. The primary data collection tool during the research phase will be the English Speaking Anxiety Scale, developed by Şenol Orakçı (Orakcı, 2018). The scale is structured in a Likert type format and comprises 16 items with two sub-dimensions. The researcher obtained necessary permissions via email to utilize the scale.

The reliability of the scale, as indicated by the Cronbach Alpha coefficient, is reported as 0.952, and the Item-Total correlations range from 0.387 to 0.794 based on the developer's reliability test. Confirmatory factor analysis (CFA) yielded a chi-square value of 482.35 ($df=207$, $p<.01$) with a ratio of $\chi^2/df=2.33$. A ratio below 3 from the sample selected during the scale adaptation and development process suggests an appropriate fit (Kline, 2005)

Data Analysis

To analyse the collected data, a t-test was employed, allowing for statistical procedures that compare the anxiety levels of university students and university graduates when English courses are taught exclusively in English. This analytical approach aims to discern potential variations in anxiety levels between these two groups.

Ethical Concerns

Following the acquisition of Ethics Committee approval for the research, participants were provided with comprehensive information regarding the research's content and objectives prior to the administration of the scale. Subsequently, participants were asked to complete voluntary participation forms. The content of these forms clarified that participants' information security would be

safeguarded, emphasizing their right to withdraw from the research at any point and request the removal of their data upon completion. Written information obtained from the research will be securely stored in a locked cabinet, accessible only to the researcher. Additionally, data transferred to the computer environment will be encrypted, reinforcing measures for information security. Comprehensive precautions have been implemented to uphold the confidentiality of participants' demographic information and data.

Results

This section encompasses the outcomes derived from the analysis of quantitative data collected from the students as part of the research. The findings are presented below in accordance with the research purpose questions. Findings that denote an insignificant or inconsequential difference are omitted.

Approximately 31.9% of the participating students exhibited a positive attitude towards engaging in English conversation with a foreigner. Conversely, 4.2% indicated they never hold such a positive attitude, 8.9% expressed disagreement, 30.4% remained undecided, and 24.6% affirmed a positive inclination. Table 2 provides detailed data regarding students' attitudes towards conversing in English with individuals of foreign origin.

Table 2.

Students' Attitudes toward Speaking English with a Foreigner

Item	Answer	Frequency	Percent	Valid Percent	Cml. Percent
Q. 1	Never	13	4.2	4.2	4.2
	Rarely	28	8.9	8.9	13.1
	Sometimes	95	30.4	30.4	43.5
	Generally	77	24.6	24.6	68.1
	Always	100	31.9	31.9	100.0
	Total	313	100.0	100.0	

Findings Regarding Research Question 1: To What Extent Does the Exclusive Use of English in English Lessons Impact Students' Anxiety Levels?

During English language instruction, an investigation into whether students experienced an increase in anxiety levels when the teacher exclusively used English yielded notable responses. Notably, participants predominantly indicated elevated anxiety levels in response to related questions.

When considering the responses to question number 4 (Concerns about others not understanding when I speak English): - 20.8% stated "Never," - 22% expressed disagreement, - 14.1% remained undecided, - 6.4% agreed, - 36.7% strongly agreed. Table 3 provides a detailed overview of students' attitudes towards others when English is employed as the primary language in the classroom setting. These responses offer valuable insights into the nuanced aspects of anxiety levels associated with English language instruction. Further analysis and interpretation of these findings will be expounded upon in subsequent sections of the research report.

Table 3.

Students' Concerns About Other Students' Attitudes

Item	Answer	Frequency	Percent	Valid Percent	Cml. Percent
Q. 4	Never	65	20.8	20.8	20.8
	Rarely	69	22.0	22.0	42.8
	Sometimes	44	14.1	14.1	56.9
	Generally	20	6.4	6.4	63.3
	Always	115	36.7	36.7	100.0
	Total	313	100.0	100.0	

When analysing the responses to question number 5 (Feeling nervous when speaking English), the following distribution of answers emerged: 15.3% responded with "Never.", 27.2% expressed disagreement, 14.4% remained undecided, 5.4% agreed, 37.7% strongly agreed. Table 4 provides a comprehensive breakdown of students' anxiety levels when speaking English. These findings contribute to a nuanced understanding of the emotional responses and concerns experienced by students during English language communication.

Table 4.

Students' Anxiety While Speaking English

Item.	Answer	Frequency	Percent	Valid Percent	Cml. Percent
Q. 5	Never	48	15.3	15.3	15.3
	Rarely	85	27.2	27.2	42.5
	Sometimes	45	14.4	14.4	56.9
	Generally	17	5.4	5.4	62.3
	Always	118	37.7	37.7	100.0
	Total	313	100.0	100.0	

In evaluating the responses to question number 7 (Concerns about others laughing when speaking English), the distribution of answers is as follows: 18.8% responded with "Never.", 25.6% expressed disagreement, 14.7% remained undecided, 7.3% agreed, 33.5% strongly agreed. Table 5 provides an organized presentation of students' apprehensions regarding the reactions of other students when speaking English. These findings illuminate the social and interpersonal dimensions of anxiety experienced by students in the context of English language communication.

Table 5.

Students' Concerns About Other Students' Possible Reactions When Speaking English

Item	Answer	Frequency	Percent	Valid Percent	Cml. Percent
Q. 7	Never	59	18.8	18.8	18.8
	Rarely	80	25.6	25.6	44.4
	Sometimes	46	14.7	14.7	59.1
	Generally	23	7.3	7.3	66.5
	Always	105	33.5	33.5	100.0
	Total	313	100.0	100.0	

When analysing the responses to question number 10 (Uneasiness when translating words one by one from the native language into English), the distribution of answers is as follows: 16% responded with "Never.", 25.6% expressed disagreement, 15.3% remained undecided, 7% agreed, 36.1% strongly agreed. Table 6 provides a comprehensive breakdown of students' anxiety levels when translating from the native language to the target language while speaking English. These findings offer insights into the cognitive challenges and discomfort experienced by students in the process of language translation.

Table 6.

Students' Anxiety While Translating Words

Item	Answer	Frequency	Percent	Valid Percent	Cml. Percent
Q. 10	Never	50	16.0	16.0	16.0
	Rarely	80	25.6	25.6	41.5
	Sometimes	48	15.3	15.3	56.9
	Generally	22	7.0	7.0	63.9
	Always	113	36.1	36.1	100,0
	Total	313	100.0	100.0	

When examining the responses to question number 12 (Fear of making mistakes while speaking in English class), the distribution of answers is as follows:13.7% responded with "Never.", 24% expressed disagreement, 18.8% remained undecided, 10.9% agreed, 32.6% strongly agreed. Table 7 provides a detailed overview of students' fear levels related to making mistakes while speaking in an English class. These findings shed light on the psychological aspect of language learning, revealing the apprehensions and concerns students experience in the context of potential errors.

Table 7.

Students' Fear of Making Mistakes While Speaking in English Class

Item	Answer	Frequency	Percent	Valid Percent	Cml. Percent
Q. 12	Never	43	13.7	13.7	13.7
	Rarely	75	24.0	24.0	37.7
	Sometimes	59	18.8	18.8	56.5
	Generally	34	10.9	10.9	67.4
	Always	102	32.6	32.6	100.0
	Total	313	100.0	100.0	

When analysing the responses to question number 16 (Concerns about mispronouncing words when speaking English), the distribution of answers is as follows: 4.8% responded with "Never.", 21.1% expressed disagreement, 21.1% remained undecided, 15% agreed, 38% strongly agreed. Table 8 provides a comprehensive breakdown of students' anxiety levels related to potential pronunciation errors while speaking English. These findings illuminate the phonological aspect of language anxiety, showcasing the concerns and unease students experience in relation to word pronunciation.

Table 8.

Students' Concerns About Mispronouncing Words When Speaking English

Item	Answer	Frequency	Percent	Valid Percent	Cml. Percent
Q.16	Never	15	4.8	4.8	4.8
	Rarely	66	21.1	21.1	25.9
	Sometimes	66	21.1	21.1	47.0
	Generally	47	15.0	15.0	62.0
	Always	119	38.0	38.0	100.0
	Total	313	100.0	100.0	

When scrutinizing the responses to question number 13 (Feeling uneasy when not understanding what the teacher says in English), the distribution of answers is as follows: 6.4% responded with "Never.", 24.9% expressed disagreement, 21.7% remained undecided, 9.9% agreed, 37.1% strongly agreed. Table 9 provides a detailed overview of students' anxiety levels concerning the possibility that the teacher may not understand them when they speak English. These findings shed light on the communication apprehensions experienced by students in the classroom setting.

Table 9.

Feeling Uneasy When Not Understanding What the Teacher Says in English

Item	Answer	Frequency	Percent	Valid Percent	Cml. Percent
Q. 13	Never	20	6.4	6.4	6.4
	Rarely	78	24.9	24.9	31.3
	Sometimes	68	21.7	21.7	53.0
	Generally	31	9.9	9.9	62.9
	Always	116	37.1	37.1	100.0
	Total	313	100.0	100.0	

When examining the responses to question number 14 (Feeling nervous when the English teacher asks me questions in English), the distribution of answers is as follows: 9.9% responded with "Never.", 21.7% expressed disagreement, 21.1% remained undecided, 9.6% agreed, 37.7% strongly agreed. Table 10 provides a comprehensive breakdown of students' anxiety levels when the teacher asks questions in English. These findings offer insights into the interpersonal dynamics and discomfort students experience during interactive sessions in the English language classroom.

Table 10.

Students' Feeling Nervous When the English Teacher Asks Questions in English

Item	Answer	Frequency	Percent	Valid Percent	Cml. Percent
Q. 14	Never	31	9.9	9.9	9.9
	Rarely	68	21.7	21.7	31.6
	Sometimes	66	21.1	21.1	52.7
	Generally	30	9.6	9.6	62.3
	Always	118	37.7	37.7	100.0
	Total	313	100.0	100.0	

Findings Regarding Research Question 2: Does a Significant Difference Exist in the Anxiety Levels of University Students as compared to Graduate Students Undergoing English Language Learning?

Among the participants in the study, 5.8% (18 individuals) were under the age of 18, 34.8% (109 individuals) were between the ages of 18-20, 38.4% (120 individuals) were between the ages of 21-23, and 21% (66 individuals) belonged to the age group of 24 years and above.

Upon examining the independent two-sample t-test results regarding whether there is a difference in the average answers to the survey questions between educational status groups, it was determined that there is a statistically significant difference between university students and university graduates. This difference is evident in terms of the arithmetic averages of the answers given to all questions, except for Question 1 (*I like talking to a foreigner in English*). Further details and implications of these findings will be elaborated upon in subsequent sections of the research report.

For example, in the context of Question 2 (Q2), the statistical hypotheses and results are presented as follows:

- Null Hypothesis (H0): $\mu 1 = \mu 2$ (There is no difference in the average answers given to Q2 between university student and university graduate participants).

- Alternative Hypothesis (H1): $\mu 1 \neq \mu 2$ (There is a difference between university student and university graduate participants in terms of the average answers given to Q2).

Given that the calculated t-statistic value is 3.675 and the corresponding probability value is <0.05, the null hypothesis (H0) is rejected. This implies that, with 95% confidence, a statistically significant difference exists between university student and university graduate participants concerning the average answers given to Q2. The rejection of the null hypothesis suggests that the observed difference is not likely due to random chance, providing evidence for a meaningful distinction between the two groups in their responses to Q2.

Another example is, in the context of Question 3 (Q3), the statistical hypotheses and results are expressed as follows:

- Null Hypothesis (H0): $\mu 1 = \mu 2$ (There is no difference in the average answers given to Q3 between university student and university graduate participants).

- Alternative Hypothesis (H1): $\mu 1 \neq \mu 2$ (There is a difference between university student and university graduate participants in terms of the average answers given to Q3).

The calculated t-statistic value is -2.971, and the corresponding probability value is 0.003. Given that the probability value is less than 0.05, the null hypothesis (H0) is rejected. This implies that, with 95% confidence, a statistically significant difference exists between university student and university graduate participants regarding the average answers given to Q3. The rejection of the null hypothesis suggests that the observed difference is unlikely to be due to random chance, providing evidence for a meaningful distinction between the two groups in their responses to Q3.

Table 11 shows the difference analysis between university students and university graduates when the Teacher speaks only English in the classroom environment.

Table 11.

Difference In Attitudes Between University Students and Graduates

	Education *(Student:1, Graduated: 2)*	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**t-statistics**	**p-value**
Q1	1	252	3.67	1.133	0.071	-1.460	0.145
	2	61	3.90	1.106	0.142		
Q2	1	252	3.19	1.379	0.087	3.675	<0.05
	2	61	2.48	1.337	0.171		
Q3	1	252	3.06	1.035	0.065	-2.971	0.003
	2	61	3.51	1.105	0.141		
Q4	1	252	3.26	1.597	0.101	2.145	0.033
	2	61	2.77	1.575	0.202		
Q5	1	252	3.33	1.532	0.097	2.227	0.027
	2	61	2.84	1.572	0.201		
Q6	1	252	3.31	1.504	0.095	1.893	0.059
	2	61	2.90	1.535	0.197		
Q7	1	252	3.25	1.535	0.097	3.242	0.001
	2	61	2.54	1.523	0.195		
Q8	1	252	3.40	1.454	0.092	4.995	<0.05
	2	61	2.38	1.331	0.170		
Q9	1	252	2.98	1.063	0.067	-3.577	<0.05
	2	61	3.52	1.120	0.143		
Q10	1	252	3.31	1.523	0.096	2.263	0.024
	2	61	2.82	1.555	0.199		
Q11	1	252	3.24	1.548	0.098	3.384	0.001
	2	61	2.49	1.534	0.196		
Q12	1	252	3.44	1.423	0.090	4.948	<0.05
	2	61	2.44	1.373	0.176		
Q13	1	252	3.56	1.339	0.084	2.548	0.011
	2	61	3.07	1.436	0.184		
Q14	1	252	3.50	1.413	0.089	1.757	0.080
	2	61	3.15	1.459	0.187		
Q15	1	252	3.35	1.466	0.092	5.105	<0.05
	2	61	2.30	1.395	0.179		
Q16	1	252	3.72	1.279	0.081	3.303	0.001
	2	61	3.11	1.330	0.170		

Findings Regarding Research Question 3: Is there a Discernible difference in English Speaking Anxiety between Genders in the Context of English Language Instruction?

Upon analysing the collected data, the study investigated potential differences between genders concerning English language anxiety. When examining the results of the independent two-sample t-test concerning whether there is a difference between gender and the average scores given to the survey questions, it was found that there is no statistically significant difference between male and female participants in terms of the arithmetic averages of the answers provided to all questions. Table 12 provides the t-statistics and p-values for the students' responses to the questions. These statistical results further affirm the absence of a significant gender-based difference in the students' average scores across the surveyed questions.

Table 12.

Differences in Answers to Questions According to Gender

	Gender (F1, M2)	Mean	Std. Deviation	Std. Error Mean	T-Statistics	P Value
Q1	1	3.73	1.114	0.101	0.213	0.831
	2	3.70	1.142	0.083		
Q2	1	3.08	1.519	0.138	0.279	0.780
	2	3.04	1.319	0.095		
Q3	1	3.26	1.051	0.095	1.496	0.136
	2	3.08	1.066	0.077		
Q4	1	3.14	1.663	0.151	-0.208	0.835
	2	3.18	1.566	0.113		
Q5	1	3.24	1.606	0.145	0.070	0.944
	2	3.23	1.517	0.110		
Q6	1	3.26	1.558	0.141	0.300	0.764
	2	3.21	1.493	0.108		
Q7	1	3.14	1.592	0.144	0.250	0.803
	2	3.09	1.536	0.111		
Q8	1	3.16	1.571	0.142	-0.325	0.746
	2	3.22	1.430	0.104		
Q9	1	3.15	1.133	0.103	0.832	0.406

	2	3.04	1.070	0.077		
Q10	1	3.22	1.572	0.142	0.037	0.970
	2	3.21	1.522	0.110		
Q11	1	3.11	1.610	0.146	0.125	0.901
	2	3.08	1.550	0.112		
Q12	1	3.28	1.544	0.140	0.315	0.753
	2	3.23	1.417	0.103		
Q13	1	3.36	1.483	0.134	-1.059	0.290
	2	3.53	1.293	0.094		
Q14	1	3.59	1.341	0.121	1.546	0.123
	2	3.34	1.474	0.107		
Q15	1	3.13	1.611	0.146	-0.148	0.883
	2	3.16	1.446	0.105		
Q16	1	3.65	1.323	0.120	0.471	0.638
	2	3.58	1.303	0.094		

Discussion and Conclusions

This research sought to ascertain the impact on anxiety levels among university students and graduates undergoing English language education in private educational institutions, distinct from formal school programs, when the instructor employs English as the medium of instruction. The investigation aimed to establish potential correlations between the anxiety levels of participants based on gender and their status as university graduates.

The findings indicated that the exclusive use of English by the instructor in the context of English language education did not yield a noteworthy discrepancy in anxiety levels based on gender. However, discernibly lower anxiety levels were observed among university graduates compared to participants currently enrolled as university students. These outcomes underscore the considerable influence of pre-existing language proficiency and individual awareness on foreign language acquisition and anxiety levels.

While the general inclination of participating students to engage in English conversation with a non-native speaker was noted, the research revealed that the presence of additional individuals during such interactions heightened anxiety, resulting in withdrawal by the speaker. It was observed that heightened anxiety related to the fear of making errors in the classroom environment significantly

amplified apprehensions of criticism from peers, thereby exacerbating English-speaking anxiety. Notably, university graduate students exhibited a comparatively lesser susceptibility to this phenomenon, while those who enrolled in university programs reported heightened anxiety levels, irrespective of gender.

The research also revealed that anxiety levels associated with the accurate pronunciation of English words were notably elevated in comparison to other facets. While graduate students exhibited a relatively lower prevalence of this particular anxiety, a general trend emerged wherein participants, across the board, tended to refrain from actively engaging in English dialogues with the instructor, primarily due to the heightened anxiety concerning pronunciation accuracy.

In light of these findings, and taking into account students' motivation, age of instruction, and academic trajectory, it is evident that instructional delivery exclusively in English by the teacher within the classroom setting results in a significant escalation of anxiety levels among students. This form of anxiety manifests across various domains, encompassing apprehension related to pronunciation errors, reticence, hesitancy to actively participate in class discussions, and challenges in effective communication with peers. Notably, college freshmen exhibit lower motivation to engage in English communication compared to their upper-class counterparts, as elucidated by Nguyen (2019). This disparity may be attributed to several factors, including the likelihood that graduate students have previously undergone English language courses, possess heightened awareness and motivation toward their professional aspirations, and pursue English courses autonomously and in alignment with their individual preferences.

Acknowledged principles emphasize the pivotal role of a student's active participation and productivity as prerequisites for fostering effective learning experiences. Active learning methodologies have been associated with a notable augmentation in student success with regard to academic performance, as expounded by Nurbavliyev et al. (2022). The impediment to effective teacher-student interaction arising from heightened anxiety levels constitutes a challenge attributable not solely to the student but also implicates the teaching methodology. Drawing upon Krashen's (1982) expertise in linguistics, which posits that second language acquisition unfolds in stages and progressing to subsequent stages is arduous without acquiring requisite foundational elements, it is postulated that the initial provision of basic explanations exclusively in English during the initial exposure of university-level students to English language education induces heightened anxiety levels and hampers the attainment of optimal levels of active learning. Accordingly, it is envisioned that

incorporating the instructor's use of the students' native language, at a requisite level, in foundational English language teaching will positively impact the learning process.

Recommendations

Based on the research findings, the following recommendations were found necessary to be proposed:

- In basic and intermediate level classes, teachers should use minimal native language to enhance student comprehension, while prioritizing accurate information transfer.
- Teachers may allocate specific times or lessons where the teacher exclusively speaks English, allowing for more flexibility in the use of English during regular lectures.
- In educational institutions, teachers may consider including an additional teacher who speaks only English to support the main course teacher.
- When teaching English as a second language, teachers should consider students' prior educational backgrounds and readiness. In mixed-level classes, beginners should be provided with more opportunities to speak.
- Mistakes caused by anxiety must be addressed and achievements must be rewarded to help reduce anxiety. As students recognize and accept their mistakes as normal, their speaking anxiety will decrease.
- To build self-confidence, teachers should encourage students to make brief speeches in front of the class with minimal interference.

Further Research

This study, due to being conducted within private institutions in a specific city, possesses certain limitations. Future investigations on this topic could benefit from including a broader participant base. The readiness of students in private institutions may differ from that of students in public schools due to various factors, such as voluntary engagement in foreign language learning, duration of exposure to foreign language education, teacher qualifications, and the presence of foreign instructors.

Therefore, research in this domain should be more comprehensive, encompassing a variety of schools, educational levels, and age groups, as this may yield different outcomes. Additionally, since the participants in this study are exclusively of Turkish origin, extending the research to include students from diverse cultural and racial backgrounds would significantly enrich the literature.

About Authors

First Author: Kamil Yar is postgraduate student in Eskişehir Osmangazi University, Faculty of Education. He is currently working as English Language Teacher in a private institution. He mainly works in the fields of Linguistics and Second Language Acquisition.

Responsible Author: Assoc. Prof. Dr. Fatih Çemrek is a member of Eskişehir Osmangazi University. He is currently working at the Department of Statistics in the Faculty of Science. He mainly works in the fields of applied statistics, time series analysis, econometric time series analysis and multivariate statistics.

Conflict of Interest

It has been reported by the authors that there is no conflict of interest.

Funding

No funding was received.

Ethical Standards

The permission of this research was approved by the number E-64075176-050.01.04-2300251558 on 18.12.2023 by ethics committee of Osmangazi University. Data were collected with the permission of the scale owners.

ORCID

Kamil Yar https://orcid.org/0009-0000-0669-5008

Fatih Çemrek https://orcid.org/00000-0001-6528-7159

References

Baş, G. (2014). Lise öğrencilerinde yabancı dil öğrenme kaygısı: Nitel bir araştırma. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi, 36*, 115–116.

Büyüköztürk, Ş., Çakmak, E., Akgün, Ö., Karadeniz, Ş., & Demirel, F. (2008). Bilimsel Araştırma Yöntemleri. (1. Baskı). Ankara: Pegem Akademi.

Ekizer, F. N. (2021). The effect of project-based teaching on language learner' ssuccess in social environments. *Training Social Actors in ELT.* Akademisyen Yayınları, 105-117.

Gaonac'h, D. (2006). L'Apprentissage précoce d'une langue étrangère. *Le point de vue de la psycholinguistique*. Paris: Hachette.

Hardacre, B. and Güvendir, E. (2020) 'Second language learning anxiety', *The TESOL Encyclopedia of English Language Teaching*. 1–7. doi:10.1002/9781118784235.eelt0988.

Horwitz, E. K. (1996). Even teachers get the blues: recognizing and alleviating language teachers' feeling of foreign language anxiety. *Foreign Language Annals, 29*(3), 365-372. doi:10.1111/j.1944-9720.1996.tb01248.x

İpek, H. (2016). A qualitative study on foreign language teaching anxiety. *Eğitimde Nitel Araştırmalar Dergisi - Journal of Qualitative Research in Education, 4*(3), p. 94. doi:10.14689/issn.2148-2624.1.4c3s5m

Kerlinger, F. N., & Lee, H. B. (1999). Foundations of behavioral research. New York: Harcourt College Publishers.

Kline, R. B. (2005). Principles and practice of structural equation modelling. NewYork: The Guilford Press.

Krahnke, K. J., & Krashen, S. D. (1983). Principles and practice in second language acquisition. *TESOL Quarterly, 17*(2), p. 300. doi:10.2307/3586656.

Krashen, S. (1982). Principles and practice in second language learning and acquisition. Oxford: Pergamon.

Lenneberg, E. (1967). Biological foundations of language. New York: Wiley-Blackwell.

Li, C. H. (2016). The effect of anxiety on university-Level L2 learner ability to recall items in the Lexicon. *The Journal of Language Learning and Teaching, 5*(1), 24-33.

MacIntyre, P., & Gardner, R. (1994). The subtle effects of language anxiety on cognitive processing in the second language. *Language Learning, 44*(2), 284. https://doi.org/10.1111/j.1467-1770.1994.tb01103.x

Medgyes, P. (1994). The Non-native Teacher. Hong Kong: MacMillan.

Merç, A. (2011). Sources of foreign language student teacher anxiety: A qualitative inquiry. *Turkish Online Journal of Qualitative Inquiry, 2*(4), 80–94. https://doi.org/10.17569/tojqi.08990

Merzifonluoğlu, A. (2014). *An investigation into English speaking problems of students at ELT department*. Ataturk University. Yüksek Lisans Tezi. Erzurum: Atatürk Üniversitesi, Eğitim Bilimleri Enstitüsü.

Nishanthi, R. (2018). The importance of learning English in today world. *International Journal of Trend in Scientific Research and Development, 3*(1), pp. 871–874. https://doi.org/10.31142/ijtsrd19061.

Nguyen, H. C. (2019). Motivation in learning English language: A case study at Vietnam National University, Hanoi. *The European Journal of Educational Sciences, 06*(01). https://doi.org/10.19044/ejes.v6no1a4.

Nurbavliyev, O., Kaymak, S., & Sydykov B. (2022). The effect of active learning method on students' academic success, motivation and attitude towards mathematics, *Journal of Language and Linguistic Studies*, *18*(2), 701-713.

Ohata, K. (2005). Language anxiety from the teacher's perspective: Interviews with seven experienced ESL/EFL teachers, *Journal of Language and Learning*, *3*(1), 133-155.

Orakcı, Ş. (2018). İngilizce Konuşma Kaygısı ölçeği'nin geçerlik ve güvenirlik çalışması, *İnönü Üniversitesi Eğitim Bilimleri Enstitüsü Dergisi*, *5*(9), 1–18. https://doi.org/10.29129/inujgse.375916.

Öztürk, G. (2016). İngilizceyi yabancı dil olarak öğreten öğretmenlerin yabancı dil öğretimi kaygısı: Türkiye'den bir örneklem, *Sakarya University Journal of Education*, *6*(6), p. 55. doi:10.19126/suje.220180.

Siddiqui, S., & Ahamed, M. M. (2020). Teachers' roles beyond and within the context: An ever-changing concept. *Arab World English Journal*, *11*(1), pp. 290–291. doi:10.24093/awej/vol11no1.21.

Tamimi Sa'd, S. H., & Qadermazi, Z. (2015) L1 use in EFL classes with English-only policy: Insights from triangulated data. *Center for Educational Policy Studies Journal*, *5*(2), 159–175. https://doi.org/10.26529/cepsj.147.

Worde, R. V. (2003). Students' Perspectives on foreign language anxiety. *Inquiry: Critical Thinking Across The Disciplines*, *8*(1), 1- 15.

Osmangazi Journal of Educational Research **Volume 11(1), Spring 2024**

RESEARCH Open Access

Suggested Citation: Altıntaş, E., İlgün, Ş., & Soyterir, İ. (2024). Examination of elementary school mathematics teachers' mathematical modelling attitudes in terms of various variables. *Osmangazi Journal of Educational Research, 11*(1), 95-117.

Submitted: 30/04/2024 **Revised:** 31/08/2024 **Accepted:** 02/09/2024 **DOI:** 10.59409/ojer.1475851

Examination of Elementary School Mathematics Teachers' Mathematical Modelling Attitudes in Terms of Various Variables

Esra Altıntaş, ** Şükrü İlgün, ***İsmail Soytetir

Abstract. This study aims to examine elementary mathematics teachers' attitudes towards mathematical modelling in terms of various variables. The current study is particularly important as it is one of the few ones in our country to investigate this type of work, focusing on the attitudes of elementary mathematics teachers towards mathematical modelling across all sub-dimensions. A survey model, one of the quantitative research methods, was used, and the sample of the study consisted of 102 elementary mathematics teachers working at official secondary schools and official imam hatip secondary schools in Aydın province during the 2023-2024 academic year, determined through an appropriate sampling method. The Mathematical Modelling Attitude Scale was used as the data collection tool in the study. The research revealed that elementary mathematics teachers exhibit a low level of attitude towards mathematical modelling. Although their motivation sub-dimension towards mathematical modelling was high, the real-life sub-dimension was moderate, while the constructivism and understanding sub-dimensions were low. However, it was found that the sub-dimension and overall scores of the mathematical modelling attitude scale of elementary mathematics teachers did not differ according to gender, faculty of graduation, age, and professional experience, but they did differ according to level of education.

Keywords: Mathematical modelling, attitude towards mathematical modelling, elementary school mathematics teachers.

* Prof. Dr., Aydın Adnan Menderes University, Faculty of Education, Aydın, Türkiye

e-mail: esra.altintas@adu.edu.tr

** Assist. Prof. Dr., Kafkas University, Dede Korkut Faculty of Education, Kars, Türkiye

e-mail: mat.ilgun@hotmail.com

*** Mathematics Teacher, Ministry of National Education, Aydın, Türkiye

e-mail: soytetirismail@gmail.com

Given the current era, it is evident that science and technology continuously affect our lives, driving change and development in today's world. This situation has also pushed the education community towards change, emphasizing the importance of learning to think, thinking creatively, producing solutions to encountered problems with creative ideas, and being able to use what is learned in daily life. In this context, mathematics plays a critical role in raising individuals who can transform their knowledge and skills into practical applications in daily life (Tutak & Güder, 2014).

Mathematics education in schools is often perceived as a purely abstract science where formulas are memorized and detached from real life. However, it is clear that teaching mathematics in a way that helps individuals in their daily lives will benefit them in overcoming problems they may encounter. Today, individuals are integrating mathematics into their lives and taking steps to concretize mathematics, an abstract science, by relating it to their daily lives. One of the most important methods used for this purpose is the modelling of mathematics. When we look at it, mathematics is a systematic way of thinking that seeks solutions to problems encountered in life through modelling. When mathematics is associated with daily life, it is seen that the foundation of mathematical concepts exists within life itself (Demir, Sert, Çelik, Arı, & Kaleli Yılmaz, 2023).

In the world of education, the concept of a model is also of great importance. According to the Turkish Language Institution's Contemporary Turkish Dictionary, a model is defined as "the first example of a designed product produced for promotion or testing purposes, a prototype" (Turkish Language Institution, 2023). While modelling is considered a process, the model is described as the product created as a result of this process (Özturan, Sağırlı, Kırmacı, & Bulut, 2010). During the modelling process, efforts are made to understand problem situations, think about and apply possible solutions, and develop models that will ensure a clear understanding of the problem. Mathematical modelling, considered a subcategory of the modelling concept, refers to a cyclical process consisting of concrete models that will facilitate the understanding of the abstract structure of real-life problems (Lesh & Doerr, 2003). In this cyclical process, an abstract daily life problem is concretized, expressed in mathematical language, solved with creative solutions, and these solutions are evaluated (Lesh & Haines, 2010). Therefore, mathematical modelling is a process that includes revisions before reaching an acceptable conclusion and involves movement between elements such as a real-world situation, a mathematical phenomenon, and a mathematical solution (Asempapa, 2020). In modelling activities, students work like researchers to solve problem situations taken from daily life using mathematics and aim to reach a generalization that can be used for similar situations (Doruk, 2010). This helps to

establish the relationship between mathematics and real-life situations, allowing students to learn mathematics more meaningfully (Asempapa, 2022).

As mentioned in the statement by the National Council of Teachers of Mathematics (NCTM) (2000), which holds an important place in mathematics education, the importance of using mathematical models in problem-solving processes is emphasized in teaching programs at every grade level, starting from early childhood, to make mathematical learning more meaningful. In our country, as on a global scale, many areas have observed development and change. The beginning of fundamental changes in the field of education started with the new elementary education program implemented since 2005. The basis of this program is the changing roles of teachers and students, changes in the learning environment, and differentiation in mathematical learning. With this program, mathematical modelling and models were comprehensively included for the first time (Ministry of National Education, 2005). Since then, there has been a greater emphasis on mathematical modelling in teaching programs, and it has been suggested as a skill to be used in the teaching process by preparing learning environments based on problem-solving and modelling activities that contain daily life situations suitable for students' levels and interests to apply the program's perspective (Ministry of National Education, 2018). Additionally, when examining textbooks, it is seen that there are daily life problems that require modelling in certain sections. When examining the Turkey Century Maarif Program, the Mathematics Course Teaching Program is associated with four basic skills: mathematical problem-solving, analysis, interpretation, developing mathematical solutions, and reflection, and their process components. The process components under these skills are the ability to develop strategies based on intuition and experience, apply these strategies, evaluate the solution of the problem and the applied strategy from various perspectives, and use mathematical modelling (Ministry of National Education, 2024).

When examining the general competencies of the teaching profession published by the Ministry of National Education, it is seen that among the competencies that teachers should have are the ability to relate lessons to daily life, use appropriate methods and approaches in lessons, and recognize, understand, and implement the current teaching program. As can be seen, teachers are expected to have the modelling skill, which is one of the skills addressed in teaching programs, and to use planning, organizing, and pedagogical content knowledge to transfer these skills to their students in the classroom (General Directorate of Teacher Training and Education, 2017). Additionally, since teachers play an important role in student success, negative attitudes they may have towards mathematical modelling can harm the modelling applications they will conduct, thereby affecting

students' learning (Asempapa & Brooks, 2022). In this context, it is necessary to determine the attitudes of teachers towards mathematical modelling and identify ways to increase productivity, especially towards mathematical modelling in the classroom.

When examining the literature, it is seen that studies focus on the mathematical modelling process (Eraslan, 2012; Tekin Dede & Bukova Güzel, 2013), the development of mathematical modelling skills (Bal & Doğanay, 2014), mathematical modelling competencies (Tekin Dede & Yılmaz, 2013), the awareness of mathematics teachers and prospective mathematics teachers towards modelling (Akgün et al., 2013; Sarı & Özturan Sağırlı, 2021; İncikabı & Biber, 2020), the opinions of mathematics teachers and prospective mathematics teachers towards modelling (Urhan & Dost, 2016; Yanık & Koparan, 2017; Işık & Mercan, 2015; Tutak & Güder, 2014; Aslan & Yadigaroğlu, 2013; Tekin & Bukova Güzel, 2011), the perceptions of prospective mathematics teachers towards modelling (Durandt & Jacobs, 2014; Arı, Demir & Çakır, 2023), and the views of elementary school teachers and prospective elementary school teachers towards mathematical modelling and their perceptions of mathematical modelling (Albayrak & Efendioğlu, 2023; Pilten, Serin & Işık, 2016). Studies on students' attitudes and habits towards mathematical modelling (Mehraein & Gatabi, 2014; Fitri & Hiltrimartin, 2020; Durandt, Blum & Lindl, 2022) are also encountered in the literature. Additionally, there are studies on measuring teachers' attitudes towards mathematical modelling, including the design of the scale (Asempapa, 2020), the adaptation of the designed scale for teachers in different countries (Hidayat et al., 2021; Demir et al., 2023), and the measurement of changes in teachers' attitudes towards mathematical modelling according to demographic variables (Asempapa, 2022). Asempapa's (2022) study shows parallelism with our study in terms of examining demographic variables. However, the current research is particularly important as it is one of the few studies conducted in our country, and it aims to reveal the attitudes of elementary mathematics teachers towards mathematical modelling in all its sub-dimensions. Teachers are key factors in the process of understanding and applying mathematical modelling standards. How they perceive mathematical modelling and their attitudes towards it are very important. The reflection of teachers' attitudes towards mathematical modelling will naturally be seen in their students. Mathematical modelling aims to provide students with the ability to relate abstract mathematical concepts to daily life and use them in practical applications. Teachers' attitudes towards mathematical modelling can help evaluate their in-class activities to achieve these goals. Additionally, measuring teachers' attitudes towards mathematical modelling offers the opportunity to understand which teaching methods and strategies are used in the classroom and the teacher's approach to modelling. This will guide teachers in

becoming aware of their strengths and weaknesses in mathematical modelling. Mathematical modelling can help students understand mathematical topics more deeply and produce easier solutions to problems they may struggle with. Teachers' attitudes towards using this approach play a key role in increasing student success and understanding levels. Since mathematical modelling offers students the opportunity to relate mathematics to daily life, it can increase motivation. Teachers' adoption of this approach can contribute to students developing a more positive attitude towards mathematics classes and showing more participation in the lesson. Positive attitudes of teachers towards modelling will encourage student-centered learning by providing opportunities for students to develop their own solutions and create mathematical models. Measuring teachers' attitudes towards mathematical modelling can guide the determination of educational policies and the design of teacher education programs. This data can be used to determine the priorities that need to be set in teacher education and professional development areas. Measuring teachers' attitudes towards mathematical modelling is an important step to improve the quality of education and develop students' mathematical skills. This measurement can help make decisions to improve educational processes and develop more effective teaching strategies. In this context, the research conducted is important.

The purpose of the current research is to measure the attitudes of elementary mathematics teachers, who are the practitioners of mathematical modelling activities in the classroom, towards mathematical modelling and to measure these attitudes in terms of various variables. In line with this purpose, the following question is sought: “Do the attitudes of elementary mathematics teachers towards mathematical modelling differ according to various variables?” The sub-problems related to this question are as follows:

1. What are the attitudes of elementary mathematics teachers towards mathematical modelling?
2. Do the attitudes of elementary mathematics teachers towards mathematical modelling differ according to gender?
3. Do the attitudes of elementary mathematics teachers towards mathematical modelling differ according to age?
4. Do the attitudes of elementary mathematics teachers towards mathematical modelling differ according to the type of faculty they graduated from?
5. Do the attitudes of elementary mathematics teachers towards mathematical modelling differ according to their level of education status?

6. Do the attitudes of elementary mathematics teachers towards mathematical modelling differ according to their professional experience?

Method

Research Model

In this research, which aims to examine the attitudes of elementary mathematics teachers towards mathematical modelling in terms of various variables, a general survey model, which is one of the quantitative research methods, was used to describe the attitudes, behaviours, and other stages of a sample or universe by applying a questionnaire, test, or scale to the researchers (Creswell, 2012; Fraenkel et al., 2012).

Study Group

The population of the research consists of mathematics teachers working in official secondary schools and official imam hatip secondary schools in Aydın province during the 2023-2024 academic year. The sample of the research consists of 102 elementary mathematics teachers working in official secondary schools and imam hatip secondary schools in Aydın province, who voluntarily participated in the research during the data collection process. An appropriate sampling method was used for being easily accessible and applicable (Büyüköztürk et al., 2023).

Table 1.

Information on Demographic Data

Demographic Information	**Variable**	**f**	**%**
Gender	Female	65	63.7
	Male	37	36.3
	Total	102	100.0
Age	21-30 Years	6	5.9
	31-40 Years	53	52.0
	41-50 Years	38	37.3
	Over 50 years	5	4.9
	Total	102	100.0
Educational Degree	Bachelor's	77	75.5
	Master's without Thesis	10	9.8
	Master's with Thesis	15	14.7
	Doctorate	-	-
	Total	102	100.0
Faculty Graduated From	Faculty of Education	93	91.2
	Faculty of Science and Literature	9	8.8
	Total	102	100.0

Professional Experience	1-5 years	1	1.0
	6-10 years	18	17.6
	11-15 years	36	35.3
	16-20 years	32	31.4
	Over 20 years	15	14.7
	Total	100	100.0

When the frequency and percentage distribution in Table 1 are examined, it is seen that there are 65 female (63.7%) and 37 male (36.3%) participants. When the distribution of elementary mathematics teachers is examined according to age ranges, it is seen that the majority of the teachers are between 31-40 years old (52%). Regarding educational degrees, it is seen that only those with a bachelor's degree (75.5%) are predominant. In terms of the graduated faculty type, it is observed that the majority of teachers graduated from the Faculty of Education (91.2%). When the professional experiences are examined, it is seen that the majority of teachers have 11-15 years (35.3%) and 16-20 years (31.4%) of experience.

Data Collection Tools

As a data collection tool, the Mathematical Modelling Attitude Scale (MMAS) developed by Demir, Sert Çelik, Arı and Kaleli Yılmaz (2023) and a demographic information form prepared by the researcher were used.

Demographic information form. The "Demographic Information Form" will be used to examine the mathematical attitudes of elementary mathematics teachers in terms of age, gender, graduated faculty, completed education status, and professional experience.

Mathematical modelling attitude scale (MMAS). In this study, the Turkish adaptation of the Mathematical Modelling Attitude Scale (MMAS) developed by Asempapa (2020) to determine the attitudes of teachers who teach mathematics towards mathematical modelling was used by Demir, Sert Çelik, Arı and Kaleli Yılmaz (2023). The attitude scale consists of 24 items. These items are rated on a six-point Likert scale, ranging from 6 "Strongly Agree" to 1 "Strongly Disagree." In the study conducted by Demir, Sert Çelik, Arı and Kaleli Yılmaz (2023), the items were evaluated by taking expert opinions, and it was decided to use the original four-dimensional and 28-item version of the scale. Subsequently, the validity and reliability study of the scale was conducted. The exploratory factor analysis (EFA) revealed that the four-factor structure explained 62.8% of the total variance. The confirmatory factor analysis (CFA) result showed that the scale had four dimensions, with factor loadings ranging from 0.600 to 0.889, and the Cronbach alpha coefficient was 0.935 for all, 0.814 for the constructivism factor, 0.922 for the motivation and relevance factor, 0.872 for real-

life, and 0.796 for the understanding factor. The convergence validity coefficients ranged from 0.868 to 0.943, and the discriminant validity (AVE) ranged from 0.415 to 0.627. As a result, it was stated that the four-dimensional and 24-item Turkish adaptation of the MMAS is a valid and reliable measurement tool to measure the attitudes of teachers who teach mathematics towards mathematical modelling.

Process

In this research, the data collection tool was the Mathematical Modelling Attitude Scale (MMAS) adapted into Turkish by Demir Sert-Çelik Arı and Kaleli-Yılmaz (2023) and originally prepared by Asempapa (2019). The administration of the scale takes an average of 15 minutes per person. The application was conducted face-to-face with the participants. The data were collected within three weeks. The factors constituting the scale are constructivism, understanding, relevance, and real-life, and motivation and interest. The Cronbach's alpha coefficients for these factors range from 0.81 to 0.95, while the general scale coefficient is 0.96. The items on the scale are scored on a six-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree," and all items consist of positive statements. In this study, the Cronbach's alpha reliability coefficient of the scale was found to be; constructivism = 0.90, understanding = 0.89, real-life = 0.93, motivation = 0.96, and MMAS general total = 0.97.

Data Analysis

The data were analyzed using a statistical package program. The data were subjected to a normality test, but it was determined that it did not have a normal distribution (Table 2). Therefore, non-parametric Mann-Whitney U test, Kruskal-Wallis H test, and descriptive statistical analysis were conducted to analyze the data that did not show normal distribution. Post Hoc Tamhane's T2 test was performed to determine the difference between groups.

Table 2.

Normality Test

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	p	Statistic	df	p
Constructivist Sub-dimension	,258	102	,000	,811	102	,000
Understanding Sub-dimension	,218	102	,000	,830	102	,000
Real-life Sub-dimension	,207	102	,000	,822	102	,000
Motivation Sub-dimension	,199	102	,000	,818	102	,000
MMAS General Total	,164	102	,000	,871	102	,000

Results

Table 3.

Attitude Levels of Elementary Mathematics Teachers towards Mathematical Modelling

Scale and Sub-dimensions	n	$\bar{x}$	Ss.	Range	Min.	Max.
Constructivism	102	12.66	7.82	20.00	5.00	25.00
Understanding	102	11.58	6.32	16.00	4.00	20.00
Real-life	102	16.71	9.77	24.00	6.00	30.00
Motivation	102	27.34	14.64	36.00	9.00	45.00
MMAS Total	102	68.31	34.99	96.00	24.00	120.00

When Table 3 is examined, the arithmetic averages of the sub-dimensions of the Mathematical Modelling Attitude Scale for elementary mathematics teachers were calculated as follows: x_constructivism = 12.66, x_understanding = 11.58, x_real-life = 16.71, x_motivation = 27.34, and the overall arithmetic average of the scale was calculated as x_MMAS = 68.31. Considering the data, it is seen that teachers have high motivation, moderate real-life sub-dimension, but low constructivism and understanding sub-dimensions. Among the sub-dimensions of the elementary mathematics teachers' attitude levels towards mathematical modelling, the understanding sub-dimension has the most homogeneous structure with SS = 6.32 and Range = 16, while the motivation sub-dimension has the most heterogeneous structure with SS = 14.64 and Range = 36. It can be stated that teachers are motivated by different factors but have a similar understanding regarding attitudes towards mathematical modelling. It was determined that teachers exhibit a low level of attitude towards mathematical modelling (x_item MMAS = 2.44).

Table 4.

Mann Whitney U Test Result for the Attitude Levels of Elementary Mathematics Teachers Towards Mathematical Modelling According to Gender Variable

Scale and Sub-dimension	Gender	n	S.O.	S.T.	U	z	p
Constructivism	Female	65	49.09	3191.00	1046.500	-1.134	.257
	Male	37	55.73	2062.00			
Understanding	Female	65	51.42	3342.50	1197.500	-.036	.972
	Male	37	51.64	1910.50			
Real-life	Female	65	52.42	3407.00	1143.000	-.425	.671
	Male	37	49.89	1846.00			
Motivation	Female	65	52.09	3386.00	1164.000	-.272	.785
	Male	37	50.46	1867.00			
MMAS Total	Female	65	51.60	3354.00	1196.000	-.046	.964
	Male	37	51.32	1899.00			

In the Mann Whitney U Test analysis shown in Table 4, it was found that the sub-dimensions and overall scores of the Mathematical Modelling Attitude Scale for elementary mathematics teachers did not differ significantly according to the gender variable ($p > 0.05$). According to this finding, it can be said that the attitude levels of teachers towards mathematical modelling are similar across all sub-dimensions according to the gender variable.

Table 5.

Mann-Whitney U Test Result for the Attitude Levels of Elementary Mathematics Teachers Towards Mathematical Modelling According to the Graduated Faculty Variable

Scale and Sub-dimension	**Faculty Graduated From**	**n**	**S.O.**	**S.T.**	**U**	**z**	**p**
Constructivism	Faculty of Education	93	50.40	4687.00	316.000	-1.259	.20
	Faculty of Science and Literature	9	62.89	566.00			
Understanding	Faculty of Education	93	51.08	4750.00	379.000	-.476	.634
	Faculty of Science and Literature	9	55.89	503.00			
Real-life	Faculty of Education	93	50.80	4724.50	360.000	-.787	.483
	Faculty of Science and Literature	9	58.72	528.50			
Motivation	Faculty of Education	93	50.87	4731.00	360.000	-.701	.483
	Faculty of Science and Literature	9	58.00	522.00			
MMAS Total	Faculty of Education	93	50.66	4711.00	340.000	-.933	.351
	Faculty of Science and Literature	9	60.22	542.00			

In Table 5, it is seen that the sub-dimensions and overall scores of the Mathematical Modelling Attitude Scale for elementary mathematics teachers did not differ significantly according to the graduated faculty ($p > 0.05$). According to this finding, it can be said that the attitude levels of teachers towards mathematical modelling are similar according to the type of faculty they graduated from.

Table 6.

Kruskal-Wallis H Test Result for the Attitude Levels of Elementary Mathematics Teachers Towards Mathematical Modelling According to Age Variable

Scale and Sub-dimension	Age Group	n	Rank Avarage	Sd	x^2	p
Constructivism	20-30 years	6	45,83	3	5.619	.13
	31-41 years	53	46,30			
	41-50 years	38	60,14			
	Over 50 years	5	47,70			
Understanding	20-30 years	6	59,83	3	5.881	.118
	31-41 years	53	44,92			
	41-50 years	38	59,11			
	Over 50 years	5	53,50			
Real-life	20-30 years	6	64,17	3	5.226	.156
	31-41 years	53	45,42			
	41-50 years	38	57,47			
	Over 50 years	5	55,30			
Motivation	20-30 years	6	53,33	3	3.238	.35
	31-41 years	53	46,74			
	41-50 years	38	57,83			
	Over 50 years	5	51,70			
MMAS Total	20-30 years	6	56,25	3	6.454	.091
	31-41 years	53	44,64			
	41-50 years	38	60,30			
	Over 50 years	5	51,60			

When Table 6 is examined, it is seen that the sub-dimensions scores (x^2_constructivism = 5.619, sd = 3, $p > 0.05$; x^2_understanding = 5.881, sd = 3, $p > 0.05$; x^2_real-life = 5.226, sd = 3, $p > 0.05$; x^2_motivation = 3.238, sd = 3, $p > 0.05$) and the overall scores (x^2_total = 6.454, sd = 3, $p > 0.05$) of the Mathematical Modelling Attitude Scale for elementary mathematics teachers did not differ significantly according to the age variable. According to this finding, it can be said that the attitude levels of teachers towards mathematical modelling are similar according to their ages variable.

Table 7.

Kruskal-Wallis H Test Result for the Attitude Levels of Elementary Mathematics Teachers Towards Mathematical Modelling According to Educational Degree Variable

Scale and Sub-dimension	Educational Degree	n	Rank Avarage	Sd	x^2	p	Tamhane's T2 (Difference)
Constructivism	1. Bachelor's	77	55.70	2	10.297	**.00***	1< 2 2>1
	2. Master's without Thesis	10	51.45				
	3. Master's with Thesis	15	29.97				
Understanding	1.Master's	77	55.71	2	11.289	**.00***	1< 2 2>1
	2.Master's without Thesis	10	53.85				
	3.Master's with Thesis	15	28.33				
Real-life	1. Bachelor's	77	54.68	2	10.321	**.00***	1< 2 2>3 3<2-1
	2.Master's without Thesis	10	59.75				
	3.Master's with Thesis	15	29.70				
Motivation	1. Bachelor's	77	54.14	2	8.465	**.01***	1< 2 2>3 3<2-1
	2.Master's without Thesis	10	60.65				
	3.Master's with Thesis	15	31.83				
MMAS Total	1. Bachelor's	77	55.62	2	11.798	**.00***	1< 2 2> 3 3<2-1
	2.Master's without Thesis	10	55.90				
	3.Master's with Thesis	15	27.43				

***p<.05**

When Table 7 is examined, it is seen that the sub-dimensions (x^2_constructivism = 10.297, sd = 2, $p < 0.05$; x^2_understanding = 11.289, sd = 2, $p < 0.05$; x^2_real-life = 10.321, sd = 2, $p < 0.05$; x^2_motivation = 8.465, sd = 2, $p < 0.05$) and the overall scores (x^2_total = 11.798, sd = 2, $p < 0.05$) of the Mathematical Modelling Attitude Scale for elementary mathematics teachers differ significantly according to the educational degree variable. The Post Hoc Tamhane's T2 test, conducted to determine the difference between groups, found that elementary mathematics teachers with master's degree with thesis had higher levels of attitudes towards mathematical modelling compared to those with a bachelor's degree and master's degree without thesis.

Table 8.

Kruskal-Wallis H Test Result for the Attitude Levels of Elementary Mathematics Teachers Towards Mathematical Modelling According to Professional Seniority Variable

Scale and Sub-dimension	Professional Seniority	n	Rank Avarage	Sd	x^2	p
Constructivism	1-5 years	1	57.00	4	5.328	.255
	6-10 years	18	40.14			
	11-15 years	36	50.18			
	16-20 years	32	54.31			
	Over 20 years	15	61.93			
Understanding	1-5 years	1	40.50	4	3.234	.519
	6-10 years	18	43.11			
	11-15 years	36	52.92			
	16-20 years	32	50.72			
	Over 20 years	15	60.57			
Real-life	1-5 years	1	54.00	4	3.248	.517
	6-10 years	18	42.81			
	11-15 years	36	50.14			
	16-20 years	32	53.84			
	Over 20 years	15	60.03			
Motivation	1-5 years	1	45.00	4	4.269	.371
	6-10 years	18	39.56			
	11-15 years	36	52.43			
	16-20 years	32	54.00			
	Over 20 years	15	58.70			
MMAS Total	1-5 years	1	44.00	4	5.146	.273
	6-10 years	18	39.58			
	11-15 years	36	50.60			
	16-20 years	32	54.86			
	Over 20 years	15	61.30			

As seen in Table 8, the Kruskal-Wallis H Test conducted to determine whether the scores of the Mathematical Modelling Attitude Scale for elementary mathematics teachers differ significantly according to the professional experience variable found no statistically significant difference among the sub-dimensions (x^2_total = 5.146, sd = 4, $p > 0.05$).

Discussion and Conclusion

This study was conducted to examine the attitudes of elementary mathematics teachers towards mathematical modelling in terms of various variables. Within the scope of the current research, it is seen that teachers have high motivation, moderate real-life sub-dimension, but low constructivism and understanding sub-dimensions. The Real-life sub-dimension examines the applicability of mathematical modelling in daily life and its relationship with real life, and it shows that teachers' level of associating mathematical modelling with real life is moderate. In the study by Akgün et al. (2013), it was determined that only one teacher partially agreed that the method of mathematical modelling represents solving daily life problems with mathematical terms. Additionally, they stated that mathematical modelling visualizes and concretizes problems in daily life, thus helping understanding. However, it was observed that teachers who stated they used mathematical modelling did not express a daily life situation in the mathematical world to their students in mathematical language. This generally shows that teachers are not proficient in the relationship between mathematical modelling and real life.

When examining the items in the Motivation sub-dimension, it can be stated that elementary mathematics teachers are aware of the importance and benefits of mathematical modeling. However, when examining the items in the Constructivism and Understanding sub-dimensions, it can be stated that they experience a lack of knowledge about mathematical modeling. In Eker's (2019) study, mathematics teachers think that modeling requires a different perspective from the traditional problem-solving approach, stating that the modeling process is both fun and useful. Additionally, they state that understanding the importance of mathematics in daily life will increase with modeling questions. This emphasizes the importance and benefits of mathematical modeling, and their findings show that teachers have high motivation but face some difficulties during modeling, which is consistent with our research results. In Saka's (2023) study, it is also indicated that teachers do not have sufficient knowledge about mathematical modeling, and this situation limits the applicability of Model-Eliciting Activities (MEA). Furthermore, it is emphasized that teachers' challenges in classroom management, activity selection, and providing feedback pose obstacles to the implementation of modeling activities. The study by Akgün et al. (2013) also supports the findings of this research, indicating that teachers lack sufficient knowledge about mathematical modeling and often confuse mathematical modeling concepts with various other concepts. Studies conducted by Albayrak and Efendioğlu (2023), Deniz and Akgün (2018), Duran, Doruk, and Kaplan (2016), Işık and Mercan (2015), İncikabı and Biber (2020), Kaya and Keşan (2022), Kertil (2008), Korkmaz

(2010), Özdemir (2014), Pilten et al. (2016), Şahal and Özdemir (2021), Tuna, Biber, and Yurt (2013), and Urhan and Dost (2016) also indicate that teachers have insufficient or incorrect knowledge about mathematical modeling. Considering the historical process of the studies conducted, it is seen that teachers still experience a lack of knowledge about mathematical modeling.

Within the scope of the current research, the results in the Understanding sub-dimension show that teachers have some difficulties in comprehending mathematical modelling. Tekin Dede and Bukova Güzel (2013), Deniz and Akgün (2018), Kaya and Keşan (2022) also reached findings supporting this situation in their studies. Sarı and Özturan Sağırlı (2020) state in their study that this is because the mathematical modelling course is not taught as a separate course in undergraduate education or is superficially covered in some courses. However, it is expected that the reflections of the mathematical modelling course, which is included at the undergraduate or master's degree level in the elementary mathematics teaching program since the 2018-2019 academic year, will be observed in educational environments. However, in Sarı and Özturan Sağırlı's (2020) study, it is observed that this is not the case, and it is determined that taking a mathematical modelling course during the undergraduate period does not cause any change in favour of mathematical modelling in their teaching process. It can be seen that teacher candidates are unable to structure the courses they took during their undergraduate period well and reflect them in their teaching activities. This situation makes it necessary to provide in-service training on mathematical modelling.

The result that teachers generally have high motivation towards mathematical modelling is supported by studies conducted by Arı, Demir, and Çakır (2023), Saka (2023), Sarı and Özturan Sağırlı (2021), and Tekin Dede and Bukova Güzel (2013), which state that teachers have high motivation in this regard, but they cannot allocate much time to mathematical modelling in their lessons due to negative conditions such as limited lesson hours, the possibility of not being able to cover the curriculum topics, and the difficulty of writing a mathematical modelling problem for each topic.

According to the data obtained in the study, there is no statistically significant difference in the attitude levels of male and female teachers towards mathematical modeling. Based on these findings, it can be concluded that gender is not a determining factor in attitudes towards mathematical modeling. Although there are conflicting results in the literature (Asempapa, 2020; Asempapa, 2022), Aslan and Yadigaroğlu's (2014) study with teacher candidates supports this situation. This also shows that the needs for education and support regarding mathematical modelling should be determined

based on general needs, not on the basis of gender. This can ensure the more effective use of these educational resources and support gender equality in education. The underlying reasons for the lack of difference in the gender variable in the research can be explained as the sample having received education at similar levels of schools, analyzing and interpreting similar topics during their educational processes, encountering similar problem situations, learning the same content, having identical teaching-learning principles, and having common practice-oriented activities.

As a result of the data obtained, there is no significant difference in the attitude levels towards mathematical modeling between teachers who graduated from the Faculty of Education and those who graduated from the Faculty of Science and Literature. Although the few of participants who graduated from the Faculty of Science and Literature makes generalization difficult, Sarı and Özturan Sağırlı's (2021) study shows that teachers who received education on mathematical modeling at university do not use mathematical modeling in their lessons, just like other teachers who did not receive such education, which supports our study.

As a result of the data obtained in the research, there is no significant difference in the attitude levels towards mathematical modeling among teachers of different age groups. These findings suggest that the attitudes of elementary mathematics teachers towards mathematical modeling do not change with age, that age is not a determining factor in attitudes towards mathematical modeling, and that teachers can exhibit the same level of attitude regardless of their age.

The data obtained show that educational degree has a significant effect on attitudes towards mathematical modeling. Elementary mathematics teachers with a master's degree with thesis exhibit higher levels of attitudes towards mathematical modeling compared to those with a bachelor's degree and a master's degree without thesis. This finding indicates that graduate education has a positive effect on attitudes towards mathematical modeling and that graduate education levels are an important factor in the attitudes of elementary mathematics teachers towards mathematical modeling. Considering that teachers with higher academic degrees exhibit more positive attitudes towards mathematical modeling, increasing the educational levels of teachers and providing graduate education opportunities to improve mathematics education could be an important strategy. In this context, encouraging and supporting participation in master's programs with thesis, as well as opening courses related to mathematical modeling at the graduate level or conducting studies in that direction, is important as it would have greater reflections on educational activities. It has been determined that theses on mathematical modeling are being prepared at the graduate and doctoral levels (Albayrak &

Çiltaş, 2017; Saka, 2023; Yenilmez & Yıldız, 2019), and it is seen that mathematics teachers are conducting studies to gain expertise in modeling. It is inevitable that this situation will have reflections in the educational environment.

Finally, it has been concluded that there is no significant difference in the attitude levels towards mathematical modeling among teachers with different levels of professional seniority. It has been observed that as teachers' professional seniority increases, their attitudes towards mathematical modeling do not change and remain at a similar level. It will be important to organize professional development programs for teachers to renew their knowledge and skills in mathematical modeling and to encourage the participation of teachers with professional seniority in these programs to keep up with current developments.

Within the scope of the current research, the following recommendations can be made: Mathematics education programs should provide comprehensive education on mathematical modeling for teacher candidates and emphasize awareness-raising activities in this regard. These training sessions should include activities that will strengthen the mathematical modeling skills of teacher candidates. Continuous professional development opportunities should be offered to support the professional development of teachers; these opportunities will allow them to update and improve their knowledge and skills regarding mathematical modeling. Additionally, encouraging policies should be implemented to increase teachers' access to graduate education opportunities, considering that teachers with a master's degree have higher attitudes towards mathematical modeling. Future research should consider other factors related to attitudes towards mathematical modeling and conduct a more comprehensive analysis. This can help us better understand the attitudes of teachers in mathematics education and the factors affecting these attitudes, and shape educational policies accordingly.

About Authors

First Author: Esra Altıntaş completed her undergraduate education at Ege University, Faculty of Science, Department of Theoretical Mathematics. She received her master's and doctoral degrees from Marmara University, Institute of Educational Sciences, Department of Mathematics Education between 2005-2007, she worked as a teaching and research assistant at Kafkas University, Faculty of Education from 2007 to 2015, she worked as a research assistant in the mathematics education program at Marmara University, Faculty of Education, and from 2015 to 2018, she served as a lecturer at Kafkas University. She received the title of associate professor in 2018 and worked in the mathematics education program at Kafkas University, Faculty of Education, until 2022. Since 2022, she has been working in the mathematics education program at Aydın Adnan Menderes University, Faculty of Education. In 2024, she was awarded the title of Professor. Her areas of expertise are mathematics education, mathematics education for gifted students and differentiated instruction.

Second Author: Şükrü İlgün graduated from faculty of education of Atatürk University as a mathematics teacher in 2000. He worked as a teacher at the Ministry of Education between 2000 and 2014, and in 2014 he started working as a faculty member at Kafkas University Dede Korkut Faculty of Education and continues to work there.

Third Author: İsmail Soytetir graduated from Dokuz Eylül University, Faculty of Education, Department of Elementary Mathematics Education in 2014. He has been working as a mathematics teacher in Aydın since 2014. In 2023, he started his master's program in the Department of Mathematics Education at Aydın Adnan Menderes University, Institute of Science, and he is continuing his education.

Conflict of Interest

The authors declare that there is no conflict of interest. The authors contributed equally to the study.

Funding

"No funding was received.".

Ethical Standards

The permission of this research was approved by decision number 4 of meeting number 10 of the ethics committee of Adnan Menderes University held on 01.12.2023. Data were collected with the permission of the scale owners. However, volunteer teachers working in public schools participated in the research.

ORCID

Esra Altıntaş https://orcid.org/0000-0003-3311-7179

Şükrü İlgün https://orcid.org/0000-0002-2842-2032

İsmail Soytetir https://orcid.org/0009-0004-2455-2608

References

Akgün, L., Çiltaş, A., Deniz, D., Çiftçi, Z., Işık, A. (2013). İlköğretim matematik öğretmenlerinin matematiksel modelleme ile ilgili farkındalıkları. *Adıyaman Üniversitesi Sosyal Bilimler Enstitüsü Dergisi,* (12), 1-34.

Albayrak, E., & Çiltaş, A. (2017). Türkiye'de matematik eğitimi alanında yayınlanan matematiksel model ve modelleme araştırmalarının betimsel içerik analizi. *Uluslararası Türk Eğitim Bilimleri Dergisi, 9*, 258-283.

Albayrak, H. B., & Efendioğlu, A. (2023). Sınıf öğretmenleri ve sınıf öğretmeni adaylarının görüşlerinden matematiksel modelleme. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi*, (65), 38-70.

Arı, A. A., Demir, B., & Çakır, E. (2023). Matematik öğretmeni adaylarının matematiksel model ve modellemeye ilişkin algıları: Bir metafor çalışması. *Kocaeli Üniversitesi Eğitim Dergisi*, *6*(1), 156-176.

Asempapa, R. S. (2020). The development of teachers' knowledge of the nature of mathematical modeling scale. *International Journal of Assessment Tools in Education*, *7*(2), 236-254.

Asempapa, R. S. (2022). Examining practicing teachers' knowledge and attitudes toward mathematical modeling. *International Journal of Education in Mathematics, Science and Technology*, *10*(2), 272-292.

Asempapa, R. S. & Brooks, G. P. (2022). Factor analysis and psychometric evaluation of the mathematical modeling attitude scale for teachers of mathematics. *Journal of Mathematics Teacher Education, 25*, 131–161.

Aslan, A., & Yadigaroğlu, M. (2013). Eğitim fakültelerindeki fen ve matematik lisansüstü öğrencilerinin model ve modelleme hakkındaki görüşleri. *Eğitim ve Öğretim Araştırmaları Dergisi*, *2*(3), 123-132.

Bal, A. P., & Doganay, A. (2014). Improving primary school prospective teachers' understanding of the mathematics modeling process. *Educational Sciences: Theory and Practice*, *14*(4), 1375-1384.

Bilen, N., & Çiltaş, A. (2015). Ortaokul matematik dersi beşinci sınıf öğretim programı'nın öğretmen görüşlerine göre matematiksel model ve modelleme açısından incelemesi. *E-Kafkas Journal of Educational Research*, *2*(2), 40-54.

Büyüköztürk, Ş., Çakmak, E. K., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2023). *Bilimsel araştırma yöntemleri* (34.baskı). Ankara: Pegem Akademi.

Creswell, J. W. (2012). Educational research Planning, conducting, and evaluating quantitative and qualitative research. New Jersey: Pearson Merrill Prentice Hall.

Dede, A. T., & Güzel, E. B. (2013). Ortaöğretim matematik öğretmenlerinin model oluşturma etkinlikleri ve matematik derslerinde kullanımlarına ilişkin görüşleri. *Bartin University Journal of Faculty of Education*, *2*(1), 300-322.

Demir, B., Sert Çelik, H., Arı, A. A. & Kaleli Yılmaz, G. (2023). Matematiksel modelleme tutum ölçeği'nin (MMTÖ) Türkçe uyarlaması. *EKEV Akademi Dergisi, 94*, 52-65.

Deniz, D., & Akgün, L. (2018). İlköğretim matematik öğretmeni adaylarının matematiksel modelleme becerilerinin incelenmesi. *Akdeniz Eğitim Araştırmaları Dergisi, 12*(24), 294-312.

Doruk, B. K. (2010). *Matematiği günlük yaşama transfer etmede matematiksel modellemenin etkisi*. Doktora Tezi, Hacettepe Üniversitesi, Ankara.

Duran, M., Doruk, M., & Kaplan, A. (2016). Matematik öğretmeni adaylarının matematiksel modelleme süreçleri: Kaplumbağa paradoksu örneği. *Cumhuriyet Uluslararası Eğitim Dergisi, 5*(4), 55-71.

Durandt, R., & Jacobs, G. J. (2014). Mathematics student teachers' approach to, experience of and attitudes towards mathematical modelling. In *Proceedings of the 5th International Conference on Mathematics, Science and Technology Education,* 70-80.

Durandt, R., Blum, W., & Lindl, A. (2022). Fostering mathematical modelling competency of South African engineering students: which influence does the teaching design have?. *Educational Studies in Mathematics, 109*(2), 361-381.

Eker, T. (2019). Matematik öğretmenlerinin matematiksel modelleme etkinliklerinde karşılaştıkları güçlükler (Yayınlanmamış yüksek lisans tezi). Mersin Üniversitesi Eğitim Bilimleri Enstitüsü. https://acikbilim.yok.gov.tr/bitstream/handle/20.500.12812/218641/yokAcikBilim_10318793.pdf?sequence=-1&isAllowed=y

Eraslan, A. (2012). Prospective elementary mathematics teachers' modeling processes on a model eliciting activity. *Educational Sciences: Theory & Practice, 12*(4), 2953-2968.

Fitri, P., & Hiltrimartin, C. (2020). Attitude of middle school students toward mathematical modelling. In *Journal of Physics: Conference Series* (Vol. 1480, No. 1, p. 012043). IOP Publishing.

Fraenkel, J. R., Wallen, N., & Hyun, H. (2012). How to design and evaluate research in education (8. b.). New York: McGraw-Hill.

Güder, Y. (2013). *Ortaokul matematik öğretmenlerinin matematiksel modellemeye ilişkin görüşleri/Opinions of secondary school mathematics teachers on mathematical modelling*. Yayımlanmamış Yüksek Lisans Tezi. Fırat Üniversitesi Eğitim Bilimleri Enstitüsü, Elazığ.

Hidayat, R., Idris, W. I. W., Qudratuddarsi, H., & Rahman, M. N. A. (2021). Validation of the Mathematical modeling attitude scale for Malaysian mathematics teachers. *Eurasia Journal of Mathematics, Science and Technology Education, 17*(12), em2047.

Işık, A., & Mercan, E. (2015). Ortaokul matematik öğretmenlerinin model ve modelleme hakkındaki görüşlerinin incelenmesi. *Kastamonu Eğitim Dergisi, 23*(4), 1835-1850.

İncikabı, S., & Biber, A. Ç. (2020). Ortaokul matematik öğretmen adaylarının matematiksel modelleme farkındalıklarının araştırılması. *Türk Akademik Yayınlar Dergisi (TAY Journal), 4*(1), 55-72.

Kaiser, G., & Sriraman, B. (2006). A global survey of ınternational perspectives on modelling in mathematics education. *ZDM, 38*(3), 302-310.

Karalı, D. (2013). *İlköğretim matematik öğretmen adaylarının matematiksel modelleme hakkındaki görüşlerinin ortaya çıkarılması*. Yüksek Lisans Tezi, Abant İzzet Baysal Üniversitesi, Bolu.

Karasar, N. (2012). *Bilimsel araştırma yöntemi*, (23. Basım), Ankara: Nobel Akademik Yayıncılık.

Kaya, D., & Keşan, C. (2022). İlköğretim matematik öğretmeni adaylarının matematiksel modelleme süreçleri: su israfı örneği. *Van Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi, 19*(3), 1068-1097.

Kertil, M. (2008). *Matematik öğretmen adaylarının problem çözme becerilerinin modelleme sürecinde incelenmesi*. Doktora Tezi, Marmara Üniversitesi, İstanbul.

Korkmaz, E. (2010). *İlköğretim matematik ve sınıf öğretmeni adaylarının matematiksel modellemeye yönelik görüşleri ve matematiksel modelleme yeterlikleri*. Yayınlanmamış doktora tezi. Balıkesir Üniversitesi Fen Bilimleri Enstitüsü, Balıkesir.

Lesh, R., & Doerr, H. M. (2003). A modeling perspective on teacher development. In R. A. Lesh & H. Doerr (Eds.), *Beyond constructivism: Models and modeling perspectives on mathematics problem solving, learning, and teaching* (pp. 3-33). Mahwah, NJ: Lawrence Erlbaum.

Lesh, R., & Harel, G. (2003). Problem solving, modeling, and local conceptual developing. *Mathematical Thinking and Learning*, *5*(2&3), 157-189.

Lesh, R., Galbraith, P. L., Haines, C. R., & Hurford, A. (2010). Modeling students' mathematical modeling competencies. *Boston, MA: Springer US. doi*, *10*, 978-1.

Mehraein, S., & Gatabi, A. R. (2014). Gender and mathematical modelling competency: primary students' performance and their attitude. *Procedia-Social and Behavioral Sciences*, *128*, 198-203.

Milli Eğitim Bakanlığı (2005). *Ortaöğretim matematik (9-12. Sınıflar) dersi öğretim programı. Milli Eğitim Bakanlığı Talim ve Terbiye Kurulu Başkanlığı*. Ankara: Devlet Kitapları Müdürlüğü Basım Evi.

Milli Eğitim Bakanlığı (2017). *Öğretmen strateji belgesi (2017-2023)*. Ankara: Öğretmen Yetiştirme ve Geliştirme Genel Müdürlüğü.

Milli Eğitim Bakanlığı (2024). Matematik dersi *öğretim programı (5, 6, 7 ve 8. sınıflar) -Türkiye Yüzyılı Maarif Modeli.* https://cdn.eba.gov.tr/icerik/GorusOneri/2024Programlar/2024programmat5678.pdf

Özdemir, E. (2014). *Matematik eğitiminde modelleme üzerine öğrenme-öğretme uygulamaları*. Yayınlanmamış doktora tezi. Balıkesir Üniversitesi Fen Bilimleri Enstitüsü, Balıkesir.

Özturan Sağırlı, M., Kırmacı, U. & Bulut, S. (2010). Türev konusunda uygulanan matematiksel modelleme yönteminin ortaöğretim öğrencilerinin akademik başarılarına ve öz düzenleme becerilerine etkisi. *Erzincan Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 3*(2), 221-247.

Pilten, P., Serin, M. K., & Işık, N. (2016). Sınıf öğretmenlerinin matematiksel modellemeye ilişkin algılarını belirlemeye yönelik bir olgubilim çalışması. *Electronic Turkish Studies*, *11*(3), *1919-1919*

Saka, E. (2023). Teachers' opinions on the applicability of model eliciting activities. *International Journal of Education, Technology and Science, 3(3), 1053-1077.*

Sarı, O. S., & Özturan Sağırlı, M. (2021). Ortaokul matematik öğretmenlerinin matematiksel modelleme hakkındaki farkındalıkları. *Erzincan Üniversitesi Eğitim Fakültesi Dergisi*, *23*(2), 335-359.

Soon, T. L., & Cheng, A. K. (2013). Pre-service secondary school teachers' knowledge in mathematical modelling–A case study. *Teaching mathematical modelling: Connecting to research and practice*, 373-384.

Şahal, M., & Özdemir, A. (2021). Matematiksel modelleme eğitiminin ilköğretim matematik öğretmeni adaylarının matematiksel modellemenin doğasına ilişkin bilgilerine katkısı: Bir eylem araştırması. *Türkiye Eğitim Dergisi*, *6*(1), 124-145.

Şahin, N., & Eraslan, A. (2019). Ortaokul matematik öğretmeni adaylarının matematik uygulamaları dersinde modelleme etkinliklerinin kullanılmasına yönelik görüşler. *Turkish Journal of Computer and Mathematics Education (TURCOMAT), 10*(2), 373-393.

Türk Dil Kurumu. (2023). *Türkçe Sözlük*. Erişim adresi: https://sozluk.gov.tr/

Tekin, A. (2012). *Matematik öğretmenlerinin model oluşturma etkinliği tasarım süreçleri ve etkinliklere yönelik görüşleri*. Yayımlanmamış Yüksek Lisans Tezi. Dokuz Eylül Üniversitesi Eğitim Bilimleri Enstitüsü, İzmir.

Tekin, A. & Bukova Güzel, E. (2011). Ortaöğretim matematik öğretmenlerinin matematiksel modellemeye ilişkin görüşlerinin belirlenmesi. *20. Eğitim Bilimleri Kurultayı*. Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi, 8-10 Eylül 2011, Burdur.

Tekin, A., Hıdıroğlu, Ç. & Bukova Güzel, E. (2011). Examining of model eliciting activities developed by prospective mathematics teachers. *Proceedings of the 35th Conference of the International Group for the Psychology of Mathematics Education*. ODTÜ, 10-15 Temmuz 2011, Ankara.

Thomas, K., & Hart, J. (2010). Pre-service teachers' perceptions of model eliciting activities. *Modeling Students' Mathematical Modeling Competencies: ICTMA 13*, 531-538.

Tuna, A., Biber, A. Ç., & Yurt, N. (2013). Matematik öğretmeni adaylarının matematiksel modelleme becerileri. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi, 33*(1), 129-146.

Tutak, T., & Güder, Y. (2014). Matematiksel modellemenin tanımı, kapsamı ve önemi. *Turkish Journal of Educational Studies, 1*(1), 173-190

Urhan, S., & Dost, Ş. (2016). Matematiksel modelleme etkinliklerinin derslerde kullanımı: öğretmen görüşleri. *Elektronik Sosyal Bilimler Dergisi,* 15(59), 1279-1295.

Yanık, H. B., Bağdat, O., & Koparan, M. (2017). Ortaokul öğretmen adaylarının matematiksel modelleme problemlerine yönelik görüşlerinin incelenmesi. *Eğitimde Nitel Araştırmalar Dergisi, 5*(1), 80-101.

Yenilmez, K., & Yıldız, Ş. (2019). Matematiksel modelleme ile ilgili lisansüstü tezlerin tematik içerik analizi. *Eskişehir Osmangazi Üniversitesi Sosyal Bilimler Dergisi, 20, 1-22. https://doi.org/10.17494/ogusbd.548180*

Osmangazi Journal of Educational Research **Volume 11(1), Spring 2024**

RESEARCH Open Access

Suggested Citation: Şahin, S., Demir, Ö., & Şevik, Y. K. (2024). Teacher disappointments from teacher's perspective. *Osmangazi Journal of Educational Research, 11*(1), 118-155.

Submitted: 18/05/2024 **Revised:** 27/08/2024 **Accepted:** 30/08/2024 **DOI:** 10.59409/ojer.1486105

Teacher Disappointments from Teacher's Perspective

***Semiha Şahin, **Ömer Demir, ***Yavuz Kamil Şevik**

Abstract. The psychological aspect of teachers in the context of the field of education has attracted significant scholarly attention in recent years due to its potential to enhance the academic achievements of students, teachers, and school leaders, as well as to cultivate a positive learning environment amidst modern uncertainties. Nonetheless, the disappointments experienced by teachers, who hold a crucial position within educational institutions, have been somewhat overlooked. The principal aim of this paper is to gain a comprehensive understanding of teachers' encounters with disappointment, specifically focusing on their daily experiences in school settings. By employing a qualitative research methodology, this investigation adopts a phenomenological framework. The application of thematic analysis enabled an in-depth exploration of teachers' experiences in relation to the phenomenon of disappointment. The analysis was rooted in data collected through semi-structured interviews with 28 teachers from schools in İzmir, Türkiye. The findings of the research reveal that the primary sources of teachers' disappointments include the education system, educational administrators, parents, students, the teaching profession, and colleagues. These key themes were meticulously examined in the study, and both the positive and negative impacts of disappointments on teachers were also deliberated.

Keywords. Teacher emotions, teacher disappointment, teacher frustration, teacher unhappiness.

* **(Responsible Author)** Prof. Dr., Dokuz Eylül University, Faculty of Education, İzmir, Türkiye

e-mail: semiha.sahin@deu.edu.tr

****** PhD Candidate, Dokuz Eylül University, Faculty of Education, İzmir, Türkiye

e-mail: zeso_omer@windowslive.com

*** PhD Candidate, Dokuz Eylül University, Faculty of Education, İzmir, Türkiye

e-mail: yksevik@icloud.com

Note: This study presented in 13th International Forum of Educational Administration (IFEA-13) organized within the Association of Educational Managers and Experts (EYUDER), Dokuz Eylül University Buca Faculty of Education on 10-15 May 2022 as an oral presentation.

The rapid pace of change in our contemporary world not only astounds us but also unveils new dimensions of emotions and thoughts. As the world undergoes constant transformation, the traditional mechanical approach to human interaction is gradually being replaced by a more nuanced understanding of managing emotions in individuals. The realm of emotions emerged as a significant area of study in the late 1800s, gained substantial attention in the 1990s, and continues to be a subject of ongoing research in contemporary times. Emotions play a significant role in the realm of education, as evidenced by the surge in academic research dedicated to this topic over the past few years, indicating a growing recognition of their importance in the educational sphere (Dilekci & Manap, 2022).

According to Sutton, the significance of emotions in the context of teaching becomes relevant when there is an indication that emotions have an impact on teachers, the teaching process, and the students involved in the educational setting (Sutton, 2007). Through the process of emotion regulation, educators are able to significantly alter the dynamics of their interactions and surroundings, thereby shaping the emotional landscapes and behaviors that will unfold in the days to come (Morris & King, 2018). Emotions, when manifested in professional settings, can elicit a wide array of internal responses in individuals, including but not limited to feelings of love, disappointment, hate, pity, fear, frustration, joy, guilt, jealousy, motivation, attention, teamwork, and creativity (Grossman & Oplatka, 2020; Seçer, 2005). Empirical research and subjective narratives from teachers and learners have indicated that the emotional experiences of both educators and students have a reciprocal and interconnected relationship, where the emotions of teachers and learners continually influence and mold one another in a dynamic manner (Zembylas, 2014; Titsworth et al., 2013). Consequently, emotions constitute an indispensable component of both work environments and social interactions (Ashkanasy et al., 2002). As correctly emphasized by Pekrun and Linnenbrink-Garcia, emotions play a crucial role in the educational process, serving not only as subjective experiences but also as essential factors influencing academic success and individual development. Emotions are not merely passively felt but actively contribute to shaping students' learning outcomes and overall personal growth (Pekrun, & Linnenbrink-Garcia, 2014).

Educational institutions have also recognized the significance of emotions in their organizational dynamics. Given that schools play a pivotal role in shaping individuals and are tasked with aligning educational practices with the overarching objectives of national education systems, the emotional well-being of teachers holds paramount importance (Argon, 2015). The determination of the role of teachers is intricately connected to the methodologies employed within educational

settings. This role is not solely defined for pedagogical purposes but also encompasses emotional considerations. When considering active methodologies, the shift in the teacher's traditional role from being primarily instructional to one of guiding students involves a specific emotional context. This emotional framework plays a crucial role in shaping and being shaped by the overall dynamics within the educational environment (Martinez-Roig et al., 2023).

Teachers facing frustration from off-topic conversations are influenced by personal factors, such as their relationships with students, teaching context, and the task at hand, making it challenging to find a universal solution for emotional issues (Morris, 2019). Research investigations have provided evidence suggesting that emotions play a significant role in impacting various aspects of the learning process, including but not limited to, attentional mechanisms, levels of motivation, utilization of learning strategies, and eventual educational achievements (Pekrun, 1992). Furthermore, it is important to note that negative emotions play a partial role in mediating the impact of teacher mindfulness on work engagement, whereas positive emotions act as a complete mediator in this relationship. These findings underscore the significance of promoting teacher mindfulness through interventions that are mindfulness-based, enhancing the competence of teachers in regulating their emotions within the realm of teacher education, and fostering a conducive classroom and school environment that supports teachers in experiencing a greater influx of positive emotions from both their students and administrator (Tao, 2022). It can be posited that the happiness of teachers significantly influences the learning outcomes of students. Studies indicate that academic achievements are generally higher in schools where teachers exhibit satisfaction and contentment in their roles (Ingersoll & Smith, 2003). Furthermore, contented teachers are more likely to be motivated and serve as positive role models for their students. Nevertheless, impediments to the happiness of teachers often stem from various challenges encountered in the workplace. Issues such as unfavorable working conditions, large class sizes, difficulties in classroom management, and administrative challenges can adversely impact the job satisfaction of teachers. Consequently, educational institutions and administrators should prioritize initiatives aimed at enhancing the happiness of teachers by addressing factors that contribute to improving their working conditions. According to this perspective, it is unquestionably believed that any emotion characterized by a pleasant quality or positive emotional tone serves as a conducive environment for learning. Conversely, any negative or unpleasant emotional state is unequivocally viewed as a hindrance to the learning process (Bachler et al., 2023).

In a study on the positive and negative emotions experienced by teachers in the classroom, disappointment was identified as one of the most common negative emotions (Jiang et al., 2022). When examining the concept of disappointment, one can identify it as a negative emotional state resulting from unfulfilled expectations or desires, as described in the literature (Brady, 2010). We can best understand disappointment by placing it within the context of societal limitations and belief systems, unmet aspirations, and the impact of standards and circumstances that lead to feelings of inadequacy through unfavorable comparisons (Greenberg & Muir, 2022). The definitions of disappointment can be categorized into two main dimensions for a more comprehensive understanding. The primary dimension pertains to unmet expectations stemming from individuals or circumstances, while the secondary dimension involves disappointment triggered by emotional responses like remorse, wrath, or self-reproach (Foster, 2013; Johnson & Connelly, 2014; Lelieveld et al., 2012). By delving into these dimensions, researchers are able to explore the multifaceted nature of disappointment and its implications on human behavior and well-being in various contexts.

When examining both national and international literature, it becomes evident that there is a scarcity of studies focusing on teachers' disappointments. Unlike research on disappointments within organizations, studies conducted within the teaching profession have predominantly identified external factors that hinder teaching and learning processes, blocked teacher objectives, and disruptive student behaviors as the key sources of disappointment for teachers (Sutton, 2007; Levering, 2000). Accepting this intra and interpersonal perspective entails acknowledging the presence of a guiding sociocultural element influencing teachers' emotional episodes, which in turn necessitates a thorough examination of their experiences and handling of frustration while taking into account the various contextual factors that surround them (Morris & King, 2018). Given the limited research on teachers' disappointments, there is a crucial need to explore deeper into this area. Specifically, comprehending the impacts of teachers' disappointments on educational activities stands as a pivotal stride towards enhancing the quality of teaching.

Studies exploring disappointment within educational institutions have traditionally examine closely the external elements contributing to teachers' dissatisfaction with their jobs (Çevik, 2019; Demir, 2021; Dinham & Scott, 2000; Epstein et al., 2018; Grossman & Oplatka, 2020; Ingersoll & Smith, 2003; Jennings & Greenberg, 2009; Klassen et al., 2010, 2012; Lazarus & Folkman, 1984; Leithwood et al., 2004; Morris & King, 2018; Özgan & Bozbayındır, 2011; Skaalvik & Skaalvik, 2010; Sutton, 2007; Tang & Hu, 2022; Yıldırım & Tabak, 2019; Zeichner & Gore, 1990; Zhao et al., 2022). Nevertheless, investigations among teachers have underscored the significance of

concentrating on classroom dynamics as primary sources of their disappointment. Student misbehavior can dishearten teachers and adversely influence classroom interactions. When considering this aspect, it is crucial to acknowledge that this is reciprocal and students may encounter discouraging attitudes and ineffective teaching methods from their instructors, resulting in a sense of disappointment within them. Consequently, this disappointment can trigger a decline in motivation towards learning. Students who encounter elevated emotional reactivity when faced with stress or disappointment, coupled with a lack of validation for the intensity of their emotions, may encounter challenges in regulating their behavioral reactions within the framework of these emotions, consequently elevating their susceptibility to engaging in aggressive behaviors (Byrd et al., 2023). This observation underscores the significance of disappointment as a crucial mediating factor through which various influences exert their effects on students' levels of demotivation, offering valuable insights into the complex dynamics at play in educational setting (Tang & Hu, 2022). Consequently, a more intricate examination of classroom dynamics is imperative to devise effective strategies for alleviating teachers' disappointment.

Understanding how the various factors triggering teachers' disappointment interplay within diverse contexts, such as educational regulations, management strategies, and student conduct, is crucial. Exploring the process of teachers' learning is essential in the field of education as it provides valuable insights into the various factors that influence professional growth. It is important to illuminate the urgent requirements for acknowledging and validating the harmonious coexistence of teachers' emotions and their continuous professional development (Yin Yung, 2022). By doing so, educational leaders and policymakers can formulate more efficient approaches to enhance teachers' job contentment. Ultimately, further research on teachers' disappointments holds the promise of instigating positive transformations within the education sector. These studies can empower teachers to lead their students in a more joyful, inspired, and efficient manner, ultimately fostering success within the education system. Moreover, teachers' discontent with the current educational system, feeling undervalued, constantly changing educational methodologies, regulatory frameworks, and the absence of internal fairness have started to fuel a sense of disappointment among numerous educators (Özgan & Bozbayındır, 2011).

In the research carried out in Türkiye/Turkey by Yıldırım and Tabak (2019), it was discovered that pre-service teachers commonly experienced emotions such as compassion, love, and boredom at high intensity levels. These emotional states played a significant role in shaping the emotional landscape of pre-service teachers during their educational journey. Similarly, Çevik's (2019) study

highlighted that classroom teachers encountered a wide range of emotions, including both positive ones like happiness, love, hope, pride, and excitement, as well as negative ones such as disappointment, regret, boredom, helplessness, and anger, with a notable increase in negative emotions over time compared to their initial years in the profession. This shift in emotional balance over the years reflects the evolving emotional dynamics within the teaching profession. The research indicated that positive emotions and experiences had a constructive impact on teachers' professional lives, while negative emotions and events had a detrimental effect. Another study reached a similar conclusion. Teacher emotion labor, commonly referred to as the emotional work and effort invested by educators in managing their emotions in the classroom setting, played a pivotal role as the focal point for the adjustments and changes made to their teaching methods and approaches, thereby influencing the way in which they interacted with their students and delivered the curriculum (Zhao et al., 2022).

Seçer's (2005) study delved into the concept of emotion from sociological, psychological, and organizational theory perspectives, exploring the role of rationality in emotional labor. By examining the broader emotional landscape of teachers and assessing the level of emotion management among school administrators, Erkol (2021) aimed to investigate the influence of cultural values on emotion regulation. Furthermore, Demir (2021) focused on the emotion management strategies employed by high school students, shedding light on a different aspect of emotional dynamics within educational settings. Additionally, seminal works by Grossman and Oplatka (2020) and Sutton (2007) provide crucial insights into teachers' disappointments related to their profession, contributing significantly to the understanding of teachers' emotional experiences and their interconnectedness with their work environment.

The primary objective of this study is to uncover the disappointments that teachers encounter as employees of educational institutions, analyze these disappointments based on teachers' perspectives, and identify their underlying causes. The research problem centers on exploring teachers' viewpoints regarding the disappointments they face while fulfilling their professional duties. Understanding the nature of teachers' disappointments in school settings, concerning students, colleagues, school administration, and the broader educational system, holds paramount importance. Given the limited existing literature on teachers' disappointments from the teachers' standpoint, this study is positioned as original and poised to enrich the academic discourse by capturing the insights of teachers working in public schools under the Ministry of National Education across various educational levels primary school, secondary school, special education, and high school.

Method

In the methodology section of the research, detailed elucidations are provided regarding the theoretical framework that underpins the research model, the composition and characteristics of the study group, the methods and procedures employed for data collection, as well as the analytical techniques utilized for data analysis and interpretation.

Research Model

The research was carried out employing a phenomenological approach, which is recognized as one of the qualitative research methodologies widely used in the academic field. Phenomenology searches deeply into the subjective experiences of individuals, aiming to elucidate the underlying meanings attributed to these experiences (Bogdan & Biklen, 2007). Particularly in cases where the phenomena under investigation are beyond our full comprehension, the phenomenological research design provides a robust framework for us to interpret and navigate the complexities of the world we inhabit and the experiences we encounter (Yıldırım & Şimşek, 2005). Within the context of this particular study, the phenomenological approach served as a valuable instrument in gaining insights (Denzin & Lincoln, 2011) into the challenges and disappointments faced by teachers within their professional domains. By capturing and analyzing the narratives of teachers' experiences, the objective was to uncover a more profound understanding of the origins, catalysts, and outcomes of these disappointments. Through the lens of the phenomenological approach, the aim is to construct a nuanced and comprehensive interpretation rooted in the personal narratives of individuals' lived experiences (Lin, 2013). Ultimately, the primary goal of this research endeavor is to explore and scrutinize the various disappointments encountered by educators in the course of their professional endeavors.

Study Group

The research study comprises a group of teachers employed at various educational institutions such as BİLSEM, special education, primary school, secondary school, and high school within the geographical boundaries of the Bornova district located in the province of Izmir. The selection process followed the guidelines of the maximum variation sampling technique, a method categorized under purposive sampling. The primary objective of employing the maximum variation sampling approach is not merely to ensure diversity for the purpose of generalization, but rather to detect any common phenomena present across a range of diverse scenarios and to unveil distinct dimensions of each situation based on these variations (Yıldırım & Şimşek, 2005). The determination of the total

number of teachers included in the study group was made through a collective decision taken by the researchers once the research had reached the saturation point, indicating that ample information had been gathered on the subject under investigation leading to the commencement of repeated interviews. According to Creswell (2007), the saturation point is characterized as the juncture at which researchers come to a consensus that they have acquired adequate data pertinent to the topic being studied. In the context of this particular research, a total of 28 teachers from the official BİLSEM (Science and Art Center), primary school, secondary school, special education, and high school levels, all operating under the jurisdiction of the Ministry of National Education in the Bornova district of Izmir, were actively involved in the interview process. Detailed demographic attributes pertaining to the composition of the study group can be found in Table 1 for reference and analysis.

Table 1.

Demographic Characteristics of the Study Group

Variable	**Range**	**n**	**%**
Age	20-30 Years-old	7	25
	31-40 Years-old	14	50
	41-50 Years-old	7	25
Total		28	100
Gender	Male	10	64.3
	Female	18	35.7
Total		28	100
School Type	Primary School	7	25
	Secondary School	11	39.3
	High School	8	28.6
	Special Education	1	3.6
	Bilsem	1	3.6
Total		28	100
Education Status	Postgraduate	9	32.1
	Bachelor's Degree	19	67.9
Total		28	100
Years of Service	1-9 Years	10	35.7
	10-20 Years	13	46.4
	21-30 Years	5	17.9
Total		28	100

Data Collection Tools

Before the commencement of the face-to-face interviews carried out for data collection, participants were duly notified that their involvement in the research was voluntary. They were assured that they had the liberty to withdraw from the study at any point without any repercussions. Furthermore, it was emphasized that no data would be utilized without their explicit consent. Throughout the study, participants were assigned a code to ensure anonymity, and their identities

were not retained in any data collection instrument. A semi-structured interview protocol, encompassing 3 core questions along with additional probing inquiries, was employed for the face-to-face interviews. This interview form was specifically devised to gather insights from educators regarding the challenges encountered in public educational institutions ranging from preschools to high schools. Subsequently, the interview form underwent meticulous scrutiny by 3 distinguished scholars specializing in educational administration and supervision. Following the incorporation of recommendations provided by these experts, 2 preliminary interviews were conducted to refine the clarity of the questions based on the insights garnered from the pilot study.

The questions incorporated in the interview protocol are as follows:

1) What are the underlying causes of the disappointments you face in the educational setting?

2) In the context of your educational experiences, could you elaborate on instances that have led to feelings of disappointment?

3) How do these challenges impact your personal development, professional demeanor, and daily life, both positively and negatively?

The interview form underwent rigorous validation processes to ensure both face and content validity. The interviews were arranged at various time slots to accommodate the schedules of the participating teachers. Participants were verbally informed about the issues in the consent form. Then, the consent form was given to them, and time was given, to read and sign, and after it was seen that they explicitly approved to participate in the research and approved the consent form, the interview section was started. Participants were first asked demographic questions. The interviews were then conducted with the explicit consent of the participants and with full information about data confidentiality, and were audio-recorded on mobile phones for accuracy. The duration of the face-to-face interviews was at least 32 minutes and at most 41 minutes.

Data Analysis

The examination of the interviews was conducted through the application of the thematic content analysis technique commonly utilized in qualitative research methodologies as discussed by Creswell (2007). This method involves the systematic process of deconstructing the gathered data into relevant concepts and themes by employing various codes, subsequently presenting them in a coherent manner for the comprehension of the audience (Yıldırım & Şimşek, 2005). In order to ensure the integrity and consistency of the research findings, the interviews were meticulously recorded with

the aid of electronic recording devices. Subsequently, these recordings were transcribed into written texts and provided to the researchers for further scrutiny and analysis. The researchers meticulously reviewed the texts in conjunction with the audio recordings, engaging in a comprehensive cross-verification process. Furthermore, three additional participants who were accessible from the study cohort were invited to review their respective transcripts, with the accuracy of their accounts being duly validated. Following the confirmation of text accuracy, the transcripts were disseminated among three researchers to initiate the coding process.

The researchers diligently examined and coded the transcripts repetitively over the course of a week, culminating in a subsequent meeting convened to discuss the codes that had been generated. Within this meeting, attended by all researchers, a comprehensive code table was devised, outlining detailed explanations of the agreed-upon codes. Subsequently, the researchers were tasked with conducting a secondary round of coding utilizing this newly established code table. Upon completion of this coding process, wherein the researchers cross-referenced the codes with the transcripts over another week-long period, a second meeting was convened. During this meeting, the researchers first addressed the codes for which a consensus had been reached before proceeding to develop overarching themes. In addition, the researchers took the necessary step of providing the code table, coding results, and emerging themes to two selected participants to establish the trustworthiness and dependability of the research findings. These two chosen participants were each allocated their individual sets of scripts and the predetermined codes derived from these scripts, and were then tasked with the validation process. This meticulous approach aimed to ensure the accuracy and consistency of the coding process and subsequent analysis, thereby enhancing the overall credibility and robustness of the study, in alignment with the principles outlined by Maxwell (2009). Additionally, to bolster the credibility of the research, substantial emphasis was placed on presenting the participants' own words prominently throughout the study, while limiting the extent of explanations provided. Finally, a third meeting was conducted to deliberate on the various phases of the research, with each step subjected to rigorous self-assessment to mitigate potential biases. These methodical processes were implemented with the overarching goal of enhancing the validity and reliability of the research findings (Creswell, 2007).

Results

In this particular section of the research, a comprehensive elucidation is provided regarding the outcomes derived from the study, including detailed discussions, conclusive remarks, and insightful recommendations. Through a meticulous examination of the findings, the identities of the teachers

whose viewpoints were solicited were systematically encoded and represented as "T1, T2, T3, ..., T26, T27, T28".

Findings for the First Question

The inquiry posed to the individuals comprising the study cohort pertained to their reflections on the origins of the various instances of disappointments encountered within the educational setting, specifically focusing on the query "What are the underlying causes of the disappointments you face in the educational setting?" This line of questioning was further reinforced through the incorporation of supplementary probing inquiries designed to delve into the underlying elements that precipitate instances of disappointments among educators operating within educational institutions. A comprehensive tabulation detailing the responses garnered from these inquiries is delineated in the subsequent sections for elucidation and analysis.

Table 2.

Teachers' Views on the Source of the Disappointments They Experienced at School

THEMES	**CODES**		***f***	**Teachers (%)**
Education System	Constant System Change		4	14
	Assignment		2	7
	Educational Philosophy and Policy		2	7
	Political Activities		1	4
	Inability to Act Autonomously		1	4
	Forcing Professional Development		1	4
	Bureaucratic Obstacles		1	4
Education Administrators	Administrator Approaches		11	39
	Unqualified Administrators		5	18
	Conflict with Administrators		3	11
	Negligence of Administrators		2	7
Parents	Intervention in Education		6	21
	Disturbing Behaviors		4	14
	Lack of Support		2	7
Students	Indifference		7	25
	Failure		5	18
	Transformation of Student Profile		2	7
	Cultural Differences		1	4
Teaching Profession	Inadequacy of University Education		6	21
	Physical	Financial Dissatisfaction	15	50
		Inadequacy of Learning Environment	10	36
		Social Life	7	18
	Psychological	Loss of Respect for the Profession	14	39
		Professional Expectations	13	32
		Lack of Professional Satisfaction	2	7

Teachers expressed their opinions about the code "Assignment" (*f*=2) as follows: "When we look at it, many teachers are caught up in the status quo and lead a static life after their assignment. This situation has a lot to do with the psychology of the teacher; the reactive behavior of each actor towards the event affects the personality and mood of the teacher over time. Unfortunately, it is impossible to reduce disappointment to a single point. The disappointments I have experienced do not mean that disappointments will be disappointing for everyone, and I have faced many situations what I consider normal, someone else considers extraordinary disappointing. This cannot be distinguished with sharp lines" (T12). "There can be many reasons. I can say reasons such as not being able to apply the knowledge gained in theory in practice, communication problems or misunderstandings with both teachers and administrators, disagreements, not being appointed after studying for years, not being paid the wage that is economically deserved, not valuing teachers, students not respecting teachers enough" (T20).

Regarding the code "Political Activities"; "I can say that success is not appreciated; favoritism, insufficient salary and using education for political activities is common. I can't speak too openly, but I think everyone is aware of what is it is. Political thoughts can find a place in the school environment. I think people with these thoughts should be purified from the education system" (T23). Also, when the "Educational Philosophy and Policy" code was examined in detail; "The policy carried out by the state is more than enough to upset you; complaint platforms such as CIMER etc. have destroyed the identity of the teacher and made him/her anonymous" (T26). "First of all, the decrease in purchasing power indexed to the economic picture of the country and the wrong policies followed in education negatively affect the expectations of the teachers" (T22). Moreover, when the "Constant System Change" code is analyzed; "The disappointment of teachers with the national education system is related to the constant change of the system. Especially teachers with exam group students may experience difficulties due to this situation" (T10).

Regarding the "Inability to Act Autonomously" code; "Teachers may experience disappointment especially because teachers cannot act autonomously, and their expertise is not respected. Teachers may feel under pressure. They cannot do what they want for children in their classrooms" (T10). Likewise, when the code "Forcing Professional Development" is examined; "Another one is that the teacher in the system is in such a big cycle that everything he/she thinks of developing himself/herself both personally and professionally starts to feel like a burden" (T19). Also, in the "Bureaucratic Barriers" code; "Bureaucratic barriers cause disappointments when they are forced to see a lot of paperwork and many people while getting a job done. This paperwork density and waiting in line robs teachers' time and prevents us from focusing on other tasks" (T15).

In addition, when the theme of "Educational Administrators" (*f*=21) was analyzed, teachers expressed their opinions about the code "Administrator Approaches" (*f*=11) as follows: "I was

disappointed not to receive appreciation from anyone at the end of something I had worked hard for. For example, I worked for days for an important duty and at the end of the day, I was very disappointed that no one even said "Teacher, Thank you for everything." I was very disappointed that no one even said such sentences" (S28). "In other words, there is a managerial mentality that says "come on, you are a teacher, you are a hard worker, you are good, you are this and that" but does not recognize the teacher when the first complaint is made. Enough is enough, teaching is a professional profession. It is not a profession of benevolence and charity. Why don't the state elders and the administrators in charge understand this? Can you say the same to the soldier, let's say you are unselfish, you are good, you are the king, don't give them their salary or cut their opportunities, let's see what happens. Isn't the soldier also a state employee, and this creates great disappointment in me" (T26).

Regarding the code "Unqualified Administrators" (*f*=5); "Our profession is not valued. Non-merit administrators alienate us from the profession. The fact that instead of merit, buddy-buddy-sergeant relations and political will play a role for promotion" (T13). "My biggest disappointment was the attitudes of administrators without merit. In particular, I encountered administrators who did not see, support and try to hinder our efforts. When we got a degree in the TÜBİTAK regional exhibition, the branch manager called us to his room and then took us out of his room without listening to us, saying why did you come here? Again, they gave certificates of achievement to their acquaintances, but those who really deserved it were not appreciated even verbally. Although these caused disappointments, we continue to work with love because our main duty is to serve our homeland by educating our children" (T6). Moreover, regarding the code "Negligence of Administrators" (*f*=2); "I think that the basis of the disappointments is due to the institution and living conditions. I do not think that the ministry and our country give the necessary importance and value to our profession. We encounter an approach outside of our professional definition" (T19); "Teachers, one of the most important elements of education, are ignored by governments and ministries" (T13). Besides, in the code "Conflict with Administrator" (*f*=3); "There may be many reasons. Not being able to apply the knowledge gained in theory in practice, communication problems with both teachers and administrators, or misunderstandings, disagreements and arguments are disappointing for me. It is very painful and insulting when administrators make a big deal out of small situations and then they hold a grudge and plan to victimize you by bringing it up in your first trouble" (T20).

When the theme of "Parents" (*f*=12) was examined, "Lack of Support" (*f*=2); "As a village teacher, I can say this: I am working in a region where parental support is almost non-existent. This was a big disappointment for me in my first year of office and still is..." (T18). Furthermore, upon scrutinizing the code "Intervention in Education" (*f*=6); "Of course, this is not only the fault of the children but also the parents, they think they are more knowledgeable than the teacher and they want to interfere in everything" (T16); "Instead of understanding and respecting the work done by teachers, parents can easily interfere in

education and even give advice" (T10); " Parents' expectations are different, they try to interfere with our profession, for example, some of them say, "You give too little homework", the other one says, "Teacher, you give too much homework, give less"..." (T7); "Sometimes parents try to give us advice about our profession as if they have a command of the teaching profession and always think that their children are right" (T4). Also, in the code of "Disturbing Behaviors" (*f*=4); "Parents' accusatory attitudes towards teachers under all circumstances and spoiled generation are among the reasons why teachers experience disappointments. In addition, the fact that teachers who work for years in the east cannot be stationed places they want for a long time and that they cannot get the wages they deserve also lead to disappointments" (T6).

Besides, when the theme of "Students" (*f*=15) was analyzed; "Failure" (*f*=5); "We want to observe that all the efforts we make are successful, but we observe that this success is not always seen. I think that the teacher's effort alone is often insufficient. Sometimes so much effort is given to a student, but the child does not study and fails. The student's failure and the grades they get drag me into a great disappointment" (T1); "Teaching is a multidimensional profession and disappointments can occur differently. Maybe it is mobbing by the school principal, maybe it is not being able to get the return for the efforts of the students. When students do not study and take responsibility, in short, when they fail at school, it creates disappointment in me" (T17). Also, upon examination of the code "Lack of interest" (*f*=7); "The biggest disappointment for me was the students who did not want to learn, I keep struggling to teach something to people who never want to learn a single word, this is a very tiring thing for me, and the colleagues who do not understand me are another issue, as well as the administrators who stand in my way when I want to do something" (T24); "Inadequate teacher salaries, irresponsible students and administrators, having to teach in the classical way within the framework of the impossibilities of most schools, and overcrowded classrooms are inevitable to cause disappointment in teachers over time" (T14). Furthermore, considering the code "Cultural Differences" (*f*=1); "Many factors such as the problems of foreign students getting used to the culture cause disappointment in teachers. We experience disappointment especially when Syrian students try to integrate into our education system. Language problems and cultural problems; I think it is also very difficult for the student to get used to us. When all these situations are taken into consideration, it is impossible not to experience disappointment" (T14). In addition, upon scrutiny, the script titled "Transformation of Student Profile " (*f*=2) is analyzed; "Although I define myself as a new generation teacher ... Not being able to keep up with the new generation, not being able to adapt to them, their aimlessness leads me to a great concern about the future" (T25); "I think the constantly changing student profile is a great disappointment. The fact that students are a completely changing generation with social media tools such as tiktok etc. upsets us, the teachers. Failure to see the behaviors expected from students is one of the most important reasons for this. Even the way the students dress has changed now, long hair, earrings, dyed hair, it is hard to call a student a student" (T18).

Upon scrutiny, the theme titled "Teaching Profession" (*f*=67); "Inadequacy of University Education" (*f*=6); "Based on all these, it is very difficult to express this issue in such a short way. The biggest disappointment is the mismatch between expectation and reality. This is the biggest reason for the disappointment of a teacher who has just graduated from university and has never seen a classroom. It is very difficult for him/her ….. to shape them at a level that the student can understand. Anyway, the biggest excitement or disappointment happens at first. Then we accept the situation and as this peak situation decreases over time, comfort becomes inevitable. As long as there are no unexpected or unforeseen new situations, we enjoy our comfort zone" (T12); "The education received at the university and the practical training in schools in certain periods are not sufficient to prepare them for the situations they face when they are assigned. The theoretical education received according to idealized conditions and the internships they experience in public schools in the provinces where they receive university education cannot prepare prospective teachers well enough to produce solutions to the problems they may encounter in reality. For this reason, teachers who cannot find what they expect in the schools they are assigned with different expectations may experience disappointment" (T10).

As a sub-code of the main code "Physical"; "Financial Dissatisfaction" (*f*=15) is examined; "I think of the disappointments in the profession by dividing them into two as material and spiritual. The material financial difficulties and trying to keep up with the expensive living conditions wear people out and this situation continues throughout our professional life. Of course, although savings or expenditures are personalized, it would not be wrong to say that the income provided to teachers as a country is behind compared to other developed countries. Although this fact is not felt much in the first years of the profession, I think it turns into disappointment in the following years" (T17). Also, when the sub-code "Social Life" (*f*=7) is analyzed; "At the same time, the province/district/regional conditions where the school is located constitute one of the major obstacles for the teacher to hold on to the profession and be successful. It would not be wrong to add economic conditions to the inadequacy of regional conditions; in fact, great economic deprivation lies under the inadequacy of regional conditions. Unfortunately, I cannot go without mentioning the socio-economic inequality, the negativities in this society's view of the profession, it is impossible to change them, why teachers are not liked; why teachers are lying down, this situation should be investigated" (T15). Likewise, when the sub-code "Inadequacy of Learning Environment" (*f*=10) is examined; "I think that learning by doing and experiencing should be provided in the same way in all schools. Similar environments should be provided to all students" (T1); "It is inevitable that reasons such as insufficient teacher salaries, irresponsible students and administrators, having to teach the lesson in the classical way within the framework of the impossibilities of most schools, and overcrowded classrooms will cause disappointment in the teacher over time" (T14).

As a sub-code of the main code "Psychological"; " Lack of Professional Satisfaction" (*f*=2) is examined; "I can say that teachers are not appreciated for their achievements, that part of their educational life is not teacher-based, that there is no teacher satisfaction and that they are not emotionally satisfied" (T27). Additionally, when the sub-code "Professional Expectations" (*f*=13) is analyzed; "One of the biggest factors of disappointment is to enter into expectations that are disconnected from reality, or it means that we fall into a situation where the conditions are no longer enough to produce the results we desire. This also has to do with taking ourselves seriously and vice versa. It's about not seeing ourselves as we are, because we avoid facing reality. If we are on a path to get somewhere and there is an obstacle in the way and avoiding that obstacle prevents us from going further, we should not avoid that obstacle. The best thing to do is to be willingly and voluntarily exposed to things that we are afraid of or that affect us emotionally and be prepared for what it will transform us into, whereas the biggest disappointment here is not having that mental mindset and being emotionally weak and constantly running away from what we must face. It's very difficult to schematize it before we experience that what we're facing is different from what we think it is. We have templates in our head, and we perceive the world in these templates. For example, there are three different terms, and they are very unrelated to each other, but it is very difficult to talk or explain something to a second person who is not familiar with the professional jargon or the literature, because the second person has only two templates in his/her head. Let's say we have three templates (A, B and C). In this case the person we are talking to has two templates in his/her mind, A and B, but we are talking about C. In this case, the person accepts the C template as it should be by including it in B or A, which he finds closest to him" (T12); "The teacher who starts his/her career with great excitement and energy is often disappointed with the school where he/she is assigned, the administration, student and parent profile. He/she wants to see highly respectful students who are hungry for knowledge and always want to learn new things. They want to see smiling parents who have raised their children like flowers. He would like to see an administrator who is like a speedy rescue in every difficulty and fatigue. Unfortunately, most of the time they do not get the situations they want to see and live in. This creates disappointment for the teacher. When considering about the situation we are in, I envy our old teachers, because we were very respectful students. If we saw our teachers on the road, let alone complaining, we would change our way, we respected them so much that we couldn't bear to see them upset. Nowadays, students have gone so far astray that they almost pull down the teacher's pants. This is a great disappointment for me" (T16). What is more, upon examination of the code "Loss of Respect for the Profession" (*f*=14); "In addition to this, the teaching profession is becoming a profession that is increasingly discredited. Teachers are not given the value and prestige they deserve both in the eyes of students and parents and in the public opinion. Teachers may experience disappointment especially because teachers cannot act autonomously, and their expertise is not respected" (T10).

Findings for the Second Question

The participants who were part of the study group were prompted with the following inquiry: "In the context of your educational experiences, could you elaborate on instances that have led to feelings of disappointment?" This question was supplemented with a series of probing inquiries aimed at unearthing the specific instances of disappointments encountered by teachers within the school environment. The subsequent sections showcase the tabulated responses provided by the participants in relation to the aforementioned queries.

Tablo 3.

Main Themes Related to the Incidents leads to Disappointments Experienced by Teachers at School

Main Themes	***f***	**%**
Parents	53	21
Education System	52	21
Students	50	20
Colleagues	49	20
Education Administrators	43	18

When Table 3 is examined, a total of five main themes related to the second question were formed, namely "Parents (*f*=53)", "Education System (*f*=52)", "Students (*f*=50)", " Colleagues (*f*=49)" and " Education Administrators (*f*=43)". Sub-themes, codes and sub-codes of the main themes above are shown in Tables 3.1, 3.2, 3.3, 3.4, and 3.5 respectively.

Table 4.

Codes Related to the "Parents" Theme of the Disappointments Experienced by Teachers at School

Theme	**Codes**	***F***	**Teachers (%)**
Parents	Indifference	13	43
	Having Different Expectations	5	18
	Considering Child Right in Every Situation	5	18
	Not Respecting Work Hours	5	14
	Not Respecting Expertise	5	18
	Making Official Complaints	4	14
	Not Accepting the Child's Situation	3	11
	Helicopter Parent	2	7
	Expecting Privilege	2	7
	Being Open to the Student's Manipulation	2	7
	Condemn the Teacher	2	7
	Negative Behaviors towards the Teacher	2	7
	Gender Discrimination	1	4
	Seeing the Child as an Income Generator	1	4
	Seeing the Teacher as a Babysitter	1	4

Upon analyzing the code "Indifference" (*f*=13); "All school types I worked in were vocational and technical Anatolian high schools. Since they were disadvantaged regional schools, I was able to see the parents of most of my students almost one or two times for 4 years. When I asked them why they did not come to school when they came, even though it was rare, the answer of most of my parents was that "I could not find time to work for these children". Indifference and broken families are my biggest disappointment about parents" (T9); "A student whose parents are concerned usually does not cause problems. Indifferent and irresponsible parents cause disappointment. I told an illiterate 6th grade student that we should study an hour before school started, but neither the child nor her parents came. His mother didn't care. She had an older sister who went to high school. When I asked the boy if she would not help you, he said that his sister was also indifferent. A child left to his fate, no matter how eager and intelligent he is, is lost among such families" (T14). Moreover, regarding the code "Negative Behaviors towards the Teacher" (*f*=2); "There are negativities in the parents' point of view towards the teacher, there is a constant aim to look down on the teacher. Not to mention the fact that they belittle the teacher at every opportunity, I think parents have a complex. I really wonder what lies underneath this, why parents have such a negative view of teachers" (T15). Also, upon scrutinizing the code "Seeing the Child as an Income Generator" (*f*=1); "Unfortunately, parents are not educated enough themselves, so their children are not enthusiastic about reading, reading requires a certain cost, and if the student is not very successful, the parent is not in favor of studying, he wants his child to work as soon as possible and get into life and earn money, last year I met with a parent, he came to ask about the situation of the male student, he complained that his child did not study, he said that he had nearly 1000 small cattle and that the child preferred to take care of them" (T24). Likewise, upon examination of the code "Helicopter Parent" (*f*=2); "Parents make and are ready to make all kinds of sacrifices for their children. Parents are incredibly concerned about the future of their children and shaping their future is one of the biggest life goals for them. For a living creature to sacrifice itself for its own offspring is the greatest source of pleasure for it, this is an instinct that exists in living things. If we apply this to humans, a parent always wants the best for their child or children and is overprotective. This protective behavior makes it very difficult for children to become self-confident individuals. For a long time, the child cannot act as an individual and cannot make decisions. Making decisions means taking responsibility, and the greatest power is to take decisions on the side and to believe that this decision is right and to put it into practice, and leaders are strong because they do exactly this. I have seen such parents who come to the classroom, pick up the books under the desk, tie their shoes and feed them. The student who cannot take even this much responsibility, who cannot organize himself/herself and therefore cannot individualize, reflects this very clearly in his/her attitude in the lesson. Subconsciously, they develop a belief that why do I have to work for these things, my family is already taking care of me. Unfortunately, they do not develop the need and belief in the profession they will do when they are on their own in the future and the knowledge required for this profession. Families should contribute to the preparation of their children for transition rituals and should be supported" (T12).

Table 5.

Codes Related to the "Students" Theme of the Disappointments Experienced by Teachers at School

Themes	Codes		*f*	Teachers (%)
Students	Wasted Efforts		10	36
	Lack of Purpose		8	29
	Readiness Level		2	7
	Language Culture Problems		1	4
	Negative Behaviors	Disrespectful Behaviors	8	29
		Indifference	6	21
		Excessive Use of Social Media	3	11
		Ignoring Rules	3	11
		Breaking Promises	2	7
		Manipulating Parents	1	4
		Unnecessary Complaints	1	4
		Threatening	1	4

Upon scrutiny, the script titled "Wasted Efforts" (*f*=10) is analyzed; "One of the main disappointments that teachers experience with students is that the teacher thinks that the students understand him/herself and/or his/her lesson when he/she explains it. Teachers who do not receive feedback about the subjects or activities taught in the lesson may experience disappointment. For example, if the teacher does not get the results, he/she expected after the assessment and evaluation, the teacher feels disappointed and starts to question the education method. He/she thinks why success was not achieved" (T10). Similarly, upon scrutiny, the script titled "Lack of Purpose" (*f*=8); "They never want to learn anything, they are kept in the classroom by force, as if they were forced to go to school by their families. I want to show them that knowledge is not something terrible. I want to show them that learning has fun sides, but it is very difficult to make a person who does not want to cooperate, and it is very exhausting, and I am constantly compromising myself. Sometimes I don't recognize myself and the other day I found myself trying to persuade a student to give his pencil to another student. I have students who don't bring pencils even though they know they are going to take an exam and there are not only a few of them" (T24). Besides, upon scrutiny of the code "Disrespectful Behaviors" (*f*=8); "I think the biggest disappointment about the students may be the reasons such as disrespect, insulting, not listening to the teacher. For example, when I hear students using foul language in class or swearing when talking among themselves about another teacher, it bothers me. Sometimes I say that in our time there was respect for the teacher, and we were shy, but the new generation is not like that. This attitude of the students creates disappointment in me" (T20).

Table 6.

Codes Related to the "Education Administrators" Theme of the Disappointments Experienced by Teachers at School

Themes	Codes	*f*	Teachers (%)
Education Administrators	Not Acting Justly	9	29
	Mobbing	6	18
	Failure to Meet Expectations	5	18
	Not Supporting the Teacher During Hard Times	4	14
	Not Appreciating	4	14
	Communication Skills	3	11
	Not Complying with Legislation and Rules	3	11
	To Act Biased According to the Union	3	11
	Not Being Solution Oriented	2	7
	Being Inexperienced	1	4
	Having Excessive Expectations	1	4
	Paper Based Management	1	4
	Long and Boring Meetings	1	4

Regarding the code "Failure to Meet Expectations" (*f*=5); "Inadequate administrators who do not have leadership qualities... When you look at most school principals, we cannot see that they have not even picked up a book, have not read a book, have no desire to educate and develop themselves scientifically, academically or in terms of field, and they prevent teachers who want to improve themselves. Most of them are selected through methods such as unions etc. This has a negative effect on teachers' willingness" (T23). Similarly, upon examination of the code "Lack of Appreciation" (*f*=4); "A form of education carried out in cooperation with the school administrator leads both teachers to enjoy their working environment and to increase success, which is one of the most important outcomes of the education process. Teachers who have problems with the school administration may be reluctant to do their jobs and their commitment to the institution they work for decreases. For example, a teacher whose work is not appreciated or constantly criticized by the school principal will experience disappointment" (T5).

Table 7.

Codes Related to the "Education System" Theme of the Disappointments Experienced by Teachers at School

Themes	Codes		*f*	Teachers (%)
Education System	Education	Curriculum	6	18
		Constant Changes in the Education System	4	14
		Constant Changes in the Evaluation System	2	7
		Inadequacy of the Scope of Auxiliary Educational Resources	2	7
		Not Failing the Class	1	4
		Lack of Adequate Supervision	1	4
	Education Management	Educational Policies	5	18
		Reducing Teacher Authority	2	7
		One-sided View (from the Student's Perspective)	2	7
		Appointing Unqualified Administrators	2	7
		Inadequacy of Central Administration	2	7
		Political Relations	2	7
		Bureaucratic Obstacles	2	7
		Force to Make Unqualified Projects	2	7
		Not Taking Expectations into Consideration	1	4
		Assigning Drudgery	1	4
	Personnel Procedures	Not Being Able to Relocate (Transfer)	5	14
		Not Supporting Staff	2	7
		Not Giving Opportunities for Self-development	2	7
		Not Being Able to Allocate Time for Self-development	1	4
		Being Supernumerary	1	4
		Long Duration of Personnel Procedures	1	4

Upon analyzing the code "Curriculum" (*f*=6); "I felt like saying that it should be completely changed. There is a curriculum that tries to robotize the students and dulls their creativity and questioning skills for almost all courses, I do not find this right, we have become robots in this system, according to the annual plan, teach the subject by competing with minutes, then make an exam, then why students do not like school, why they run away from school, the reasons are obvious. This system destroys children's energies, lights, thinking skills and imagination" (T7); "One of the biggest problems teachers face in the national education system is the curriculum. The curriculum, which has a very dense content, is not suitable for every class or every school, and it may be more appropriate to flex the lesson plans on the basis of school and class. Most of the teachers are worried about the curriculum and they cannot get the desired success from the students." (T5). Moreover, upon examination, the code " Educational Policies " (f=5) was scrutinized; "The education system is based on keeping students in the system, but not every student should stay in the system, some have very different needs, there is no point in forcibly keeping them in school. Even though the student harms other students and we have suspended him/her many times, the student continues to come to

school, he/she never gives up, the school is like his/her kingdom, we can neither stop him/her from absenteeism nor expel him/her for disciplinary offenses, unless he/she leaves the school voluntarily, that student is with us and he/she continues to harm other students, teachers and everyone around him/her, he/she uses substances, he/she has behavioral disorders, this student should be treated as an inpatient." (T24); "We have adopted constructivism as an educational philosophy, but in practice we continue with essentialism. The classes are very crowded. Therefore, there is no opportunity to deal with each one individually. I think this is the biggest disappointment. Class size should be reduced, school facilities should be increased and children's learning by doing and experiencing should be supported in every sense" (T14). And, upon examination of the code "Not being able to relocate" (*f*=5); "It needs to be updated according to the needs of the age. These disappoint me. For example, it is difficult to relocate newly appointed teachers…" (T28).

Table 8.

Codes Related to the "Colleagues" Theme of the Disappointments Experienced by Teachers at School

Themes	Codes		*f*	Teachers (%)
Colleagues	Human Relationships	Jealousy	8	18
		Schism	7	25
		Gossiping	6	18
		Put Pressure On	3	11
		Not Respecting Opinions	2	7
		Complaining	2	7
		Gotcha	1	4
		Discourtesy	1	4
		Self-seeking	1	4
	Teaching Profession	Refusing to Cooperate	8	29
		Failure to Develop Professionally	4	14
		Losing Enthusiasm	3	11
		Not Taking Responsibility	1	4
		Rubber-stamp	1	4
		Being Technologically Backward	1	4

Upon analyzing the code "Jealousy" (*f*=8); "The disappointments that teachers experience with each other can be seen as teachers seeing each other as rivals and sometimes exhibiting attitudes that do not suit an educator. For example, hiding course materials from each other, gossiping with other teachers, forming cliques and excluding each other. Although these situations are more common in private schools, they can also occur in public schools." (T10). What is more, upon scrutinizing the code "Refusing to Cooperate" (*f*=8); "From time to time, there may be problems with cooperation. As long as each teacher respects each other's field and branch, I don't think these problems will occur. However, the biggest problems arise from disrespect and lack of cooperation" (T19). Also, upon examination of the code "Schism" (*f*=7); "The efforts of some teachers to turn the school into the golden days those housewives attended, the intense gossip they spread about the school staff, the unnecessary student races of those from the same group, union clans, the intolerance of

some teachers who are about to retire to the chirpy children's voices." (T16). Similarly, upon scrutiny, the script titled "Gossiping" (*f*=6) is analyzed; "I think the biggest problem with our teacher friends is gossip. They talk about everything except education in the teachers' room and the most painful thing is that they cannot unite when a teacher is in trouble, and they always think about their interests" (T26).

Findings for the Third Question

The inquiry posed to the individuals within the research cohort pertained to the impacts, both favorable and unfavorable, of the disappointments encountered during their educational tenure on their personal attributes, occupational demeanor, and daily routines spanning from their initial employment to retirement. This inquiry was complemented by supplementary prompts aimed at elucidating the constructive and adverse repercussions of disappointments faced by educators in educational institutions. The responses to these inquiries have been delineated in the ensuing Table 9.

Table 9.

Teachers' Views on the Positive and Negative Effects of the Disappointments They Experienced at School

Themes	Codes	*f*	Teachers (%)
Positive Effects	Gain Experience	8	29
	Becoming Patient	3	11
	Learning to be Happy in Every Situation	2	7
	Becoming Attached to the Profession	2	7
	Acting According to the Legislation	2	7
	Learning to Stay Unresponsive	2	7
	Becoming Idealistic	1	4
Negative Effects	Disengagement from the Profession	9	32
	Burnout	6	18
	Unrest in Family Life	4	14
	Decline in Motivation	4	14
	Becoming Aggressive	3	11
	Learning to Role Play	2	7
	Unhappiness	2	7
	Fear of Social Exclusion	2	7
	Lose Confidence	2	7

Upon scrutiny, the script titled " Disengagement from the Profession" (*f*=9) is examined; "These disappointments we experience make me hopeless, I feel that no matter how hard I try, I cannot achieve a result and I think I will give up trying. Disappointments affect me negatively in this aspect in daily life" (T28). Moreover, upon scrutiny of the code " Gain Experience" (*f*=8); "There have been and are situations that affect me in both senses. I think in this process, I will learn something from every class I enter and every student I communicate with. Some things will settle over time, every disappointment or a good memory we

experience has a great impact on my teaching, my personality, whatever makes me who I am. While a negative moment reminds me to be careful in another event, a good memory makes me say that I am glad I am a teacher" (T18). In addition, upon examination of the code "Burnout" (*f*=6); "I don't think it has a positive effect. The negative effect is burnout syndrome and loss of idealism. I can say that I start to stay completely away from education and the feeling of loneliness" (T13). Furthermore, upon analyzing the code "Becoming Patient" (*f*=3); "Positive reflections: Not losing self-belief and self-esteem, learning to be patient, being able to empathize, using correct communication, being self-confident as a result of increasing professional experience over the years in the profession, being able to fight against difficulties" (T20).

Discussion and Conclusion

As a consequence of the data uncovered in the findings section, the outcomes pertaining to the disappointments encountered aligning with the viewpoints of the teachers were initially examined in terms of the origins of the disappointment, subsequently in relation to the causes, and lastly in consideration of the favorable and unfavorable impacts on their careers.

The research was initially planned with the goal of exploring teachers' perspectives and insights on disappointment, starting from a broad perspective and moving towards more specific aspects. The first question in the semi-structured interview format used for this purpose is focused on identifying the root causes of disappointments encountered in educational settings. This particular question aims to assess whether teachers possess a systematic and analytical understanding of the reasons behind their disappointments in general. It was chosen to be the first question due to its alignment with the deductive approach of the study and the expectation for teachers to approach their disappointments in a professional manner. The objective is to analyze the concept of disappointment as perceived by teachers by encouraging them to reflect on their experiences from a broader perspective, and to investigate whether they have a structured approach towards understanding the underlying reasons for the negative situations they encounter.

After inquiring whether the teacher possesses a professional perspective on the concept of disappointment, the subsequent query "In the context of your educational experiences, could you elaborate on instances that have led to feelings of disappointment?" delves into more routine, personal, and small-scale occurrences. Furthermore, an investigation is conducted concerning the distinctive incidents encountered by the teacher in their daily professional life, aiming to unveil circumstances that may have escaped their notice. The complementary nature of the first and second inquiries in terms of their objective becomes apparent. The researchers initially hypothesized that diverse themes and codes would emerge during the design phase of the study for the first and second

questions. However, it was observed that both questions yielded comparable results upon completion of the research. This finding indicates that educators demonstrate a heightened level of consciousness regarding the challenges they face in their daily professional routines, exhibit a capacity for systematic reflection, and are adept at identifying the root causes of adversities as a crucial initial step towards resolution.

When comparing the outcomes of the first and second inquiries, a consensus emerges regarding the education system, educational leaders, parents, and students. This indicates a convergence of nearly 80%, leading researchers to infer that disappointment is a prominent issue among teachers that warrants consideration. The first question necessitates a more in-depth and theoretical explanation concerning the systemic factors contributing to disappointment. Consequently, teachers scrutinized the adverse circumstances and recounted personal anecdotes, recognizing that the challenges impacting their daily routine were a byproduct of a larger system. Given the overlapping results of these two questions, it was deemed that they served a distinct purpose, contributing uniquely to the qualitative study. Therefore, it was determined that presenting the initial and subsequent inquiries separately in the research findings was appropriate.

This study provides a nuanced understanding of the multifaceted nature of teacher disappointment within the Turkish educational context. The findings illuminate the various sources of disappointment that teachers encounter, encompassing the education system, educational administrators, parents, students, the teaching profession itself, and their colleagues. These disappointments, as revealed in the teachers' narratives, can exert both positive and negative influences on their personal and professional lives. While they may lead to disengagement, burnout, and diminished motivation, they can also foster resilience, patience, and a profound commitment to the teaching profession (Grossman & Oplatka, 2020). The study's findings underscore the urgent need for systemic changes to address the root causes of teacher disappointment. The implementation of policies and practices that cultivate a more supportive and empowering environment for teachers is imperative. To achieve this, it is essential to allocate sufficient resources, encourage continuous professional growth for educators, and nurture collaborative partnerships between teachers and school leaders. The creation of a thriving and effective learning environment hinges upon fostering transparent communication, mutual respect, and a shared sense of responsibility among all stakeholders, including teachers, parents, and students. The study's emphasis on the Turkish educational landscape provides invaluable insights into the unique obstacles encountered by educators within this specific context. However, the findings also resonate with broader themes in the

literature on teacher disappointment, suggesting that these challenges are not unique to Türkiye. This underscores the global nature of teacher frustration and the need for international collaboration to address these issues. The study's limitations, including the relatively small sample size and its confinement to one district in Türkiye, warrant consideration. The scope of future investigations could be broadened by encompassing a larger and more geographically diverse sample of teachers, enabling a deeper exploration of their experiences across various educational settings. Furthermore, longitudinal research designs could shed light on the enduring effects of teacher disappointment on their overall well-being and career paths. This study, despite its limitations, offers a substantial contribution to the existing body of knowledge on teacher disappointment. By providing a nuanced comprehension of the origins and ramifications of disappointment from the perspective of educators themselves, this research has the potential to inform initiatives aimed at enhancing teacher well-being and, consequently, elevating the overall quality of education. The insights garnered from this study can serve as a valuable resource for teachers, empowering them to navigate the intricacies of their profession with heightened resilience and effectiveness, thereby cultivating a more favorable and gratifying educational milieu for all stakeholders involved.

The research indicates that the actions and decisions of those in leadership positions within schools play a substantial role in the discontent experienced by teachers. Reasons for teacher disappointment stemming from educational leaders include the inability to establish fairness, lack of support from superiors, ineffective communication management, and deficiencies in leadership abilities. These issues highlight communication challenges and misunderstandings between teachers and school leaders. Such occurrences are unexpected in our education system, where administrators are typically former teachers. To address teachers' discontent with administrators, efforts should focus on enhancing teacher-administrator collaboration and implementing a mutually beneficial approach. By offering leadership development training to administrators, it is believed that teacher morale can be improved (Özgan & Bozbayındır, 2011). The current study aligns with previous research indicating that teachers often experience disappointment due to administrators' perceived lack of merit, conflicts with administrators, and their negligence (Çevik, 2019). The significant impact that school administrators have on the well-being and job satisfaction of teachers is a well-established concept in the field of education. The existing research consistently emphasizes the crucial role of supportive leadership, clear communication, and the acknowledgment of teachers' professional skills in creating a positive and fulfilling work environment (Dinham & Scott, 2000; Leithwood et al., 2004). In line with this, Sutton (2007) emphasizes the critical role of school leadership in shaping the

overall school climate and teacher experiences. The research highlights that when school leaders fall short of fulfilling teachers' expectations, exhibit unjust behavior, or engage in harmful practices like mobbing, it can result in a profound sense of disappointment among teachers, significantly affecting their overall well-being.

Considering the duration of time that educators and students spend in an educational environment, it would not be deemed highly effective from an efficiency standpoint to confine two key participants who are unable to showcase a willingness to collaborate harmoniously while also lacking mutual comprehension within the confines of a physical structure such as school walls. Therefore, research endeavors aimed at uncovering the expectations that students harbor towards their teachers are poised to yield substantial benefits, particularly with regards to enabling educators to establish more profound connections with the evolving student populace. Furthermore, the study also highlights the potential existence of problematic areas within the teacher cohort, underscoring the importance of investigations that shed light on the impacts of interpersonal teacher dynamics and occupational conditions on their ability to effectively collaborate while discharging their professional duties. The establishment of agreement, reconciliation, and effective teamwork amongst teachers is poised to permeate throughout the entire educational institution, consequently exerting a positive influence on the overall quality of education imparted within the organization. Previous research supports the notion that student indifference, failure, and changing student profiles can be significant sources of teacher disappointment (Grossman & Oplatka, 2020). Moreover, the current study echoes findings from other research that points to the negative impact of colleagues' jealousy, gossip, and lack of cooperation on teacher morale (Demir, 2021). The literature extensively covers the difficulties that arise from student behavior and interactions with peers, with research underscoring the necessity for effective classroom management techniques, conflict resolution abilities, and a nurturing school atmosphere (Jennings & Greenberg, 2009; Klassen et al., 2010). The adverse impact of student apathy and lack of motivation on teachers' emotional well-being, resulting in feelings of disappointment and frustration, is further emphasized by Tang and Hu (2022). The current investigation contributes to this existing knowledge base by pinpointing specific student behaviors, such as disrespect, excessive social media usage, and a perceived lack of purpose, that contribute to teacher disappointment. These results highlight the critical importance of addressing student engagement and motivation to enhance teacher well-being and job satisfaction. Furthermore, the study reveals that cultural disparities can also play a role in teacher disappointment, particularly in educational settings characterized by diverse student populations.

The current research also sheds light on the significant role of parents in shaping teachers' experiences. Parental indifference, unrealistic expectations, and interference in educational matters can lead to frustration and disappointment among teachers. The results of the current research resonate with prior investigations that have recognized parental involvement as a potential contributor to teacher stress and burnout (Epstein et al., 2018; Skaalvik & Skaalvik, 2010). This study contributes to this understanding by highlighting specific instances of parental behavior that contribute to teacher disappointment, such as making complaints, not respecting teachers' expertise, and expecting privileges for their children. The results of this study emphasize the critical need for establishing open and effective communication channels, as well as fostering a collaborative relationship between teachers and parents. The aim is to create a nurturing and supportive learning environment that benefits the students. The narratives shared by the teachers shed light on the difficulties they encounter when navigating the intricate dynamics of parent-teacher relationships, particularly in situations where parental expectations and involvement might not align with the practical realities of the classroom setting.

Furthermore, the study reveals that teachers' disappointment can also stem from systemic factors, such as the education system itself and the teaching profession. Constant changes in the education system, inadequate university education, and financial dissatisfaction were identified as significant contributors to teacher disappointment. These findings resonate with existing literature that highlights the challenges associated with educational reforms, teacher preparation programs, and the perceived lack of respect and recognition for the teaching profession (Ingersoll & Smith, 2003; Zeichner & Gore, 1990). The current study adds to this discourse by providing specific examples of how these systemic factors manifest in the Turkish context and contribute to teacher disappointment. The teachers' accounts express a sense of discontentment with the continuous policy changes and reforms, which they view as disruptive and detrimental to their professional autonomy. The perceived shortcomings in their university education and the limited opportunities for professional development further exacerbate their feelings of disappointment and disillusionment.

The current investigation's examination of the diverse ways in which teacher disappointment affects their personal and professional lives provides a deeper understanding of the intricate relationship between the emotional experiences of educators and their overall well-being. The findings reveal that teacher disappointment can have both detrimental and constructive consequences, highlighting the dynamic nature of this emotional state. The study reveals that teacher disappointment can have several detrimental consequences, including a growing sense of detachment from their work,

emotional exhaustion, disruptions in their personal lives, decreased motivation, and heightened levels of irritability or anger. These observations are consistent with prior research that has established a link between teacher stress and frustration and adverse effects on their mental health, job satisfaction, and overall well-being (Klassen et al., 2010; Skaalvik & Skaalvik, 2010). The accounts shared by the teachers in this study offer tangible illustrations of how disappointment can permeate their lives, resulting in emotions such as despair, fatigue, and a sense of disconnection from their professional responsibilities.

On the other hand, the study also uncovers positive impacts of teacher disappointment, such as gaining experience, becoming more patient, learning to be happy in every situation, and developing a stronger attachment to the profession. These findings offer a unique perspective that challenges the prevailing narrative of teacher disappointment as solely detrimental. The teachers' narratives reveal that disappointment can also serve as a catalyst for growth and development, fostering resilience, adaptability, and a deeper sense of purpose. The notion that negative emotions, when handled adeptly, can yield positive outcomes such as heightened self-awareness, improved coping mechanisms, and enhanced problem-solving skills, finds support in existing research (Grossman & Oplatka, 2020; Lazarus & Folkman, 1984). The current investigation further enriches this understanding by shedding light on the specific avenues through which educators can transmute their encounters with disappointment into opportunities for both personal and professional development.

The research findings indicate that teacher disappointment is not a fixed or one-dimensional issue, but rather a fluid and intricate emotional experience with the potential for both positive and negative outcomes. The teachers' personal accounts shed light on the multifaceted nature of disappointment, emphasizing the interconnectedness of individual, interpersonal, and systemic factors in influencing their emotional reactions. The study's findings underscore the importance of recognizing and addressing the diverse impacts of teacher disappointment to promote teacher well-being and create a more supportive and fulfilling educational environment.

This research inquiries into the psychological aspect of teachers, a pivotal component in the realm of education, with a specific focus on the disappointments that teachers encounter within the context of their professional careers. The significance of this study in shedding light on such matters cannot be overstated; however, a more thorough examination of the emerging themes is warranted, necessitating additional research endeavors. Exploring distinct research avenues stemming from the

findings of this study will facilitate a comprehensive analysis of the various disappointments that teachers face during their tenure.

The qualitative approach employed in this research allows for a profound understanding of the subject matter, but the limited number of participants restricts the generalizability of the findings to a wider population. Consequently, conducting field surveys utilizing scales developed based on this research will pave the way for more inclusive studies with larger sample sizes that can be generalized with greater confidence. The primary factors contributing to teacher disappointment can be traced back to the interactions and relationships they have with various stakeholders in the educational environment, including parents, students, school administrators, and fellow colleagues. Upon closer inspection of the stakeholders in education, it is evident that these factors, often perceived as sources of disappointment, actually form the foundation of the system and are essential components. Therefore, the study highlights an issue that arises among stakeholders, emphasizing the need for a more detailed analysis of this problem and an exploration into the underlying reasons for the challenges encountered between each stakeholder group and teachers. In the contemporary landscape where the characteristics of parents and students are evolving, conducting research in this area offers an opportunity to foster collaboration by redefining the expectations and responsibilities of stakeholders towards one another. Consequently, investigating the dynamics between teachers and parents holds considerable significance. Research focusing on the efficacy of communication methods between teachers and parents within the educational context will facilitate discussions on modern communication tools like WhatsApp vs., shedding light on the necessity for establishing effective channels of communication. This exploration into the realm of communication between stakeholders has the potential to enhance the overall educational experience and foster stronger partnerships between all involved parties.

The subject matter of this study is intricately linked with cultural influences. The exploration of teacher disappointment across different cultures can illuminate the common challenges faced by educators globally, while also revealing the subtle cultural influences that shape their emotional experiences and coping strategies (Klassen et al., 2012). The research conducted by Yıldırım and Tabak (2019) with pre-service teachers in Türkiye, which identified the prevalence of intense emotions like compassion, love, and boredom, suggests that cultural factors may indeed play a significant role in shaping the emotional landscape of teachers. The current study's findings on the sources and impacts of teacher disappointment in Türkiye can serve as a valuable point of comparison for future research conducted in different cultural contexts.

In summary, this research has illuminated the intricate nature of teacher disappointment, revealing the interconnectedness of personal, interpersonal, and systemic factors that contribute to this phenomenon. The study's results underscore the necessity of adopting a multifaceted strategy to tackle teacher disappointment, encompassing policy adjustments, leadership enhancement initiatives, improved communication channels, and a dedicated focus on cultivating positive relationships among all stakeholders within the educational sphere. By proactively addressing the underlying causes of teacher disappointment, we can create a more nurturing and fulfilling professional environment for educators, ultimately leading to enhanced student outcomes and a more dynamic and thriving educational landscape.

Recommendations

When examining the factors that lead to teacher dissatisfaction, they can be identified as the constant changes in the educational system, negative attitudes from administrators, parental interventions in the education process, students' lack of interest and direction, and discontent with the financial aspects of the profession. The sources of disappointment reveal that teachers are significantly impacted by both the physical and psychological aspects of the school environment. In essence, teachers are subjected to a wide range of influences during the educational process. Therefore, the active involvement of teachers, who are key stakeholders in education, in decision-making processes can help alleviate disappointment and promote teacher well-being in schools. By allowing teachers to voice their needs and preferences, they can cultivate a more positive work environment for themselves.

Parents contribute to teachers' disappointment by failing to engage in the education process, making demands beyond the school's objectives, disregarding the teacher's personal life after hours, and neglecting to support the professional expertise of the teacher. In the realm of education, while the teacher and student can achieve success independently, parental involvement is crucial for this progress. Parents should be integrated into the school environment akin to students, facilitating their active participation and support. Even though a student cannot navigate the educational journey without parental guidance, the teacher, student, and parent collaborate in this endeavor. Developing a curriculum for parents to follow alongside students in educational institutions, incorporating it into lifelong learning and distance education, will elevate the school's role in society to a more significant and crucial position, thereby transforming parental disappointments into unity and collaboration.

The study's findings suggest that educational administrators, who play leadership roles in schools, significantly contribute to the dissatisfaction felt by teachers. Reasons for teacher disappointment stemming from educational leaders include the inability to establish fairness, lack of support from superiors, ineffective communication management, and deficiencies in leadership abilities. These issues highlight communication challenges and misunderstandings between teachers and school leaders. Such occurrences are unexpected in our education system, where administrators are typically former teachers. To address teachers' discontent with administrators, efforts should focus on enhancing teacher-administrator collaboration and implementing a mutually beneficial approach. By offering leadership development training to administrators, it is believed that teacher morale can be improved.

This research inquiries into the psychological aspect of teachers, a pivotal component in the realm of education, with a specific focus on the disappointments that teachers encounter within the context of their professional careers. The significance of this study in shedding light on such matters cannot be overstated; however, a more thorough examination of the emerging themes is warranted, necessitating additional research endeavors. Exploring distinct research avenues stemming from the findings of this study will facilitate a comprehensive analysis of the various disappointments that teachers face during their tenure.

While the qualitative methodology employed in this study enhances the depth of comprehension regarding the subject matter, the constrained participant pool hinders the extrapolation of findings to a broader context. Consequently, conducting field surveys utilizing scales developed based on this research will pave the way for more inclusive studies with larger sample sizes that can be generalized with greater confidence. When examining the primary causes of the disappointments that teachers face, it becomes apparent that parents, students, educational administrators, and colleagues play significant roles. Upon closer inspection of the stakeholders in education, it is evident that these factors, often perceived as sources of disappointment, actually form the foundation of the system and are essential components. Therefore, the study highlights an issue that arises among stakeholders, emphasizing the need for a more detailed analysis of this problem and an exploration into the underlying reasons for the challenges encountered between each stakeholder group and teachers. In the contemporary landscape where the characteristics of parents and students are evolving, conducting research in this area offers an opportunity to foster collaboration by redefining the expectations and responsibilities of stakeholders towards one another. Consequently, investigating the dynamics between teachers and parents holds considerable

significance. Research focusing on the efficacy of communication methods between teachers and parents within the educational context will facilitate discussions on modern communication tools like WhatsApp vs., shedding light on the necessity for establishing effective channels of communication. This exploration into the realm of communication between stakeholders has the potential to enhance the overall educational experience and foster stronger partnerships between all involved parties.

Considering the duration of time that educators and students spend in an educational environment, it would not be deemed highly effective from an efficiency standpoint to confine two key participants who are unable to showcase a willingness to collaborate harmoniously while also lacking mutual comprehension within the confines of a physical structure such as school walls. Therefore, research endeavors aimed at uncovering the expectations that students harbor towards their teachers are poised to yield substantial benefits, particularly with regards to enabling educators to establish more profound connections with the evolving student populace. Furthermore, the study also highlights the potential existence of problematic areas within the teacher cohort, underscoring the importance of investigations that shed light on the impacts of interpersonal teacher dynamics and occupational conditions on their ability to effectively collaborate while discharging their professional duties. The establishment of agreement, reconciliation, and effective teamwork amongst teachers is poised to permeate throughout the entire educational institution, consequently exerting a positive influence on the overall quality of education imparted within the organization.

Given that the subject matter of this study is intricately linked with cultural influences, it is posited that conducting similar studies across diverse nations could provide a basis for comparative analysis. Through such endeavors, the psycho-social dynamics within educational institutions can be accentuated, offering a more nuanced understanding of the processes at play within schools.

About Authors

First Author: Semiha Şahin is a professor at Dokuz Eylül University. He works at the Faculty of Education, Educational Management Department. Her research interests include Educational Management, Leadership, Organizational Psychology, School Architecture.

Second Author: Ömer Demir is a PhD candidate at Dokuz Eylül University. He is currently at the Faculty of Education, Educational Management Department.

Third Author: Yavuz Kamil Şevik is a PhD candidate at Dokuz Eylül University. He is currently at the Faculty of Education, Educational Management Department.

Conflict of Interest

It has been reported by the authors that there is no conflict of interest.

Funding

No funding was received.

Ethical Standards

We have carried out the research within the framework of the Helsinki Declaration; the participants are volunteers and know that they can give up if they do not want to participate the research. The research does not include any harmful implementation, or the researchers do not obtain any special or sensitive information from participants.

ORCID

Semiha Şahin https://orcid.org/0000-0002-1135-0327

Ömer Demir https://orcid.org/0000-0001-6677-6993

Yavuz Kamil Şevik https://orcid.org/0000-0002-6264-9361

References

Akman, Y. (2019). Eğitim fakültelerinin misyonları üzerine bir araştırma. *Pamukkale University Journal of Education*, *46*(46), 39-56. https://doi.org/10.9779/pauefd.452829

Argon, T. (2015). Öğretmenlerin sahip oldukları duygu durumlarını okul yöneticilerinin dikkate alıp almamalarına ilişkin görüşleri. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi*, *15*(1), 377-404. https://doi.org/10.17240/aibuefd.2015.15.1-5000128614

Ashkanasy, N. M., Zerbe, W. J., & Hartel, C. E. (2016). *Managing emotions in the workplace*. Routledge.

Bachler, R., Segovia-Lagos, P., & Porras, C. (2023). The role of emotions in educational processes: The conceptions of teacher educators. *Frontiers in Psychology*, *14*. https://doi.org/10.3389/fpsyg.2023.1145294

Bogdan, R., & Biklen, S. K. (2007). *Qualitative research for education: An introduction to theories and methods*. Allyn & Bacon.

Brady, M. (2010). II—Michael Brady: Disappointment. *Aristotelian Society Supplementary Volume*, *84*(1), 179-198. https://doi.org/10.1111/j.1467-8349.2010.00191.x

Byrd, A. L., Frigoletto, O. A., Vine, V., Vanwoerden, S., Jennings, J. R., Zalewski, M., & Stepp, S. D. (2023). Maternal invalidation and child RSA reactivity to frustration interact to predict teacher-reported aggression among at-risk preschoolers. *Psychological Medicine*, *53*(13), 6366-6375. https://doi.org/10.1017/s0033291722003713

Cantürk, G. (2021). Economic problems faced by teachers and their views on salary increase demands: Twitter analysis. *Maarif Mektepleri Uluslararası Eğitim Bilimleri Dergisi*, *5*(2), 202-223. https://doi.org/10.46762/mamulebd.991380

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches*. SAGE.

Çankaya, İ., & Çanakçı, H. (2011). Sınıf öğretmenlerinin karşılaştıkları istenmeyen öğrenci davranışları ve bu davranışlarla başa çıkma yolları. *Turkish Studies - International Periodical For The Languages, Literature and History of Turkish or Turkic*, *6*(2), 307-316.

Çevik, S. (2019). *Sınıf öğretmenlerinin yaşadığı duyguların mesleklerine yansıması* [Unpublished master's thesis]. Necmettin Erbakan University.

Çınkır, Ş., & Kurum, G. (2017). Atanmak ya da atanamamak: ücretli öğretmenlerin yaşadıkları sorunlar. *Eğitimde Nitel Araştırmalar Dergisi*, *5*(3), 9-35.

Demir, B. N. (2021). *Lise öğrencilerinin bağlanma stilleri ile sınav kaygısı arasındaki ilişkide duygu yönetiminin aracı rolü* [Unpublished master's thesis]. Kahramanmaraş Sütçü İmam University.

Denzin, N. K., & Lincoln, Y. S. (2011). Introduction: the discipline and practice of qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *The SAGE Handbook of Qualitative Research* (4th ed., pp. 1-21). SAge Publications, Inc.

Dilekci, Ü., & Manap, A. (2022). A bibliometric analysis of research on teacher emotions. *International Journal of Psychology and Educational Studies*, *9*(4), 1222-1235. https://doi.org/10.52380/ijpes.2022.9.4.860

Dinham, S., & Scott, C. (2000). Moving into the third, outer domain of teacher satisfaction. *Journal of Educational Administration*, *38*(4), 379-396. https://doi.org/10.1108/09578230010373633

Epstein, J. L., Sanders, M. G., Sheldon, S. B., Simon, B. S., Salinas, K. C., Jansorn, N. R., Voorhis, F. L., Martin, C. S., Thomas, B. G., Greenfeld, M. D., Hutchins, D. J., & Williams, K. J. (2018). *School, family, and community partnerships: Your handbook for action*. Corwin Press.

Erkol, H. (2021). *İlköğretim ve ortaöğretim okul yöneticilerinin duygu yönetimi düzeyleri ve kültürel değerlerin duygu yönetimine etkisi* [Unpublished master's thesis]. Ankara University.

Erol, İ. (2021). Türkiye'de okul yöneticilerinin belirlenmesinde "liyakat ilkesi". *Eğitim Yönetimi ve Politikaları Dergisi*, *2*(1), 54-65.

Foster, B. (2013, August 11). *Great expectations; great disappointments*. HUFFPOST. https://www.huffpost.com/entry/managing-expectations_b_3417425

Greenberg, J., & Muir, S. (2022). Disappointment. *Annual Review of Anthropology*, *51*(1), 307-323. https://doi.org/10.1146/annurev-anthro-041520-105355

Grossman, S., & Oplatka, I. (2020). Teacher disappointment: Subjective definitions, factors and consequences. *Journal of Professional Capital and Community*, *6*(3), 205-220. https://doi.org/10.1108/jpcc-03-2020-0012

Ingersoll, R. M., & Smith, T. M. (2003). The wrong solution to the teacher shortage. *Educational Leadership*, *60*, 30-33.

Jennings, P. A., & Greenberg, M. T. (2009). The prosocial classroom: Teacher social and emotional competence in relation to student and classroom outcomes. *Review of Educational Research*, *79*(1), 491-525. https://doi.org/10.3102/0034654308325693

Jiang, Z., Mok, I. A., Yang, X., Liu, S., & Chen, M. (2022). Pattern and dynamics of teacher emotions during teaching: A case study of a senior secondary mathematics teacher. *Sustainability*, *14*(15), 9097. https://doi.org/10.3390/su14159097

Johnson, G., & Connelly, S. (2014). Negative emotions in informal feedback: The benefits of disappointment and drawbacks of anger. *Human Relations*, *67*(10), 1265-1290. https://doi.org/10.1177/0018726714532856

Klassen, R. M., Perry, N. E., & Frenzel, A. C. (2012). Teachers' relatedness with students: An underemphasized component of teachers' basic psychological needs. *Journal of Educational Psychology*, *104*(1), 150-165. https://doi.org/10.1037/a0026253

Klassen, R. M., Usher, E. L., & Bong, M. (2010). Teachers' collective efficacy, job satisfaction, and job stress in cross-cultural context. *The Journal of Experimental Education*, *78*(4), 464-486. https://doi.org/10.1080/00220970903292975

Koç, M. H. (2020). Zor velilerle baş etme stratejilerine ilişkin sınıf öğretmenlerinin görüşleri. *Trakya Eğitim Dergisi*, *10*(2), 394-411. https://doi.org/10.24315/tred.606480

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer Publishing Company.

Leithwood, K., Louis K. S., Anderson S., & Wahlstrom K. (2004). *How leadership influences student learning: Review of research*. New York, NY: Wallace Foundation.

Lelieveld, G., Van Dijk, E., Van Beest, I., & Van Kleef, G. A. (2012). Why anger and disappointment affect other's bargaining behavior differently. *Personality and Social Psychology Bulletin*, *38*(9), 1209-1221. https://doi.org/10.1177/0146167212446938

Levering, B. (2000). Disappointment in teacher-student relationships. *Journal of Curriculum Studies*, *32*(1), 65-74. https://doi.org/10.1080/002202700182853

Lin, C. S. (2013). Revealing the "Essence" of Things: Using Phenomenology in LIS Research. *Qualitative and Quantitative Methods in Libraries (QQML)*, *4*, 469-478.

Martinez-Roig, R., Iglesias-Martínez, M. J., & Lozano Cabezas, I. (2023). Las emociones percibidas POR el profesorado en activo en el USO de metodologías activas en el aula. *Research in Education and Learning Innovation Archives*, (30), 46. https://doi.org/10.7203/realia.30.24336

Maxwell, J. A. (2009). Designing a qualitative study. In L. Bickman & D. Rog (Eds.), *The SAGE Handbook of Applied Social Research Methods* (2nd ed., pp. 214-253). Sage Publications, Inc.

Morris, S. (2019). The frustration regulation journal: A reflective framework for educators. *Relay Journal*. https://doi.org/10.37237/relay/020205

Morris, S., & King, J. (2018). Teacher frustration and emotion regulation in University language teaching. *Chinese Journal of Applied Linguistics*, *41*(4), 433-452. https://doi.org/10.1515/cjal-2018-0032

Özgan, H., & Bozbayındır, F. (2011). Okullarda Adil olmayan uygulamalar ve etkileri, *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi, 16*, 66-85.

Pekrun, P., & Linnenbrink-Garcia, L. (2014). Introduction to emotions in education. In P. Pekrun & L. Linnenbrink-Garcia (Eds.), *International Handbook of Emotions in Education* (1st ed., pp. 11-20). Routledge.

Pekrun, R. (1992). The impact of emotions on learning and achievement: Towards a theory of cognitive/Motivational mediators. *Applied Psychology*, *41*(4), 359-376. https://doi.org/10.1111/j.1464-0597.1992.tb00712.x

Prosen, S., Smrtnik Vitulić, H., & Poljšak Škraban, O. (2013). Observing teachers' emotional expression in their interaction with students. *The New Educational Review*, *31*, 75-85. https://doi.org/10.15804/tner.13.31.1.06

Seçer, H. Ş. (2005). Çalışma yaşamında duygular ve duygusal emek: sosyoloji, psikoloji ve örgüt teorisi açısından bir değerlendirme. *Sosyal Siyaset Konferansları Dergisi, 50*, 813-834.

Skaalvik, E. M., & Skaalvik, S. (2010). Teacher self-efficacy and teacher burnout: A study of relations. *Teaching and Teacher Education*, *26*(4), 1059-1069. https://doi.org/10.1016/j.tate.2009.11.001

Sutton, R. E. (2007). Teachers' anger, frustration, and self-regulation. *Emotion in Education*, 259-274. https://doi.org/10.1016/b978-012372545-5/50016-2

Sönmez, A. (2014). *Ortaokul Yöneticilerinin Görevlerini Yaparken Karşılaştığı Veli, Öğretmen, Üst Yöneticilerden Kaynaklanan Olumsuz Davranışlar* [Unpublished master's thesis]. Yeditepe University.

Tang, Y., & Hu, J. (2022). The impact of teacher attitude and teaching approaches on student demotivation: Disappointment as a mediator. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.985859

Tao, W. (2022). Understanding the relationships between teacher mindfulness, work engagement, and classroom emotions. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.993857

Titsworth, S., McKenna, T. P., Mazer, J. P., & Quinlan, M. M. (2013). The bright side of emotion in the classroom: Do teachers' behaviors predict students' enjoyment,

hope, and pride? *Communication Education*, *62*(2), 191-209. https://doi.org/10.1080/03634523.2013.763997

Türk, H., & Kıroğlu, K. (2018). Ailelerin sınıf öğretmenlerine uyguladıkları mobbing davranışları. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi*, *18*(4), 2357-2389. https://doi.org/10.17240/aibuefd.2018.18.41844-429343

Yin Yung, C. (2022). Emotions as an accelerator: Case studies on the effects of emotions on teachers' perception and learning when being in conflicts with school leaders. *European Journal of Teaching and Education*, *4*(1), 48-60. https://doi.org/10.33422/ejte.v4i1.725

Yıldırım, A., & Şimşek, H. (2005). *Sosyal bilimlerde nitel araştırma yöntemleri*. Seçkin Yayıncılık.

Yıldırım, K., & Tabak, H. (2019). Öğretmen adaylarının duygu durumlarının farklı sınıflamalara göre incelenmesi. *İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi*, *19*(4), 1441-1457. https://doi.org/10.17240/aibuefd.2019..-473905

Zeichner, K. M., & Gore, J. M. (1990). Teacher socialization. In W. R. Houston (Ed.), *Handbook of research on teacher education* (pp. 329-348). Macmillan Publishing Company.

Zembylas, M. (2014). Making sense of the complex entanglement between emotion and pedagogy: Contributions of the affective turn. *Cultural Studies of Science Education*, *11*(3), 539-550. https://doi.org/10.1007/s11422-014-9623-y

Zhao, H., Li, D., & Zhong, Y. (2022). Teacher emotion and pedagogical decision-making in ESP teaching in a Chinese University. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.955474

Osmangazi Journal of Educational Research **Volume 11(1), Spring 2024**

RESEARCH Open Access

Suggested Citation: Alkın, Z. E., & Anılan, B. (2024). Differentiated instruction in the world and Türkiye through studies. *Osmangazi Journal of Educational Research, 11*(1), 156-184.

Submitted: 20/05/2024 **Revised:** 02/09/2024 **Accepted:** 03/09/2024 **DOI:** 10.59409/ojer.1487015

Differentiated Instruction in the World and Türkiye through Studies

***Zeynep Ecem Alkın , **Burcu Anılan**

Abstract. With the emergence of individuals with different characteristics with the developing age and the shaping of needs in these directions, approaches in education and training processes are diversifying. One of these approaches is the differentiated instruction approach based on individual learning differences. In our study; to reveal the change process of differentiated instruction approach from past to present, studies published in English and Turkish languages were examined according to various variables and it was aimed to compare them according to foreign and domestic perspectives. The research data consisted of Turkish and English articles published on differentiated instruction approaches between 2006 and 2023. The data were obtained from reliable sources by searching the Google Scholar database for Turkish articles and the Web of Science database for English studies. Document analysis, one of the qualitative research designs, was preferred as the research design and the data were analyzed by descriptive analysis method. As a result of the research, it was observed that more teacher-oriented and process-planning studies were conducted in English, while more student-oriented process-planning was observed in Turkish studies. Based on these results, it is recommended that researchers conduct studies with groups such as parents and administrators to observe the effects of the process on different data groups.

Keywords. Differentiated instruction, qualitative research, document analysis, web of science, google scholar.

* Student, Eskisehir Osmangazi University, Institute of Educational Sciences, Eskisehir, Türkiye

e-mail: ecmalk@gmail.com

** Assoc. Prof. Dr., Eskisehir Osmangazi University, Faculty of Educatıon, Eskisehir, Türkiye

e-mail: anilan.burcu@gmail.com

Note: Research VII. International Ankara Multidisciplinary Studies presented as a paper at the congress.

In line with their developmental characteristics, each individual differs from other people in society just like the colors of a rainbow and stands out with their different aspects. This difference not only supports individuals to be unique beings but also allows for the diversification of views by presenting various perspectives. Because each individual comes from environments where different life opportunities are provided and the points where they can differ from each other diversify within these opportunities. Although some of the diversity can be expressed by classifying them in terms of learning styles, intelligence areas, interests, abilities, and skills (Levy, 2008, p. 161; NMSA Research Committee, 2003), the idea that each individual is special and unique and that the studies should be diversified in this direction is adopted. In societies where this way of thinking is not supported, the desire to squeeze individuals into uniform patterns emerges as a process that leads the individual towards blunting. In the educational process, these situations can be prevented if students with different learning styles in schools have an educational environment in which teachers take into account their differences.

As a result of the research, it has been revealed that the use of different teaching strategies in the educational process is important in both the academic success of students and the development of their sense of self (NMSA Research Committee, 2003, p. 1), while in environments where differences are not taken into consideration, it is observed that children gradually move away from the education and training process. In this context, the most effective learning opportunities are tried to be provided with various approaches that aim to make children a part of the process, to provide active learning opportunities for each student, and to take the individual as the basis. One of these approaches is the differentiated instruction model.

Differentiated teaching studies reveal individuals who are different from each other in terms of their characteristics as an output of the processes in which individual needs and differences are increasing day by day within the framework of age. In order for these differences to be at the right level and beneficial to the individual, the outputs within the education and training processes need to be organized and developed. Based on these needs, the differentiated instruction approach based on individual differences was first introduced to the literature by Tomlinson in 1995 (Avcı et al. 2022). Differentiated instruction, whose theoretical foundations are based on many teaching approaches such as multiple intelligences, brain-based learning, and social constructivism, is an approach that argues that the education and training process should be designed for individual differences such as interest, readiness, and learning styles of individuals instead of a single common idea that is compatible with everyone (Gregory & Chapman, 2007; Tomlinson & Allan, 2000).

A differentiated instruction approach is a learning experience in which various ways are adopted for students to explore the course content, practices, and processes are structured for meaningful learning, reaching their own knowledge and ideas, and students can make unique choices to demonstrate their learning (Tomlinson, 1995). In this way, each student will be able to make sense of and construct their inferences in a unique way within the framework of the opportunities offered to them by the teaching approach. In this process, teachers will act as a guide by differentiating teaching elements according to the student's readiness, interest, or learning profile and thus create a more qualified learning environment.

These instructional elements, which are followed within the educational outcomes, are examined under different headings (Tomlinson, 2000). The first of the elements, the content stage, provides the answer to the question "What will we teach?" in order to reveal the target phenomenon, which is the first stage of the teaching process, and emphasizes that students with different learning levels can have a learning experience with the same curriculum content, but in this process, the content may differ quantitatively or qualitatively (Levy, 2008). The process stage, which is the second step, seeks answers to the questions "How will we transfer the outcome?" or "How will we ensure that the student internalizes the subject?" in the planning stage of the lesson process, which can be diversified according to the comprehension levels of the students, while in the product stage, which is the third step, it answers the question "At what level has the student learned?" in a way that will allow the evaluation of the process and the result together with the suitability of the learned information for the student. In fact, Tomlinson (2000) suggests that in order to differentiate the product and assessment stages in terms of course outcomes, students can be given options to express their learning differently, and assessment documents that correspond to different skill levels and can be deepened can be preferred. The last stage, the learning environments stage, is based on the idea that an effective learning environment should be created in order to optimize students' learning outcomes in the process.

The differentiated instruction approach (TCSII, 2001, p. 140), which allows students to acquire new knowledge and provides various opportunities for them to internalize what they have learned and put it into performance, provides the individual with the opportunity to manage the teaching process in line with their differences as a result of the steps followed. Thus, students will be able to better assimilate the information conveyed by the instructors within their current readiness and different areas of intelligence and will be able to reveal it in a way that can be observed in the process outcomes.

In order to be able to involve all students willingly in the process within the education system and to provide effective teaching environments, it is necessary to recognize the characteristics of students and to search for innovative ways of learning. In this sense, examining the studies conducted around the world will be guided in order to understand and use the differentiated instruction approach and to conduct related studies.

When the literature that includes the studies shaped within the framework of these basic objectives is examined, it is seen that the studies on differentiated instruction mostly originate from abroad (Abbati, 2012; Chen, 2011; Etienne, 2011; Gilbert, 2012; Learn, 2012; Mathis, 2012; Stevens, 2012; Waller, 2011; White, 2012; Williams, 2012), while the studies conducted in Türkiye have been observed to be insufficient in conveying this approach (Bekler & Kozikoğlu, 2022; Olçay Gül, 2014; Zoraloğlu & Şahin, 2022; Demir, 2013), there is no recent study that provides a comparison of the world and Türkiye that can reveal this insufficiency. In this context, this study will be able to reveal the place of the differentiated instruction approach in the world and Türkiye and in which subject areas it tends to be more in the world and Türkiye by approaching the differentiated instruction approach carried out in the field of science, where course content can be differentiated at more appropriate levels within the framework of individual characteristics, from an international perspective. Thus, it will be possible to describe the current place of this approach in Turkish literature together with the positive and negative aspects that emerged in the process of transferring the approach. At the end of the study, it is thought that the descriptions made at the end of the study can significantly guide the researchers who may carry out studies in this field and provide detailed information about the points that should be given importance.

The aim of this research is to reveal the change process of the differentiated instruction approach from past to present, to reveal its contributions to the education process by examining the studies carried out in the literature on the subject areas in which the differentiated instruction approach, which is adopted as an alternative learning approach in the world and in Türkiye, is mostly used and how it is integrated into the curriculum outcomes of the countries. In line with this purpose, the questions sought to be answered in the study are as follows;

1. What is the distribution of studies on differentiated learning approaches according to languages?

2. What is the distribution of studies on differentiated learning approaches according to years?

3. What are the aims of the studies on differentiated learning approach?

4. Which research designs were used in published studies on differentiated learning?

5. Which study groups were used in the studies on the differentiated learning approach?

6. Which data collection tools were used in published studies on differentiated learning?

7. What are the data analysis methods used in published studies on differentiated learning?

8. What results were obtained in published studies on differentiated learning approaches?

9. What recommendations were given in published studies on differentiated learning?

Method

In this section, the type of research, selection of participants, data collection tools, data collection, process, and data analysis are presented.

Research Model

In this study, document analysis, one of the qualitative research designs, was used in order to synthesize quantitative, qualitative, and mixed-design studies that include the usage areas and forms of differentiated learning approach, which is an alternative learning approach in the education and training process. Document analysis reveals the process of examining and evaluating the materials presented in various data publishing environments (Bowen, 2009). In another definition, document analysis covers the analysis of studies on the phenomena planned to be examined (Yıldırım & Şimşek, 2016). The document analysis method is analyzed by dividing it into certain steps and the studies carried out for each step in this research are shown in Figure 1 (Forster, 1994);

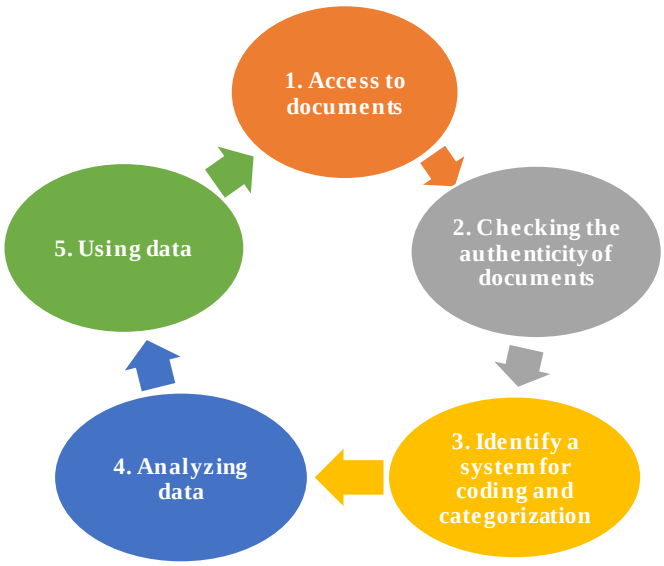


Figure 1. Steps of Document Analysis (Forster, 1994).

In this study, which was conducted by following the analysis steps developed by Forest (1994), in the first step of accessing the documents, Turkish and English articles on differentiated instruction conducted in the field of Science between 2006 and 2023 were searched. Web of Science and Google Scholar databases were searched in accordance with the step of checking the originality of the documents. Web of Science database was preferred to access international studies and Google Scholar database was preferred to access studies published in Turkish. In the third step of adopting a system for coding and categorization, in order to examine the studies included in the scope of the subject as a systematic whole, descriptive analysis methods were used to collect and integrate general information about the languages and years in which the studies were conducted, and after examining the colophon information of the studies with the descriptive analysis method, the fourth step of analyzing the data, which is the fourth step, was carried out by using document analysis method for data such as purpose and data collection group. In line with all the data obtained, the similarities and differences of the studies in terms of many variables such as the languages in which they were published and the years of publication were revealed and analyzed in the step of using the data in a way to reveal the approaches of Türkiye and other countries in the studies on differentiated instruction approach.

Study Group

In order to access Turkish studies, the Google Scholar database was searched with the keyword "differentiated instruction" and 12 studies were found. In order to access the studies in English, Web of Science database was searched and 12 studies were reached. As a result of the searches, a total of 24 articles, both in English and Turkish, on the applications of differentiated learning approaches in education were reached. In order to contribute to the analysis and interpretations in the findings section of the studies, English studies were categorized as Eng1, Eng2, Eng3... and Turkish studies were coded as Tr1, Tr2, Tr3.....

Data Collection Tools

In the study, Web of Science and Google Scholar databases were searched in order to find answers to the questions asked in order to reveal to what extent the usage areas of the differentiated learning approach have developed in the education-teaching process and in which areas the studies are concentrated. During the preliminary screening in the research process, 10 studies were found when the keyword "differentiated teaching" was searched in the Web of Science database in order to access English studies. In order to access more studies related to the concept, 2 more studies were

found when the keyword "differentiated instruction" was searched, which may have translation differences.

Data Analysis

In line with the criteria determined in this study, systematic information was collected by conducting a descriptive analysis of the existing studies in the literature on the differentiated instruction approach between 2006 and 2023. The findings obtained in line with the information collected were interpreted by the researcher, all the data obtained were analyzed with the help of Microsoft Excel program and presented to the reader in tables and graphs.

In order to ensure validity and reliability in the study data and findings, Web of Science and Google Scholar databases used as data collection tools were scanned more than once to avoid publication bias and impartiality was adopted. Since the research process included articles published between 2006 and 12.01.2023, all current studies were followed. In addition, in order to get general information about the differentiated instruction approach, which is the subject of the study, and to get opinions about the way to be followed in the study, three field education experts were consulted and their suggestions were taken into consideration.

Results

The findings of the data obtained in order to answer the questions describing the current place of the differentiated instruction approach in the literature are included in this section.

Distribution of the Analyzed Articles According to Years

When the distribution of the studies included in the scope of the research is examined according to the languages in which they were published, it is seen that the studies were published equally in English and Turkish languages, while the distribution of the studies on the approach according to the years of publication is given in Figure 2.

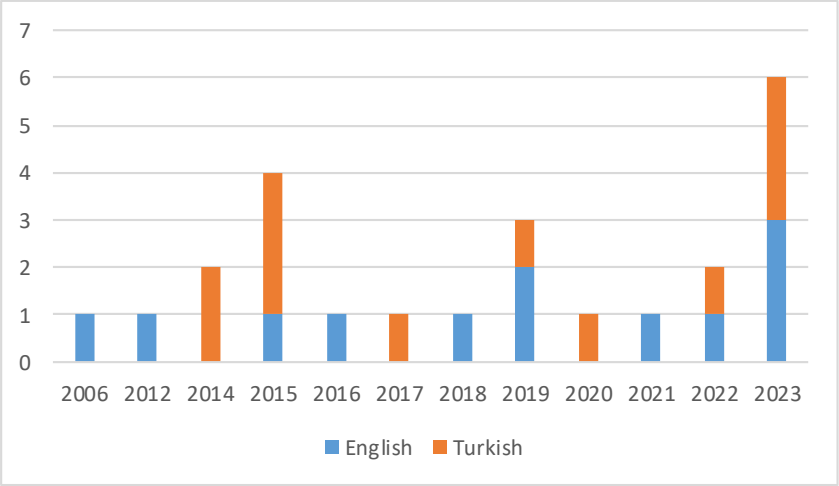


Figure 2. Distribution of the Studies Included in the Scope of the Research According to Years.

From the distribution of the studies included in the scope of the research according to the years of publication, it can be said that the studies conducted in English have a longer history than the Turkish studies. In addition to these data, it is observed that English studies increased in 2019 (2 articles) and 2023 (3 articles), while Turkish studies were mostly conducted in 2014 (2 articles) and 2015 (3 articles).

Distribution of the Analyzed Articles According to Their Purposes

Table 1 shows the objectives adopted for the studies included in the scope of the research, which enable the studies to proceed in line with certain objectives.

Table 1.

Objectives of the Studies Included in the Research

Aims of the Studies	**Codes of Work**
Academic success	Tr1, Tr2, Tr10, Tr12
Impact on students' attitudes towards the course	Tr8, Tr9
Effects on students' science literacy levels	Eng1
The effect of differentiated learning approach practices on the level of learning NOS concepts	Eng10
The effect on students' motivation to learn science	Tr8, Tr10
Impact on the development of students' scientific process skills	Eng11, Tr10
Identification of misconceptions	Tr1

The effect of the DL approach on question switching strategies	Eng2
Entrepreneurship skills	Tr2
To investigate the knowledge, attitudes and practices of lecturers on differentiated instruction	Eng3
Impact on the perspective on learning approaches	Tr3
The effect on science teachers' practices shaped by the approach	Eng6
Uncovering and developing missing knowledge of subject concepts	Tr11
Impact on the retention of learning	Tr3
The effect of the DL approach on peer relations of students in inclusive science classrooms	Eng8
Teachers' perspectives on the applications designed with the DL approach	Eng4, Eng7, Tr6
Pre-service physics teachers' experiences and limitations of differentiated learning environments	Eng12
Impact on classroom climate	Eng2, Tr4
To reveal the approach perceptions and usage patterns of laboratory exercises based on differentiated learning approach	Eng9
The effect on teachers' ideas of competence regarding the DL approach	Eng4, Eng5, Tr6
The effect on pre-service teachers' conceptual perceptions and evaluations	Tr7

When Table 1, which includes the preferred purposes of the studies included in the scope of the research, is examined, it is seen that the English studies were generally conducted with the purpose of revealing teachers' perspectives and levels of use of differentiated instruction (2 articles), while the Turkish studies were generally conducted with the purpose of revealing the effect of the approach on academic achievement (5 articles). It is seen that English studies have very few similar aims with Turkish studies.

Distribution According to Research Methods Used in the Analyzed Articles

The research methods used in the studies are presented in Figure 3.

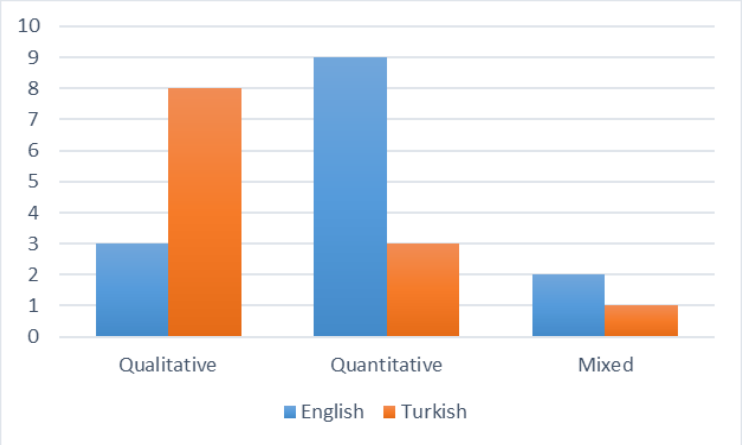


Figure 3. Distribution According to Research Methods Used in the Studies.

In Figure 3, the research methods used in English and Turkish studies are analyzed separately. While qualitative research methods were mostly preferred in English studies (9 articles), quantitative research methods were mostly preferred in Turkish studies (8 articles). It is observed that mixed research methods, which allow qualitative and quantitative research methods to be examined as a whole, are used more in English studies (2 articles) than in Turkish studies (1 article).

Distribution According to the Research Designs Used in the Analyzed Articles

The distribution of the research methods used in the articles in terms of designs is also given in Figure 4.

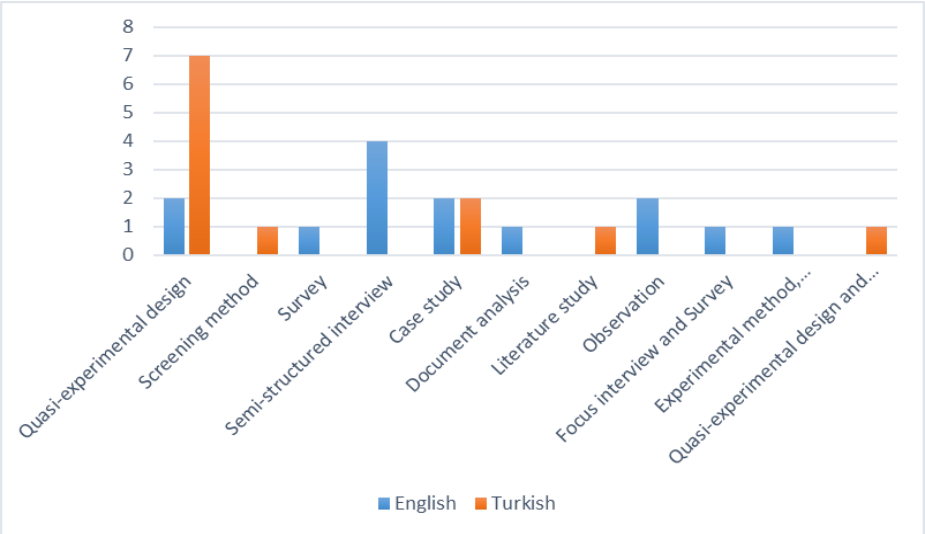


Figure 4. Distribution According to the Research Designs Used in the Studies.

When Figure 4, which shows the preferred research designs in the studies, is examined, it is seen that while semi-structured interviews are generally used in English studies (4 articles), quasi-experimental designs (2 articles) and observation (2 articles) are also preferred. In Turkish studies, quasi-experimental designs were mostly used similar to English studies (7 articles), while case study (2 articles) was also one of the preferred research designs. In addition to these, it is observed that research methods such as survey method, literature review and mixed methods, quasi-experimental design and case study are not preferred in English studies, while research designs such as questionnaires, semi-structured interviews and document analysis are not preferred in Turkish studies. Another finding was that other research designs were used in English and Turkish studies in common but with low frequency.

Distribution of Reviewed Articles According to Study Groups

The distribution of the study groups used in the studies is presented in Figure 5.

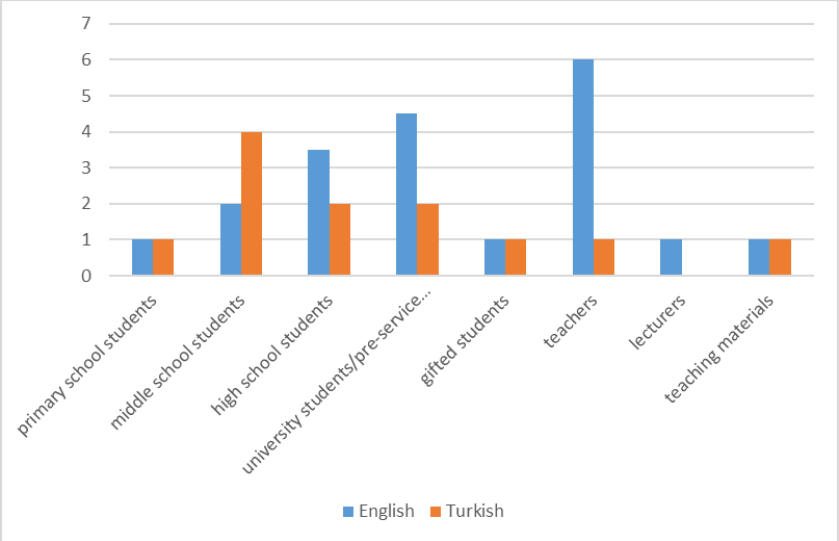


Figure 5. Study Groups of Turkish and English Studies.

When Figure 5 is analyzed, it is observed that the English studies included in the scope of the research were generally conducted with teachers (5 articles), followed by middle school (2 articles) and high school (2 articles) students. Turkish studies, on the other hand, were generally conducted with groups of middle school students (5 articles), followed by groups of high school students (2 articles) and university students/pre-service teachers (2 articles). Another finding is that the study groups preferred in Turkish studies consist of younger student groups than the study groups preferred in English studies.

Distribution According to Data Collection Tools Used in the Analyzed Articles

The quantitative and qualitative data collection tools used in the step of reaching the data by analyzing the articles preferred in the research are given in Tables 2 and 3.

Table 2.

Quantitative Data Collection Tools Used in the Studies Included in the Research

Research model	***Data Collection Tools***	***Codes of Work***
Quantitative Model	Academic Achievement Test (AAT)	Tr1, Tr3, Tr10
	Multiple Intelligence Inventory	Tr1
	Chemistry Achievement Test (KBT)	Tr12
	Electricity in Our Lives Achievement Test	Tr2
	Science Laboratory Entrepreneurship Scale	Tr2
	Learning Approach Inventory	Tr3
	Genetics and Ecology Survey	Eng7
	Learning Styles Scale	Tr2
	Personal Information Form	Tr6
	Teachers' Implementation of Differentiated Instruction and Level of Competence Scale	Tr6
	Fowler Test of Scientific Process Skills (Fsps)	Eng11
	Raven Advanced Progressive Matrices Test	Tr12
	Laboratory Online Survey	Eng9
	FGD (Focus Group Discussion)	Eng3

When Table 2 is examined, it is seen that the quantitative data collection tools preferred in the studies included in the scope of the research are not concentrated within the framework of a single tool in English studies, but tools such as Fowler Scientific Process Skills Test (1 article), Laboratory Online Questionnaire (1 article), FGD (Focus Group Discussion) (1 article) and Genetics and Ecology Questionnaire (1 article) were used in equal proportions. In Turkish studies, Academic Achievement Test (3 articles) was the most used data collection tool, while instruments such as Multiple Intelligences Inventory (1 article) and Learning Styles Scale (1 article) were also preferred.

Table 3.

Qualitative Data Collection Tools Used in the Studies

Research model	***Data Collection Tools***	***Codes of Work***
Qualitative Model	Videos	Eng2
	Classroom Activities	Eng5, Eng6, Eng6
	Motivation Scale for Learning Science	Tr8
	Semi-structured Interviews	Eng1, Eng3, Eng4, Eng5, Eng6, Eng9, Eng12, Tr7
	Student Agendas	Tr11
	Science Attitude Scale (SAS)	Tr8, Tr9
	Motivation Scale for Learning Science	Tr10
	Scientific Process Skills Scale	Tr10
	L	Eng1, Eng5
	Student Diaries Teaching Materials	Eng5, Eng6, Eng8, Eng10
	Classroom Climate Observation Form" (Sigf)	Tr4
	Observation Form	Eng1, Eng4
	Metaphor Form	Tr7
	Literature Review	Tr5

When Table 3 is examined, the qualitative data collection tools preferred in the studies included in the scope of the research are Semi-structured Interviews (7 articles), Instructional Materials (4 articles) and Classroom Activities (3 articles) in English studies, while Science Attitude Scale (SAS) (2 articles) is the most used data collection tool in Turkish studies. In addition to these tools, it is seen that tools such as Motivation Scale for Learning Science (1 article), Metaphor Form (1 article), Literature Review (1 article) are equally used in Turkish studies.

Distribution According to the Types of Data Analysis Used in the Analyzed Articles

The data analysis types preferred in the process of analyzing the data obtained in the studies are examined in Figure 6.

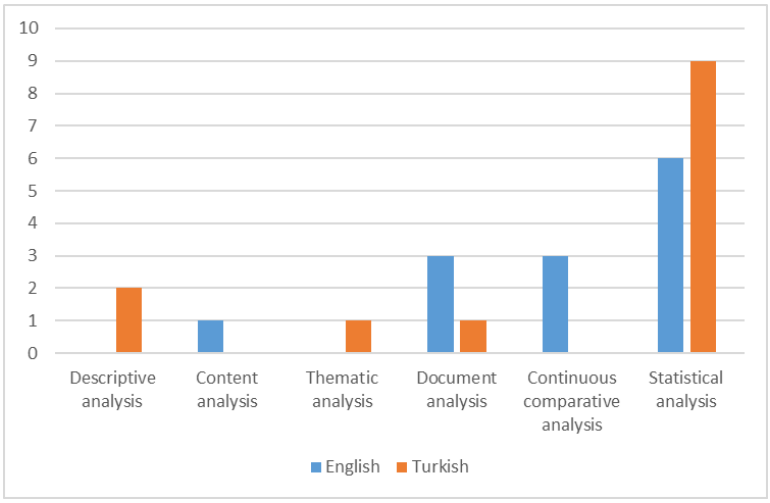


Figure 6. Data Analysis Methods Used in the Studies Included in the Research.

When Figure 6, which reveals the preferred data analysis types in order to interpret the findings, is examined, it is seen that qualitative analysis designs were preferred in English studies, while quantitative analysis designs were preferred in Turkish studies. From these qualitative and quantitative analysis methods, it was concluded that the studies published in both languages showed similarities in analysis methods, with statistical analysis methods (6 articles) mostly preferred in English studies and statistical analysis methods (9 articles) mostly included in Turkish studies. In addition to these, document analysis (3 articles) and constant comparative analysis (3 articles) methods were also preferred in English studies, while descriptive analysis method (2 articles) as well as statistical analysis the method was preferred in Turkish studies.

Distribution of Reviewed Articles According to Results

The results obtained from all the data were analyzed with the word clouds in Figures 7 and 8, which were created with the most common concepts in English and Turkish studies, and in addition to this, they were classified under different categories in Tables 4, 5 and 6.

Figure 7. English Studies.

Figure 8. Turkish Studies.

The results obtained from the studies were categorized under certain words and these words are presented as word clouds in Figures 7 and 8. When Figure 7, which was created in line with the results obtained from the English studies, is examined, it is observed that the results focused on are classified as science literacy, interest, enjoyment, attitude, process control, and dynamic process, while when Figure 8, which was created in line with the results obtained from the Turkish studies, is examined, it is observed that the Turkish studies are mostly classified under the titles of academic achievement, entrepreneurship skills, attitude, misconceptions, and incentives. In order to examine the results in more detail, the results revealing the effect of the approach on students by classifying them under different categories are analyzed in Table 4.

Table 4.

Results Revealing the Impact of the Approach on Students in the Studies Included in the Research

Category	***Code***	***Studies***
In terms of the student	Increased academic success	Tr1, Tr2, Tr10, Tr11 Tr12
	Contribution to science literacy level	Eng1
	Elimination of misconceptions	Tr1
	Their enjoyment	Eng8
	Increases entrepreneurial skills	Tr2
	Developing a positive attitude toward the lesson	Eng9, Eng11, Tr8, Tr9
	Increasing interest in science, technology, and the environment	Eng1
	Question switching strategy	Eng2
	Increasing deep learning scores	Tr3
	Increased motivation toward the course	Eng9, Tr8, Tr10
	Encouragement to attend class	Tr4
	Developing scientific process skills	Eng11, Tr10
	No difference in attitudes toward the course	Tr6

When Table 4, which describes the results of the studies included in the scope of the research, is examined, it is seen that the studies published in English mostly focused on students' attitudes towards science courses (2 articles), while results such as contribution to students' science process skills (1 article) and increase in motivation levels (1 article) were also reached. In the studies published in Turkish, the main outcome of the approach was a positive increase in students' academic achievement (5 articles), while similar to the English studies, an increase in students' motivation levels (2 articles) was also found. Another category, the results revealing the impact of the approach on teachers and pre-service teachers, is analyzed in Table 5.

Table 5.

Results Revealing the Effects of the Approach on Teachers and Pre-Service Teachers in the Studies Included in the Research

Category	***Code***	***Studies***
In terms of Teachers/Prospective Teachers	Preference in your classes	Eng6
	Making the lesson effective	Eng5
	Developing a positive attitude	Eng3
	Failure to fully implement the approach	Eng3
	Observe student differences more clearly	Eng4
	Control learning processes	Eng4, Eng6
	Giving responsibility to the student	Eng6
	Preparing a quality lesson plan	Tr7
	Making the learning process dynamic	Eng5, Eng12

When Table 5, which presents the results of the studies included in the scope of the research on the effects of the approach on teachers and pre-service teachers, is examined, it is concluded that the English studies contributed to the development of the idea that the approach helped teachers to control the learning process (2 articles) and to make the process dynamic (2 articles), while in Turkish studies, only one output was reached and the idea that the approach helped teachers to prepare qualified lesson

plans (1 article) was more prominent. The results regarding the impact of the approach on the curriculum in the studies are examined in Table 6.

Table 6.

Results Revealing the Impact of the Approach on the Curriculum in the Studies Included in the Research

Category	***Code***	***Studies***
In terms of the program	More effective than the current curriculum	Tr2
	Increased quality of cognitive-epistemic representation of the nature of science	Eng10

When Table 6, which presents the results of the studies included in the scope of the research on the effect of the curriculum on the curriculum, is examined, one study in English and one study in Turkish were found to reveal the results of the curriculum. In the English study, it was emphasized that students could better assimilate science and cognitive representations with the differentiated teaching approach integrated into the curriculum (1 article), while in the Turkish study, it was concluded that the differentiated teaching approach techniques were more efficient than the current curriculum approach (1 article).

Distribution of the Suggestions in the Analyzed Articles

In line with the results obtained, suggestions were made in some studies by identifying the shortcomings of the approach, and these suggestions are analyzed in Tables 7, 8, 9, and 10.

Table 7.

Suggestions Presented in terms of Students in the Studies Included in the Scope of the Research

Category	***Code***	***Studies***
In terms of the student	Conducting studies to reveal the level of science literacy and adoption of scientific process skills	Eng1
	To take into account the individual differences between gifted and talented students such as interest, motivation, and ability	Tr9
	Increasing academic achievement by creating homogeneous or heterogeneous groups	Tr1

When the suggestions presented in the studies are analyzed numerically, it is seen that suggestions were included in 8 studies published in English and 11 studies in Turkish. When Table 7, which examines the suggestions presented in terms of students, is analyzed, it is seen that Turkish studies mostly suggested that an increase in academic achievement can be observed by forming homogeneous or heterogeneous groups among students (1 article) and that the differences of gifted and talented students should be respected under appropriate conditions (1 article), while English studies suggested that appropriate studies should be carried out to improve students' science literacy and scientific process skills (1 article). In addition, the suggestions presented to teachers and pre-service teachers are analyzed in Table 8.

Table 8.

Suggestions for Teachers and Pre-Service Teachers in the Studies Included in the Scope of the Research

Category	***Code***	***Studies***
In terms of Teachers/Prospective Teachers	Improving the individual competencies of teachers who have difficulty in communicating effectively with their students	Tr4
	Teachers can be informed about the approach through various seminars	Tr5
	Teachers can be enabled to exchange information with each other	Tr10
	The deficiencies in the incomplete knowledge of prospective teachers can be identified	Tr11
	Plan the education and training process by taking into account the individual differences of students	Eng2, Eng7, Tr5
	Teachers should follow the technological developments and develop themselves according to the requirements of the age	Eng5, Eng6, Tr6
	There should be a tendency towards technological developments in undergraduate programs where teacher candidates are trained	Tr3

When Table 8, which analyzes the suggestions presented in the studies in terms of teachers and pre-service teachers, is examined, it is seen that 4 suggestions are presented in English studies and 7 suggestions are presented in Turkish studies. While the suggestions presented in English were that

teachers should take into account the individual differences of students (2 articles) and improve themselves by following technological developments (2 articles), the Turkish studies also included the suggestions presented in the English studies, and in addition to these, suggestions such as teachers or pre-service teachers should be informed about the approach (1 article), missing information should be identified (1 article), and they should plan an education-teaching process in a way to interact with each other (1 article). In the studies based on the approach, suggestions in terms of the program are also examined in Table 9.

Table 9.

Suggestions Presented in terms of Curriculum in the Studies Included in the Scope of the Research

Category	***Code***	***Studies***
In terms of the program	Individual differences in teaching practices should be given more space in the curriculum	Tr3
	The use of various approaches within differentiated instructional practices should be encouraged	Tr2
	Modern education approaches should be based on modern education approaches instead of traditional education	Eng3
	Differentiated science teaching modules can be developed for the individual development of gifted students	Eng8, Tr7
	Courses on the approach should be diversified and the number of courses should be increased	Eng9
	It can be done by developing new designs at different grade levels and subject levels	Tr8

When Table 9, which examines the suggestions in terms of the program presented in the studies, is examined, it is observed that there are 3 suggestions in English studies and 4 suggestions in Turkish studies. In English studies, suggestions such as basing the approach on contemporary educational philosophy in order for it to be effective (1 article) and encouraging studies such as courses and seminars (1 article) were made, while in Turkish studies, suggestions such as individual differences should be given more space in the curriculum (1 article), the approach should be internalized in every aspect and its different dimensions should be encouraged to be used (1 article) and diversifications should be made on the basis of class and subject (1 article) were made. In addition to these, it was

suggested that teaching could be made more effective by developing various modules by taking into account the developmental characteristics of gifted students in Turkish and English studies. Among the suggestions made in the studies to make the approach more effective, those related to learning environments are analyzed in Table 10.

Table 10.

Suggestions Presented in terms of Learning Environments in the Studies Included in the Scope of the Research

Category	***Code***	***Studies***
Learning environments	School conditions should be improved for differentiated teaching practices to become widespread	Eng3, Tr6
	Class sizes should be reduced	Eng3, Tr6
	Material aid should be provided to schools	Eng3, Tr6

When Table 10, which analyzes the suggestions in terms of learning environments presented in the studies, it is seen that 3 suggestions were made in English studies and 4 suggestions were made in Turkish studies. It is seen that the suggestions have common features on the basis of languages and are mostly presented as improving school conditions (2 articles), reducing class sizes (2 articles), and improving materials in schools (2 articles).

Discussion and Conclusion

In this study, the articles in this field were examined in order to reveal the perspective of the differentiated instruction approach in the world and Türkiye between 2006-2023 and how this alternative learning approach was integrated into the education process. Within the framework of this purpose, the place of differentiated instruction approach in the world and in Türkiye is described based on qualifications, and the perspective on the approach is tried to be revealed with its positive and negative aspects. The findings were categorized and analyzed under nine headings: languages of the studies, years, purposes, research methods and designs used, study groups, data collection tools, analysis methods, conclusions reached, and recommendations.

When the Turkish and English studies selected in line with the targeted objectives were examined, it was seen that a total of 24 studies based on differentiated instruction approach were found in the preferred databases and 12 of these studies were published in Turkish and 12 in English.

In the research conducted by Karadağ et al. (2008), it was found that Türkiye started to adopt the constructivist approach in the first level of primary education in 2005-2006 and although the studies published on differentiated instruction, which entered our lives as output of this approach, are numerically equal, when examined on the basis of the years they were conducted, the oldest English study was published in 2006, while the oldest Turkish study was published in 2014, which leads us to conclude that the interest in differentiated instruction in the world started to develop before Türkiye. In addition, the increase in the number of studies published in English mostly in 2019 and 2023, and the increase in the number of Turkish studies mostly in 2014, 2015, and 2023 reveals that the recent interest in approach phenomena has been increasing. In this context, when the distributions according to years are analyzed comparatively, it supports the idea that Türkiye is conducting studies that can close the gap with recent studies, although it is one step ahead in terms of the adoption of the phenomena with the studies published in the world on the approach starting earlier than Türkiye.

In order for the studies to be capable of describing a problem situation, they are carried out under certain objectives and this is one of the main points where they differ from each other. The diversity of the objectives taken as a basis in the studies most accurately reveals the general tendency of the approach in the conditions in which they are published. In this context, it is seen that a total of 14 objectives were adopted in English studies and mostly aimed at revealing teachers' attitudes towards differentiated instruction and their level of implementation, while in Turkish studies, a total of 19 objectives were adopted and mostly focused on the effect on student's academic achievement, attitudes and motivation towards the course, similar to the studies conducted by Baumgartner, Lipowski, and Rush (2003) and Gilbert (2011). In addition to these aims, the studies focusing on providing opportunities for students to develop scientific process skills and aiming to reveal the differences in teachers' perspectives on the approach were addressed from common aspects in both Turkish and English studies. Thus, it is observed that the studies carried out in both languages in order to obtain similar outputs are in an effort to develop the approach for the future rather than characterizing the current state of the approach.

Planned research becomes meaningful when the process of creating the research design, collecting and interpreting information, and reaching the results complement each other (Yıldırım, 1999), and in this direction, certain research designs that allow the studies to proceed in a certain systematic manner are preferred. In this direction, when we examine the research designs preferred in the studies, it is seen that qualitative methods, which are the designs that can best reveal the effect of the approach by Civitillo et al. (2016), stand out in English studies. 14 In the English studies where

the research design was preferred, semi-structured interviews from qualitative methods were used as the majority. In Turkish studies, it is seen that quantitative methods, which are supported by Deunk et al. (2018) and aim to reveal statistical data, come to the fore. In the 12 Turkish studies, the research process was carried out using a quasi-experimental design, which is mostly quantitative methods. In addition to these designs, while it is observed that the quasi-experimental design from quantitative designs and the case study method from qualitative designs are preferred in English and Turkish studies, it is also concluded that some of the studies carried out are carried out within the scope of joint planning.

The method of obtaining qualified data in the process is to select the study groups that will provide the most accurate access to the target outcomes. When we look at the study groups in the published studies, it is observed that the English studies are mostly conducted with teachers who are the transmitters of the differentiated instruction approach, while the study groups preferred in Turkish studies consist of secondary school students, which is the main focus of the approach. In the research conducted by Karadağ et al. (2016), it is emphasized that the studies revealing the differentiated instruction approach are mostly at the 5th-grade level. Thus, it is concluded that the perspective on the differentiated instruction approach in the world is the idea that the approach can be shaped by teachers, whereas in Türkiye, the way the approach is adopted is the idea that students themselves will play an active role. In addition, the fact that the studies conducted with lecturers are only seen in studies published in English reveals the missing point in the Turkish literature. Another conclusion is that gifted students and the instructional materials used in the lessons are common in both English and Turkish studies, while differentiation features are observed to overlap in the studies published in both languages.

In the process of obtaining the most accurate data in line with the objectives of the studies, the preferred data collection tools are as important as the data collection group, and a total of 23 data collection tools were used in the English studies and 22 data collection tools were used in the Turkish studies. Although semi-structured interviews from qualitative models are a common data collection tool for studies published in both languages, classroom activities, student diaries, and observation forms are the most preferred tools in English studies. In Turkish studies, on the other hand, quantitative models were preferred and tools such as academic achievement tests and student agendas were used. The data obtained were analyzed using a total of 26 quantitative and qualitative analysis types, 13 in English and 13 in Turkish, within all the plans. In Turkish studies, the statistical analysis method is preferred more to the quantitative step, while in English studies, analysis methods such as

comparative analysis and document analysis are preferred. In addition to these, it is also concluded that document analysis and statistical analysis methods are also used in common in studies published in both languages and that they are similar to each other at this point. In the study conducted by Özkal (2020), it was emphasized that the content analysis analyses used in the study provided significant guidance in reaching the outcomes related to the differentiated instruction approach.

As a result of analyzing the imprint and content information of all the studies, it is observed that the studies were completed with different purposes and systematic processes in both languages and some results were reached. In the English studies, which mostly focus on teachers' perspectives and attitudes towards the approach, positive results such as the fact that teachers, who are the implementers of the process, can reach the outcomes of the differentiated instruction approach at the desired levels and make their lessons more qualified within the framework of these directions are mentioned. Kapusnick and Hauslein (2001, p. 159) emphasized that the approach should guide teachers. In terms of students, Anderson (2007, p. 52), it is concluded that the approach has an effect on increasing students' motivation towards the course and allows them to grow up as individuals who develop science literacy and scientific process skills, while in Turkish studies, which mostly aim to reveal the level of students' access to the outcomes of the approach, which is the main point of the approach, students can develop academic achievements at the desired level within the education-teaching process carried out on the basis of the differentiated instruction approach, It is concluded that their motivation towards the lesson increased, they were able to realize the misconceptions they had, and they were able to take a broad perspective in line with scientific and technological outputs. In addition, in Turkish studies, it is concluded that there may be some problems such as inadequate school facilities at the level of achieving the approach outcomes from the teacher's point of view, while in English studies, negative results such as the problems encountered are due to the teachers' competencies are also reached. In a similar and common way, both Turkish and English studies suggest that a more qualified education process will be carried out as a result of the integration of the approach outcomes into the existing program contents.

In light of all the findings obtained, in order to internalize the differentiated instruction approach in the best way, common suggestions were made in both languages, such as the need for teachers to plan education and training processes by taking into account the individual differences of students and to be open to renewing themselves in accordance with the developments of the age, and in terms of environments, learning environments should be organized so that individual differences can be realized in more authentic environments. In addition to these, in English studies, it was emphasized

that an individual-oriented education should be provided on the basis of the contemporary understanding of education, while in Turkish studies, it was emphasized that students should be provided with environments where they can express themselves by participating more in the education-training process.

When all the English and Turkish studies included in the scope of the research are analyzed, it is concluded that while English studies focus more on the contribution to the development of students' affective characteristics such as attitude, motivation, and interest, Turkish studies focus on cognitive characteristics such as academic achievement by taking into account the characteristics of students such as whether the approach helps them learn factual terms or not, and the view that the real difference in students may emerge in affective aspects is ignored. Thus, as stated in the study by Lawrence-Brown (2004), the differentiated instruction approach will be able to maximize achievement levels and abilities by updating curricula in line with student needs.

Recommendations

- The effectiveness of the approach can be questioned by selecting different samples including other groups such as parents and school administrators who play a role in the education and training process.
- Learning environments can be organized in accordance with the outcomes of a differentiated teaching approach.

About Authors

First Author: Zeynep Ecem Alkın is a Master's student at Eskişehir Osmangazi University Institute of Educational Sciences, Science Education with a Thesis. She completed her undergraduate education at Eskişehir Osmangazi University, Department of Science Education.

Second Author: Burcu Anılan is a member of Eskişehir Osmangazi University. She works at the Faculty of Education. She is currently working at the Mathematics and Science Education Department. He mainly works in the fields of Science and Chemistry Education.

Conflict of Interest

It has been reported by the authors that there is no conflict of interest.

Funding

No funding was received.

Ethical Standards

We have carried out the research within the framework of the Helsinki Declaration.

ORCID

Zeynep Ecem Alkın https://orcid.org/0009-0000-9569-0822

Burcu Anılan https://orcid.org/0000-0002-4153-1866

References

(The articles analyzed in the research are indicated with *)

Abbati, D. G. (2012). *Differentiated instruction: Understanding the personal factors and organizational conditions that facilitate differentiated instruction in elementary mathematics classrooms*. [Degree of Doctor of Education, California University].

*Akıllı, M., Keskin, H. K., & Ay, Ş. (2017). Farklılaştırılmış fen deneylerini değerlendirme sürecinin öğrencilerin fene karşı tutum ve motivasyonları üzerindeki etkisi. *E-Kafkas Journal Of Educational Research, 4*(1), 51-56.

Anderson, K. M. (2007). Tips for teaching: Differentiating instruction to include all students. *Preventing School Failure, 51*(3), 49-54.

*Avcı, Ö., Çelik, H., & Bayram, K. (2022). Farklılaştırılmış öğretim uygulamalarının ortaokul öğrencilerin elektrik ünitesindeki başarısı ve girişimcilik becerisi üzerinde etkisi. *Fen Matematik Girişimcilik Ve Teknoloji Eğitimi Dergisi, 5*(3), 278-297.

Baumgartner, T., Lipowski, M. B., & Rush, C. (2003). *Increasing reading achievement of primary and middle school students through differentiated instruction*. Erişim adresi: https://eric.ed.gov/?id=ED479203

Bekler, Ö., & Kozikoğlu, İ. (2022). Öğretimi farklılaştırmayı güçleştiren faktörlere ilişkin öğretmen algı envanteri: geçerlik ve güvenirlik çalışması. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi, 42*(2), 1025-1052.

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal, 9*(2), 27-40.

*Camcı Erdoğan, S. (2014). Üstün zekalı ve yetenekli öğrenciler için fen bilimleri eğitiminde farklılaştırmanın gerekliliği. *Journal for The Education Of Gifted Young Scientists, 2*(2), 1-10.

*Camcı Erdoğan, S., & Kahveci, N. G. (2015). Farklılaştırılmış fen ve teknoloji öğretiminin üstün zekalı ve yetenekli öğrencilerin tutumlarına etkisi. *Hayef Journal of Education, 12*(1), 191-207.

Chen, W. (2011). *Differentiation in art education: Exploring two art teachers' responsive pedagogy in an elementary school in Taıwan.* [Degree of Doctor of Philosophy in Elementary Education, Illinois University].

*Çalgıcı, G., & Duru, M. K. (2023). Farklılaştırılmış öğretimin kütle ve ağırlık kavram yanılgılarının giderilmesine ve akademik başarıya etkisi. *Marmara Üniversitesi Atatürk Eğitim Fakültesi Eğitim Bilimleri Dergisi, 57*(57), 201-225.

Çam, Ş. S., & Acat, M. B. (2023). Öğretmenlerin farklılaştırılmış öğretim yaklaşımını uygulama ve buna ilişkin yetkinlik düzeyleri. *Muş Alparslan Üniversitesi Eğitim Fakültesi Dergisi, 3*(1), 96-120.

Civitillo, S., Denessen, E., & Molenaar, I. (2016). How to see the classroom through the eyes of a teacher: consistency between perceptions on diversity and differentiation practices. *J. Res. Spec. Educ. Needs 16*, 587–591. doi: 10.1111/1471-3802.12190

Demir, S. (2013). *Farklılaştırılmış öğretim yöntemlerinin öğrencilerin akademik başarı, öğrenme yaklaşımları ve kalıcılık puanları üzerindeki etkisi.* [Yayımlanmamış Doktora Tezi, Yıldız Teknik Üniversitesi].

*Demir, S., & Gürol, M. (2016). Farklılaştırılmış öğretim yöntemlerinin derin ve yüzeysel öğrenen öğrencilerin kalıcılık puanları üzerindeki etkisi. *Pegem Eğitim ve Öğretim Dergisi, 5*(2), 187-206.

Deunk, M. I., Smale-Jacobse, A. E., de Boer, H., Doolaard, S., & Bosker, R. J. (2018). Effective differentiation practices: a systematic review and meta-analysis of studies on the cognitive effects of differentiation practices in primary education. *Educ. Res. Rev. 24*, 31–54. doi: 10.1016/j.edurev.2018.02.002

Etienne, J. S. (2011). *A grounded theory approach to the use of differentiated instruction to improve students' outcomes in mathematics*. [Degree of Doctor of Education, Walden University]

Forster, N. (1994). The analysis of company documentation. C. Cassell & G. Symon (Ed.) içinde, *Qualitative methods in organizational research, a practical guide* (s. 147-166). SAGE publication.

*Fricke, K. & Reinisch, B. (2023). Evaluation of nature of science representations in biology school textbooks based on a differentiated family resemblance approach. *Sci & Educ 32*, 1583–1611.

Gilbert, D. (2011). *Effects of differentiated instruction on student achievement in reading* [Doktora tezi]. Accessed through ProQuest Dissertations and Theses Database.

Gilbert, D. L. (2012). *A teacher's perception: Perception of the impact of differentiated instruction*. [Degree of Doctor of Education, Jones International University].

*Graaf, A., Westbroek, H. & Janssen, F. (2019). A practical approach to differentiated instruction: how biology teachers redesigned their genetics and ecology lessons. *Journal of Science Teacher Education, 30*(1), 6-23.

Gregory, G., & Chapman, C. (2007). *Differentiated instructional strategies: One size doesn't fit all.* Thousand Oaks, CA: Corwin Press.

Kapusnick, R., A., & Hauslein, C. M. (2001). The silver cup' of differentiated instruction. *Kappa Delta Pi Record 37*(4), 156-159.

Karadağ, E., Deniz, S., Korkmaz, T., Deniz, G. (2008). Yapılandırmacı öğrenme yaklaşımı: Sınıf öğretmenleri görüşleri kapsamında bir araştırma. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi, 21*(2), 383-402.

Karadağ, R. (2014). Dünyada ve türkiye'de farklılaştırılmış öğretimle ilgili yapılmış çalışmaların değerlendirilmesi. *Kastamonu Eğitim Dergisi, 22*(3), 1301-1322.

Karadağ, R. (2016). The evaluation of Phd dissertations on differentiated instruction in Turkey and other countries. *Kastamonu Eğitim Dergisi, 22*(3), 1301-1322.

*Kutlu Abu, N. K. A., & Gökdere, M. (2020). Üstün yeteneklilere yönelik farklılaştırılmış fen öğretim modülü hakkında sınıf öğretmeni adaylarının kavramsal algıları ve değerlendirmeleri. *Van Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi, 17*(1), 768-798.

Lawrence-Brown, D. (2004). Differentiated instruction: Inclusive strategies for standards-based learning. *American Secondary Education, 32*(3), 34-62

Learn, D. T. (2012). *Differentiatıng instruction on the basis of cognitive tools: A case study of honors and mainstream middle school classes*. [Degree Doctor of Philosophy, Capella University].

Levy, H. (2008). Meeting the needs of all students through differentiated instruction: Helping every child reach and exceed standards. *The Learning House, 81*(4), 161-164.

*Maeng, J. L. (2017). Farklılaştırılmış lise fen öğretimini kolaylaştırmak için teknolojiyi kullanmak. *Res Sci Educ, 47*, 1075–1099.

*Maeng, J. L. &. Bell, R. L. (2015) Differentiating Science Instruction: Secondary science teachers' practices. *International Journal of Science Education, 37*(13), 2065-2090.

*Mastropieri, M. A., Scruggs, T. E., Norland, J. J., Berkeley, S., McDuffie, K., Tornquist, E. H., & Connors, N. (2006). Differentiated curriculum enhancement in inclusive middle school science: effects on classroom and high-stakes tests. *The Journal of Special Education, 40*(3), 130-137.

Mathis, C. (2012). *A framework for meeting the needs of all students through differentiated instruction at Richardson Park Learning Center*. [Degree of Doctor of Education, Wilmington University].

*Melese, S. (2019). Instructors' knowledge, attitude and practice of differentiated instruction: The case of college of education and behavioral sciences. *Bahir Dar University, Amhara region, Cogent Education, 6*(1), 1642294.

*Mok, Heng. (2012). Student usage patterns and perceptions for differentiated lab exercises in an undergraduate programming course. *Education, IEEE Transactions on. 55*. 1-1.

NMSA Research Committee. (2003). *Multiple learning and teaching approaches that respond to their diversity*. in Research and Resources in Support of this We Believe Westerville, OH: National Middle School Association

Olçay Gül, S. (2014). Farklılaştırılmış öğretim ve uyarlamalar. *Ufuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 3*(5), 111-123.

*Özdemir, E., & Yurtseven, N. (2023). Ubd temelli farklılaştırılmış fen öğretiminin öğrencilerin motivasyonlarına, bilimsel süreç becerilerine ve akademik başarılarına etkisi. *Ulusal Eğitim Akademisi Dergisi, 7*(1), 1-16.

Özkal, N. (2020). Eğitim programları ve öğretim alanında yapılan doktora tezlerinin incelenmesi: 2015- 2019. *Opus International Journal of Society Researches, 15*(25), 3415-3442.

Sak, R., Şahin Sak, İ. T., Öneren Şendil, Ç., & Nas, E. (2021). Bir araştırma yöntemi olarak doküman analizi. *Kocaeli Üniversitesi Eğitim Dergisi, 4*(1), 227-250.

*Salar, R., & Turgut, Ü. (2015). Implementing differentiated instruction on pre-service physics teachers: agendas /fizik öğretmen adaylarına farklılaştırılmış öğretimin uygulanması: ajandalar).... Doi: 10.14686/Buefad.V4i2.5000136908. *Bartın University Journal of Faculty of Education, 4*(2), 682-695.

*Salar, R., & Turgut, Ü. (2019). Farklılaştırılmış öğretimin sınıf iklimine etkisi: nitel bir çalışma. *Cumhuriyet Uluslararası Eğitim Dergisi, 8*(4), 1048-1068.

*Santoso, P. H., Istiyono, E. & Haryanto (2022). Physics teachers' perceptions about their judgments within differentiated learning environments: a case for the ımplementation of technology. *Educ. Sci., 12*, 582.

Stevens, K. Y. (2012). *Elementary, general-education teachers' reports of self-efficacy in using evidenced-based instructional strategies to differentiate instruction for students with disabilities*. [Degree of Doctor of Education, Hartford University].

*Şentürk, C., & Sari, H. (2018). Investigation of the contribution of differentiated instruction into science literacy. *Qualitative Research in Education, 7*(2), 197-237.

*Thapliyal, M., Ahuja, N.J. & Shankar, A. (2022). A differentiated learning environment in domain model for learning disabled learners. *J Comput High Educ, 34*, 60–82.

*Tobin, Ruthanne & Tippett, Chris. (2014). Possıbılıtıes and potentıal barrıers: learnıng to plan for dıfferentıated ınstructıon ın elementary scıence. *International Journal of Science and Mathematics Education. 12*. 10.1007/S10763-013-9414-Z.

Tomlinson, C. A. (1995). *How to differentiate instruction in mixed-ability classrooms*. USA, Alexandria, VA: Association for Supervision and Curriculum Development

Tomlinson, C. A. (2000). Reconcilable differences: Standards-based teaching and differentiation. *Educational Leadership*, 58, 6-11.

TCSII. (2001). Taking Center Stage – Act II. Characteristics of differentiated instruction. *California Department of Education*, 140, 141.

*Umar, Ç. N., Reis, Z.A., (2014). Karma öğrenme yöntemi ile farklılaştırılmış öğretim ortamının üstün zekâlı ve yetenekli kişilerin akademik başarılarına etkisi. *İZÜ Sosyal Bilimler Dergisi, 3*(5), 1-30.

Waller, T. H. (2011). *Advanced placement teachers' perceptions of differentiated instruction*. [Degree of Doctor of Education, Walden University].

White, M. E. (2012). *An examination of professional development on differentiated instruction with K-4 teachers*. [Degree of Doctor of Education, Northcentral University].

Williams, T. (2012). *Differentiated mathematics instruction for students in grades 3 and 4 in a rural school district*. [Degree of Doctor of Philosophy, Walden University].

Yıldırım, A. (1999). Nitel araştırma yöntemlerinin temel özellikleri ve eğitim araştırmalarındaki yeri ve önemi. *Eğitim ve Bilim, l*(2). 112, ISSN 1300-1337.

Yıldırım, A., & Şimşek, H. (2016). *Sosyal bilimlerde nitel araştırma yöntemleri* (10. Baskı) Ankara: Seçkin Yayıncılık.

*Zerai, D., Eskelä-Haapanen, S., Posti-Ahokas, H. & Vehkakoski, T. (2023). The use of question modification strategies to differentiate instruction in Eritrean mathematics and science classrooms. *Educ. Sci., 13*, 284.

Zoraloğlu, S., & Şahin, A. E. (2022). Bir sınıf öğretmeninin farklılaştırılmış öğretim yaklaşımıyla ilişkilendirilebilir uygulamaları. *Yaşadıkça Eğitim, 36*(3), 834-854.

Osmangazi Journal of Educational Research **Volume 11(1), Spring 2024**

RESEARCH Open Access

Suggested Citation: Özen, E., & Çıray Özkara, F. (2024). Investigation of middle school students' attitudes towards mathematics course in the context of different variables (Eskişehir-Türkiye Case). *Osmangazi Journal of Educational Research, 11*(1), 185-207.

Submitted: 03/06/2024 **Revised:** 31/08/2024 **Accepted:** 31/08/2024 **DOI:** 10.59409/ojer.1494919

Investigation of Middle School Students' Attitudes towards Mathematics Course in the Context of Different Variables (Eskişehir-Türkiye Case)

Emin Özen, Funda Çıray Özkara

Abstract. It is believed that students' motivation and emotions have an important role in their understanding of mathematics teaching. In this context, this study aims to investigate middle school students' attitudes towards mathematics lessons in the light of various variables. A quantitative cross-sectional survey approach was used in the design of the study. It was tried to understand how these variables affect students' attitudes towards mathematics. In the study, various variables such as gender, grade level, school type, technology use, use of concrete materials/activities in lessons and use of Education Information Network (EBA), an online platform for distance education, were taken into consideration. According to the findings of the study, students' attitudes towards mathematics lessons are positively affected by educational policies, curriculum designs and the creation of concrete materials and activities in the classroom. In particular, a detrimental change was observed in the attitudes of students who used EBA less. The perspective provided by this study is crucial for understanding middle school students' attitudes about mathematics in learning environments. It is also recommended that the study be extended to cover more samples and regions, as the findings can serve as a basis for further research.

Keywords: Attitude, middle school, EBA, open and distance education, mathematics education.

***(Responsible Author).** Dr., Assessment and Evaluation Department, Ministry of National Education, Eskisehir, Türkiye

e-mail: eminozen@anadolu.edu.tr

** Dr., R&D Department, Ministry of National Education, Eskisehir, Türkiye

e-mail: fcry1085@gmail.com

Today, it is seen that middle school students' attitudes, motivation and emotions towards mathematics have a significant effect on their achievements. Motivation and emotions play an important role in students' learning process and mathematical achievement (Fazlı & Avcı, 2022; Filiz & Gür, 2020; Çalık, 2024). Nolting (2007) states that students' performance in mathematics courses is related to their attitudes as well as their mathematical knowledge. Interestingly, research on students' attitudes towards mathematics has become more important in recent years (Schukajlow et al., 2023). Research that tries to identify the variables that contribute to the success of mathematics teaching typically considers students' abilities or attitudes towards the subject as an output (explained variable) and investigates the inputs that affect this output and the links between the inputs (Duran et al., 2023).

Students' attitudes are one of the most crucial markers of their emotive qualities in a course (Gardner & Lambert, 1972; Stern, 1983; Brown, 2001; Karasakal & Saracaloğlu, 2009; Kaya et al., 2009 quoted in Kazazoğlu, 2013). According to the Turkish Language Association (In Turkish TDK) (2023), the concept of attitude, which is briefly defined as the way, attitude, is also referred to as a method of finding a way that determines what people see, hear, think and do (Allport, 1935 quoted in Bohner & Dickel, 2011). Attitude, one of the main topics of social psychology, is also defined as a mindset or tendency to behave in a certain way depending on both the individual's experience and temperament, which is a combination of personality, beliefs, values, behaviors, and motivation (Pickens, 2005). Value systems further define attitude as the preconceived notion that categorizes anything, someone, the world, or a symbol as either good, bad, harmful or beneficial (Tavşancıl, 2014).

One of the key factors thought to be responsible for explaining pupils' willingness or inability to study is their attitudes (Hotaman & Okumuş, 2020). While middle school mathematics courses appear to be primarily cognitive, emotive qualities are also crucial to the mathematical learning process (Boz, 2017). Students' performance or lack thereof in mathematics, as well as their enthusiasm for the subject, are significantly influenced by their attitudes (Çoban, 1989). Affective traits are crucial for mathematical learning even if the middle school mathematics curriculum appears to be mostly a cognitive endeavor (Boz, 2017). Students' attitudes greatly impact whether they succeed or fail in math and how much they enjoy the subject. Demirgören (2010) cites research demonstrating that students in various nations have a fear of mathematics and that there are negative views toward the subject, as well as historical examples. Despite being a required and fundamental course in middle education, many students find mathematics to be a challenging subject to study.

Students' achievement suffers as a result of this circumstance, which makes them have a negative attitude toward mathematics (Kurbanoğlu & Takunyacı, 2012). Furthermore, it can be claimed that the middle school mathematics course is one of those that draws attention to procedures like the High School Entrance Examination (In Turkish LGS) because of things like the superiority of the mathematics score coefficient and how it affects students' success scores. It was reported that middle school students found mathematics to be the most challenging subject during the pandemic (Karataş, 2020). According to Ministery of National Education, [MoNE] (2018), the impact of cultivating a positive attitude towards mathematics on mathematical achievement is a significant consideration while implementing the middle school mathematics curriculum. In a study involving high school students, Sezgin (2013) found a strong correlation between students' attitudes toward mathematics and academic self-efficacy and their mathematical achievement. The correlation between mathematics achievement and attitudes toward mathematics courses, which are seen as essential courses for students to take, has been noted by Koca (2011) and by Cantürk-Günhan et al. (2019).

The COVID-19 epidemic is believed to have an impact on several variables, including pupils' academic performance, attitude, self-efficacy, anxiety level, and motivation in courses requiring numerical skills like science and mathematics that are taught in middle schools in Turkey (Bakioğlu & Çevik, 2020; Bakırcı, Doğdu & Artun, 2021; Çoban & Ellez, 2022). As a result of the literature review, it was understood that many studies determine students' attitudes towards mathematics courses from primary school to higher education and examine their attitudes in terms of different variables, but after the Covid-19 outbreak in Turkey, there were few studies such as Kılıç (2022), Kara and Özkaya (2022), which determined the mathematics attitudes of middle school students in Turkey and investigated the relationship with different variables such as LGS achievement scores of 8th-grade students and motivation. Nevertheless, no research has been done to ascertain the attitudes of middle school students at various grade levels toward mathematics courses and to investigate the impact of various factors, including the frequency of EBA usage and the integration of educational technologies in the classroom, on the attitudes of the students.

One of the online learning platforms utilized by Turkish middle school pupils is the Education and Informatics Network (In Turkish EBA). During the COVID-19 pandemic, the MoNE advised using this platform, which has also been used for conducting online learning courses (Vahit, 2019; Çoban & Ellez, 2022). Known as the integrated distance education process, it is the process by which schools take a break from providing face-to-face instruction beyond 2020. EBA TV and the EBA live classroom application have grown to be valuable tools for teachers in this regard. Some middle school

courses, such as mathematics, were provided to pupils via the EBA live classroom application for around a year. Teachers attempted to incorporate many tools and resources, like Web 2.0 tools and augmented reality applications, into real-time classroom applications during this phase (Çıray-Özkara, 2023). While it is acknowledged that the use of technology in learning environments affects students' arithmetic achievement and attitudes, the majority of studies have focused on teachers' perceptions of ICTs (Higgins et al. 2017; Vahit, 2019; Viberg et al. 2023). Studies that involve students thinking about related topics in mathematics education are needed. Teachers should be the target audience for these studies, which also measure students' attitudes toward mathematics and look at the relationship between variables influencing attitudes toward mathematics from various angles, like the use of technology.

In the context of all this information, the aim of this study is to examine the attitudes of middle school students in Eskişehir province towards mathematics lessons by considering demographic factors such as gender, school type, and frequency of using educational technologies, frequency of participating in applied activities in mathematics lessons and frequency of using EBAs. The study also aims to provide suggestions for improving these attitudes. In this framework, the study aims to address the following questions:

1. What is their attitude level?
2. Do their attitudes vary according to gender?
3. Do their attitudes vary according to school type?
4. Do their attitudes vary according to their grade level?
5. Do their attitudes vary according to the frequency of EBA use?
6. Do their attitudes vary according to the use of educational technologies in lessons?
7. Do their attitudes change according to the situation of performing concrete activities in lessons?

Method

The research will be designed in the cross-sectional survey model of the quantitative research method (Büyüköztürk et al., 2012). The cross-sectional survey model aims to take a picture of the situation collecting data simultaneously to illuminate a situation, variable, phenomenon and to reveal

the situation, variables and relationships between variables by examining this photograph (Barış, 2015).

The Study Group

The population of the study is all middle school pupils (N=72,145) enrolled in Eskişehir during the 2022–2023 academic year. By getting approval from the appropriate units, the mathematics teachers of every middle school in Eskişehir distributed the link to the data collection tool to the students as part of the study. In the process of data collection, the 'online survey' technique was utilized and the data collection tool was uploaded to the online survey platform called Google Forms. Within the scope of the study, data were collected from 501 (n=501) middle school students. The calculation made through the Rao soft sample size calculation program shows that the data obtained from at least 384 students represent the universe, and Creswell (2013) states that 360 or more participants in survey studies generalize the universe. In this context, it is concluded that the data collected within the scope of the study is sufficient.

Data Collection

To gather data, a questionnaire form that aligned with the study's objectives was created. The initial section of the survey asks about the personal details of the students, including their gender, grade level, type of school, use of educational technologies, use of the Education Information Network (In Turkish EBA), and performance of concrete activities during math lessons. In the second part, the Mathematics Attitude Scale developed by Gülburnu and Yıldırım (2015) was included. The 5-point Likert-type scale consists of 5 sub-dimensions and 27 items. In order to reveal the reliability of the scale, Cronbach Alpha internal consistency coefficient was calculated. Cronbach Alpha coefficient was found to be .880 for all items. As a result of the factor analysis, it was seen that the scale items reflected the dimensions of 'In-Course, Nature of Mathematics, Problem Solving, Understanding and Self-Efficacy' towards mathematics. According to the findings obtained, it was concluded that the ITS has a reliable structure with measurement validity that measures primary and middle school students' attitudes towards mathematics and consists of five sub-dimensions. In this context, the scale, whose validity and reliability tests have been conducted, is applicable to middle school students.

Sub-factor averages, factor correlations, and diagnostic statistics about the study group are all included in the analysis of the quantitative data from the questionnaire form that was administered to 501 students (281 female and 220 male) in the 2022–2023 academic year using the IBM SPSS 25

package program. In addition, in the comparison of quantitative data, the normality assumption for the data was first tested and then parametric tests were applied. This study employed a t-test to compare variables with two categories. For variables with three or more categories, a one-way analysis of variance (ANOVA) was used. If the ANOVA indicated a significant difference, post-hoc tests were conducted to pinpoint specific group differences.

Data Collection Tools

Form for participant information. Completing concrete activities in math lessons, using educational technology frequently, *gender, grade level and type of school attended, frequency of using EBA, and performing activities* in math classes were all questions on the Participant Information Form, which was created per the research's objectives.

Math attitude scale. A study was conducted by Gülburnu and Yıldırım (2022) developed a mathematics attitude scale. The scale demonstrated good internal consistency with a Cronbach's Alpha of .880 for all items and above .7 for subscales. The Kaiser-Meyer-Olkin (KMO) measure was .888, indicating suitability for factor analysis. The analysis revealed that the scale items effectively capture five dimensions related to student attitudes towards mathematics: In-Course, Nature of Mathematics, Problem Solving, Understanding, and Self-Efficacy. These findings suggest the scale is a reliable and valid measure of middle school students' mathematics attitudes. The scale consists of 27 items across five sub-dimensions and utilizes a 5-point Likert format. Overall, the scale appears appropriate for use with middle school students to assess their mathematics attitudes.

Data Analysis

The researchers used the SPSS software package to analyze the collected data. They set a significance level of 5% and a confidence interval of 95% to interpret the results. Analyses focused on sub-factor averages, factor correlations, and incorporating the study group's diagnostic data. For quantitative data comparisons, one-way ANOVA was used for variables with more than two categories, while the t-test was employed for variables with two categories. If the ANOVA indicated a significant difference, post-hoc tests were conducted to pinpoint specific group variations.

To assess the reliability of the scale used in the study, the researchers calculated Cronbach's Alpha. A value of .936 suggests the scale has very high internal consistency.

Results

The results of the Mathematics Attitude Scale showed that the scores' skewness and kurtosis coefficients ranged from +1.5 to -1.5. The data are considered to fit the normalcy assumption based on the values obtained (De Carlo, 1997). Table 1 displays descriptive statistics according to the students' Mathematics Attitude Scale scores.

Table 1.

Results Associated with Students' Attitude Scale Scores in Mathematics

Variables	n	Min.	Max.	Average	Sd	Skewness	Kurtosis
Math Course	501	1.00	5.00	3.63	.873	-.455	-.553
Attitude						.109	.218

This table presents the average scores and standard deviations obtained by students on a math attitude scale. The scale uses a Likert-type format, where scores are assumed to be evenly spaced across the range. An average score range factor of 0.79 is applied (Çokluk et al., 2010). To determine the actual score range, the lowest possible score (1) is subtracted from the highest possible score (which depends on the number of items in the scale). The result is then divided by the number of scale items, and this value represents the width of each score range (Erkuş, 2012). Table 2 shows the resulting score ranges for this particular scale.

Table 2.

Math Attitude Scale Item Rating Intervals

Level	Item Value Ranges
1 - Very Low	1.00 – 1.79
2 - Low	1.80 – 2.59
3 - Medium	2.60 – 3.39
4 - High	3.40 – 4.19
5 - Very High	4.20 – 5.00

Considering the scoring ranges explained in Table 2, the average score of 3.63 suggests a "high" level of mathematics attitude among the students.

Findings Related to the Study Group

This section presents the background information collected from participants. Table 3 specifically details the gender breakdown of the student population.

Table 3.

Table of Distribution Based on Student Gender

Variables	Groups	Frequency	Percentages
Gender	Female	281	56.1
	Male	220	43.9
	Total	501	100

Table 3 indicates that female participants made up 56.1% of the study group that replied to the relevant scale within the study's scope, while male participants made up 43.9%. It is assumed that female students engaged in the study to a greater extent than male students.

Table 4 shows the distribution of students according to school type.

Table 4.

Table of Distribution Based on School Type

Variables	Groups	Frequency	Percentages
School Type	Middle Schools	371	74.1
	IHSS	130	25.9
	Total	501	100

As seen in Table 4, it is seen that 74.1% of the study group responding to the relevant scale within the scope of the study consisted of students studying in middle schools and 25.9% in Imam Hatip middle schools.

Table 5 shows the distribution of students according to their grade levels.

Table 5.

Class Level of Students

Variables	Groups	Frequency	Percentages
Class Level	Grade 5	136	27.1
	Grade 6	95	19.0
	Grade 7	184	36.7
	Grade 8	86	17.2
	Total	501	100

Table 5 shows the participation rates for the study according to grade level. Among the respondents who completed the relevant scale, 7th graders had the highest participation rate at 36.7%, followed by 5th graders at 27.1%. Participation was lowest among 8th graders at 17.2%.

Table 6 shows the frequency of students' use of the Education Information Network (In Turkish EBA).

Table 6.

Students' Frequencies of Using EBA

Variables	Groups	Frequency	Percentages
EBA Frequency of Use	Never	153	30.5
	Rarely	179	35.7
	Once a week	46	9.2
	Several times a week	101	20.2
	Every day	22	4.4
	Total	501	100

As seen in Table 6, when the responses of middle school students regarding the frequency of weekly EBA usage are examined; 30.5% of the students stated that they never use EBA, while 35.7% stated that they rarely use it. While 4.4% of the students answered that they use EBA every day, it is

seen that these students are the least number of students in the study. It is understood that students generally use EBA rarely or never.

Findings Related to Research Questions

Do the attitudes of the study group towards mathematics courses change according to gender?. To assess students' mathematical attitudes across different genders, researchers utilized an attitudes scale encompassing five components: course content, the perceived nature of mathematics, problem-solving skills, comprehension, and self-efficacy in math. An independent samples t-test was then employed to analyze potential gender differences in these attitudes.

Table 7.

Independent Samples t-Test Table according to the Gender of the Students Participating in the Study

Variables	**Groups**	**Average**	**F**	**P**
Course Content	Female	3.53	1.446	0.230
	Male	3.59		
The Nature of Mathematics	Female	3.51	1.963	0.162
	Male	3.57		
Problem-Solving Skills	Female	3.74	.593	0.442
	Male	3.73		
Understanding	Female	3.71	.410	0.552
	Male	3.58		
Self-efficacy	Female	3.79	.045	0.832
	Male	3.75		

According to Table 7, no significant difference was found in the attitudes of middle school students towards mathematics courses in all sub-factors of the mathematics attitude scale in the context of gender variables.

Do the attitudes of the study group toward mathematics courses change according to the type of school?. To assess if students' school background (public vs. private) influenced their perception of math classes, an independent samples t-test was conducted to compare attitudes between the two groups. Table 8 presents the findings regarding the second sub-question of the study, the effect of school type on students' attitudes toward mathematics courses.

Table 8.

Independent Samples t-Test Table according to the School Type of the Students Participating in the Study

Variables	**Groups**	**Average**	**F**	**p**
Course Content	Middle School	3.58	.809	0.230
	İmam Hatip S.S.	3.47		
The Nature of Mathematics	Middle School	3.57	.262	0.162
	İmam Hatip S. S.	3.45		
Problem-Solving Skills	Middle School	3.72	.206	0.442
	İmam Hatip S.S.	3.77		
Understanding	Middle School	3.65	.559	0.552
	İmam Hatip S.S.	3.67		
Self-efficacy	Middle School	3.79	.948	0.832
	İmam Hatip S.S.	3.74		

According to Table 8, no significant difference was found in all sub-factors of the mathematics attitude scale in the attitudes of middle school students towards mathematics courses in the context of the school-type variable.

Do the attitudes of the study group toward mathematics course change according to the grade levels of the students?. One-way ANOVA is performed to analyze the significant difference in the attitudes of middle school students studying in Eskişehir towards mathematics courses according to the grade levels they study. Table 9 shows the findings regarding the third sub-question of the research, the effect of the grade level variable on students' attitudes towards Mathematics courses.

Table 9.

ANOVA Table Summarizing Differences in Student Performance by Class Level

Variables	**Groups**	**Average**	**F**	**P**	**Difference**
Math Course Attitude	Grade 5	3.76	3.029	.028*	1-3
	Grade 6	3.72			
	Grade 7	3.48			
	Grade 8	3.62			

The analysis (likely referring to an ANOVA test) revealed significant differences ($p < .05$) in student attitudes towards math courses depending on their grade level. To pinpoint these differences between groups, follow-up tests were conducted. Due to unequal variances among groups ($p= .012 <.05$) and potentially unequal sample sizes, the Games-Howell test was chosen for further analysis.

According to the Post-Hoc test results related to the grade levels of the students; it is seen that the attitudes of the 5th-grade students are significantly different from the attitudes of the 7th grade students. In addition, it is seen that 5th-grade students developed higher attitudes towards mathematics courses compared to other groups, while 7th-grade students had the lowest attitudes in the group.

Do the attitudes of the study group toward mathematics course change according to the frequency of EBA usage?. One-way ANOVA is performed to analyze the significant difference in the attitudes of middle school students studying in Eskişehir towards mathematics courses according to their EBA usage status. Table 10 shows the findings regarding the fourth sub-question of the research, the effect of the variable of EBA usage frequency of students on their attitudes towards Mathematics courses.

Table 10.

ANOVA Table According to the Frequency of EBA Usage of the Students Participating in the Study

Variables	**Groups**	**Average**	**F**	**p**	**Difference**
Math Course Attitude	Never (1)	3.47	4.758	.001*	1-3
	Rarely (2)	3.48			1-4
	Once a week (3)	3.57			
	Several times a week (4)	3.83			
	Every day (5)	4.09			

The ANOVA analysis (likely from Table 10) showed a significant difference ($p < 0.05$) in student attitudes towards the math course based on their EBA usage. To identify which groups differed, follow-up tests were necessary. Because the variances between groups were similar ($p = 0.147 > 0.05$), but the sample sizes might be unequal, the Hochberg's GT2 test was chosen for further analysis.

According to the Post Hoc test results regarding the frequency of EBA use, there is a significant difference between students who never use EBA and students who use it several times a week and every day. It is seen that as the frequency of students' use of EBA increases, the mean attitudes towards mathematics courses also increase.

Do the attitudes of the study group towards mathematics course change according to the use of educational technologies in the lessons?. To determine if middle school students in Eskişehir have significantly different views toward mathematics courses based on the Use of Educational Technologies in Lessons, a one-way ANOVA is conducted. The results for the fifth sub-question of the study, which examines how students' attitudes toward mathematics courses are impacted by the variable of their usage of educational tools in the classroom, are displayed in Table 11.

Table 11.

One-way ANOVA Table According to the Use of Educational Technologies in the Courses of the Students Participating in the Study

Variables	**Groups**	**Average**	**F**	**p**	**Difference**
Math Course Attitude	Never	3.42	1.040	.375	
	Rarely	3.48			
	Often	3.50			
	Always	3.61			

According to Table 11, no significant difference was found as a result of the analysis of students' attitudes towards Mathematics course in the context of the frequency of using educational technologies in lessons (P= .375> .050).

Do the attitudes of the study group towards mathematics lesson change according to the status of performing concrete activities in lessons?. A one-way ANOVA test was conducted to see if using concrete materials in math lessons affected the attitudes of students towards the subject. Table 12 presents the results related to the research question about the impact of incorporating concrete activities (sixth sub-question) on student attitudes.

Table 12.

ANOVA Table according to the Participating Students' Performing Concrete Activities in Lessons

Variables	**Groups**	**Average**	**F**	**P**	**Difference**
Math Course Attitude	Never (1)	3.42	9.659	.000*	
	Rarely (2)	3.48			3-1, 3-2
	Often (3)	3.75			4-1, 4-2
	Always (4)	4.09			

The analysis (likely referring to a one-way ANOVA test in Table 12) revealed a significant difference ($p < 0.05$) in student attitudes towards math based on whether concrete activities were used in lessons. To pinpoint which groups differed in their attitudes, further tests were conducted. Because the variances between groups were similar ($p = .496 > .05$), but the sample sizes might be unequal, the Hochberg's GT2 test was chosen for further analysis.

According to the Post-Hoc test results related to the frequency of using concrete activities in the lessons, there is a significant difference between the students of teachers who frequently or always use concrete materials, activities, etc. in the lessons and the students of teachers who rarely or never use them. It is seen that as the use of concrete materials in the lessons increases, the mean attitudes of the students towards mathematics lessons also increase.

Discussion and Conclusion

This study aimed to ascertain the attitudes of middle school students in the province of Eskişehir toward mathematics courses following the COVID-19 pandemic. The attitudes of the participants were analyzed concerning various variables, including gender, type of school attended, and frequency of EBA use. According to their results on the mathematical attitude scale, 501 pupils were determined to have a "high" level of mathematics attitude, with an average of 3.63. Similar findings were obtained in studies by Deniz and Cıtdır (2020) with middle school students and Çavdar (2019) with 4th-grade primary school pupils. The mathematical attitude levels of the eighth-grade students in Kılıç's (2022) study were found to be medium level. The relevance of mathematics courses is reflected in the high degree of student attitudes about them.

The reliability level of the scale used in this study was .936 and it is understood that the scale has very high reliability. As a result of the meta-analysis study of Cantürk Günhan et al., (2019), it was stated that students' achievement in mathematics will increase as a result of developing positive attitudes towards mathematics. As a result of this study, it is thought that students' high levels of mathematics attitude will positively affect many factors such as students' academic achievement and self-efficacy.

It was found that 56.1% of the students in the study group were females and 43.9% were males, 74.1% of them were studying in middle school and 25.9% in Imam Hatip Middle School, and students were participating in the study at all grade levels in the middle school level. When the participation status of the study group according to grade levels was examined, it was seen that the highest participation in the study was at the 7th-grade level with 36.7% and the lowest participation was from

the 8th-grade with 17.2%. It is believed that this circumstance results from eighth-grade kids getting ready for LGS. The information regarding middle school pupils' weekly EBA usage frequency is astounding. It is acknowledged that most students use EBA infrequently or never.

In line with the first sub-question of the research, it was revealed that the mathematics attitudes of middle school students did not show a significant difference in terms of gender variables. This result is similar to the results of the studies conducted by Koca (2011), Tuncer and Yılmaz (2016), Çavdar (2019), Deniz and Cıtdır (2020) before the Covid-19 pandemic, and Kılıç (2022) and Kara and Özkaya (2022) after the Covid-19 pandemic. One could argue that middle school pupils' attitudes toward mathematics are not much influenced by their gender. It was reported that female students' attitudes were positive than male students' attitudes in Demirgören's (2010) study including high school students. Similar sentiments on mathematics were shown by female students in Ergin's (2022) survey of middle school pupils. In Saracoğlu's (2016) study conducted with 6th-grade middle school students, it was stated that male students had positive attitudes toward mathematics courses than female students. These different results may have been caused by many factors such as the region where the study was conducted and the study groups. A similar situation was observed in terms of the second sub-question of the study, which was the students' attitudes towards mathematics in terms of school type. In this study, it was understood that the school-type variable did not affect students' attitudes toward mathematics. In Saracoğlu's (2016) study, there was no difference between the attitude towards middle school mathematics courses and the school type variable, while Deniz and Cıtdır (2020) concluded that middle school students' interest in mathematics was significantly higher than Imam Hatip Middle School students.

Within the scope of the third sub-question of the research, it was concluded that students' attitudes towards Mathematics courses differed according to their grade levels. It was seen that 5th-grade students' attitudes differed significantly from 7th-grade students' attitudes and 5th-grade students developed higher attitudes towards mathematics courses compared to other groups, while 7th-grade students had the lowest attitude in the group. The reflections of the adolescence period, which is the developmental period in which the students are, and the COVID-19 process may be the reason for this situation. In the study conducted by Deniz and Cıtdır (2020) with middle school students, it was stated that the scores of middle school students from the attitude scale differed according to their grade levels. In the aforementioned study, it was stated that 8th-grade students' interests, studies, and attitudes toward mathematics were significantly lower than other grade levels. Unlike the study in which it was stated that students' attitudes towards mathematics decreased as the

grade level increased, in this study, it was understood that 8th-grade students exhibited higher attitudes towards mathematics compared to 7th-grade students. However, when a comparison is made from 5th grade to 7th grade, it is seen that there is a similar result to Deniz and Cıtdır's (2020) study. According to Boz (2017), for mathematics teaching to achieve its goals, the development of students' attitudes towards mathematics and the formation of positive changes in attitudes towards mathematics as the grades progress should be one of the main tasks of schools.

As a result of the analysis conducted within the scope of the fourth sub-question of the research, it was seen that as the frequency of students' use of EBA increased, their average attitudes toward mathematics increased. In Özbey's study conducted in 2019, it was concluded that an EBA-supported learning environment did not affect middle school students' attitudes toward mathematics. This situation may have resulted from students' online education and integration into distance education after the COVID-19 pandemic process. EBA can also be characterized as a platform that provides e-learning to its users. According to Etlioğlu and Tekin (2020), students need to acquire positive affective behaviors to achieve easy and permanent learning and success in the e-learning process. The research data also reflect the effect of increasing the frequency of EBA usage on students' attitudes, suggesting that this situation facilitates the learning process.

Within the scope of the fifth sub-question of the research, no significant difference was found in the attitudes of students towards Mathematics courses in the context of the frequency of using educational technologies in lessons. In the study conducted by Eryiğit and Kılıç (2022) with primary school 4th-grade students during the pandemic period, it was stated that attitude towards technology is one of the important predictors of mathematics achievement and that students' attitudes towards technology negatively affect their mathematics achievement. The results of this study showed that the frequency with which instructional resources were utilized in the classroom had no bearing on students' attitudes about mathematics.

In line with the sixth sub-question of the research, it was concluded that as the use of concrete materials increased in the lessons, the average attitudes of the students towards the mathematics course also increased. To realize permanent learning, it is also important to design materials that appeal to students' affective characteristics (Etlioğlu & Tekin, 2020). Consequently, to improve students' attitudes about the course in middle school mathematics classes, it is imperative to promote the usage of actual materials.

Expressed as the ninth objective within the scope of special objectives in the curriculum of the Middle School Mathematics course: "Students will develop a self-confident approach to mathematical problems by developing a positive attitude towards mathematics through their experiences in learning mathematics" (MoNE, 2018), it can be said that the change in students' attitudes towards mathematics after the COVID-19 outbreak will also affect their approach to mathematical problems. The stated goal of the mathematics course is believed to be accomplished if the middle school pupils included in this study have favorable attitudes about mathematics and constructively tackle mathematical issues.

Recommendations

In the aftermath of the COVID-19 pandemic, the attitudes towards mathematics of students studying at different educational levels such as primary and middle education in Turkey can be examined. With the use of measures that can be implemented through EBA, it is possible to periodically assess students' attitudes toward subjects like science and math.

In this study, variables that came to the forefront during the COVID-19 pandemic process such as school type, frequency of EBA use, and use of technology in education were associated with students' attitudes towards mathematics, while middle school students' attitudes towards mathematics course can be interpreted by taking into account different variables such as students' learning styles, learning methods and techniques, and educational staff in schools.

In this study, a quantitative method was used and the research was designed in a cross-sectional survey model. In future studies, detailed studies can be conducted by including students' opinions and mixed methods can be used. Experimental studies can also be conducted to focus on the relationship between variables such as students' use of technology in lessons and concrete activities with attitudes toward mathematics courses. In addition, in this study, students' attitudes toward mathematics courses were determined. In another study, comparative studies can be conducted by examining students' attitudes towards different processes such as distance education process, technology use, and attitudes towards online education. The data presented in the study are limited to 501 students studying at middle school level in Eskişehir. In order to determine the attitudes towards mathematics course of more students studying at different grade levels at the middle school level in Eskişehir or to obtain general results by overcoming the stated limitation, the attitudes of students studying in similar school types from different cities towards mathematics course can be determined.

About Authors

First Author: Emin Özen completed his bachelor's degree in Mathematics Education in 2008, his master's degree in Educational Administration and Supervision in 2013, and his doctorate in open and distance education in 2022. Since 2008, Dr. Özen has been working as a mathematics teacher / administrator and trainer of trainers in schools and institutions affiliated to the Ministry of National Education and is currently working as a Measurement and Evaluation Specialist in a unit affiliated to the Ministry of National Education.

Second Author: Funda Çıray Özkara, after completing the Science Education undergraduate program at Eskişehir Osmangazi University, Faculty of Education in 2007, received her MA and PhD degrees from Anadolu University, Department of Curriculum and Instruction. She worked as a science teacher in four different public middle schools for 14 years. She is working in the R&D Unit of Eskişehir Provincial Directorate of National Education and is in her 17th year.

Conflict of Interest

It has been reported by the authors that there is no conflict of interest.

Funding

No funding was received.

Ethical Standards

This research adhered to all ethical guidelines. Approval was granted by the Eskişehir Provincial Directorate of National Education's research commission on March 6, 2023 (decision number E-88074293-605.01-71604229), with the Governorate's consent.

ORCID

Emin Özen https://orcid.org/0000-0001-7026-1503

Funda Çıray Özkara https://orcid.org/0000-0001-7912-0563

References

Ardıç, M. A. (2023). Matematik öğretmenlerinin Covid-19 sürecinde gerçekleştirdikleri uzaktan eğitimlerin teknolojiye yönelik tutumlarına etkisi [The effect of distance education provided by mathematics teachers during the Covid-19 period on their attitudes towards technology]. *Van Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi, 20*(1), 48-78. https://doi.org/10.33711/yyuefd.1120418.

Bakırcı, H., Doğdu, N. & Artun, H. (2021). Covid-19 pandemi dönemindeki uzaktan eğitim sürecinde fen bilgisi öğretmenlerinin mesleki kazanımlarının ve sorunlarının incelenmesi. *Ahi Evran Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 7*(2), 640-658.

Bakioğlu, B. & Çevik, M. (2020). Covid-19 pandemisi sürecinde fen bilimleri öğretmenlerinin uzaktan eğitime ilişkin görüşleri. *Turkish Studies, 15*(4), 109-129.

Barış, M. F. (2015). Üniversite öğrencilerinin uzaktan öğretime yönelik tutumlarının incelenmesi: Namık Kemal Üniversitesi örneği [Examining university students' attitudes towards distance education: Namık Kemal University example]. *Sakarya University Journal of Education, 5*(2), 36-46. https://doi.org/10.19126/suje.38758

Bohner, G., & Dickel, N. (2011). Attitudes and attitude change. *Annual Review of Psychology, 62*(1), 391-417. https://doi.org/10.1146/annurev.psych.121208.

Boz, H. (2017). Matematiğe yönelik tutum gözlem formunun geliştirilmesi [Development of attitude observation form towards mathematics]. [Unpublished master's thesis]. Necmettin Erbakan University.

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş. & Demirel, F. (2012). *Bilimsel Araştırma Yöntemleri* [*Scientific Research Methods*]. (11th ed.). Pegem Akademi.

Cantürk-Günhan, B., Topuz, F. & Bedir, D. (2019). Türkiye'deki öğrencilerin matematik dersine yönelik tutumları ile matematik başarıları arasındaki ilişki: Bir Meta-Analiz çalışması [The relationship between students' attitudes towards mathematics in Turkey and their mathematics achievement: A Meta-Analysis study]. *Erzincan Üniversitesi Eğitim Fakültesi Dergisi, 21*(3), 148-164. https://doi.org/10.17556/erziefd.483521

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches* (2nd ed.). Sage.

Çalık, B. (2024). The relationship between mathematics achievement emotions, mathematics self-efficacy, and self-regulated learning strategies among middle school students [Unpublished Master's Thesis]. Middle East Technical University.

Çavdar, D. (2019). Matematik dersinde akademik başarı, öz yeterlik ve matematik dersine yönelik tutum arasındaki ilişkinin incelenmesi [Examining the relationship between academic success, self-efficacy and attitude towards mathematics course]. [Unpublished master's thesis]. Balıkesir University.

Çıray-Özkara, F. (2023). Covid-19 pandemi sürecinde uzaktan fen eğitiminde kullanılan örnek uygulamalar. In E. Özen (Ed.). *Kalite bağlamında uzaktan eğitim* [*Distance education in the context of quality*]. (p.125-156). Kriter Yayınevi.

Çoban, A. (1989). Ankara Merkez ortaokullarındaki son sınıf öğrencilerinin matematik dersine ilişkin tutumları [Attitudes of senior students in Ankara Central middle

schools towards mathematics course]. [Unpublished master's thesis]. Gazi University.

Çoban, C. & Ellez, A. M. (2022). Covid-19 pandemi sürecinde uzaktan eğitimde ve sonrasında öğretmen olmak: ortaokul matematik öğretmenlerinin görüşleri In H. Şahin (Ed.). *Eğitim Bilimleri Çalışmaları*. (p. 25-58). Livre de Lyon.

Çokluk, O., Şekercioglu, G., & Büyüköztürk, S. (2010). *Sosyal bilimler için çok degişkenli istatistik SPSS ve LISREL uygulamaları* [*SPSS and LISREL applications of multivariate statistics for social sciences*]. Pegem A.

De Carlo, L. T. (1997). On the meaning and use of Kurtosis, *Psychological Methods*, *2*, 292-307. Retrieved March 5, 2023, from http://www.columbia.edu/~ld208/psymeth97.pdf.

Demirgören, D. (2010). İzmir ili öğretmen lisesi öğrencilerinin Matematik dersine yönelik tutumları ve kullandıkları öğrenme stratejileri [Attitudes of teacher high school students in Izmir towards Mathematics and the learning strategies they use]. [Unpublished master's thesis]. Dokuz Eylül University.

Deniz, L. & Cıtdır, N. (2020). Ortaokul öğrencilerinin matematiğe yönelik tutumlarının incelenmesi [Examining middle school students' attitudes towards mathematics]. *Anadolu University Journal of Education Faculty*, *4*(3), 294-322. https://doi.org/10.34056/aujef.704071.

Duran, S., Berk, Ş., & Köklü, O. (2023). Matematik öğretmenlerinin görüşlerine göre ortaokul matematik öğretiminde karşılaşılan sorunların ve çözüm önerilerinin incelenmesi [Examining the problems and solution suggestions encountered in middle school mathematics teaching according to the opinions of mathematics teachers]. *Marmara Üniversitesi Atatürk Eğitim Fakültesi Eğitim Bilimleri Dergisi, 57*(57), 128-150. https://doi.org/10.15285/ maruaebd.1181564.

Ergin, G. (2022). Ortaokul öğrencilerinin matematik öz yeterlik, kaygı, tutum ve algılanan öz düzenlemeler arasındaki ilişkinin incelenmesi [Examining the relationship between middle school students' mathematics self-efficacy, anxiety, attitude and perceived self-regulation]. [Unpublished master's thesis]. Alanya Alaaddin Keykubat University.

Erkuş, A. (2012). Varolan ölçek geliştirme yöntemleri ve ölçme kuramları psikolojik ölçek geliştirmede ne kadar işlevsel: Yeni bir öneri [How functional are existing scale development methods and measurement theories in psychological scale development: A new proposal]. *Journal of Measurement and Evaluation in Education and Psychology*, *3*(2), 279-290. Retrieved July 5, 2022, from https://dergipark.org.tr/tr/ download/article-file/65963

Eryiğit, K. & Kılıç, R. (2022). Predictors of Mathematics Achievement in Pandemic: Academic Grit and Technology Attitude. *OPUS Journal of Society Research*, *19*(49), 762-770. https://doi.org/10.26466/ opusjsr.1170924

Etlioğlu, M. & Tekin, M. (2020). Elektronik öğrenmede öğrenci tutum ve akademik başarı arasındaki ilişkide öğrenci merak ve kaygısının aracılık rolü [The mediating role of student curiosity and anxiety in the relationship between student attitudes and academic achievement in electronic learning]. *Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, (43), 34-48. https://dergipark.org.tr/tr/pub/ susbed/issue/ 61825/925046.

Fazlı, E. & Avcı, O. (2022). Matematik eğitiminde motivasyon ve öz-düzenleme: Tek bir durum çalışması. *Harran Maarif Dergisi*, *7*(1), 1-45. http://dx.doi.org/10.22596/hej.976349.

Filiz, A., & Gür, H. (2020). Matematikte özyeterlik algılar, motivasyonlar, kaygılar ve tutumlar arasında ilişki. *Balıkesir Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 23*(44), 783-804. https://doi.org/10.31795/baunsobed.704334

Gülburnu, M., & Yıldırım, K. (2015). İlkokul ve ortaokul öğrencilerine yönelik matematik tutum ölçeği geliştirilmesi ve uygulanması [Development and implementation of a mathematics attitude scale for primary and middle school students]. *VI. Uluslararası Türkiye Eğitim Araştırmaları Kongresi* içinde (s.568-581). Hacettepe University.

Higgins, K., Huscroft-D'Angelo, J. & Crawford, L. (2017). Effects of technology in Mathematics on achievement, motivation, and attitude: A Meta-analysis. *Journal of Educational Computing Research, 0*(0), 1-37.

Hotaman, D., & Okumuş, H. N. (2020). Oyunla matematik öğretiminin 5. sınıf öğrencilerinin matematik dersine karşı tutumları üzerindeki etkisinin incelenmesi [Examining the effect of teaching mathematics through games on 5th grade students' attitudes towards mathematics course]. *Uluslararası Sosyal Araştırmalar Dergisi, 13*(70). 736-744.

Kara, Y. & Özkaya, A. (2022). Ortaokul öğrencilerinin matematik motivasyonları, tutumları ve başarıları arasındaki ilişkinin incelenmesi [Examining the relationship between middle school students' mathematics motivation, attitudes and achievement]. *International Journal of Educational Studies in Mathematics, 9*(1), 33-48. https://doi.org/10.17278/ijesim.1032457.

Karakuş, G., & Erşen, Z. B. (2021). Öğretmenlerin uzaktan eğitime yönelik tutumları ve Covid-19 korkularının farklı değişkenler açısından incelenmesi [Examining teachers' attitudes towards distance education and their fears of Covid-19 in terms of different variables]. *Manisa Celal Bayar Üniversitesi Eğitim Fakültesi Dergisi, 9*(2), 66-85. https://doi.org/10.52826/mcbuefd.954341.

Karataş, Z. (2020). COVID-19 pandemisi sürecinin LGS ve YKS sınavına hazırlık sürecinde olan çocuk ve ergenlerin psikolojilerine yansımalarının incelenmesi. In B. Gençdoğan (Ed.), *Pandemi döneminde çocuk ve ergen psikolojisi* [*Child and Adolescent Psychology during the Pandemic Period*]. (1st ed., p. 54–74). Türkiye Klinikleri.

Kazazoğlu, S. (2013). Türkçe ve İngilizce derslerine yönelik tutumun akademik başarıya etkisi [The effect of attitude towards Turkish and English lessons on academic success]. *Eğitim ve Bilim, 38*(170), 294-307.

Kılıç, F. (2022). Sekizinci sınıf öğrencilerinin matematiğe ilişkin tutum ve motivasyon düzeyleri ve LGS başarı puanları arasındaki ilişki [The relationship between eighth grade students' attitudes and motivation levels towards mathematics and LGS success scores]. [Unpublished master's thesis]. Aydın Adnan Menderes University.

Koca, S. (2011). İlköğretim 8. sınıf öğrencilerinin matematik başarı, tutum ve kaygılarının öğrenme stillerine göre farklılığının incelenmesi [Examining the differences in mathematics achievement, attitudes and anxiety of primary school 8th grade students according to their learning styles]. [Unpublished master's thesis]. Afyon Kocatepe University.

Kurbanoğlu, N. İ., & Takunyacı, M. (2012). Lise öğrencilerinin matematik dersine yönelik kaygı, tutum ve öz-yeterlik inançlarının cinsiyet, okul türü ve sınıf düzeyi açısından incelenmesi [Examining high school students' anxiety, attitude

and self-efficacy beliefs towards mathematics in terms of gender, school type and grade level]. *Uluslararası İnsan Bilimleri Dergisi*, *9*(1). 111-130.

MoNE. (2018). İlkokul ve *ortaokul matematik dersi (1, 2, 3, 4, 5, 6, 7 ve 8. sınıflar) öğretim programı* [Primary and middle school mathematics course (1st, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th grades) Curriculum]. Milli Eğitim Bakanlığı. Retrieved March 10, 2023, from http://mufredat.meb.gov.tr/ProgramDetay. aspx?PID=329

Nolting, P. (2007). Manage math and test anxiety for success in math. Bradenton, FL: Academic Success Press, Inc.

Özbey, A. (2019). EBA destekli öğrenme ortamının ortaokul öğrencilerinin eşitlik ve denklem konusundaki başarı, tutum ve motivasyonlarına etkisi [The effect of EBA supported learning environment on middle school students' success, attitude and motivation regarding equality and equation]. [Unpublished master's thesis]. Zonguldak Bülent Ecevit University.

Pickens, J. (2005). Attitudes and perceptions. *Organizational Behavior in Health Care*, *4*(7), 43-76.

Polat, H. & Baysal, E. (2022). Ortaokul öğrencilerinin Covid-19 salgın sürecinde yürütülen uzaktan matematik öğretimine yönelik görüşlerindeki farklılıkların incelenmesi [Examining the differences in middle school students' opinions about distance mathematics teaching during the Covid-19 epidemic]. *Erzincan Üniversitesi Eğitim Fakültesi Dergisi*, *24*(2), 319-332. https://doi.org/10.17556/erziefd. 975190.

Saracoğlu, F. (2016). İlköğretim altıncı sınıf öğrencilerinin matematik başarıları ve matematik dersine yönelik tutumlarının incelenmesi [Examination of primary school sixth grade students' mathematics achievements and attitudes towards mathematics course]. [Unpublished master's thesis]. Ahi Evran University.

Schukajlow, S., Rakoczy, K., & Pekrun, R. (2023). Emotions and motivation in mathematics education: Where we are today and where we need to go. *Mathematics Education*, *55*, 249–267. https://doi.org/10.1007/s11858-022-01463-2.

Sezgin, M. (2013). Öğrencilerin Matematiğe yönelik tutumlarının akademik özyeterlik algıları ve algıladıkları öğretmen davranışları açısından incelenmesi [Examining students' attitudes towards Mathematics in terms of their academic self-efficacy perceptions and perceived teacher behaviors]. [Unpublished master's thesis]. İstanbul University.

Tavşancıl, E. (2014). *Tutumların Ölçülmesi ve SPSS ile Veri Analizi* [*Measurement of Attitudes and Data Analysis with SPSS*]. (5th ed.). Nobel Yayın Dağıtım.

TDK. (2023). *Tutum* [*Attitude*]. Retrieved April 4, 2023, from https://sozluk.gov.tr/

Tuncer, M. & Yılmaz, Ö. (2016). Ortaokul öğrencilerinin matematik dersine yönelik tutum ve kaygılarına ilişkin görüşlerinin değerlendirilmesi [Evaluation of middle school students' opinions regarding their attitudes and concerns towards mathematics course]. *KSÜ Sosyal Bilimler Dergisi*, *13*(2). 47-64.

Vahit, H. R. (2019). EBA etkinlikleriyle yapılan matematik öğretiminin başarıya ve tutuma etkisi [The effect of mathematics teaching with EBA activities on success and attitude]. [Unpublished master's thesis]. Kastamonu University.

Viberg, O., Grönlund, Å. & Andersson, A. (2023) Integrating digital technology in mathematics education: a Swedish case study, *Interactive Learning Environments*, *31*(1), 232-243, DOI: 10.1080/10494820.2020.1770801