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# Investigation of the relationship between school maturity levels and speech and language development of preschool students

Fatih KOÇAK<sup>1</sup> Cemile Ceyda KORKMAZ<sup>2</sup>

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## Abstract:


This study aims to examine the relationship between school maturity levels and speech and language development of children receiving preschool education. The correlational survey models was used to determine these relationships. The sample of the study consists of 44 boys and 58 girls who are studying in public schools in Meram district of Konya province in the 2022-2023 academic year and a total of 102 kindergarten students and 6 kindergarten teachers responsible for the education of these students. In the study, the Metropolitan School Maturity Test was used to determine the school maturity levels of the students as a data collection tool, and the Speech and Language Development Questionnaire was used to determine the students' speech and language development characteristics. The research data were analyzed by using SPSS 25 program. Accordingly, it was found that there was a significant positive relationship between the speech and language development of the students and the general preparation and number preparation sub-dimensions of school maturity. It was found that there was a significant differentiation in favor of girls between speech and language development by gender and all sub-dimensions of school maturity. It was found that there was no significant differentiation between the speech and language development levels of the students according to age; and in all sub-dimensions of school maturity, there was a significant differentiation in favor of the 6-year-old students according to age.

**Keywords:** Preschool, speech and language development, school maturity.

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## INTRODUCTION

Each of the developmental processes is a prerequisite for the next process for children who go through many physical, cognitive, emotional, and social developmental processes from the moment they fall into the mother's womb. In accordance with the characteristics of each developmental period, the child goes through critical periods to acquire and learn the skills related to the period. Critical periods are the periods when the child has reached sufficient physical, cognitive, emotional, and social maturity and maturity to learn a skill. The pre-school period, which is the period before starting primary school, also includes critical periods for the next period. The preschool is the period in which the child spends time apart from the mother or caregiver, enters a social environment, and experiences social life for the first time. In this period, the child develops rapidly in the areas of motor and cognitive development, as well as all the social and psychological skills necessary for independence. The period of preparation and beginning of primary school is considered one of the developmental and difficult stages that children have to overcome in early childhood (Gill et al., 2006).

Preschool education is an important condition for the child's maturity for primary school and adaptation to school (Yavuzer, 2000; 2010). School maturity is defined as the child's maturity to start primary school in the areas of physical, emotional, cognitive, and social development (Yavuzer, 2010). In this period, children who have not reached sufficient maturity in these developmental areas may show various psychological and social adaptation problems and difficulties in learning to read and write during primary school. Although studies have shown that children's behavior problems decrease, their friendship relations, social skills, and school adjustment increase as their age increases in terms of maturity for primary school (Campbell, 2006; Vandell et al., 2006), a certain age alone is not sufficient as an indicator of reaching school maturity. Here, the feature of development emphasizing individual differences emerges. There are individual differences in development, and children who are chronologically the same age may have very different characteristics in the physical, cognitive, social, and emotional areas of development. There are many factors such as the characteristics of the family, parental attitudes, socioeconomic level, and cultural differences. For this reason, it is important to evaluate the child in a way that covers all developmental areas when deciding on the age to start primary school (Esaspehlivan, 2006).

When the studies on school maturity are examined, it is seen that there are studies on the effects of variables such as socioeconomic level, gender, parental education levels, and preschool education on school maturity. Güzel and Özyurt (2018) examined the school maturity levels of 221 children receiving preschool education and the opinions of teachers about school maturity. According to the research results, as the duration of preschool education and the age of children increases, their school maturity increases; the school maturity scores of the children in independent kindergartens are higher than those in

kindergartens affiliated with primary schools. It is seen that teachers expect children with school maturity to show physical and mental skills, to show similar characteristics with their peers, to be responsible, to understand and apply the classroom and school rules, and to express themselves comfortably. In his study, Şimşek (2007) examined the effect of the Turkish language activity program on the reading maturity level of kindergarten children, and at the end of the research, he concluded that the school maturity level of the students in the experimental group in which the activity program was applied was higher. Elter (2021) examined the relationship between school maturity and the physical and emotional development of preschool children. According to the research, gender does not cause differentiation in school maturity and emotional development; there is a low level of correlation between physical development and school maturity and there is a significant relationship between school maturity and emotional development. It has been observed that as the level of emotional intelligence increases, school maturity also increases. Arı and Özcan (2014) examined the effect of school maturity levels of first-grade students on their learning to read and write, and it was found that whether or not they received preschool education and the age of starting school had a significant effect on school maturity. They concluded that school maturity makes a significant difference in reading and writing skills.

In the international literature, Dennis et al. (2021) examined the effects of language problems and ADHD in preschool on school maturity in a socioeconomically disadvantaged school. According to the results of the research, there is a positive relationship between receptive language and cognitive and mathematical maturity; There is a negative relationship between ADHD behaviors and social, emotional, physical, and cognitive maturity. It was observed that ADHD is a risk factor for a lack of receptive language and social-emotional school maturity. In a survey study investigating the perception and understanding of school maturity, it was found that many children start school before they gain the skills to communicate clearly, eat independently, and toilet training; 89% of parents think that their children are ready for school when they start school, but according to teachers' opinions, this rate is 54% (The Perception And Understanding Of School Maturity, 2023). In a longitudinal study (Józsa et al., 2022) examining the effects of preschool intelligence and maternal education level on sixth-grade school performance, cognitive and social skill levels, intelligence level, and socioeconomic status in the preschool period were predictive of sixth-grade math, reading tests, and school grades. Sosu et al., (2023), in their study examining the effect of participation in early childhood education on school maturity in low and middle-income countries, found that early childhood education is associated with school maturity; the areas where this relationship is strongest are literacy and math maturity. It was concluded that the socioeconomic status of the family affects the school maturity. In a study examining the effects of behavioral and emotional self-regulation on school maturity (Guedes et al., 2023), it was found that behavioral self-regulation levels had a determining effect on children's school maturity and early social skills. Christensen et al. (2022), in their study in which school maturity was considered multidimensional, four risk

groups were determined in terms of school maturity. These are developmental disabilities, risky parenting, emotional immaturity, language, and developmental disabilities. These four profiles were found to be significantly associated with low reading comprehension, emotional and behavioral difficulties.

School maturity means that the child has reached the necessary and specific competencies for the primary school period in all developmental areas. Language development, which is one of the most important areas of cognitive development, also has an important place in gaining school maturity. Language development is directly related to the child's ability to express himself, establish social relations, and realize various learnings when participating in a social environment in the preschool period. Language is one of the indicators used in the evaluation of early childhood development, and when it is considered in terms of school maturity, children should have some verbal language skills during the school start period (Rhode Island KIDS COUNT, 2005). In terms of receptive and expressive language skills, the child can use detailed sentences, communicate easily with peers or adults, tell stories about a topic, listen and understand short stories, understand the questions asked about a story he listens and is expected to have skills such as understanding most of what is spoken in the home and school environment. (Sharp & Hillenbrand, 2006). The child's vocabulary, ability to form sentences, and ability to understand verbal expressions are important in adapting to school, learning to read and write, and achieving grade-level academic achievements (Oktay, 2013). Children who are at the stage of transitioning from preschool to primary school are expected to have language skills such as listening, comprehension, and verbal language skills, forming long and complex sentences following the grammatical structure, and using a wide vocabulary (Razon, 1982).

When the studies evaluating language development in the preschool period are examined, Studies examining the interaction of the parents with the child and the effect of reading to the child on the language development of the child (Cirhinlioğlu, 2001); the effect of the education level of the parents on the scores of the children in the vocabulary test (Gürocak, 2007; Yıldırım Doğru et al., 2010); the effect of socio-economic level on school maturity, the number of words and sentences used by children and (Harman & Çelikler, 2012; Yıldız Çiçek, 2010; White et al., 1990); the effect of the number of siblings on vocabulary (Yıldırım Doğru et al., 2010) were found. Günay (2020) reached 70 teachers in his study to determine the awareness of preschool teachers about speech and language disorders in preschool children. According to the evaluations of the teachers, the prevalence rate of speech and language disorders was 8.66%; speech sound disorder is the most common disorder observed in children; speech and language disorders are more common in males; It was concluded that stuttering is more common in males, the disorders are most common in the 4-year-old group and the lowest in the 6-year-old group. Umec et al., (2008), in their study examining the effect of preschool education on children's school maturity, concluded that children's intellectual abilities and language proficiency are important predictors of school maturity levels and that the education level of parents is a determinant in the child's

language development. The results of the same research revealed that children's intellectual skills and language proficiency are effective in school maturity scores. Some studies show that children with reading difficulties experience speech and language problems (Bishop & Adams, 1990; Bowers & Wolf, 1993; Scarborough, 1990). Children with a rich vocabulary learn to read and write more easily (Güneş, 2013). There are also studies on monolingual and bilingual children regarding language development in the preschool period. In their study, Yazıcı and Temel (2012) concluded that bilingual children scored lower than monolingual children in all score types of the school maturity test and that there was a positive correlation between language development and school maturity. In his study, in which he evaluated the relationship between language development and various demographic factors in monolingual and bilingual children, Küçük (2016) concluded that there is a strong correlation between the children's Metropolitan School Maturity test scores and TIFALDI test scores.

Adaptation to school is a concept that is related to social skills, communication, and emotion regulation skills as well as academic success. The main function of pre-school institutions is to prepare students for higher education, namely primary schools. When starting elementary school, students need to be ready for literacy, math, and many other aspects. The results of this study will contribute to the preparation of students who will transfer from pre-school to primary school more readily for the transition process. It will help to ensure that the interventions are correct and serve the purpose. Language development is one of the most important areas of development related to school maturity and adaptation to school, as it constitutes a large part of cognitive development and is a tool for communication and social adaptation. When the studies examining school maturity and school adjustment are examined, there are studies on the effects of many factors such as having preschool education, gender, age, socio-economic status, and parental education status on school maturity and school adjustment. Among these studies, it is seen that there are few studies directly related to language development and school maturity. The preschool period is critical in terms of school maturity, as it is the first place where pre-reading and writing skills and school adaptation behaviors are experienced. Preschool teachers, on the other hand, have the opportunity to closely observe children during this period. This study aimed to examine the relationship between the school maturity levels of the students attending preschool education and the language development characteristics based on the opinions of their preschool teachers. For this purpose, answers are sought for the following three questions:

(Q1) Is there a significant relationship between speech and language development and school maturity levels of students attending preschool education?

(Q2) Do the speech and language development and school maturity levels of students attending preschool education differ according to age?

(Q3) Do the speech and language development and school maturity levels of students attending preschool education differ according to gender?

## METHOD

### *Research Model*

In this study, the correlational survey model was used to examine the relationship between school maturity levels and language development characteristics of students attending preschool education. Correlational survey models aim to determine the existence and degree of the relationship between two or more variables (Karasar, 2009). The variables of this research are the school maturity level, language, and speech development level, age, and gender of the participants. In the correlational survey model, the level of relationship between two or more variables is measured using statistical tests. The correlation coefficient is used to determine the level of the relationship. The correlation coefficient reveals whether two or more variables show a consistent and significant change together.

### *Participants*

The study group of the research consisted of 102 students, 44 boys and 58 girls, aged between 60 months and 72 months, attending preschool education in schools affiliated with the Ministry of National Education in the 2022-2023 academic year in the Meram district of Konya and 6 preschool teachers responsible for the education of these students. Participants were determined by easily accessible sampling from the groups studying in the two mentioned schools. Attention was paid to the similar distribution of classes in terms of gender in both groups. Educator participants were determined from teachers working with participating students through purposive sampling. The demographic information of the student and teacher participants is given in Table 1 and 2 respectively:

**Table 1**

*Demographic Information of the Participant Student*

<b>Student</b>		
	<b>n</b>	<b>%</b>
Age		
5	38	37,26
6	64	62,74
Gender	<b>n</b>	<b>%</b>
Girl	58	56,86
Boy	44	43,13

Participants are in 2 groups: students and teachers. The data obtained from the students were interpreted as quantitative data with the statistical method, and the qualitative data obtained from the teachers were used as a validation tool in the interpretation of the quantitative data.

**Table 2**

*Demographic Information of the Participant Teachers*

Teacher		n	%
Age	40-49	4	66,6
	50-59	2	33,3
Degree Level	undergraduate	6	100
Experience	11 years and above	6	100

### *Data Collection Tools*

Since there were no more than 20 questions in each of the subtests applied when choosing the sample group formed by the students, reaching 5 times the number of questions was considered sufficient in line with similar studies. The Speech and Language Development Questionnaire developed by Günay (2020) was used to determine the students' speech and language development characteristics. The questionnaire was prepared for teachers to fill out and consists of two parts. The first part consists of demographic information and the second part consists of 16 items for the evaluation of students' age, gender, language, and speech development. The Metropolitan School Maturity Test was used to determine the school maturity levels of the students. Metropolitan School Maturity Test was developed in 1949 by G.H. Hildreth, N. L. Griffiths, and M. Mc Gauvran. It was adapted into Turkish by Oktay (1980). It consists of reading preparation, number preparation, and general preparation sub-dimensions. There are 6 subtests and 100 items in the test. The reading preparation sub-dimension (0-66 points) consists of 66 items: word comprehension (19), sentences (14), general knowledge (14), and matching (19); the number preparation sub-dimension (0-24 points) consists of 34 items, including numbers (24) and copying (10). The general preparation sub-dimension (0-100 points) refers to the total score obtained from all subtests

### *Data Analysis*

The data collection phase was carried out in May 2023 with the participants who volunteered for the study. The Metropolitan School Maturity Test was administered to 102 children participating in the study, with the permission of their parents, by the second researcher, who was a psychological and guidance counselor. At the same time, 6 preschool

teachers, who carried out the education of the participating children, were provided to fill out the questionnaires.

The data obtained from the research were analyzed with the SPSS 25 program. Pearson Correlation Analysis was used to determine the relationship between students' speech and language development and their levels of general preparation, number preparation, and reading maturity, which are sub-dimensions of school maturity. The level of differentiation between the speech and language development of the students and the sub-dimensions of school maturity according to gender and age was determined by the t-test.

*Ethical considerations (Subtitle is left justified, only the first letter of the title is capital, bold, color will not be changed, 8pt before the title, then 8pt space will be left) Italic*

Ethical considerations should be explained in this section. (Examples: Quantative data was collected electronically and the lack of demographic information collection allowed for anonymity. For the qualitative phase, the interview participants were informed in writing of the study's nature and that there were was no ramification if they decided to opt-out at any time. The interview instrument and consent information were hosted on the researchers' personel computer and safeguarded by a password. Study's participation resulted in minimal risks to respondents.)

In this study, all rules stated to be followed within the scope of "Higher Education Institutions Scientific Research and Publication Ethics Directive" were followed. None of the actions stated under the title "Actions Against Scientific Research and Publication Ethics", which is the second part of the directive, were not taken.

Ethical review board name: Necmettin Erbakan University Chairmanship of the Social and Humanities Scientific Research Ethics Committee

Date of ethics review decision: 12.04.2023

Ethics assessment document issue number: 5

## FINDINGS

In this section, the findings obtained as a result of the statistical analyzes carried out to find answers to the research problems and to test the research hypothesis are given. The correlation analysis results regarding the relationship between school maturity level and speech and language development are given in Table 2.



**Table 2***Relationship between School Maturity Level and Speech and Language Development*

	Speech and language dev.	General Maturity	Number maturity	Reading maturity
Speech and language dev.	1	,344**	,392**	,220*
General maturity		1	,786**	,932**
Number maturity			1	,600**
Reading maturity				1

When Table 2 is examined, there is a moderately significant positive correlation between the speech and language development questionnaire scores and the general preparation sub-dimension of the Metropolitan School Maturity test ( $r=.344$ ,  $p<.01$ ); there is a positive and moderately significant relationship between speech and language development scores and number preparation scores ( $r=.392$ ,  $p<.01$ ); On the other hand, it is seen that there is a positive and low-level significant relationship between speech and language development scores and reading maturity scores ( $r=.220$ ,  $p<.05$ ).

The t-test results regarding the differentiation of school maturity level and speech and language development levels according to age are given in Table 3.

**Table 3***Statistics on the Differentiation of School Maturity Level and Speech and Language Development Level according to Age*

	Age	n	$\bar{x}$	s.s	t	p	d
<b>Speech and lang. Dev.</b>	5	37	12,92	1,963	1,687	0,095	-
	6	64	13,48	1,391			
<b>General Maturity</b>	5	37	64,70	14,890	3,285	0,001	0.659
	6	64	73,63	12,046			
	5	37	15,11	4,427		0,003	0.612

<b>Number Maturity</b>	6	64	17,56	3,527	-	3,064	
<b>Reading Maturity</b>	5	37	42,22	11,048	-	<u>0,015</u>	0.488
	6	64	46,95	8,121	2,468		

When Table 3 was examined, it was found that the difference between the averages was not significant according to the results of the independent sample t-test conducted to determine whether the speech and language development levels of the students differ according to age ( $t=-1.687$ ,  $p>.05$ ). According to the results of the independent sample t-test on whether there is a difference in the general preparation sub-dimension of school maturity according to age, the difference between the means was found to be significant and had a moderate effect size (0.659) ( $t=-3.285$ ,  $p<.01$ ). The mean general preparation score of the 6-year-old students ( $\bar{x}=73.63$ ) is statistically significantly higher than the 5-year-old students' mean score ( $\bar{x}=64.70$ ). According to the results of the independent sample t-test performed to determine whether there is differentiation according to age in the number preparation sub-dimension, the difference between the means was found to be significant and it had a moderate effect size (0.612) ( $t=-3.064$ ,  $p<.05$ ). The mean score of the 6-year-old students' number preparation score ( $\bar{x}=17.56$ ) is statistically significantly higher than the 5-year-old students' mean score ( $\bar{x}=15.11$ ). According to the independent sample t-test results regarding whether there is differentiation according to age in the reading preparation sub-dimension, the difference between the means was found to be significant and it had a moderate effect size (0.488) ( $t=2,468$ ,  $p<.05$ ). The reading preparation score average of the 6-year-old students ( $\bar{x}=46.95$ ) is statistically significantly higher than the 5-year-old students' average score ( $\bar{x}=42.22$ ).

The t-test results regarding the differentiation of school maturity level and speech and language development levels according to gender are given in Table 4.

**Table 4**

*Statistics on the Differentiation of School Maturity Level and Speech and Language Development Level by Gender*

	Gender	n	$\bar{x}$	s.s	t	p	d
<b>Speech and lang. Dev.</b>	Boy	44	12,89	2,202	-	<u>0,041</u>	0.390
	Girl	58	13,55	0,940	2,069		
<b>General Maturity</b>	Boy	44	71,02	13,253	0,422	0,674	-
	Girl	58	69,86	14,144			

<b>Number Maturity</b>	Boy	44	17,11	3,743	1,061	0,291	-
	Girl	58	16,26	4,237			
<b>Reading Maturity</b>	Boy	44	45,89	9,362	0,602	0,548	-
	Girl	58	44,74	9,622			

When Table 4 is examined, it was found that the difference between the averages was significant according to the results of the independent sample t-test conducted to determine whether the speech and language development levels of the students differ according to gender ( $t=2.069$ ,  $p<.05$ ). The mean score of speech and language development of female students ( $\bar{x}=13.55$ ) is statistically significantly higher than the average score of male students ( $\bar{x}=12.89$ ). The significance effect size value (0.390) according to language-speech development levels shows a moderate effect. According to the results of the independent sample t-test on whether there is a gender difference in the general preparation sub-dimension of school maturity, the difference between the means was not significant ( $t=0.422$ ,  $p>.05$ ). According to the results of the independent sample t-test conducted to determine whether there is a difference according to gender in the number preparation sub-dimension of school maturity, it was seen that the difference between the averages was not significant ( $t=1,061,422$ ,  $p>.05$ ). According to the results of the independent sample t-test conducted to determine whether there is a gender difference in the reading preparation sub-dimension of school maturity, it was seen that the difference between the averages was not significant ( $t=0.602$ ,  $p>.05$ ).

## DISCUSSION

In this study, which aimed to examine the relationship between the school maturity levels of preschool students and their speech and language disorders, it was seen that there was a moderately significant positive correlation between the students' speech and language disorders questionnaire scores and the general maturity and number preparation sub-dimensions of the Metropolitan School Maturity test. Accordingly, as the speech and language disorders level of the participants increases, as the speech and language disorders levels decrease, the general preparation and number preparation levels decrease. The general preparation sub-dimension of the Metropolitan School Maturity Test consists of the sum of the scores obtained from all areas of the test (word comprehension, sentences, general knowledge, matching, numbers, and copying) and reflects the level of school maturity in the most general sense. The number preparation sub-dimension refers to the score obtained from the numbers test. When the findings of the study are examined, according to the speech and language disorders questionnaire of children whose general preparation and number preparation scores are below average and weak, it was observed that they showed features such as repetition, stuttering and blinking, using other sounds instead of some sounds, repeating and prolonging sounds, difficulties in understanding

speech by friends, inability to follow simple instructions, and the difference in the tone of voice while speaking. When the studies in the literature are examined, it is seen that the findings of the research show similarities with the literature. Küçük (2016) examined 190 children who grew up in monolingual or bilingual families in his study to examine individual and familial factors related to school maturity and language development in children at school age. According to the results of the study, it was observed that there was a strong correlation between Metropolitan general maturity, number maturity, and reading maturity scores and TIFALDI Receptive Language Test and Expressive Language Test. In another study, it was concluded that children's intellectual skills and language proficiency are effective on school maturity levels (Marjanovic et al., 2008). Dennis et al. (2021), reported a positive relationship between the receptive language level of preschool children and the cognitive and mathematics sub-dimensions of school maturity. They concluded that the lack of receptive language is a risk factor in the emotional and social dimensions of school maturity. In the study of Güzel and Özyurt (2018), in which they evaluated school maturity according to teachers' opinions, teachers mentioned the skills of children with school maturity to express themselves easily and to communicate well with their friends and environment. Similarly, in another study, it was revealed that school maturity is also related to communication skills, including other developmental areas (Senemoğlu, 2011).

Another finding of the study is that there is a positive and low-level significant relationship between speech and language disorders scores and reading maturity scores. The development of reading begins with processes such as making connections between spoken sounds and written sounds (Gough and Hillinger, 1980), decoding the sounds heard, and combining linguistic clues with content (Shmidman & Ehri, 2010). From this point of view, it can be thought that there is a relationship between reading maturity, which is one of the sub-dimensions of school maturity, and language development. In a study, it was seen that reading skill was related to variables such as verbal expression, phonetics, sound-letter relationship, vocabulary, comprehension, thinking skills, and memory (Güneş, 2013). According to Oktay (2013), one of the factors affecting school maturity is cognitive development and language development related to it. The vocabulary of the child, the ability to form sentences, and the quality of the words he uses are important. When examined in terms of these factors, one of the dimensions of preparation for primary school is that the child has language development and vocabulary at a level that will enable him to express himself and understand what is said. Language development is a part of cognitive development and one of the determining factors of the learning process (Cummins, 1984). Cognitive development is an area of development in which many other factors such as attention, abstract thinking, problem-solving, memory, and intelligence level are also determinative. According to the results of this study, the low level of correlation between reading preparation and language development may be due to the fact that children with language development deficiencies make up for this gap in their proficiency in other areas of cognitive development.

When the findings related to the differences in the level of school maturity and speech and language disorders levels of the participants in the study were examined, it was seen that there was no significant difference in the levels of speech and language disorders according to age. When the literature is examined, Günay (2020) in his study examining the language and speech disorders of four, five, and six-year-old students, concluded that the incidence of language and speech disorders in the four-year-old students is significantly higher than the rate in the six-year-old group. In another study on this subject, it was observed that the incidence of language and speech disorders decreased as age increased (McKinnon et al., 2007). In a study conducted by Gürocak (2007), it was concluded that language development in 60-72-month-old students attending preschool education did not differ according to age and other variables examined. Küçük (2016) evaluated children at the stage of starting school in terms of language development and school maturity. According to this study, it was found that there is a very weak relationship between the ages of children and their receptive and expressive language scores. Dereli and Koçak (2005), in their study in which they examined the expressive language levels of children between the ages of four and six attending preschool in terms of different variables, concluded that age did not make a significant difference in the level of language development.

Studies show that children's behavior problems decrease, and their friendship relations, social skills, and school adjustment increase as they get older (Campbell, 2006; Vandell et al., 2006). In the literature, there are different findings regarding the relationship between age and school maturity. In a study examining the effect of school maturity levels of first-year students on their learning to read and write, it was seen that there was no significant difference between the school maturity levels of students in the 60-66 months, 66-72 months, and 72-80 months age groups (Arı and Özcan, 2014). In another study examining the school maturity of children at school age, it was concluded that there is a very weak relationship between age, number maturity, and general maturity (Küçük, 2016). In his study, Esaspehlivan (2006) concluded that there is a significant difference between the school maturity levels of the students aged 78 and 68 months in favor of the older children. Similarly, in a study in which the school maturity levels of 5, 5.5, and 6 age group students were determined, it was found that there was a significant difference in favor of 6 age group students (Unutkan, 2003). In their study, Güzel and Özyurt (2018) found that there is a significant difference according to age in all sub-dimensions of the school maturity test in preschool students. In our study, students' school maturity levels differ significantly in all sub-dimensions according to age. Accordingly, the school maturity levels of the six-year-old participants are significantly higher than the five-year-old participants. The findings of this study support studies showing a relationship between age and school maturity level. Since school maturity is a broad concept that is not related to age alone, the effect of the age factor may vary in studies. Based on the principle of individual differences in development, the fact that children of the same age are at different levels in different developmental areas may affect the results of the research.

102 pre-school students and 6 teachers participated in this research. The relationship between school maturity and language and speech development and school maturity and language and speech development were examined in terms of age and gender. In the study, it was observed that the speech and language disorders levels of the students differed significantly according to gender. The average score of speech and language disorders of female students is significantly higher than the average of male students. The results of the research are compatible with the results of the research showing the relationship between language development and gender in the literature. In the study of Günay (2020) in which he examined the language and speech disorders of preschool students, it was seen that 30% of the students with speech and language disorders were girls and 70% were boys, according to the evaluation of the teachers. According to this, the rate of language and speech disorders in female students is 5.81% and 10.91% in male students. Similarly, Şahlı and Belgin (2017), in a study they conducted, found that 31% of students with general language and speech disorders were girls and 68% were boys. In a survey conducted on 12,388 children in Australia in 1995, the rate of speech sound disorder was calculated as 2.4% in boys and 0.9% in girls (Keating et al., 2001). It is known that stuttering is more common in men (Borsel et al., 2006; Ella et al., 2015). There are also studies showing that there is no significant relationship between gender and language development. Although the general understanding is that girls develop language faster than boys, some studies do not support this view (Stowe et al., 1999; Gürocak, 2007; Küçük, 2016; Elter, 2021). In these studies, it was seen that there was no significant relationship between language development and gender. In the studies examining gender and language development, the studies in which a significant relationship is revealed are mostly researches on the existence and frequency of language and speech disorders; It is seen that the studies that reveal that there is no significant relationship are those that investigate the level of language development. From this point of view, the presence of language and speech disorders differs according to gender; Since the level of language development is a broader concept, it can be said that it does not differ according to gender and is affected by other factors.

In the study, it was observed that there was no significant difference in the scores of students in all sub-dimensions of school maturity according to gender. Güzel and Özyurt (2018), in their study in which they investigated the school maturity levels of preschool children, concluded that reading maturity did not differ significantly according to gender, while numerical maturity and general maturity scores differed significantly in favor of girls. In his study, Çıkrıkçı (1999) examined the relationship between school maturity and family attitudes in 150 children attending kindergarten and concluded that there was no significant gender difference in the results of the study on the relationship between school maturity and gender. Arıkök (2001) examined 94 children in his study and concluded that the reading maturity levels of children did not differ according to gender. Similarly, Arı and Özcan (2014) found that there was no significant relationship between school maturity and gender in their study examining the school maturity levels of first-grade students. The effect of

gender on school maturity can also be affected by cultural and environmental factors (Oktay, 2000). Some studies show the opposite effect on the effect of gender. According to these studies, men have more language disorders, reading and spelling difficulties, verbal language problems, and attention deficit problems and accordingly show lower school maturity (Soderman et al., 2003); There are findings that there is no significant gender difference in school maturity levels in children with different socioeconomic levels (Gonca, 2004).

### LIMITATIONS AND RECOMONDATIONS

In this study, 102 students aged 5 and 6 attending preschool education in two preschool institutions during the 2022-2023 academic year were chosen as participants. The relationship between school maturity and speech and language disorders was examined according to age and gender variables.

Future research can employ different and larger sample groups. Moreover, the association between school maturity and language development can be explored in light of various factors, such as socio-economic status, family attitudes, parental education level, number of siblings, birth order, intelligence level, disability status, and school type.

In this study, the language and speech proficiency of the students were assessed based on the teachers' observations. The findings indicate that the students' level of school maturity significantly increases with age. Thus, the possibility of children starting primary school at an older age should be considered.

Further studies can be conducted to determine the same variables using different scales for speech and language disorders and then make comparisons. Additionally, the faster development of girls until puberty, personality traits, and the influence of psychological and environmental factors should not be overlooked. From this perspective, it is essential to address the speech and language disorders in males.

### CONCLUSION

The research findings highlight the impact of speech and language disorders on both the general preparation and number preparation sub-dimensions of school maturity. Given that language development commences the moment a child starts to hear, nurturing this development in early childhood is crucial for enhancing school maturity levels. The rapid brain development and high neuroplasticity during early childhood signify a critical period for supporting language development. Acquiring language skills becomes extremely challenging beyond this crucial phase.

It is imperative to address speech disorders and language development issues that emerge during this period as early as possible, and families should be cognizant of this fact. Parents and primary caregivers in early childhood are instrumental in fostering language development. The depth and frequency of parents' interactions with their children play a

pivotal role in shaping the child's language development. Therefore, initiatives aimed at bolstering family support and heightening awareness about children's early language development processes are essential.

Another observation from this study is the gender disparity in language and speech levels, favoring girls. Societal norms might set distinct expectations for male and female roles. For instance, encouraging boys to engage in more physical activities, while directing girls towards games that prioritize verbal interactions over physical exertion, is a common practice.

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# Effect of Mobile Instructional Design on Student Perception of Distance Learning<sup>1</sup>

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## Abstract:

Learning through mobile applications has become more relevant as mobile tools have evolved. The COVID-19 outbreak that spread across the globe in 2019 promoted to a brief period of distance learning. The purpose of the study was to investigate how the students' perceptions of distance learning were affected by the use of a mobile application designed for a seventh-grade mathematics course. The research was performed using quasi-experimental design. The study was conducted in the distance education process with 7th grade students studying in a secondary school in the 2020-2021 academic year. The mobile application was used to deliver the instruction to the students in the experimental group, whereas the control group received instruction based on the textbook. To collect the data for the study, Yıldırım et al. (2014) designed the "Student Opinions Scale for Distance Education". T-tests were used to assess the data for dependent and independent samples, respectively. The study revealed a substantial difference in the post-test results of the students in the experimental and control groups. It was discovered that there was no significant difference between the pre and posttest scores of the control group students' opinions on distance education and that there was a substantial increase in the experimental group students' attitudes on distance education between the two assessments. According to the findings, it has been suggested that by creating mobile applications in various ways and including them into the distance learning process, the impacts of using them for mathematics classes on distance learning can be studied.

## Keywords:


distance education, instructional design models, mathematics education, mobile learning

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## INTRODUCTION

Schools are venues where educational activities are carried out with intention, planning, regularity, and control within the framework of a pre-planned curriculum. Teaching is defined as learning-teaching activities carried out in schools. In other words, teaching includes both teaching and learning. In this regard, while educational activities are carried out, they are prepared with a specific goal in mind. While instruction is delivered in schools, relevant face-to-face education activities are prepared. Face-to-face instruction may need to be interrupted in specific instances. In these circumstances, education can be supplemented with a variety of techniques to avoid interruptions. With the worldwide expansion of the COVID-19 outbreak in 2020, it has been assured that schooling continues remotely. It is intended to design and implement education across various platforms to accomplish the targeted benefits of face-to-face education in the remote education process.

The impacts of technology on the educational environment very depend on the development of technology. Web pages, instructional software, mobile applications, web 2.0 tools, and other such technologies demonstrate the effects of technology. Given the kids' ages and time period, they can utilize mobile devices, laptops, and other smart devices easily and acquire the information they seek via online sites. In terms of the generation they belong to, they are willing to employ technology instruments. Depending on this situation, it was requested to create a learning environment according to the ADDIE design model for the teaching of mathematics course Geometry and Measurement sub-learning subjects. Instructional design; It is stated as a systematic development process that proceeds by using learning and teaching theories to ensure the quality of teaching. In this process, there is an analysis of the needs and goals of the learners and the development of systems suitable for the aforementioned requirements. Within these systems, the development of instructional materials and activities and the evaluation of instruction and learners are also included in the instructional design process (Berger & Kam, 1996). In this study, the ADDIE instructional design model, which is the most well-known example of instructional design models, was used. It is stated that when the steps of the ADDIE model are followed, it can be easily applied in online or face-to-face environments (Aldoobie, 2015). For this reason, the learning environment was designed using the ADDIE model in the study. One of the systematic models with five steps is the ADDIE design model. The initials of the steps that make up this model are combined to create the name of the design model. The following steps: analysis, design, development, implementation, and evaluation. The material of the GeoHepta mobile application was organized according to the 5E learning paradigm during the design stage, and a learning environment was established for students to learn by discovery as the topics were taught. While the material of each topic is provided in the GeoHepta application using the 5E learning methodology, it is arranged so that the subjects are found using GeoGebra 6.0 exercises. After the subjects have been comprehended, GeoHepta has been designed in such a manner that they may conduct online assessments



using the evaluation questions on the mobile application and web 2.0 capabilities through the application. The GeoHepta mobile application was thoughtfully set up during the development stage so that it could be used as a web page. The usage of mobile application technologies during mathematics sessions will have a variety of outcomes depending on the age at which the pupils find them appealing. In this regard, the outcomes of the implementation of education using the GeoHepta mobile application, which was created using the ADDIE design model, were examined and reviewed.

The ADDIE instructional design model was first introduced as a general model. When research on the frequency of usage of instructional designs (Göksu et al., 2014; Khodabandeloua & Abu Samah, 2012; Royal, 2007) is analyzed, the ADDIE model ranks among the most commonly used instructional design models. The study was conducted at various levels of education based on the applicability of the ADDIE design model (Albalawi, 2018; Cihan, 2019; Durak & Ataizi, 2016; Fitrani & Ekawati, 2018; Muruganatham, 2015; Yıldırım, 2019).

According to research in the literature, the ADDIE method promotes academic success, motivation, the permanence of learning, and the student's self-confidence, and has a favorable influence on the student's attitudes and approaches (Arkün et al., 2009; Göksu et al., 2014; Mamolo, 2019). The following discussions with academicians that are specialists in the subject, it was determined to adopt the ADDIE technique to perform instructional design in a learning area. In this approach, research has begun in the first semester of the 2019–2020 academic year, following the ADDIE design model phases for educational design. As a consequence of the research conducted during the analysis stage using the ADDIE design model phases, it was determined to create a mobile application for use in the field of studying geometry and measurement in the 7th grade mathematics course. Mobile learning allows for quick communication without regard to time or location, as well as the capacity to carry digital data in the individual's pocket. Mobile technology enables learning to occur outside the traditional classroom setting as well. Because of enabling students to learn outside the classroom, mobile learning encourages informal learning (Crompton, 2013).

Studies on the use of mobile learning-based research in the teaching and application phases have been conducted in many educational sciences domains (Almelhi, 2021; Berberoğlu, 2020; Sönmez, 2018), as well as other scientific fields (Kestel, 2020). However, among the studies on mobile-assisted education, there have been few studies on mathematics instruction. One of these studies, Koparan and Kaleli Yılmaz (2020), investigated pre-service mathematics instructors' perceptions of the learning environment facilitated by mobile learning. Yılmaz, Ustun, and Guler (2021) conducted research on secondary school students who received distant education during the pandemic to assess how they felt about the usage of mobile learning in their mathematics sessions. The study findings showed that secondary school pupils had a modest attitude toward mobile

learning. There is no significant difference in the views of students toward mobile learning according to the variables relating to internet connection type, grade level, gender, and internet usage time. When studies abroad are examined, Franklin and Peng (2008) provided a case study with middle school students in which algebraic equations, slope and absolute value were learned using a smart phone. Because of this research, some difficult concepts in mathematics lessons are learned better with mathematics videos. In their research, Wijers et al. (2010) examined students' participation in mathematics activities by developing a mobile game about geometry. In the research game, it was discovered that the pupils were motivated and had fun. Students stated that they learned quadrilaterals, using GPS and reading maps.

The way that students learn and the way that learning environments are set up may change based on shifting circumstances in daily life. Mobile phones are a helpful tool for individualized learning because they offer several applications. In this research, unlike other research, it is aimed to use in the teaching process by developing a mobile application according to an instructional design model. Studies based on mobile learning are typically conducted using applications on mobile devices, according to the literature (Baya'a & Daher, 2009; Franklin & Peng, 2008; White & Martin, 2014).

The research found that a learning environment should be constructed using technology based on the perspectives gathered from the requirement analysis using the ADDIE design model. In order to communicate with the instructor, the course material, and other students, learners often turn to employing a variety of wireless devices and networks (Sönmez, 2010). According to the needs analysis findings, it was requested that a mobile application be created and used in a fashion that would allow the students to learn the 7th grade Geometry and Measurement learning field subjects using the 5E learning paradigm. The development and use of technology such as mobile applications is anticipated to enhance the distance education process and make studying more engaging. Students have an easier time using technology tools because of their generation. According to research based on mobile applications, using mobile applications increased students' academic performance and attitude toward lessons (Calder & Campbell, 2016; Franklin & Peng, 2008; Taleb et al., 2015). A mobile application for math lessons was employed in the distance learning process due to the COVID-19 outbreak; however research, on its impacts was hampered. To better understand how a mobile learning-based instructional design affects students' perceptions of remote learning, research is being conducted.

### Sub-Problems of the Investigation

The main aim of this study is to present the themes to the students using the GeoHepta mobile application created for the math lesson and to assess the degree to which it has an impact on how the students perceive distance learning. In this situation, two groups—control and experimental—were created to compare how students' opinions of distance learning changed when they used the GeoHepta mobile application (Experimental Group)

versus when they did not (Control Group). The participants in the control group do not use the GeoHepta mobile application, whereas the experimental group participants do. Within the parameters of the investigation, the following issues were looked:

i) Is there a significant difference in the teaching of 7th grade geometry and measurement subjects between the experimental group of students studying in the learning environment designed according to the ADDIE instructional design model and the control group of students where textbook-based teaching occurs takes place according to the Student Views on Distance Education Scale pre-application scores?

ii) Is there a significant difference in final application scores between experimental group students studying in the learning environment designed according to the ADDIE instructional design model and control group students studying in the textbook-based teaching of 7th-grade geometry and measurement subjects?

iii) Is there a statistically significant difference between the pre-test and post-test measurement scores of experimental group students studying in the learning environment developed according to the ADDIE instructional design paradigm in the teaching of 7th-grade geometry and measurement subjects?

iv) Is there a statistically significant difference in the pre-test and post-test measurement scores of the control group pupils who were taught textbook-based education in the field of 7th-grade geometry and measurement?

### Literature

The aim of the study was to investigate the impact of using the GeoHepta mobile application, which was created using the ADDIE instructional design approach, during the distance learning phase. Under this title, the ADDIE design model and distance learning, respectively, are explained.

### *ADDIE Design Model*

If instructional design is considered as a process, it means systematically improving instruction by using learning and instructional theories to increase the quality of instruction (Brown & Green, 2016). One of the instructional design models, the ADDIE model, has been proposed as a general model. When the different variants of the ADDIE model are examined, it is seen that the basic components are the same, only the processes between the steps can differ. Initially to drive the development of military education at Florida State University The ADDIE instructional design model developed by Branson et al. (1975) steps are indicated in Figure 1.

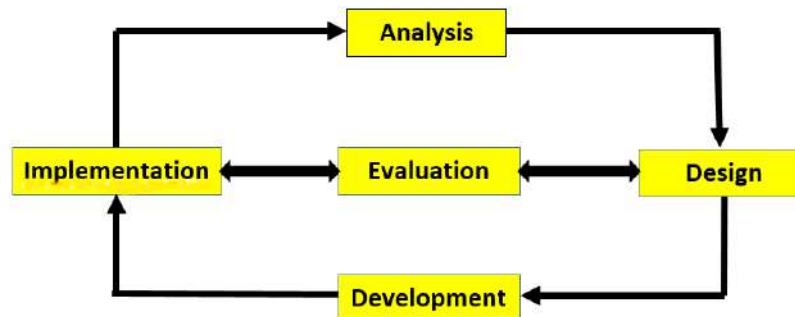


Figure 1. Components of the ADDIE model (Seel et al., 2017)

The ADDIE model is shaped within the framework of five steps. These steps are, respectively; analysis, design, development, implementation and evaluation. In the Analysis step, which is the first step of ADDIE; possible causes of the existing problem are investigated. In order to understand the characteristics of the students who will participate in the teaching, it is possible to look at the unique characteristics of the students, what information they bring from the past and what they see as a need (Peterson, 2003). At the design stage; measurement and evaluation strategies are determined by using learning objectives and learning objectives. At the development stage; content teaching, strategy, and materials to be used in teaching is determined and prepared. During the development phase, the learning process created by making a pilot application is tested. At the application stage, students; and trainers are informed about the application process and the developed design is implemented. In the last stage, Evaluation, tools are determined to measure the quality of teaching and teaching is evaluated. Evaluation can occur not only after the application, but also throughout the instructional design process (Branch, 2009). Research has been conducted at many levels of education in accordance with the applicability of the ADDIE model (Albalawi, 2018; Arisetyawan et al., 2021; Arkün & Akkoyunlu, 2008; Wahab et al., 2017). There are studies based on the ADDIE model at various levels, to simply review these studies. Albalawi (2018) aimed to investigate the effectiveness of using the flipped classroom method, which was prepared in accordance with the ADDIE design, in teaching Math2 to preparatory class students at a university. Because of the research, it has been found that teaching is effective in increasing the performance of students. In their research, Arkün and Akkoyunlu (2008) aimed to determine the effects of the interactive multi-learning environment developed according to the ADDIE instructional design model on academic success and students' views on the fourth grade mathematics lesson column chart. Because of the research, it was found that the developed learning environment increased academic success and students found the software enjoyable.

### *Distance Education*

Individuals who cannot attend in-person education due to time, place, age, geographic distances, working a full-time job, financial hardships, health issues, or family

obligations can still receive an equal education through distance learning. Distance learning has created a wonderful opportunity to improve educational performance as the educational environment has confronted the need for adjustments (Ball & Crook, 1997). It benefits people in a variety of ways, including flexibility with the advantages of technical advancements, individualism in the learning environment, and having the freedom to choose their own participation time and place (Odabaş, 2003). Literature analysis on distant learning has revealed that there are many alternative definitions of distance learning. Alkan (2005) described distance education as a teaching strategy in which the interaction and communication between the instructor and the student are controlled by a system when traditional learning-teaching methods cannot be used. According to Moore and Kearsley (2011), distance education is a method of teaching and learning that was developed via the development of educational activities that allowed students to communicate in a variety of settings while using some instructional technologies. Distance education provides different opportunities in the learning environment. There are different studies in the literature on the effects of distance education in mathematics education (Lowrie & Jorgensen, 2012; Maltempi & Malheiros, 2010; Xu & Jaggars, 2011; Yates & Beaudrie; 2009).

While there was no teacher-student interaction in the early instances of distant learning, there are now numerous ways to establish it. Distance learning had to be moved to 2019 because of the COVID-19 pandemic. Depending on the efficient use of instructional technologies, distance education occurs in virtual environments, of time and location. Schools in Turkey have been shuttered because of the pandemic, as they have done everywhere else. During this procedure, the EBA underwent the necessary adjustments, and online and broadcast television were used to continue education. Live courses delivered by EBA were also used to provide the instruction during the remote learning era. Numerous researches have been conducted on the COVID-19 pandemic, both internationally (Cassibba et al., 2021; El Refae et al., 2021; Lavidas et al., 2022) and nationally (Durak et al., 2020; Korkmaz, 2021; Özdemir Baki & Çelik; 2021). According to Cassibba et al. (2021), in their work; carried out how Sicilian state university mathematics professors faced the challenge of teaching via distance education during the first wave of the COVID-19 pandemic. A new teaching modality has begun to be adjusted as a result of this research. It is feasible to apply brand-new instructional strategies and resources. In her study, Korkmaz (2021) investigated how teacher candidates felt about the Google Classroom digital platform and distance education that were used in the 2019–2020 distance learning process because of the COVID-19 epidemic. The findings concluded that gender and the device used for the lesson had a statistically significant impact on respondents' attitudes about distance education. On the other hand, it has been discovered that factors like working status, the setting in which they take the course, or the family's monthly income level have no statistically significant impact on the attitude scale for distance education.

The GeoHepta mobile application was created in accordance with an instructional design based on studies from the literature. The created mobile application was put to use during the distance learning session to determine what the students thought about it.

## METHOD

### *Research Model*

The research is designed as a quasi-experimental design with a pre-test and post-test control group to investigate the effect of instructional design steps on the views of students toward distance education in the quantitative research design of the 7th-grade mathematics course, as an experiment and a control group.

**Table 1**

#### *Research Design*

<b>Groups</b>	<b>Pre-Measurements</b>	<b>Activities</b>	<b>Post-Measurements</b>
<b>Experimental</b>	Student Views on Distance Education Scale	Mobile App-Based Education	Student Views on Distance Education Scale
<b>Control</b>	Student Views on Distance Education Scale	Based on instruction from textbooks	Student Views on Distance Education Scale

### *Participants*

This study's universe comprises 7th grade secondary school students from all areas of Turkey. The study group of this research consisted of 7th grade students studying in two groups in a public secondary school in the Central Anatolia region in the second semester of the 2020–2021 academic year. The experimental and control groups were selected using an impartial assignment procedure among the designated 7th grade branches. There were 47 students in the study group, with 21 in the control group and 26 in the experimental group. In Table 2, the demographic characteristics of the experimental and control groups students participating in the research are indicated.

Table 2

*Demographic Information on the Sample Group*

Gender	Experimental Group		Control Group	
	Number of Students in the Group	%	Number of Students in the Group	%
Female	14	54	9	43
Male	12	46	12	57
Total	26	100	21	100

*Data Collection Tools*

The data of the study were obtained by using "Student Views on Distance Education Scale". Yıldırım et al. (2014) developed the "Student Views on Distance Education Scale" to ascertain how people who are enrolled in distance education feel about these environments and to better design those environments. Students were given access to the 42-item measure online, which was designed based on surveys comprising comments on distant education services. Participants in the study were 1040 undergraduate nursing students at Atatürk University. The provided items were scored on a 5-point Likert scale. Principal Component Analysis was used to examine the data and create the final scale. The study findings created a scale that had 18 elements and 4 variables. According to Yıldırım et al. (2014), the Cronbach's Alpha coefficient of the internal consistency analysis of the entire scale was found to be 0,864. With permission, the scale created to assess how individuals participating in distance education feel about these settings, to improve the settings, and to implement the required interventions was used in the study.

*Process*

Final preparations were made for teaching to be done with the students in the experimental and control groups one week before the start of the experimental process. One week before the start of the experimental procedure, the experimental group's students who had been chosen following the pre-test application were emailed the link necessary for installing the GeoHepta mobile application on their phones via the WhatsApp group set up for the group's distance learning. Students were taught that a web page could also be used to access the GeoHepta program. An individual user name and password for the GeoHepta student login were issued to each student in the experimental group. The researcher explained how to install the mobile application and how to access it during the live lesson to the experimental group's students before the trial began. The subjects, activities, and evaluation sections in the mobile application were explained to the pupils after it had been

installed. Live lessons were conducted individually during the experimental process in the experimental and control groups, adhering to the lesson plans created for each group, and were initiated by the researcher in each group. During the live classes, the students in the experimental group launched the GeoHepta application on their phones or tablets, while the researcher presented GeoHepta to the class as a web page. By examining the videos and exercises associated with each subject from the mobile application, the students were able to understand the relevant concepts while being guided by the researcher. After understanding the ideas, the students completed evaluation and sample questions. The researcher taught the pupils in the control group using the mathematics textbook for the seventh grade. The researcher assisted in this process by keeping an eye on and directing the students in the experimental group. The researcher used each of the quantitative data gathering instruments in the study at the designated time. The "Student Views on Distance Education Scale", developed by Yıldırım et al. in 2014, has 18 items and a 5-point likert-type scale. Students can complete several questions in around 20 minutes. To collect the data, the "Student Views on Distance Education Scale" was applied as a pre-test before the quasi-experimental research and as a post-test following the research.

### *Data Analysis*

The results of the pre and posttest administered to the experimental and control groups of students were evaluated using the SPSS program. The dependent sample t-test was used to evaluate data within the same group, while the independent sample t-test was used to study data between groups. Because the pre-test and post-test results from the applied scales suggested a normal distribution, the analysis was carried out using parametric testing. Therefore, the opinion scores on distance education between the experimental and control groups were compared using the independent samples t-test (also known as the t-test for unrelated samples). As a result, the scores of the students in the two groups' pre-test and post-test were compared to determine if there was a statistically significant difference. The association between the pre-test and post-test scores of experimental and control groups students was examined using the dependent sample t-test (t-test for related samples).

### *Ethical considerations*

In this study, all rules stated to be followed within the scope of "Higher Education Institutions Scientific Research and Publication Ethics Directive" were followed. None of the actions stated under the title "Actions Against Scientific Research and Publication Ethics", which is the second part of the directive, were not taken.

Ethical review board name: Necmettin Erbakan University

Social and Humanities Scientific Research Ethics Board

Date of ethics review decision: 19.02.2021



Ethics assessment document issue numbers: 2021/50

## RESULTS

In the first sub-problem of the study, first, it was determined how the distribution of scores in the groups was in order to determine the test to be used to determine whether there was a significant difference between the groups of students according to the pre-application scores of the "Student Views on Distance Education Scale". The normality distribution of the pre-application scores of students in the "Student Views on Distance Education Scale" groups was investigated using the normality test. The distribution of the scale mean scores for the experimental ( $p=,343>,05$ ) and control ( $p=,225>,05$ ) groups of students was normal. The parametric test was used because the group averages had a normal distribution.

From the parametric tests, it was determined if all of the t-test assumptions were satisfied for unrelated samples due to assumptions, the relationship between the experimental and control group students' pre-application measures was investigated.

**Table 3.**

*Results of the t-test for Unrelated Samples Based on the Students' Views on Distance Education Scale Pretest Data*

Test Name	Measurement	n	Arithmetic Average	Ss	Sd	t	p
Scale of Opinions on Distance Education	Experiment group pre-test	26	51,92	8,84	45	-1,708	,094
	Control group post-test	21	56,48	9,38			

Table 3 shows that there is no significant difference in pre-application ratings on the "Student Views on Distance Education Scale" between experimental and control groups students.

In the second sub-problem of the study, first of all, it was determined how the distribution of scores in the groups was in order to determine the test to be used to determine whether there was a significant difference between the groups of students according to the post-application scores of the "Student Views on Distance Education Scale". The normality distribution of the post-application scores of students in the "Student Views on Distance Education Scale" groups was investigated using the normality test. Students' scale mean scores in the experimental ( $p=,629>,05$ ) and control ( $p=,442>,05$ ) groups had a normal distribution. The parametric test was used because the group averages had a normal distribution.

From the parametric tests, it was determined if all of the t-test assumptions were satisfied for unrelated samples due to these assumptions, the relationship between the experimental and control group students' post-application measures was investigated.

The t-test results for unrelated samples based on post-application data from experimental and control groups are shown in Table 4.

**Table 4.**

*Results of the t-test for Unrelated Samples Based on the Students' Views on Distance Education Scale Post-test Data*

Test Name	Measurement	n	Aritmetic Mean	Ss	Sd	t	p
Scale of Opinions on Distance Education	Experimental group post-test	26	59,23	5,61	45	3,074	,004
	Control group post-test	21	53,10	8,05			

The t-test findings for the unrelated samples regarding the post-test data in Table 4 show a significant difference in the students' perspectives on distance education. The effectiveness of the independent variable or factor on the dependent variable is demonstrated by eta-square, a statistic that does not require the assumption of linearity between the variables (Büyüköztürk, 2014, p. 44). The effect size, which ranges from 0 to 1, describes how much of the overall variance in the dependent variable is explained by the independent variable or factor. According to Büyüköztürk (2014); it has a tiny impact size of 0,01, a medium effect size of 0,06 and a big effect size of 0,14.

The effect size was determined to be 0,173 in Table 4. As a result, it may be claimed that the effect size is large because it is near 0,14.

In the third sub-problem of the research, first the pre-test and post-test score distributions were determined in order to determine the test to be used to determine whether there is a significant difference between the "Student Views on Distance Education Scale" pre-test and post-test measurement scores of the experimental group students. Because the pre-test and post-test score distributions were regularly distributed, the parametric test was chosen. Because the measurements were on linked samples, it was determined whether all the t-test assumptions were satisfied for the associated samples due to these assumptions, the link between the experimental group students' pre-test and post-test measures was investigated. Table 5 shows the t-test results for the relevant samples based on the experimental group's pre-test and post-test application data.

**Table 5.**

*The Results of the t-tests for Related Samples Based on the Pre-test and Post-test Application Data of the Experimental Group's Student Views on Distance Education Scale*

Name of the Test	Measurement	n	Arithmetic Mean	Ss	Sd	t	p
Scale of Opinions on Distance Education	Experimental group pre-test	26	51,92	8,84	25	-3,643	,001
	Experimental group post-test	26	59,23	5,61			

According to Table 5, there is a substantial difference between the experimental group students' pre-test and post-test scores on the "Student Views on Distance Education Scale". The effect size is listed as 0,346 in Table 5. As a result, it may be claimed that the effect size is large because it is near 0,14.

In the fourth sub-problem of the study, first it was determined how the pre-test and post-test score distributions of the control group students were in order to determine the test to be used to determine whether there was a significant difference between the pre-test and post-test measurement scores of the control group students.

Because the pre-test and post-test score distributions were regularly distributed, the parametric test was chosen. Because the measurements were on linked samples, it was determined whether all the t-test assumptions were satisfied for the associated samples. The association between the pre-test and post-test measures of the control group students was investigated due to making the assumptions.

Table 6 presents the t-test results for the associated samples for the control group students' pre-test and post-test application data.

**Table 6.**

*Results of the t-tests for Related Samples Based on Pre-test Post-test Application Data of the Control Group's Student Views on Distance Education Scale*

Name of the Test	Measurement	n	Arithmetic Mean	Ss	Sd	t	p
Scale of Opinions on Distance Education	Control group pre-test	21	56,48	9,38	20	1,499	,150
	Control group post-test	21	53,10	8,05			

According to Table 6, there was no significant difference in the control group students' pre-test and post-test scores on the "Students' Opinions About Distance Education Scale".

The effect size is listed in Table 6 as 0,101. As a result, it can be claimed that the effect size is medium because it ranges between 0,06 and 0,14.

## DISCUSSION AND CONCLUSION

Before beginning the applications within the scope of the experimental process, the scale of perspectives on distant education was applied to the students in the experimental and control groups throughout the research phase. The purpose of this pre-application was to determine the opinions of experimental and control groups students on remote education before the application in accordance with the experimental method. The t-test findings for independent samples revealed that there was no statistically significant difference between the two groups' mean scores. Following the completion of the lectures, the "Students' Opinions About Distance Education Scale" was administered to the groups as a post-test. The significance of the students' post-test results in the groups was investigated using the t-test on unrelated samples. The results of the t-test for independent samples showed that there was no statistically significant difference between the mean scores of the two groups. In other words, before the experimental method, the students in the experimental and control groups were equivalent in terms of their scale scores for their opinions on distant education. Following this, the scores of the students' perspectives on distant education were compared using the scale used before and after the experimental process. It was discovered that the scores of the pupils in the experimental group increased. The results of the children in the control group did not improve. A t-test was employed for related samples during the experimental phase to examine if the change in the scores of the experimental group students' perspectives on remote education was significant or not. Similarly, whether or not the difference in the control group students' ratings of distant education is substantial.

The t-test was used to determine the t-test for related samples. According to the findings, only the experimental group of students had a statistically significant shift in their scale scores regarding remote education. There was no statistically significant difference in the changes in scores obtained from the control group. Based on these findings, it can be concluded that the average scores of students who had the learning process assisted by the GeoHepta mobile application improved more than the average scores of students who had the textbook-based learning process. In other words, whereas a textbook-based learning environment had no effect on students' perceptions of remote education, a learning environment that employed a mobile application had a favorable impact on students' perceptions of distance education. As a result, it was discovered that the statistically significant rise in attitudes toward distant education happened solely in the experimental group. Because of the research, it can be thought that the positive increase in the opinions of the experimental group students toward distance education is due to a learning environment based on a mobile application. Similar research results supporting these findings have been reported in the literature (Ergüney, 2017; Sönmez, 2010).

Studies evaluating students' perspectives on remote education based on the usage of mobile applications during teaching are uncommon in the literature. Gökbulut (2021) conducted research to investigate the views and preparedness of distant education students toward distance education and mobile learning in terms of several aspects. According to the findings of the study, while university students' perceptions of remote education were modest, their willingness for mobile learning was high. In the study, there was also no significant difference in students' perceptions of remote education and readiness for mobile learning based on gender, age or education level. On the other hand, the study discovered a marginally favorable association between university students' impressions of remote education and their willingness for mobile learning. The students who used the GeoHepta mobile application in the study had a good development in their attitudes toward distance education, which supports the positive relationship achieved here.

It is the goal of the study by Yousuf (2007) to better understand and measure students' attitudes and beliefs regarding the significance of mobile learning in remote education. The survey findings obviously show that by permitting mobile learning, remote learners, tutors, and support personnel can communicate more effectively, which benefits the overall distance education system. The main benefit of this technology is that it can be used at any time and anywhere, making it accessible to more distance learners.

Fuegen (2012), addressed the increasing research on the use of mobile technologies in education. Because of the research, it has been concluded that traditional learning theories in both traditional and distance education environments are applicable to mobile learning and that mobile devices can be brought into pedagogy in distance education in a suitable way. The development of mobile application-based education throughout the distance education era aids the improvement of students' perceptions of distance learning in this approach.

The following aspects are regarded to be responsible for GeoHepta's beneficial impact on attitudes toward remote education:

1. Based on the findings, the usage of a mobile application called GeoHepta in the teaching process during the distant learning process using COVID-19 is an application that they may benefit from both during and after teaching. Students' good attitudes about distant education may have been influenced by the fact that they benefitted from a different application in distance education with this application.

2. The study was conducted in a remote education setting with student groups during the COVID-19 epidemic. The experimental group received exercises using dynamic mathematics software via the mobile learning environment, and formative evaluations via web 2.0 technologies. Students' perceptions of distant education may have shifted after witnessing how different technology tools are employed.

3. The learning process may be improved by switching from the GeoHepta mobile application to the dynamic mathematics software GeoGebra. This could benefit the experimental group. In particular, the ability to view objects made using unit cube structures from various angles enables students to grasp the subjects more quickly and clearly. According to research, dynamic mathematics software such as GeoGebra 6.0 enhances students' spatial ability and helps the mathematics instruction. It was assured that the structures whose appearances were presented in the course book were imagined in their thoughts in the desired directions in the control group, where textbook-based instruction was carried out in the distant education process. It is discussed how pupils construct based on their responses. In the experimental group, individuals could see the structures provided in the program in an interactive environment and sketch their appearance on the software in any manner they chose. This setting may have allowed them to form a spatial link and influence the success of the experimental group of pupils. As a result, it may be inferred that they have a beneficial impact on their perceptions of remote education.

4. Future research can examine how to employ mobile learning more frequently in classroom settings.

### LIMITATIONS AND RECOMMENDATIONS

Based on the findings of the research with 7th-grade students, the following recommendations were made:

- The GeoHepta mobile application created in this study is restricted to geometry and measurement learning areas in 7th-grade mathematics sessions. In the future, mobile applications with a Turkish interface for other subjects of the mathematics course can be developed, and students' perspectives on distant education can be investigated.

- The experimental duration of this study was restricted to 9 weeks. Students of various achievement levels were able to attend the class throughout the lesson using mobile application technologies. The influence of using mobile applications at different times on students' attitudes on distant education may be examined in future research among students with varying degrees of achievement.

- In order for technology tools to be used effectively in the teaching process, it should be attempted to guarantee that the tools produced follow teaching principles and are used by instructors by paying attention to the learning-teaching process. A mobile application intended for any topic may be claimed to aid in meaningful learning provided it is based on a solid pedagogical foundation. It is critical to examine relevant research in the literature and current mathematics curriculum from the start of the design process in future mobile application development studies.

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## Number system conversions in spreadsheets for vocational school students: A case study from instrumental genesis

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### Abstract:

Theoretical frameworks for mathematics teaching and learning technology-supported provide a systematic structure in examining the contribution of the tool to conceptual development. This study examines the processes for the use of spreadsheets and the mathematical development of the participants in the tasks for performing the conversions between number systems using the instrumental genesis approach, which deals with transforming a tool into an instrument that will contribute to the conceptual development. In the study, the screen images of the worksheets of the participants, who are at the Department of Computer Technologies Program in a vocational school in Turkey, are analyzed together with the observation notes and evaluation scales prepared based on the outcomes. In the study, while the efforts of the participants to transform the spreadsheet into an instrument are observed, it is seen that their habits of paper-and-pencil experiences and misconceptions lead to an obstacle to transferring their operations to the spreadsheet and hesitations. However, their developments in instrumentalization processes are reflected by the following: they use subjective usage schemes, realize the advantages of spreadsheet functions and features, and create dynamic worksheets through dragging and cell addresses. Nevertheless, it can be stated that the reflections of instrumentalization progress on the instrumentation processes for conceptual development are limited.


### Keywords:

Instrumental genesis, vocational schools, number systems, spreadsheets, a case studies, content analysis


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## INTRODUCTION

Mathematics education is one of the main areas in education that aims for students to gain basic skills for the use of technology for the necessity of the digital age. It is realized that the potential of the use of technology in mathematics education and its contribution to the development of students' mathematical thinking skills (NCTM, 2015). For this reason, there are many studies on the integration of technology into education (Artigue, 2002; Balacheff & Kaput, 1996; Hoyles & Lagrange, 2010; Miles, 2021).

It is stated that technology-supported teaching processes in mathematics education have a complex structure. (Miles, 2021; Drijvers et al., 2010). The prior studies on this subject refer to the opportunities for students to spend more time and focus on the concepts thanks to the convenience of technology (Artigue, 2002). Despite this, some following studies state that didactical obstacles arise by ignoring the relationship between using technology and conceptual understanding. It is notified that there is a tight dialectic between the technical use of tools and conceptual understanding in learning environments in which technological tools are used. Related studies examine the relationships among theoretical frameworks, digital tools, and mathematical backgrounds. Instrumental genesis is one of the main theories used in this field (Hoyles & Lagrange, 2010). The instrumental genesis approach, which deals with the use of technology in mathematics education through the techniques used and conceptual developments, is the theoretical framework of this study (Drijvers et al., 2010; Trouche, 2004).

Spreadsheet as a technology used in various areas of life is one of the benefits of mathematics education with the convenience it provides in terms of presentation, manipulation and recording of data (Abramovich et al., 2019; Bakos, 2022; Marley-Payne & Dituri, 2019). This study examines converting performance on the number systems of computer programming students in a vocational school from the perspective of the instrumental formation.

### Mathematics Education and Spreadsheets

Spreadsheets can be defined as an office program that allows the entry of several data and consists of worksheets with cells used for organizing, analyzing, and storing data (Mays, 2015). Using the cell address when creating the formula for the operations to be performed in Spreadsheets allows monitoring the changes of the cells dynamized. This situation contributes to mathematical thinking by creating, manipulating and monitoring the operations with the numbers it contains instantly (Baker & Sugden, 2015). It leads individuals to think algebraic as well as follow change instead of dealing with operations and thinking arithmetic (Ainley et al., 2005; Haspekian, 2014). Sutherland (2007) describes spreadsheets as a new way to mathematical understanding beyond calculations.

Spreadsheets offer the opportunity to update all formulas for each change rather than programming or coding for each function or command. It provides a significant advantage in terms of saving time to monitor changes (Drier, 2001; Sanford, 2018). Students' experience with spreadsheets highlights the feature of being a tool for developing new specific solutions for mathematical concepts. Spreadsheets have the edge over calculators in terms of enabling multiple calculations and dynamiting operations on paper and pencil (Jalbert & Jalbert, 2019). Spreadsheets are important as a learning environment, especially since they enable abstract concepts to be handled in concrete ways with multiple representations such as graphical, numerical, and algebraic (Abramovich et al., 2019; Ainley et al., 2005; Castle, 2021). In addition, spreadsheets give the green light to analytical and in-depth thinking processes for transferring mathematical concepts to a technological environment with the opportunity to design learning environments (Beigie, 2017; Caglayan, 2017; Ozdemir Erdogan & Turan, 2014).

### Number System Conversions

Numbers are mathematical objects that have diversified and developed from the first ages to this day with their representations and writing systems. Today, although this representation is usually based on the decimal system, it may also be performed in the binary, hexadecimal number system or with Roman numerals. The sequence of symbols used to represent numbers may correspond to different numbers in number systems. For example, the number of 5 (five) products of the same kind is symbolized as 5 in the decimal system and as 101 in the binary system. It is considerable to use these representations and convert them between them in mathematics.

The binary system is introduced as a different language by those who are interested in computer sciences, which Stewart (2009) describes as a privilege and "there are 10 kinds of people in the world: those who understand binary numerals and those who do not". It is expected that students deal with the conversions between the decimal system and binary systems (4, 8, 16, etc.), the relations between the number systems and the numbers they contain, the arithmetic-algebraic structures, and patterns among numbers. In addition, it is important that the results of division operations and exponential notations rely on the conversions of number systems (Figure 1).

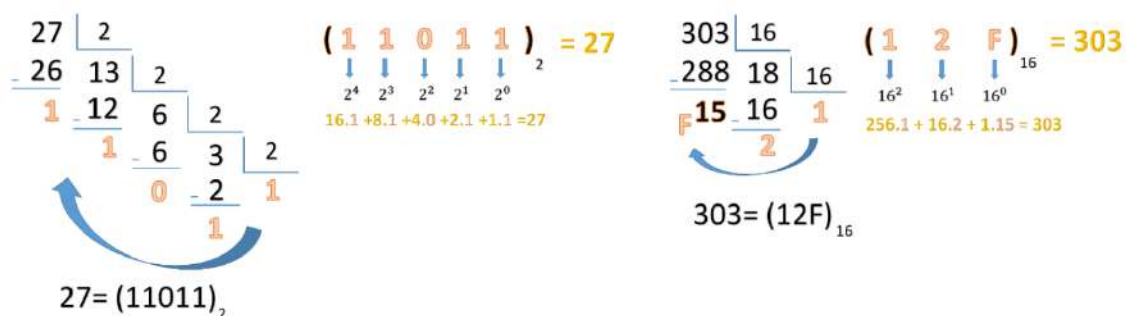


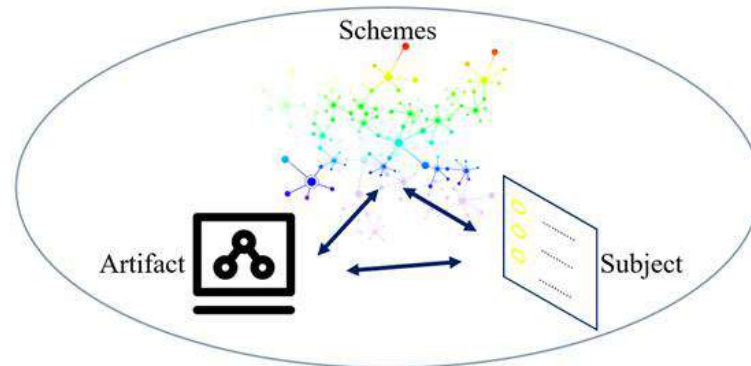
Figure 1. Examples for conversions of number systems

Although students have some difficulties in number systems, in a study with pre-service teachers, it is noticed that the relations between the exponential representations of numbers and the binary system support each other (Melkonian, 2019). In general, studies conducted using a learning environment on technology focus on the skills and motivation for the use of technology as well as try to examine the difficulties experienced by the students in the binary system.

### Theoretical Framework: Instrumental Genesis

In a learning environment supported by technology, learners should make sense of the conceptual background of the techniques they use to display their conceptual development. Instrumental genesis examines the relationship between the tool and the learning process, the techniques developed by the learners in the use of tools, and their conceptual development (Trouche, 2004). Instrumental genesis consists of the following dimensions: instrumentalization, instrumentation, tool(artifact)-instrument, and schemes.

While an artifact(tool) is a material or abstract structure to be used for a task; an instrument is a subjective process developed on this tool by the learner. A schema is a solution created through an instrument (Drijvers & Trouche, 2008). There are two dimensions of instrumental genesis: instrumentalization expresses the usage schemes that contribute to the transformation of the tool into an instrument, and instrumentation emphasizes the conceptual schemes formed during the task (*Figure 2*).



*Figure 2.* The Conversion of a Tool to an Instrument (Drijvers & Trouche, 2008)

Schemas can be revealed with the techniques formed by customizing the general features of the tool (Drijvers et al., 2013). Learners can transform the same tool into different instruments in terms of their experience. Therefore, it is important whether the tools are suitable for the task and the individual's background (Drijvers & Trouche, 2008). It is expected that the schemes that lead to the transformation of the tool into an instrument include the techniques preferred in the use of the tool and the mathematical background on which it is based. These schemes can be monitored using the processes of instrumentalization and instrumentation (*Figure 3*).



## Instrumental Genesis

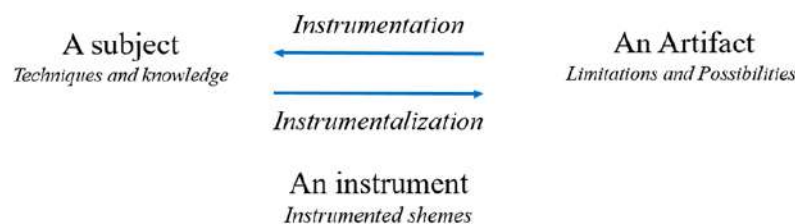


Figure 3. The processes of instrumental genesis (Drijvers & Trouche, 2008)

While *instrumentalization* is the learners' mental paths that lead to solutions by personalizing the instrument, *instrumentation* is the relationship between mathematical structure and its reflections on the formation of the instrument (Drijvers & Trouche, 2008). Instrumentation is a learning process that learners develop through the relationship of task and tool. Instrumentation is not a purely mathematical/conceptual development. It should be examined with instrumentalization together (Trouche, 2004). Goos et al., (2009); express conceptual schemes of geometric features created by dragging as an example of instrumentation, while they express the techniques of how to drag geometric structures in the dynamic geometry environment as instrumentalization. Gueudet and Trouche (2011) emphasize the necessity of determining the conceptual components of the task and the features used in the transformation of the tool into an instrument to reveal these processes.

### Purpose of the research

This study examines converting performance on the number systems of computer programming students in a vocational school from the perspective of the instrumental formation. In our study, the use of spreadsheets by students of computer programming in a vocational school is examined from the perspective of the instrumental genesis approach within the framework of the tasks given to number systems. Based on this, we determine the research questions;

- What are the using schemes of the participants on spreadsheets?
- What are the reflections of the participants' use of spreadsheets in number system conversion tasks on conceptual understanding?

## METHOD

### Participants

In the study, the participants were determined as two girls and two boys, on a voluntary basis, among the second year students of the department of computer programming at a vocational school at a state university in Turkey. The participants encounter both spreadsheets and the binary number system in vocational courses and mathematics.

### Data Collection Tools

Data collection tools of the research are the following: (1) screen recordings of students while performing the tasks, (2) audio recordings taken from the lessons, and (3) observation notes taken by the researcher. Relationships between audio recordings and students' actions and thoughts are tried to be revealed as well as supported by observation notes to increase the validity and reliability of the research data by using more than one data collection tool (Corbin & Strauss, 1990).

### Data Analysis

In the research, the tasks to be presented to the students in the sessions consisting of 45 min per week, a total of four weeks were designed to appropriate instructional planning. Participants studied individually on the same spreadsheet program (Excel) in the same environment with different computers that had the same hardware. Explanations about the sessions and tasks followed in the research processes are given in *Table 1*.

**Table 1**

#### *The feature of Seasons and Tasks*

Seasons	Tasks
Season 1	<p><b>Task 1:</b> transfers the process of finding the equivalent of a binary system of a two-digit number to the worksheet. Form a readable worksheet, describe the functions and features you use.</p> <p><b>Key features of the task</b>      Transferring and solving the task from papers to spreadsheets without interfering with students</p>
Season 2	<p><b>Task 2:</b> finds the binary system equivalents of 40, 72, 99, and 2 in a worksheet. Use appropriate functions such as =base, =mode, =value, =concatenate, and =quotient. Explain the features of the spreadsheet you used and the process of creating the worksheet, along with the reasons.</p> <p><b>Key features of the task</b>      Discussion on functions and features of spreadsheets</p>
Season 3	<p><b>Task 3:</b> presents the binary and hexadecimal equivalents of sequences 1, 2, 4... in a worksheet using appropriate functions and features of spreadsheets. Develop a format that will reveal the relationships between the numbers. If there are different results between the worksheet and the paper you formed, explain the reasons.</p> <p><b>Key features of the task</b>      Evaluation in terms of mathematical processes of the formed worksheets</p>
Season 4	<p><b>Task 4:</b> presents the binary and hexadecimal equivalents of the sequence 1, 4, 16... in a worksheet using appropriate functions and features of spreadsheets. Develop a format that will reveal the relationships between the numbers. Explain how you use the functions and features with reasons.</p> <p><b>Key features of the task</b>      Evaluation in general of student development processes</p>

The tasks were given to the participants in a written text. The answers given by the participants were not limited to screen recordings; they were recorded with audio recordings and observation notes during the tasks.

Content analysis was used in the study (Corbin & Strauss, 1990). The content analysis from the perspective of instrumental genesis focuses on the processes of instrumentalization and instrumentation. While the themes given in *Table 2* in terms of functions and properties of spreadsheets for instrumentalization were discussed in *Table 3* regarding the instrumentation process. These content analysis themes reveal the subjects' schemes defined within the framework of the instrumental genesis.

**Table 2**

*Processes on Participants' Use Spreadsheets (Instrumentalization)*

<b>Themes</b>	<b>Tasks and outcomes on the instrument</b>
Task 1: Examining preliminary knowledge about number systems	
1. Readability	a. Use worksheets effectively. b. Prepare readable worksheets. c. Fix the columns and rows for base, quotient, divisor, and reminder.
2. Skill on spreadsheets	a. Use cell addresses along with =value, =mode, =concatenate, =base excluding dragging.
3. Skills on Office programs	a. Realize the arrangements of columns, rows and cells.
Task 2: Examining the functions of spreadsheets with their features by conceptual learning	
1. Dynamize cells	a. Dynamize cells for manipulations.
2. Use cell addresses	a. Type cell addresses correctly. b. Use right cell addresses for functions, use the syntax correctly.
3. Type functions	a. Use functions of =quotient, =mode, =concatenate, =value and =base effectively.
4. Dragging	a. Realize vertical and horizontal dragging using fixing (\$). b. Realize that fixing (\$) aims to perform more operations with minimum typing.
5. Skills on Office programs	a. Use the features of spreadsheets. b. Check the results relied on cell addresses.
6. Dynamize	a. Dynamize the cells for multiple manipulations.
Task 3: Examining the conversions of bases on multiple manipulations	
1. Readability	a. Form a readable worksheet that indicates comparisons of number systems.
2. Dragging	a. Drag and drop for multiple manipulations.
3. Dynamize	a. Dynamize the worksheet for multiple manipulations.
Task 4: Examining knowledge and skills on number systems using spreadsheets	
1. Readability	a. Prepare a readable worksheet.
2. Use functions and developing	a. Realize that the functions of =quotient and =mode should be dragged separately. b. Realize the integration of the functions =quotient, =mode, =base, =concatenate, and =value.
3. Dragging	a. Use dragging by patterns and functions, avoid manual typing.
4. Use cell addresses	a. Prefer the cell addresses and explain the reasons why cell addresses are used.

Table 3

*Conceptual Processes on Conversions of Number Systems (Instrumentation)*

Themes	Tasks and outcomes on mathematical processes
Task 1: Examining preliminary knowledge about number systems	
1. On the number systems	a. Reflect the task given on a paper on the spreadsheet by using pre-knowledge on number systems.
2. The purpose of mathematical use of functions	a. Realize the reason for the use of functions. b. Check the operations on the paper through =base. c. Explain the relations between spreadsheets and number systems (typing reverse, removing zeros).
Task 2: Examining the functions of spreadsheets with their features by conceptual learning	
1. Place value	a. Express the effect of zeros on place value by =concatenate and =value.
2. The relation between mode-remainder	a. Use =mode in terms of its mathematical aspect (remainder).
3. The relation between conversions of number systems and division operations	a. Realize the status of the divisor, quotient, dividend <sub>7</sub> and remainder for the conversions.
4. The relation between number systems and spreadsheet functions	a. Realize the mistakes in the use of functions and features of spreadsheets by checking results.
Task 3: Examining the conversions of bases on multiple manipulations	
1. The relations between place values and bases	a. Express the relation between bases and place values.
2. Patterns	a. Express the relation between bases and numbers in them.
3. The relation among the number systems	a. Realize the relationships between binary and hexadecimal systems on spreadsheets. b. Compare the results of conversions from binary and hexadecimal bases to decimal bases.
Task 4: Examining knowledge and skills on number systems using spreadsheets	
1. Patterns	a. Express the relation between bases and numbers in them by multiple manipulations. b. Realize the results and reasons of consecutive operations that are not appropriate for the pattern. c. Express the relations among bases, place values, and numbers.
2. Use of functions	a. Handle mathematical aspects of =quotient, =mode and =base on spreadsheets.
3. The relation among the number systems	a. Realize the status of zero for various number systems on spreadsheets.
4. Place value	a. Handle the effect of the status of zero for place values by =mode.

The data collected in the research were analyzed according to the determined themes and outcomes. It is presented through the notes on participants' progress prepared for each session and the evaluation scales developed for the first and last sessions.

### *Ethical considerations*

In this study, all rules stated to be followed within the scope of "Higher Education Institutions Scientific Research and Publication Ethics Directive" were followed. None of the actions stated under the title "Actions Against Scientific Research and Publication Ethics", which is the second part of the directive, were not taken.

Ethical review board name: Isparta Uygulamalı Bilimler Üniversitesi Bilimsel Araştırma ve Yayın Etik Kurulu

Date of ethics review decision: 16.11.2021

Ethics assessment document issue number: 72/01

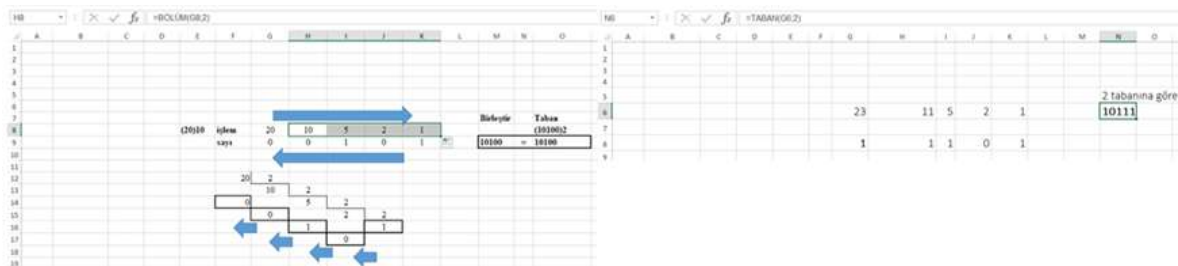
## RESULTS

### *The Processes of Using Spreadsheets*

The processes of participants for the use of spreadsheets are addressed with four components: readability, using functions, cell addresses, dynamizing, and dragging.

#### *Readability*

In the first task, it is seen that participants try to transfer the structures they have built in the paper-and-pencil to spreadsheets instead of focusing on functions used for transformation in number systems. In *Figure 4*, it is seen that participants who can perform operations related to conversions in the number systems in a paper-and-pencil environment create more readable worksheets.



*Figure 4.* Task 1 in terms of readability by Duygu and Cenk

While participants without a good grasp of the conversion algorithm in the paper-pencil environment are able to use the =base function in the spreadsheet environment, they are hesitant about the accuracy of the results of the operations. The readability of their pages is low. Some participants' structures do not change in the following tasks. According to the

findings, the readability of worksheets is more dependent on the location of the variables, the cell in which each value is involved in the operation.

One of the expectations in Task 1 is to ensure the readability of the worksheets while monitoring the changes by dynamizing the cells. However, it is seen that the lack of developing and dynamiting in spreadsheets, such as the inability to write numbers in reverse and not removing unnecessary zeros (0), are reflected in the readability of the worksheets (Figure 5).

Figure 5. The status of zero (0) to the place values, Task 3 by Ada

### Using functions

Depending on the conversion tasks in the number systems discussed in the research, the use of functions =quotient, =mode, =base, =value and =concatenate is more noticeable. It is seen that participants prefer general functions such as =base instead of specific functions such as =Dec2bin. Figure 6 indicates which function participants prefer in which seasons.

	=quotient				=mode				=base				=value				=concatenate			
	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4
A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
B	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
C	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
D	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

√: realized    ■: no run    ▨: not notified in the seasons

Figure 6. Analysis of students' use of function

Ada and Duygu are the participants who regularly use the functions in the tasks. While Ada does not use =value only in the last task, Duygu does not use =mod in the first task. Ada preferred manual entries in the last task, while Duygu, on the other hand, performed division operations manually using arithmetic symbols (=, /) without using a function in the first task. Cenk uses =base and =value regularly from the first tasks, while he especially starts to use =quotient, =mode and =concatenate throughout the process. Cenk expresses that he believes that the use of the relevant functions facilitates the operations as well as the operations in this way.

In terms of using functions, Berk exhibits a different behavior compared with other participants throughout the research. He uses =base throughout all tasks. While he starts to

use =concatenate from Task 2, he does not use the other functions regularly. Berk focuses on the results and does not consider other functions so that they are not necessary. He thinks that they only appeal to the visual. For this reason, he uses =base consistently because of its role in the results, contrary to other functions. Cenk and Berk continue to write their results manually instead of using =quotient and =mode. They declare that they do not need these functions because of the accuracy of their operations and they can perform manual entries more easily. However, participants who gain experience in these functions apply them more frequently in the following seasons because of their facilities. Nevertheless, it is observed that the participants have difficulty abandoning their usage habits and mistakes on the functions and features of spreadsheets.

4.Ada: Yeah, I think I had a mistake in =concatenate again. ...I should have written it backward.

4.Berk: ...because it is going to be wrong (He explains why he does not use cell address and dragging).  
I can see more easily through this way (manually), but I am not sure about the results in the other (cell addresses).

Here, Cenk said he could not remove doubts about the use of spreadsheets and the accuracy of the results throughout the four-week period.

2.Cenk: ...I am sure that my numbers are correct, I did =concatenate correctly, but it is different according to the result of =base. I do not understand where I have made the mistake.

4.Cenk: ... I did not make a mistake in the operation, but this number is very large, is there a wrong thing?

It is seen that all participants showed improvement. While there are participants who do not prefer =mode, which is one of the basic functions for number systems, in Task 1 there are no participants who do not use any relevant functions in Task 4. From the first study, all participants used =base. Throughout the research, the participants constantly compare their own predictions with the results of the operations they obtain based on the functions on the spreadsheet. In this context, it is observed that some participants recognize that they have some misconceptions about the results after using the function.

### *Using cell addresses and dynamizing*

It is important for the purposes of the research that cells become dynamic for calculations using cell addresses. *Table 4* indicates whether participants used cell addresses in the tasks.

**Table 4**

Participants using cell addresses in the tasks

Using cell addresses	Task 1	Task 2	Task 3	Task 4
Ada	✓	✓	✓	✓
Berk	-	✓	-	✓
Cenk	-	-	✓	✓
Duygu	✓	✓	✓	✓

While some participants who had problems writing cell addresses encountered false results, some could not reach any results (*Figure 7*).

*Figure 7.* The screenshot on the mistakes to type the functions Task 3 by Ada

Ada and Duygu used their cell addresses from Task 1. On the other hand, some participants continue entry operations manually in Tasks 2 and 3 (Berk and Cenk). It is seen that participants who continue manual entries are deprived of multi-processing skills as well as not being able to follow or notice their mistakes (*Figure 8*).

*Figure 8.* The screenshot of the reflections of manual typing Task 3 by Berk

In contrast, it is observed that the participants who are sure about the use of cell addresses leave their habit of controlling their operations on paper and pencil. In the last task, everyone uses cell addresses properly except Berk. While Ada and Duygu provide the dynamism of their worksheets, Berk and Cenk impair the dynamism of their worksheets by manually correcting the errors. In general, it is seen that using cell addresses, which is not preferred at the beginning, is preferred in the following tasks due to the convenience of dynamism and the necessity of performing multiple operations.

### *Dragging for multiple manipulating*

the participants who do not prefer the use of functions and cell addresses could not realize dragging and fixing (*Table 5*).



**Table 5**

Participants using dragging in the tasks

<i>Dragging</i>	Task 1	Task 2	Task 3	Task 4
Ada	✓	✓	✓	✓
Berk	-	-	-	✓
Cenk	-	-	✓	✓
Duygu	✓	✓	✓	✓

In Task 1, there is no situation where dragging or fixing can be used. From Task 2, the participants start to benefit from dragging with the guidance of the researcher. However, the discussions among the participants show their hesitations about whether they are doing the dragging correctly or not.

2.Ada: I have used all the functions, that is right, but one zero are missing! Did I do the dragging wrong?

On the other hand, it is observed that some participants who use =mod and =base also tend to rewrite functions for each row instead of dragging.

2.Berk: ...I wrote separately for each, nevertheless, there was a mistake....

It is also seen that the participants bring their past experiences to the tasks. For example, Cenk prefers copy paste instead of dragging. As a reason, he expresses that he has no control over dragging and that he is not sure of the results.

2.Cenk: I used copy paste for the functions of =concatenate and =base because when I pulled it down (dragging) different numbers appeared. Sometimes it can be wrong...

However, Cenk benefits from dragging and fixing along with other functions in Task 3. Duygu benefits from dragging in Tasks 3 and 4 for cells and when entering powers of two (Figure 9).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1																	
2		0	1	iglem	1	0	0	0	0	0	0	birlestir		sayi degeri	(sayi)16	(sayi) 2	
3				sayi	1	1	0	0	0	0	0	000001	=	1	= 1	1	
4		1	2	iglem	2	0	0	0	0	0	0						
5				sayi	2	2	0	0	0	0	0	000002	=	2	= 2	10	
6		2	4	iglem	4	0	0	0	0	0	0						
7				sayi	4	4	0	0	0	0	0	000004	=	4	= 4	100	
8		3	8	iglem	8	0	0	0	0	0	0						
9				sayi	8	8	0	0	0	0	0	000008	=	8	= 8	1000	
10		4	16	iglem	16	1	0	0	0	0	0						
11				sayi	16	0	1	0	0	0	0	000010	=	10	= 10	10000	
12		5	32	iglem	32	2	0	0	0	0	0						
13				sayi	32	0	2	0	0	0	0	000020	=	20	= 20	100000	
14		6	64	iglem	64	4	0	0	0	0	0						
15				sayi	64	0	4	0	0	0	0	000040	=	40	= 40	1000000	
16		7	128	iglem	128	8	0	0	0	0	0						
17				sayi	128	0	8	0	0	0	0	000080	=	80	= 80	10000000	
18		8	256	iglem	256	16	1	0	0	0	0						
19				sayi	256	0	0	1	0	0	0	000100	=	100	= 100	100000000	
20		9	512	iglem	512	32	2	0	0	0	0						
21				sayi	512	0	0	2	0	0	0	000200	=	200	= 200	1000000000	
22		10	1024	iglem	1024	64	4	0	0	0	0						
23				sayi	1024	0	0	4	0	0	0	000400	=	400	= 400	10000000000	
24																	

Figure 9. Examples of horizontal and vertical dragging Task 3 by Duygu

4.Duygu: ...If I do not do that (talking about dragging both rows together) the process takes longer, I delete the in-between now (means the cells which are not related to the result)

### Conceptual Processes Intended for Converting Number Systems

*Examining the purpose of using functions and their relationships with the conversions of number systems*

In Task 1, the schemes developed by the participants while transferring their paper-pencil operations to spreadsheets are examined. It is seen that Duygu can express operational reflections of functions she uses in spreadsheets.

1.Duygu: What we mean by the operation is division indicated =quotient in excel. =concatenate is used the remainders but in reverse. =base gives the result directly.

It can be said that =base is used to control the results the entire research. At the end of the tasks, participants realize that the functions of =quotient, =mode, =concatenate are reflections of the steps of the division process used in number systems. However, it is seen that they confuse the purpose of use of the functions for the operations in the number systems.

1.Ada: Here is already = quotient, we are using =mode for the remainder, we also control it through =base, but the numbers seem reversed here, I think I made a mistake in =concatenate.

2.Berk: Yes, but I do not understand why it happens. (for the same results of 6. and 7.) I wonder if I have mistyped =base?

3.Ada: ...yes I noticed the mistake (did not write backward)

Ada expresses the reason why the remainders are written in reverse, but she thinks the error relies on the use of =concatenate. In contrast, Berk and Cenk could not say that they should write the remainder in reverse. So they think that the error relies on the use of =base. In general, participants miss the use of the remainder but realize the error when checking the result by =base.

2.Ada: I have used all the functions, that is right, but one zero are missing! Did I do the dragging wrong?

...or do I use the wrong number (the cell)? Because they all have the same mistake (no last digit), =concatenate could not be wrong, I wrote it correctly.

3.Ada: ...Yes, I noticed the mistake (did not write =concatenate in reverse. It was reflected in the number value) ... it is clear from the base what the number is.

Ada sees the same error in all results and has a correct idea of the source of the error. In this process, Ada handles the results in spreadsheets with together the conversion stages she does in a paper-and-pencil. Since Ada does not start the =mode from the previous number (cell) in Task 2, she reaches improper operations and results. However, she corrects this false in Task 3. She prefers manual entries for multiples of two, but she makes a mistake in the results due to the position of zero in the digits because she uses =value and =concatenate together (Figure 10).

		D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	bölüm	1	0	0	0	0	0	0	0	0	0	birleştir	sayı		taban 16 da	taban 2 de
	kalan	1	0	0	0	0	0	0	0	0	0	100000000	100000000	1		1
2	bölüm	2	0	0	0	0	0	0	0	0	0					
	kalan	2	0	0	0	0	0	0	0	0	0	200000000	200000000	2		10
4	bölüm	4	0	0	0	0	0	0	0	0	0					
	kalan	4	0	0	0	0	0	0	0	0	0	400000000	400000000	4		100
8	bölüm	8	0	0	0	0	0	0	0	0	0					
	kalan	8	0	0	0	0	0	0	0	0	0	800000000	800000000	8		1000
16	bölüm	16	1	0	0	0	0	0	0	0	0					
	kalan	0	1	0	0	0	0	0	0	0	0	010000000	100000000	10		10000
32	bölüm	32	2	0	0	0	0	0	0	0	0					
	kalan	0	2	0	0	0	0	0	0	0	0	020000000	200000000	20		100000
64	bölüm	64	4	0	0	0	0	0	0	0	0					
	kalan	0	4	0	0	0	0	0	0	0	0	040000000	400000000	40		1000000

Figure 10. The screenshots of mistakes on the functions of =value and =concatenate, Task 3 by Ada

It is seen that participants could not reflect their mathematical knowledge on spreadsheets because they had difficulties using it. Although Berk uses more functions according to the directions of the researcher, he has difficulty demonstrating his mathematical knowledge using spreadsheets. For example, he enters the results manually rather than using the =value function. Similarly, he tends to rewrite the function in the corresponding cells of each number instead of dragging to find their binary equivalents. Berk, who can make the conversion in number systems in the paper-pencil environment and

realizes the errors he makes in his worksheet, is unsuccessful in correcting these errors on the spreadsheet. When examining the effects of the students' usage schemes in the tasks on understanding the operations and reaching the correct results, Cenk does not adopt to find the remainder through =quotient and =mode, he performs these operations in his mind and recorded them manually. He uses =value, =concatenate, and =base as control tools. He could not realize the cause of the error because he forgot to write the last remainder manually (Figure 11).

	M	N	O	P	Q	R	S
					birleştir	sonuç (taban 2)	Taban 2
5	2	1	0				
	0	1	0		010	10	101
6	3	1	0				
	1	1	0		011	11	110
7	3	1	0				
	1	1	0		011	11	111
8	4	2	1				
	0	0	1		100	100	1000

	D	E	F	G	H	I	J	K	L	M	N
										sayı değeri	2 tabanına göre
40 sıradaki sayı				20	10	5	2	1			
kalan		0	0	0	0	1	0			01000	101000
72 sıradaki sayı				36	18	9	4	2	1		
kalan		0	0	0	1	0	0	1		100100	1001000
99 sıradaki sayı				49	24	12	6	3	1		
kalan		1	1	0	0	0	0	1		100011	1100011
2 sıradaki sayı				1							
kalan		0								0	10

Figure 11. The screenshots of mistakes due to manual typing Task 2 by Berk and Cenk

Duygu matches the number systems and their remainders in the conversions in spreadsheets. For this matching, the knowledge presented by the researcher in Tasks 2 and 3 is discussed with the participants. Duygu's statements mirror these discussions. Duygu uses the =mod function, which she does not use in Task 1, and in the following tasks she also expresses its mathematical equivalent (Figure 12).

- 3.Duygu: Since the numbers are multiples (powers) of 2, I first wrote down the powers and then converted the cells to powers of 2....For example, since the base is equal to 16. I guess it is the same as base 10. =mode shows the remainder, so we always used it. I do not know another formula for the remainder.

The figure consists of two screenshots of an Excel spreadsheet. The top screenshot shows the formula bar with `=MOD(2,2)` and the spreadsheet grid with columns B through N. The data includes operations like '40 işlem', '72 işlem', '99 işlem', and '2 işlem', each with a 'sayı' (number) and a 'birleştir' (concatenated) binary string. The bottom screenshot shows the formula bar with `=BÖLÜM(E4,16)` and the spreadsheet grid with columns B through Q. The data includes operations from 0 to 10, each with a 'sayı' and a 'birleştir' binary string.

Figure 12. The screenshots of the functions of =mode ve =quotient, Task 2, and Task 3 by Duygu

### Examining patterns on the conversions of number systems

The tasks include discussions about the relationships between the number systems and the numbers it contains and the patterns between the number systems.

- 3.Ada: ... could it be like this? As the numbers are doubled, the results are multiplied by ten (in the binary system), but I did not understand the growth of 16.
- 3.Cenk: ...yes, I saw it. As bases get smaller, numbers get bigger and zeros increase.
- 3.Duygu: ...For example, since the base is equal to 16. I guess it is the same as base 10.

The participants exhibited behaviors of following and expressing the relationships between the numbers used in the conversions. Ada, who examines the relationship between the binary and decimal systems, senses that one of every two consecutive numbers in the binary system is a multiple of ten. However, since the same situation has a larger range in the hexadecimal, she could not comment on it. Cenk emphasizes the relationship between the number systems and the numbers they contain. Duygu, unlike others, enters the power

of numbers by dragging. Besides, her explanations of the number systems and the relationships between the numbers they contain show that she produces hypotheses about their conceptual structures. It is seen that Duygu can interpret the situation of reaching multiples of 10 like Ada, while Cenk has difficulties in this regard. Berk reflects the rule in his mind regarding the pattern between the 2 and 16 systems in his explanations (Figure 13).

	A	B	C	D	E	F	G	H	I	J	K	L
										sayı	sonuç (taban 16)	sonuç (taban 2)
1	sayı		0									
	kalan		1							1	1	1
4	sayı		0									
	kalan		4							4	4	100
16	sayı		1	0								
	kalan		0	1						10	10	10000
64	sayı		4	0								
	kalan		0	4						40	40	1000000
256	sayı		16	1	0							
	kalan		0	0	1					100	100	100000000
1024	sayı		64	4	0							
	kalan		0	0	4					400	400	10000000000
4096	sayı		256	16	1	0						
	kalan		0	0	0	1				1000	1000	1000000000000
16384	sayı		1024	64	4	0						
	kalan		0	0	0	4				4000	4000	100000000000000
65536	sayı		4096	256	16	1	0					
	kalan		0	0	0	0	1			10000	10000	10000000000000000
262144	sayı		16384	1024	64	4	0					
	kalan		0	0	0	0	4			40000	40000	1000000000000000000
1048576	sayı		65336	4096	256	16	1	0				
	kalan		0	0	0	0	0	1		100000	100000	10000000000000000000

Figure 13. The screenshot on the pattern of number systems Task 4 by Berk

Despite using =base in Task 1, Berk could not reach the correct solutions. In Task 2, he makes sense that there might be a pattern among the numbers and he shows patterns by explaining why in Task 4. In the operations directed to examine the effect of the position of zero in the numbers, participants' usage schemes mirror their thoughts. Cenk could not notice the mistakes in the solution he makes manually in Task 1. Therefore, he doubts the accuracy of the result by =base. On the contrary, in Tasks 3 and Task 4 he deletes the unnecessary zeros written. According to his observation notes, Cenk reflects this improvement on the other operations in his worksheets. It shows that he acts consciously in these choices (Figure 14).

	L	M	N	O	P	Q	R	S	T	U
1	bölüm		0	0						
	mod		1	0			01	1		1 1
2	bölüm		0	0						
	mod		2	0			02	2		2 10
4	bölüm		0	0						
	mod		4	0			04	4		4 100
8	bölüm		0	0						
	mod		8	0			08	8		8 1000
16	bölüm		1	0	0					
	mod		0	1	0		010	10		10 10000
32	bölüm		2	0	0					
	mod		0	2	0		020	20		20 100000
64	bölüm		4	0	0					
	mod		0	4	0		040	40		40 1000000
128	bölüm		8	0	0					
	mod		0	8	0		080	80		80 10000000
256	bölüm		16	1	0	0				
	mod		0	0	1	0	0100	100		100 100000000

*Figure 14.* Effect of zero (0) for number systems, Task 3 by Cenk

The research cannot answer the questions about the relationships between the elements of the division operation and the numbers contained in the number systems.

4.Berk: . . .there was a rule (pattern) among the results, but I could not see a rule between the remainder and the first number (converted number).

4.Duygu: Yes, there is a rule (the remainder should be less than the base) but how can we show it here?

## CONCLUSION

In this study, It is examined the process of transforming the spreadsheet, which the participants know as an office application, into a mathematical instrument. It is thought that it is considerable to examine technology-supported teaching processes in the field of education. (Mishra & Koehler, 2006). Particularly in mathematics education, the interaction between the participants' tool use and conceptual understanding in the technology environment can be examined with the Instrumental Genesis Approach. One of the results we obtained is that the instrumentalization processes progress differently for each participant despite some common points (Baker & Sugden, 2015; Trouche, 2004).

In the process that starts on a blank worksheet with a question, the readability of the worksheets of the participants show the participants' tool-using skills and mathematical skills have differences. The participants who are good at the algorithm between number systems could reflect the formation of the transformation better in the worksheet (determining the concepts, phasing the solution process, adding images, coloring, etc.). However, it is seen as a substantial result that they are not willing to change their practices and the worksheet structures are not changed in the following tasks, although conceptual development was observed in the students during the process (van Dijke-Droogers, Drijvers & Bakker, 2021).

To realize the conversions of number systems, there is a combination of some functions including =base. Participants could develop their use of functions, correct their deficiencies, and add new uses for themselves in the process. Nevertheless, it should be noted that the use of functions by some of them is not systematic. On the contrary, all the participants use =base regularly throughout the research to check their results; therefore, it is seen that =base has become an instrument as a control tool for all of them.

The feature of dragging is critical for both operations based on formulas in cell addresses used in instant manipulations and updating these operations and values for a dynamic worksheet (Bozkurt & Uygan, 2020; Jalbert & Jalbert, 2019). This feature is essential to transform a tool into an effective instrument because it reflects the potential of the spreadsheet. Although the participants use both cell addresses and functions-features of

spreadsheets in the first task scarcely, a similar development is observed in their use of them. In particular, it is observed that some participants who recognize their results in the worksheets are not false leave their habit of using paper pencils. This is important in terms of showing the change in usage schemes of the participants (Drijvers et al., 2013).

In this study, dragging was the most difficult progress for the participants in the instrumentalization process. When the participants do not reach the expected result, they first think that there may be an error due to dragging. It is thought that this reaction indicates that they hesitate to use features they are not good at (Baker & Sugden, 2015). This leads the participants who describe the use of dragging as "suspected" to enter the values manually. However, some participants who realize the benefits of dragging in terms of saving time and ease can form using schemes by dragging both horizontally and vertically (Ainley et al., 2005; Drijvers & Trouche, 2008).

The final step of the number conversions in the spreadsheet is to obtain the binary and hexadecimal equivalents of the number sequences given in the decimal system and to discover the patterns in these number sequences. At this step, in which number conversions can be made by all participants, relations on binary and hexadecimal number systems such as size, number digit expansion, and multiple/power of the number systems are partially established. In addition, it is concluded that the participants can organize their usage schemes related to cell addresses and dragging based on these relationships. On the other hand, another result is that understanding the effect of the position of the zeros (0) in the place value obtained during the conversions closely affects the use of =value and =concatenate (Haspekian, 2005; Marley-Payne & Dituri, 2019).

As a result, this study reveals how the instrumentalization and instrumentation processes of the instrumental approach affect each other and how they actually have an intricate relationship. According to the results, we suggest,

- It may need more time to observe the transformation of tool into instrument. In studies based on this approach, the observation period can be kept longer, especially depending on the characteristics of the participants.
- The results show that participants develop their usage schemes in the process. In the field of education, especially mathematics education, regular use of technology should be given importance instead of target use for research.
- A spreadsheet is a useful tool that can expose the relationships between numbers and formulas.

Therefore, it is appropriate to examine it in terms of the Instrumental Genesis Approach. Similar studies can be carried out for the use of this dynamic teaching approach at different grade levels in teaching mathematics concepts and forming instruments from tools.



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## Effect of Interactive Online Learning Material Developed on Digital Rights and Responsibilities on Students' Self-efficacies

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### Abstract:


This research aims to examine the impact of interactive online learning material on students' self-efficacy, prepared for achievements related to "digital rights and responsibility" in the Social Studies and Information Technologies and Software course. The study design is a quasi-experimental design with a pretest-posttest paired control group. The study group consisted of 40 students studying in the 7th grade in a secondary school affiliated with the Ministry of National Education (MEB) located in Ankara province. The working group was divided into experimental and control groups. Within the framework of the research purpose, the interactive online learning material was made available to the experimental group through Learning Management Systems (LMS). On the other hand, control group students face face training. As a data collection tool, five-point Likert-type "Digital Rights and Responsibility Scale" was used. In data analysis, Shapiro-Wilk analysis, Levene homogeneity test, independent sample T-test, and Paired sample T-test were used. According to the results of the study, the interactive online learning material planned and designed according to learner characteristics significantly increased students' self-efficacy levels.

**Keywords:** Digital rights and responsibilities, online learning, and self-efficacy.


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## INTRODUCTION

Continuing to live as hunter-gatherers, human beings have transitioned to a settled lifestyle with the start of agricultural activities. The settled way of life made it necessary for people to live together in large masses. This necessity has brought about concepts such as the state, society, and citizenship. Thus, the roles and responsibilities of people in society as individuals have changed. Individuals have begun to be identified as citizens who are part of developed societies and are the founders of the state. While the concept of citizenship has had many meanings from the past to the present, citizenship was meant as the provision of welfare state benefits as a right in the Ancient Greek period (Heater, 2013), it was used as the region where one was born in the Middle Ages (Yarwood, 2013). In the simplest sense, citizenship is defined as being a member of a state (Cohen & Ghosh, 2019). The definition of citizenship, which continues to change over the centuries, is positively related to the sovereignty of the people (Akbasli, 2014). Democratic steps such as the French Revolution and important developments such as the Industrial Revolution brought about important and positive changes in the understanding of citizenship. In addition to these changes, especially in the last fifty years, technologies have made life easier in many ways; computers and the internet have been used extensively in social life. All these have enabled the concept of citizenship to take its place on the stage of history as digital citizenship (Cuhadar, 2021).

Because of the rapid increase in the use of the internet, the lives of all individuals, from children to young people, from young people to the elderly, who use online environments have become easier, have also caused them to become vulnerable to many dangers such as cyberbullying and cyber victimization. For this reason, the need to use the internet in an ethical framework has also emerged and hence the concept of digital citizenship. This concept, first used by Ribble (2011), generally refers to a fundamental change in the relationship between individual and state, and specifically to the perception of citizenship (Isikli, 2015). From an educational point of view, it aims to train individuals who have the awareness of using this information for reaching the information in the internet environment (Bowen, 2018).

Although the digital citizenship has various definitions and names in the literature, all have similar emphases. Park and Ribble's (2021) definition of the compliant and reliable use of digital media with empowered technologies is among the most accepted definitions. Ribble (2011) examined digital citizenship in nine sub-dimensions: digital access, digital commerce, digital communications, digital literacy, digital ethics, digital law, digital rights and responsibilities, digital health and digital security.

Of the nine subdimensions above, the most important dimension of participation in digital societies, as in the concept of citizenship, is rights and responsibilities (Alberta, 2012). It is important for individuals to know and protect their rights in the environment, to learn the media they can complain about if their rights are violated, and to use these media. Digital rights and responsibilities are the reporting of violations of an individual's digital rights to

the relevant persons/institutions. At the same time, if an individual engages in bullying, they should be held responsible for it (Aygün, 2019). Westen and Sten (2009) examine digital rights under nine titles: getting information, transparency, petition, vote, privacy, access, assembly, and freedom of expression. Digital responsibility, on the other hand, is the necessity of knowing their responsibilities toward other users and the societies they are socially and culturally connected to and to be able to act in accordance with their responsibilities. It is also important for individuals to respect the rights of other users in terms of security in digital environments. The rights of digital citizens, such as privacy and free expression of their thoughts, should be protected and respected within the framework of the law. In addition to these rights, as stated above, certain responsibilities are imposed on individuals. Digital rights and responsibilities must be in balance in order for the order of the digital society to survive properly (digitalcitizenship.net, 2023).

As in the rest of the world, there are some fundamental rights that citizens have in digital environments. These rights are expressed by Bilgi Teknolojileri ve İletişim Kurumu (BTK) (2019) as: "privacy of private life, protection of personal data, non-violation of personal rights, right to complain about cybercrimes, freedom of expression on the internet, prevention of loss of reputation on the internet and the right to complain". BTK (2019) listed these violating information crimes under the "IT Law and IT Crime" as: "unauthorized access to information and communication technologies, digital device sabotage, digital theft, illegal use of software and programs, misuse of personal information, defrauding others with fake profiles, illegal content, disclosure of private information used for commercial purposes, acts serving terrorism, child abuse, stealing other people's accounts and other crimes (organ, prostitution, threats, drugs, etc.)".

By 2022, nearly all the world's population of around 8 billion is projected to use digital tools and the internet (We Are Social and Hootsuite, 2022). In our country, according to the data of the Türkiye İstatistik Kurumu (TUIK) (2022), the rate of internet access reached 85% in 2022. With the increase in the rate of internet usage, the risks and threats that may be encountered in terms of rights and responsibilities in digital environments are also increasing. The reason for this is that malicious users can easily be included in the internet environment (Nawaila et al, 2021). Franklin and Smeaton (2017) state that child abuse, incitement to crime, infecting bad habits, and digital bullying are increasing nowadays. Nawaila et al. (2021) stated that children should be conscious to be able to struggle against the threat of abuse and digital bullying. Children who are familiar with some risks (such as phishing) in digital environments do not have enough education regarding the awareness and level of knowledge to deal with these risks (Bratina, 2016). Both children and adults should therefore have digital skills and competencies (Livingstone et al, 2023) because individuals are vulnerable to cyberbullying, especially at a young age, and experiencing cyber victimization negatively affects them academically, socially, and psychologically (Allewa, 2019).

Regarding their safety in online environments, individuals need to be trained on what rights and responsibilities they have against threats, so they need to be conscious of ways to avoid security threats (Macaulay et al, 2020). To have this awareness, it is important that digital citizens who make up digital societies are trained in their rights and responsibilities.

Besides the studies carried out around the world, many studies have been conducted on digital rights and responsibilities in Turkey and the necessity of training on this subject. Due to the lack of education about digital rights and responsibilities, children between the ages of 9 and 16 are vulnerable to the risks they may encounter in the internet environments (Karakus et al, 2014). According to the results of studies on cyberbullying and cyber victimization of secondary school students, there is a positive significant relationship between cyberbullying and victimization and internet usage time (Kavuk, 2011). In addition, secondary school students' self-efficacy in security, digital rights, and responsibility in the digital environment has also changed positively with these pieces of training (Akcan, 2023).

In digital societies where internet usage is increasing, distance education, online learning, and interactive learning environments have been preferred recently in order to appeal to digital natives in education-teaching processes as well as in all areas of social life. Especially secondary school-age children need online learning materials and environments. In addition, the "Ministry of National Education Regulation on Textbooks and Educational Tools" published in 2021 states that digital content associated with learning areas, supporting learning, prepared according to learner characteristics, and containing interactive questions can be used by students. (MEB, 2021).

In Turkey, the subject of digital rights and responsibility is covered in the Social Studies course and the Information Technologies and Software (ITS) course in the secondary school curriculum. The ITS course contributes to the acquisition of knowledge, skills and values related to the dimension of digital rights and responsibilities (Elci & Sari, 2016), but the achievements are insufficient in number (Peker Unal, 2017). The course benefits students in terms of information security and hence digital responsibilities by increasing their consciousness (Gokcearslan et al, 2021). When evaluated in terms of the Social Studies Course, it has been stated that the digital rights and responsibilities issues are insufficient and irregular in the curriculum and content of the course (Kara & Atasoy, 2019) and the necessity of integrating the activities to be applied with these achievements (Sari, 2019). Relevant achievements are scattered up to the 7th grade for both courses. For this reason, in this research, the issue of digital rights and responsibilities is not part-by-piece but as a whole, unlike the existing teaching methods and techniques. It is presented to the students with the developed interactive online learning material. Learners need interactive and rich-content materials supported by up-to-date environments about digital rights and responsibilities and safe internet use (Kucukali & Bulbul, 2015). Therefore, the research provided digital rights and responsibility training through a tool that uses interactive animation videos and digital visuals, gives feedback, and is self-managed by the learner.



Within the scope of the training, the online learning material developed by the researchers was presented to the students through Learning Management Systems (LMS). In the literature, various reasons for preferring LMS for material presentation in online learning are listed. The presentation of online learning materials through these systems increases students' engagement in educational processes, motivation (Navimipour & Zareie, 2015), and success (Simonson, 2017). These systems are those in which students and teachers can share and communicate about the courses, where assessment and evaluation activities can be carried out and support services are provided (Oliveira et al, 2016). In the context of all this information, the aim of this research is to measure the effect of this developed interactive online learning material on students' digital rights and responsibilities self-efficacy.

In line with the main purpose of this research, answers to the following questions were sought:

1. Is there a significant difference between the digital rights and responsibility self-efficacy pretest scores of the students in the experimental and control groups?
2. Is there a significant difference between the digital rights and responsibility self-efficacy posttest scores of the students in the experimental and control groups?
3. Is there a significant difference between the digital rights and responsibility self-efficacy pre-test and post-test scores of the students in the experimental group?
4. Is there a significant difference between the digital rights and responsibility self-efficacy pre-test and post-test scores of the students in the control group?

## METHOD

### *Research Model*

In this research, it is aimed to examine the effect of digital rights and responsibilities education given to students with interactive online learning material on digital rights and responsibilities self-efficacy. For this purpose, a quasi-experimental method, one of the quantitative research methods, was used. Fraenkel et al, (2011) state that experimental research is one of the most powerful research methodologies and that the most important feature that distinguishes it from other types of research is that researchers can manipulate the independent variable. Among the independent variables manipulated in educational research are teaching methods and learning materials. Therefore, in this study, the students in the experimental group were trained with the interactive online learning material presented through LMS, while the students in the control group were given face- to-face training. At the stage of determining experimental and control groups, the measurement tool was first applied to four groups. According to the results of the pre-test, two groups with similar self-efficacy on the subject were selected through paired sampling among the four groups. In this context, pretest-posttest paired experimental design with the control

group, which is one of the quasi-experimental design types, was used in this study. The draft is shown in Table 1.

**Table 1**

*PreTest-Posttest Experimental Design Model with Control Group*

Group	Selection Type	Pretest	Application	Posttest
EG	P	O1	X	O3
CG	P	O2	-	O4

In the table above, EG is experimental group and CG is control group; P is assigned by matching subjects to groups; O1 and O3 are pretest and posttest measurements of the experimental group; O2 and O4 are pretest and posttest measurements of the control group; X indicates the independent variable (experimental variable) applied to the subjects in the experimental group (Buyukozturk, 2007).

### *Participants*

The study group consisted of 7th grade students studying in a secondary school affiliated to the Ministry of National Education in Ankara. An appropriate (convenient) sampling method, which is one of the non-random sampling methods, was used to determine the study group. The appropriate (convenient) sampling method is the sampling in which a voluntary group and ready for the study is selected. Moreover, there is no need to select a sample from the population in experimental design studies as the research aims to demonstrate the effectiveness of the method (Buyukozturk et al, 2010).

The study was carried out in the spring term of the 2022–2023 academic year, and the study group consisted of 40 students in total, 20 students in the experimental group, and 20 students in the control group. Information about the study group is shown in Table 2.

**Table 2.**

*Information about the Study Group*

Group	Existing	Percentage
Experimental(7/A)	20	50,0
Control(7/B)	20	50,0
Total	40	100,0

### *Data Collection Tools*

In this research, a five-point Likert-type scale was used to determine the effect of interactive online learning material developed on digital rights and responsibilities on

students' self-efficacies. The reason why the Likert-type measurement tool is preferred is that the feature to be measured is the perception of self-efficacy, and the scale is suitable for measuring quantitative data. For this purpose, the "Digital Rights and Responsibility Subscale" included in the "Digital Security Self-Efficacy inventory" developed by Ustundag et al, (2022) was used for data collection. The validity and reliability studies of each subscale in this inventory were carried out separately as the scales can also be used independently of each other.

### Digital Rights and Responsibility Subscale

#### Exploratory Factor Analysis (EFA):

In the Digital Rights and Responsibility Subscale, the KMO sample fit measure value is 0.81, in line with EFA. The Bartlett test of sphericity value is 2046.09, and this value is significant compared to 0.01 ( $X^2_{21}=2046.09$ ). Accordingly, a sufficient sample was used for the development of the scale.

Although the Digital Rights and Responsibility Subscale consists of 7 items with a single factor, item factor load values range from 0.51 to 0.74. The items in the scale did not remain below the value of 0.45 and they were collected in a single factor; therefore, the analysis was not repeated. Since the scale has only one factor, the rotation technique was not used. The values of the item-total correlation range between 0.38 and 0.59; accordingly, item discrimination is sufficient. The eigenvalue was calculated as 3.10. In the Digital Rights and Responsibility Subscale, 44.32% of the total variance value is explained in the single-factor structure.

#### Confirmatory Factor Analysis (CFA)

The factor loads of the items in the scale vary between 0.43 and 0.73. In the study, two modifications were established between the error loads of some items in order to improve the fit index values of the model. CFA results were evaluated according to the fit index criteria in Table 3.

**Table 3.**

*Criterion values used in the evaluation of fit index values in all measurement models*

Compliance index	Perfect Fit Criteria	Acceptable Compliance Criteria
$\chi^2/ (df)=Y$	$0 \leq Y \leq 3$	$3 < Y \leq 5$
RMSEA=Y	$0 \leq Y \leq 0.5$	$0.05 < Y \leq 0.08$
TLi/NNFi=Y	$0.97 \leq Y \leq 1.00$	$0.95 \leq Y < 0.97$
CFi=Y	$0.97 \leq Y \leq 1.00$	$0.95 \leq Y < 0.97$
NFi=Y	$0.95 \leq Y \leq 1.00$	$0.90 \leq Y < 0.95$
AGFi=Y	$0.90 \leq Y \leq 1.00$	$0.85 \leq Y < 0.90$

GFi=Y

0.95≤Y≤1.00

0.90≤Y&lt;0.95

In Table 3,  $\chi^2/ (df)$  criterion values in the fit index of the measurement model are according to Byrne (2013), and RMSEA, TLI/NNFi, CFI, NFI, AGFi, and GFi are according to Schermelleh-Engel et al. (2003; cited in Pektas, 2022).

Accordingly, in the fit index values of the subscale, the  $\chi^2/ (df)$  value is 3.14 and it has an acceptable fit index. RMSEA fit index value is 0.043, TLI/NNFi value is 0.98, CFI value is 0.99, NFI value is 0.98, AGFi value is 0.98, and GFi value is 0.99. Therefore, the measurement model of the Digital Rights and Responsibility Subscale is confirmed.

### Reliability:

The Cronbach Alpha internal consistency coefficient was checked for the reliability of the Digital Rights and Responsibility Subscale. The Cronbach Alpha coefficient in the Digital Rights and Responsibility Subscale is 0.78. Kalayci (2009) states that 0.60 and above for the reliability coefficient is at an acceptable level.

### Data Analysis

In accordance with the purpose of the research, the data collected from the students determined as the experimental and control groups were processed into the SPSS (Statistical Package for Social Sciences) 25.0 program. In order to test the normality of the pretest and posttest distribution of the two determined groups, Shapiro-Wilk analysis was used since the number of students in each group was less than 50. Levene homogeneity test was used to determine the homogeneity of the test variances of the data. The analysis results are given in Table 4.

**Table 4.**

*Shapiro-Wilk Normality Test for Pretest and Posttest Scores*

Group	Test	Shapiro-Wilk		
		Statistics	Sd	P
Experimental	Pre	.905	20	0.051
	Post	.910	20	0.099
Control	Pre	.945	20	0.294
	Post	.935	20	0.189

\*p<.05

As seen in Table 4, the normality assumptions of the distributions of the students in the experimental and control groups regarding the pre- and posttest were examined. It was concluded that the pre- and posttest Shapiro-Wilk statistical results of the students in both groups were not significant according to  $p > .05$ , and all score distributions met the assumption of normality, that is, they were normally distributed. When the Levene homogeneity test results were examined, it was concluded that the test variances according

to  $p > .05$  were homogeneously distributed, that is, they met the homogeneity assumption. It is seen that the distribution of scores obtained from the pre- and post-test applications is continuous data and is at the level of the equally spaced scale. Parametric test assumptions are met when two samples (groups) are independent of each other, dependent variables are measured on an interval or ratio scale, and normality and homogeneity assumptions are met. It is difficult to assume that the scores are normally distributed when the number of groups falls below 30 according to some and 15 according to others. However, it is seen that researchers who conduct small-group experimental studies use parametric statistics if the distribution of the data they collect is appropriate (Koklu et al, 2007). In this context, the score distributions in the study meet the parametric test assumptions, and the sample sizes in the groups being less than 30 do not affect the parametric test assumption because the score distribution exhibits a normal distribution.

Parametric tests are more powerful than nonparametric tests. Therefore, parametric tests should be performed as long as the conditions are met. While the parametric test conditions are met, performing the nonparametric form of the test in question may give erroneous results (Can, 2014). In this context, the difference between the pretest scores and the post-test scores of the students in the experimental and control groups regarding the sub-problems of the research was examined by independent sample T-Test analysis. The difference between the pretest and posttest scores of the students in the experimental and control groups was examined with Paired-Sample T-Test analysis.

### *Interactive Online Learning Material*

The interactive online learning material used in the research was created for the achievements of the Social Studies course and the "Digital Rights and Responsibility" subject in the Information Technologies and Software course by the researchers in order to examine the self-efficacy of the students in this subject. The material was finalized within the framework of the opinions received from four faculty members who are experts in the field of Computer and Instructional Technologies Education and two faculty members in the field of Social Studies Education. The material content consists of two topics. The first topic is "Digital Rights and Responsibilities" and the second topic is "The Channels We Can Complain about Inappropriate Uses in the Digital Environment". One SCORM package and interactive animation lecture videos were prepared for each topic. SCORM packages were prepared using the "Articulate Storyline" platform. The interactive animation was prepared both for subject narration purposes and for interacting with questions in its content. The SCORM package is a material in which important concepts are explained in its content, reinforcement is made with the summary section, and test questions are included for interaction at the end. The digital images used in the material were selected from "www.shutterstock.com" and "www.freepik.com" and made into 2D. The prepared scenario and 2D digital visuals were converted into interactive animated videos using the "Adobe Edge" program and voiced. The material was made available to the experimental group students through LMS.



Figure 1. Sample screenshot from the interactive animated video.

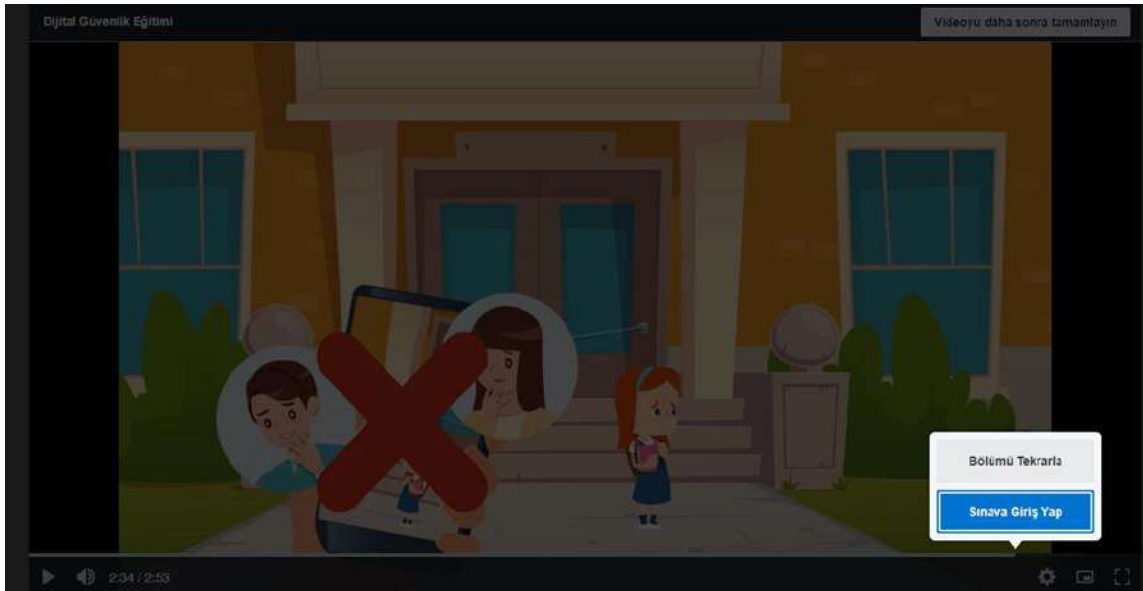


Figure 2. Sample screenshot from interactive animated video

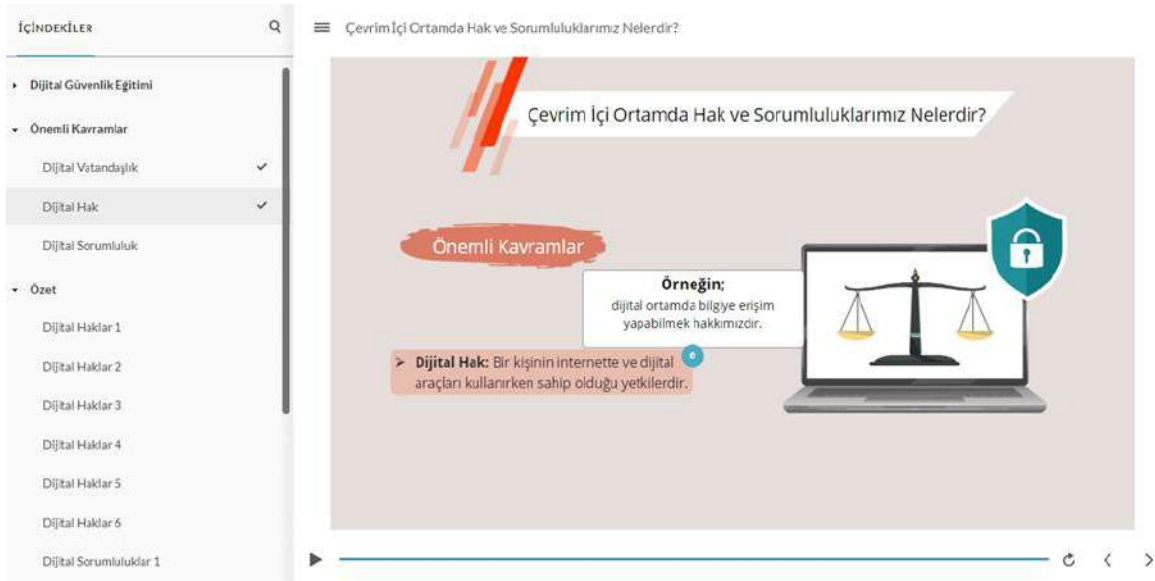


Figure 3. Sample screenshot of interactive online learning material.

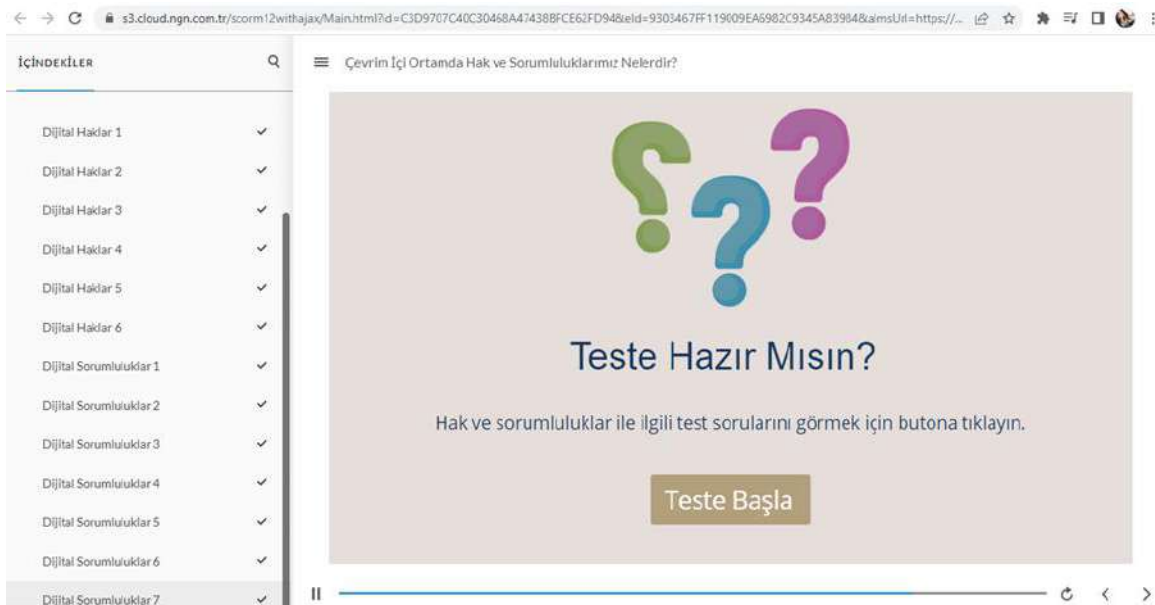


Figure 4. Sample screenshot of interactive online learning material.

### *Ethical considerations*

In this study, all rules stated to be followed within the scope of "Higher Education Institutions Scientific Research and Publication Ethics Directive" were followed. None of the actions stated under the title "Actions Against Scientific Research and Publication Ethics", which is the second part of the directive, were not taken.

Ethical review board name: Gazi University Ethics Committee

Date of ethics review decision: 31.03.2023

Ethics assessment document issue number: E-77082166-604.01.02-625604

## FINDINGS

**The first Subproblem:** Is there a significant difference between the digital rights and responsibility self-efficacy pretest scores of the students in the experimental and control groups?

**Table 5.**

*Independent samples on the difference between pretest points of students in the experimental and control groups t-test results*

Pretest	Group	N	Average	S	t	sd	p
Digital Rights and Responsibility Subscale	Experimental	20	27.00	5.68	0.21	38	.837
	Control	20	26.65	4.98			

\*p<.05

According to Table 5, the pre-experimental self-efficacy levels of students in the experimental and control groups on the subject of digital rights and responsibility were measured by the Digital Rights and Responsibility Subscale, and there was no significant difference between the scores of the two groups based on  $t = 0.21$ ,  $p = .000 < .05$ . In other words, students in the experimental and control groups fulfilled the condition that their digital rights and responsibility self-efficacy levels were equivalent before the experiment.

**The second Subproblem:** Is there a significant difference between the digital rights and responsibility self-efficacy posttest scores of the students in the experimental and control groups?

**Table 6.**

*Independent samples t-test results on the difference between posttest scores of students found in the experimental and control groups.*

Posttest	Group	N	Average	S	t	Sd	p
Digital Rights and Responsibility Scale	Experimental	20	33.95	1.05	5.42	38	.000*
	Control	20	28.70	4.21			

\*p<.05

Table 6 examines whether there is a significant difference between the post-test scores of the students in the experimental and control groups on the Digital Rights and Responsibility Subscale. Accordingly, the posttest scores of students in the experimental and control groups showed significant variation in terms of  $t = 5.42$ ,  $p = .000 < .05$ . In this regard,



experimental group students trained with interactive online learning material developed by the researchers to address the topic, and digital rights and responsibility self-efficacy scores changed meaningfully after experimental implementation compared with control group students who received face- to-face training.

**The third Subproblem:** Is there a significant difference between the digital rights and responsibility self-efficacy pre-test and post-test scores of the students in the experimental group?

**Table 7.**

*Paired - samples t-test results on the difference between pretest scores of students and posttest scores found in the experimental group.*

Experiment	Test	N	Average	S	t	sd	p
Digital Rights and Responsibility Scale	Pretest	20	27.00	5.68	5.55	19	.000*
	Posttest	20	33.95	1.05			

\*p<.05

In Table 7, we examine whether there is a significant difference between the pretest and posttest scores of the experimental group students on the Digital Rights and Responsibility Subscale. Accordingly, the preliminary and final test scores of the students in the experimental group showed significant variation between  $t = 5.55$ ,  $p = .000 < .05$ . In this regard, it may be argued that the experimental group students' self-efficacy scores changed significantly after experimental practice.

**The fourth Subproblem:** Is there a significant difference between the digital rights and responsibility self-efficacy pre-test and post-test scores of the students in the control group?

**Table 8.**

*Paired- Samples T-Test results on difference between pretest scores of students in the control group and posttest scores.*

Control	Test	N	Average	S	t	Sd	P
Digital Rights and Responsibility Scale	Pretest	20	26.65	4.98	1.90	19	.072
	Posttest	20	28.70	4.21			

\*p<.05

In Table 8, we examine whether there is a significant difference between the pretest scores of the control group students from the Digital Rights and Responsibility Subscale and the posttest scores. Accordingly, there was no significant difference between pretest and posttest scores of students in the control group relative to  $t = 1.90$ ,  $p = .000 < .05$ . In this regard, control group students' posttest scores are higher than pretest scores. Besides, while

the posttest score is high, there is no meaningful level of difference between the pretest and posttest.

## DISCUSSION, CONCLUSION AND RECOMMENDATIONS

In this research, it was aimed to examine the effect of the interactive online learning material prepared for the acquisitions related to the subject of "Digital Rights and Responsibility" in the Social Studies Curriculum and Information Technologies Curriculum on the students' self-efficacy perceptions. In this context, the interactive online learning material developed by the researchers was applied to the experimental group in the online learning method, and the same subjects were given to the control group through face-to-face training. After the experimental procedure, according to the research findings, there was a significant difference in the digital rights and responsibilities self-efficacy status of the experimental group. In the control group, where face-to-face training was given, there was an increase in the level of digital rights and responsibility self-efficacy; however, this increase was not at a meaningful level. Therefore, in general, the interactive online learning material applied in the online learning method is more successful than face-to-face education. This finding draws attention to the importance of using learning materials that are planned according to learner characteristics, prepared in a way that can increase the learner's interest, desire, and motivation level, and contain digital visuals and interactive learning materials.

According to the results of this research, when individuals receive training on their digital rights and responsibilities, their self-efficacy increases. Similar to this result, it has been observed that individuals gain awareness of being able to combat such threats when they receive training on digital rights and responsibilities (Bratina, 2016; Nawaila et al., 2021). When individuals are educated about the rights and responsibilities of individuals against security threats regarding digital rights and responsibilities of individuals in online environments, they become conscious of the ways to avoid these threats (Macaulay et al., 2020). In order for digital citizens to have this awareness, it is important that they are educated about digital rights and responsibilities. These trainings should be planned as student-centered (Mordecai, 2021) and should be started from the sub-dimension of digital rights and responsibilities (Walsh et al, 2022). Based on these results, student-centered education was pursued in this study. Similar to the results of the research, it has been observed that when children receive training on privacy, an important sub-title of digital rights and responsibilities, they are more conscious about disclosing when their privacy is violated (Desimpelaere et al, 2020). According to another study that supports the results of the research, if secondary school students receive training on digital rights and responsibilities, their usage habits and awareness levels have changed positively (Korkmaz & Kiran Esen, 2012). There are many similar studies emphasizing the importance of education in eliminating the nativities experienced (Kavuk, 2011; Mert et al, 2012; Cubukcu

& Bayzan, 2013; Karaduman & Ozturk, 2014; Sebetci et al, 2018; Sari, 2019; Golpek Sari & Seferoğlu, 2021).

In this study, it has been revealed that the interactive online learning material applied in the online learning method has a positive effect on students' self-efficacy of digital rights and responsibility. Similarly, there are studies examining the effect of the online learning environment on the perception of self-efficacy (Kaptanoglu, 2022; Oktelik, 2022; Tekinarslan, 2022; Temel, 2022; Yanc, 2022). Similar to research results, these studies emphasize the positive effect of online learning environments on learning. The presentation of digital materials to secondary school students on a different subject and digital footprint increases their academic success (Kuh Karyeli & Daghan, 2020). In this study, online learning materials were presented to students through LMS and students' self-efficacies of digital rights and responsibilities increased. The presentation of online learning materials through LMS increases students' commitment to educational processes, their motivation (Navimipour & Zareie, 2015) as well as their success (Simonson, 2017).

With the increase in the rate of internet usage in all areas in digital terms all over the world, it has become important for individuals to learn and internalize methods on how to behave in accordance with their rights and responsibilities in online environments. In recent years, it has been seen that studies on teaching digital rights and responsibilities have increased. However, in the literature, attention is drawn to the use of online learning environments and online learning materials in the education of secondary school students regarding the needs and learning characteristics of the secondary school age group. For this reason, it is thought that this research in which interactive online learning material developed according to learner characteristics on digital rights and responsibilities is presented through LMS will contribute to the literature.

Digital inequality in access to online learning environments is an important problem. In this respect, in order to find a solution to digital inequality, the problem of access can be solved through the Technology Laboratories of schools, as was done in this study. In addition, the necessary equipment can be provided to students who experience digital inequality during the research period.

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## Measuring Tool

DIGITAL RIGHTS AND RESPONSIBILITIES SCALE	Strongly Disagree	Disagree	Somewhat Agree	I agree.	Completely Agree
1. I can respect people's rights in the digital environment.	1	2	3	4	5
2. I can complain about violations of personal rights in the digital environment.	1	2	3	4	5
3. I can report harmful content and posts in the digital environment.	1	2	3	4	5
4. I can respect value concepts (religion, homeland, flag, family, race, etc.) in the digital environment.	1	2	3	4	5
5. I can avoid using other people's documents (video, photo, audio, etc.) in digital environment without permission.	1	2	3	4	5
6. I can avoid making changes to other people's documents (video, photo, audio, etc.) in the digital environment.	1	2	3	4	5
7. I can indicate in the bibliography the sources I have used from the internet in my research.	1	2	3	4	5

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## Effect of Parental Interest on the Self-Regulation Ability of Preschool Children

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### Abstract:

*This study was conducted to examine the effect of parental attention on the self-regulation ability of children aged between 48 and 66 months who have just started their preschool education. For this purpose, an example of a training program to improve parental interest was prepared for the parents of the children participating in the study. The study group consisted of 40 children who attended an independent kindergarten affiliated to the Ministry of National Education in Nilüfer District of Bursa Province in the 2019–2020 academic year and their mothers (40) and fathers (40), totaling 120 people. The “Parental Interest Scale for Children” and the “Preschool Self-Regulation Scale (OÖDÖ)” have been used as data collection tools. In addition, the “General Information Form” was used to obtain information from the participants. The obtained data were analyzed with ‘Statistical Package for Social Science (SPSS)’ 26 package program. In light of the findings; it was seen that parental attention has an effect on the self-regulation ability of children aged between 48 and 66 months who have just started their preschool education, and this positively observed effect is due to an increase in parental interest. As a result, when the correlation test analyzes between parental interest scores and self-regulation skill scores are considered. Parental interest has a positive effect on the self-regulation skills of 48-66-month-old boys and girls who have just started preschool education. Training aimed at improving parental interest is effective in achieving this.*


### Keywords:

Maternal interest, paternal interest, preschool education, self-regulation skills


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## INTRODUCTION

Preschool education, which is one of the most important variables encountered in early childhood, is a turning point in a child's life (Başal, 2007). This process, which begins with birth, continues until compulsory education. Preschool education, which is based on children's individual and developmental differences and their differentiated abilities, is implemented by parents and different institutions to benefit children's emotional, physical, and social development (Başal, 2005). Since starting school is an important stage that determines the quality of a child's school life in the following years, this first step taken by a child to school is an important situation for both families and children (Dinç, 2010). This period is critical in terms of the child's personality formation, mental thinking, self-regulation, behavior, emotion, and control skills development (Eke, 2017). Therefore, preschool education aims to raise individuals not only who are able to express themselves easily but also who are inquisitive, curious, problem solver, decider, venerational, potent, and self-mastery.

In preschools, the child prepares for primary school while gathering information about his/her environment and the peer group through play. A child who is trying to acquire many concepts and skills may need support to meet his/her educational needs, even if the socio-cultural status of his/her family is sufficient (Başal, 2005). Preschool educational institutions that implement programs aimed at the development of the child in many ways; this is the first step toward a new environment outside the family environment that the child has become accustomed to and feels confident in. This new environment includes rules that need to be learned and followed, different tasks that need to be done, friends, teachers, and perhaps, from the child's point of view, preschool education institutions are a new social environment with a more structured environment that the child can adapt to when they have the knowledge and skills they need. In this new social environment, where they have to share their toys, wait for their turn, and raise a finger to get a word, they will encounter different requests for social and self-regulation skills in many ways (McClelland & Tominey, 2011). Thus, a child who also develops self-regulation skills can balance despite new demands in his/her new social environment.

The baby has the necessary capacity for self-regulation and development, which can also be perceived as an individual concept due to the suffix "self", from the moment it is born (Adagideli, 2018). A newborn baby's relationship with his/her family in the first years of life helps him/her to focus and make sense of the stimuli he/she receives from his/her environment. Therefore, parental attention is important for children at every stage of their development. The first learning environment for a child is their family. Therefore, parents can support their children's self-regulation skills by being models and giving feedback. Motivational words such as "You can" used by parents toward their children effect increasing self-regulation. Therefore, positive statements from parents strengthen children's beliefs about self-regulation, while negative feedback may affect their existing beliefs. Self-regulation emerges as a multidimensional concept that includes the skills of regulation and control of emotion, attention, behavior, and motivation and develops in the interaction of its dimensions. These skills are of great importance in terms of social competence (Eisenberg et al., 2001) and academic success (Blair, 2002). Moreover, an individual's belief in their development increases their motivation when their self-efficacy

in reaching the desired goal increases. If children think that they are incompetent, they cannot be successful no matter how hard they try (Schunk, 2011).

According to many theories in which learning is defined as a social phenomenon, the socio-cultural environment in which a child lives has an important place in the development of self-regulation skills. Parents' interests, goals and aspirations for their children, and environmental factors such as schools and teachers are thought to shape how the child, who is a learner, makes sense of themselves. Research shows that the attention of parents is important in the learning and development of children from birth to adolescence (Coyl-Shepherd & Newland, 2012; Flouri, 2006; Smith, Wohlstetter, Kuzin & De Pedro, 2011). It can be expressed as various behaviors and activities that include parents' goals, desires, expectations, behaviors, and beliefs about children's education, whether at home or at school (Smith et al., 2011).

The family is the place where preschool children get their first social experiences, and development is quite rapid during this period. Therefore, parental attention is important for preschool children (Wilson & Prior, 2011). Because parental attention is needed for children's education, socialization, and solving problem situations (Bridge, 2001). In addition, it is stated that parental attention contributes to the development of children's cognitive and self-regulation skills and self-concept, to the increase of their knowledge and experience, and that they go to school prepared (Coyl-Shepherd & Newlad, 2012; Jeynes, 2011). Even if the living conditions, economic status, or education level of the families differ, parental attention increases children's academic achievement, ensures that they are ready for school, supports them in acquiring positive attitudes and behaviors, and is effective in developing self-confidence, social and communication skills, and positive peer relationships (Fan & Chen, 2001; Hill & Craft, 2003; Kim, 2002).

According to many studies, the basics of the concept of self-regulation date back a long time and that it appeared in the educational literature in the 1980s under the influence of the social cognitive theory of Albert Bandura (Bandura, 1991). Studies conducted on self-regulation in different countries have been widespread for years, and self-regulation behaviors have been studied in different dimensions. Although the participants, theoretical bases, and variables of the studies vary independently of each other, the research results show that the ability to self-regulate has an important place in a person's development, learning, and social relationships. This case shows that self-regulation goes beyond the individual dimension and is an important basis in the formation of society (Polnariiev, 2006). Interest in self-regulation skills has increased in Turkey recently, and research on self-regulation skills in the early childhood has been conducted (Adağideli, Sarac & Ader, 2015; Fındık Tanrıbuyurdu and Güler Yıldız, 2014; Sop, 2016; Tutkun, Tezel Şahin & Işıktekiner, 2016).

Self-regulation, which begins with the individual's life and changes and progresses with age, as in other areas of development, guides the development and adaptation processes of individuals. Since self-regulation skills first begin reactively, reflexes and events in the environment are influenced in the first months of life. Because the baby creates internal control during this period, they create self-regulation systems by deliberately directing their behavior over time with the experiences they have gained during the growth and maturing processes (Bronson, 2000). The development of self-regulation, which is based on the satisfaction of basic needs in infancy, is influenced by many factors such as innate

temperament, memory capacity, family environment, language development, and self-perception throughout the process (Acar Şengül & Yükselen, 2015; Fındık Tanrıbuyurdu, 2012; Williams, 2014). The environment influenced the child throughout his development, including his mother and father as his first teachers. Each child has an innate potential to become a philosopher, an artist, or perhaps a scientist. What is extremely important in terms of child development is to ensure that the child is aware of his or her potential and has the opportunity to use this potential (Cüceloğlu, 2021).

A child who grows up in a balanced and consistent attitude with parental attention can reach adulthood as an individual. Unfortunately, not all parents are functional or supportive, and this causes different parent behaviors than they used to be. A child who starts preschool education for the first time becomes involved in various educational environments. In this process, the child's competencies or skills affect their potential for adaptation and learning. Therefore, parental attention affects the child's self-regulation ability. The ability of individuals to alter their individual feelings and behaviors or self-regulation is an important process for preschool children to cope with difficulties (Loomis, 2021). Considering that today's children also need properly directed parental attention, it is important to determine whether parental attention affects the self-regulation skills.

In this context, it becomes important to analyze the parent training program's effect, which is being prepared to increase the interest of parents, and the effect of this effect on children's self-regulation skills. This research aims to examine the effect of parental interest on the self-regulation skills of preschool children by focusing on parental interest along with self-regulation skills. In line with this purpose, the study aimed to determine how much the training program for parental interest, which was prepared to improve parental interest, increased parental interest and how much the increased parental interest affected the child's self-regulation skills. In addition, considering the data obtained, it is thought that developing comments and suggestions that are thought to contribute to parents, preschool education institutions, and researchers can also guide regulations such as parent training that can be carried out for parents.

The problem statement of the study was determined as "Is parental interest effective on the 48–66-month-old children's self-regulation skills who have just started their preschool education?". The following research questions are analyzed within the scope of this study:

1. Is there a significant relationship between the mothers of 48–66-month-old children's interest levels who have just started preschool education, who received and did not receive training on parental interest?
2. Is there a significant relationship between the interest levels of fathers of 48–66-month-old children who have just started preschool education, who received and did not receive training on parental interest?
3. Is there a significant relationship between the self-regulation skills of children of parents who received and did not receive training to improve parental interest?
4. Is there a significant relationship between 48–66-month-old children's self-regulation skills who have just started preschool education and maternal attention?
5. Is there a significant relationship between 48–66-month-old children's self-regulation skills who have just started preschool education and paternal attention?

## METHOD

### *The Research Model*

In the study, a quasi-experimental research pattern with a pre-test, post-test, and retention test control group was used to examine the effect of parental interest on the acquisition of self-regulation skills of children who are new to preschool education. Experimental research is the research in which the most accurate results are obtained for scientific methods because the researcher applies comparable processes and then studies their effects. Therefore, the results of the research leading the researcher to definite interpretations are expected (Karasar, 2016). In the pattern, the dependent variable is the acquisition of self-regulation skills by children who have just started preschool education without training on parental interest, that is, without intervention and the existing interest of parents, and the independent variable is the family training program to increase parental interest developed by the researcher based on parental interest, the effect of which is examined on the acquisition of self-regulation skills by children who have just started preschool education. In the study, a mixed pattern with 2x3 experimental and control groups, pretest, posttest,, and permanence test was used.

### *Study Group*

In the formation of the study group a kindergarten connected to the Ministry of National Education was selected from the official institutions in Nilüfer district of Bursa province in the 2019–2020 academic term. First, interviews were conducted with kindergarten administrators and schoolteachers to determine the classes of children who were new to preschool education with similar socio-cultural characteristics. Then, experimental and control groups classes were determined from the 48-66-month group classes that were determined to have similar characteristics. The criterion sampling method was used to determine the children to be included in the experimental and control groups, and certain criteria were considered. These criteria are that the children have just started preschool education, the children 's parents are alive, the children 's parents are actively communicating and spending time together even if they are divorced, and the children 's parents have not received training on parental care, family education, etc. Considering that the families of the children in the control group may be indirectly affected by the families receiving training, the control group was selected from the morning and the experimental group from the afternoon groups. Because of all these procedures, the experimental group consisted of 20 48-66-month-old children, 20 mothers, and 20 fathers, and the control group consisted of 120 participants, including 20 48–66-month-old children, 20 mothers, 20 fathers. By analyzing the information in the general information forms used, it was determined that the experimental and control groups had similar characteristics.

In the study, the Preschool Self-Regulation Scale was applied to the children as a pre-test to determine whether the self-regulation skills of the children in the experimental and control groups were equivalent before the intervention.



**Table 1***Self-Regulation Skills of Children in Experimental and Control Groups Pre-Test Scale Scores*

Sub Dimensions	Attention/Impulse Control		Positive Emotion	
	Experiment	Control	Experiment	Control
Average	1.645	1.695	1.82	1.58
Median	2.0	2.0	2.0	2.0
The highest	3.0	3.0	3.0	3.0
The lowest	0.0	0.0	0.0	0.0
St. Divergence	1.09	1.24	0.86	0.84

According to the information in Table 1, the median score of the positive emotion sub-dimension (1.82) of the self-regulation skill levels of the children in the experimental group and the mean score of the positive emotion sub-dimension (1.58) of the children in the control group were close to each other. From the self-regulation skill levels of children, attention impulse control was observed to be almost the same in the experimental and control groups (1,645 and 1,695), respectively. Among the self-regulation skill levels of the children in the experimental group, the standard deviation of the attention impulse control sub-dimension was (1.09) in the control group (1.24), and the standard deviation of the positive emotion sub-dimension was (0.86 and 0.84) in the experimental and control groups, respectively. To conclude, children in the experimental and control groups had almost the same self-regulation skills before application.

Before starting the training program prepared by the researcher to improve parental interest with the mothers, the interest levels of the mothers of the children in the experimental and control groups were determined by applying the Maternal Interest Scale as a pre-test.

**Table 2***Maternal Interest Pre-Test Scale Scores of Mothers in the Experimental and Control Groups*

Sub Dimensions	Interest in Control		Interest in Developing Behavior		Interest in the School		Interest in Developing Interests	
	Experiment	Control	Experiment	Control	Experiment	Control	Experiment	Control
Average	55.0	58.75	45.95	49.65	19.40	21.20	9.75	9.55
Median	56.0	60.50	45.50	50.00	21.00	21.00	10.00	10.00
The highest	63.0	47.0	33.0	41.0	12.0	14.00	4.00	5.00
The lowest	42.0	64.0	55.0	55.0	27.0	30.00	13.00	14.00
St. Divergence	5.99	4.63	5.33	3.94	4.28	4.38	2.28	2.30

When the data in Table 2 were examined the fact that the mothers of the children in the experimental and control groups, respectively, had an average score of (55.0 and 58.75) interest in control, an average score of (45.95 and 49.65) interest in developing behavior, an average score of (19.40 and 21.20) interest in school, and an average score of (9.75 and 9.55) for interest in developing interests. According to the pre-test results of the mothers in the experimental and control groups, their interest levels for control were higher than the other interest levels, whereas their interest levels for developing interests were the lowest. According to these results, the mothers of the children in the experimental and control groups who participated in the study were close to each other before receiving training on parental interest.

Before starting the training program prepared by the researcher with the fathers of the children who were in the experimental and control groups to improve parental interest, the interest levels of the fathers were determined by applying the father interest scale as a pre-test.

**Table 3**

*Father 's Interest Pre-Test Scale Scores of Fathers in Experimental and Control Groups*

Sub Dimensions	Interest in Developing Behavior		Interest in Control		Interest in the School	
	Experiment	Control	Experiment	Control	Experiment	Control
Average	63.45	63.85	41.70	46.25	32.20	30.10
Median	64.50	65.50	43.00	48.50	34.50	28.00
The highest	24.00	45.00	24.00	32.00	13.00	21.00
The lowest	102.00	96.00	52.00	54.00	45.00	49.00
St. Divergence	18.39	9.90	7.14	6.15	10.56	8.04

When the data in Table 3 were examined, it was found that the fathers of the children in the experimental and control groups, respectively, had an average score of (41.70 and 46.25) interest in control, an average score of (63.45 and 63.85) interest in behavior development, and an average score of (32.20 and 32.10) interest in school. Based on the pre-test results of the fathers in the experimental and control groups, their interest levels for developing behavior were higher than the other interest levels, whereas their interest levels for school were at the lowest level. According to these results, the fathers of the children in the experimental and control groups who participated in the study were almost equal before receiving training on parental interest. When the data in Table 2 and Table 3 are compared, the fathers who were in the experimental and control groups had higher levels of interest in developing behavior than the mothers, whereas the mothers had higher levels of interest in the control group than the fathers.

### *Data Collection Tools*

Considering the research questions of the study, the researcher used the Preschool Self-Regulation Scale and the Scale of Parental Interest in Children as data collection tools to define the problem in detail and to obtain data about the solution of the problem. In

addition, the General Information Form was used to form the experimental and control groups.

The "Preschool Self-Regulation Scale" which developed by Smith-Donald et al. (2007) and adapted to Turkey by Fındık Tanrıbuyurdu and Güler Yıldız (2014), was used to assess the children's self-regulation skills included in the study. In a validity and reliability study conducted in Turkey, the Preschool Self-Regulation Scale was found to be reliable for measuring children's attention, emotions, and impulses because it was compatible with the original version (Fındık Tanrıbuyurdu, 2012). In this study, it was found that the scale consisted of two factors: positive emotion and attention/impulse control. The Cronbach's alpha coefficient ( $\alpha$ ) calculated for reliability was found to be .83. In the sub-dimensions of the scale, Cronbach's alpha reliability coefficients ( $\alpha$ ) were found to be .80 for the Positive Emotion sub-dimension and .88 for Attention/Impulse Control. The correlation coefficient was determined to be .86. The scale has a high level of reliability in terms of measuring children's self-regulation skills. It is known that the closer Cronbach's alpha value is to 1, the higher the reliability value (Büyüköztük et al., 2008).

The "Parental Interest Scale for Children" developed by Sucuoğlu et al. (2015) to determine the level of interest of parents of 4-6-year-old children attending preschool education toward their children was also used to evaluate the interest levels of the parents of the children included in the study. The item-total correlations for all items differ between 0.31 and 0.62 in the maternal interest scale and between 0.24 and 0.72 in the paternal interest scale, and the t-values are significant ( $p < .001$ ) (Sucuoğlu et al., 2015). Therefore, the items in maternal and paternal interests scales have high reliability and are intended to measure similar behaviors. Consisting of 34 items, the total internal consistency coefficient of the maternal interest scale was 0.91. The total internal consistency coefficient of the 40-item father interest scale was 0.94 (Sucuoğlu et al., 2015). According to these values, the reliability level of the mother's interest and father's interest scales is acceptable.

The researcher attempted to prepare a training program aimed at improving parental interest and self-regulation skills, raising awareness of families about the child's home or school education, and enabling families to evaluate their attitudes and beliefs. Sessions were held with parents. The training program, which was planned for eight sessions (8 weeks), lasted for 3 h one day a week, and the researcher used various methods and techniques to ensure the active participation of the participants.

### *Data Collection*

During the stage of data collection, kindergarten was visited and the children were told that a study would be conducted with them. A voluntary participation form and a general information form were sent to the families through the teachers, and the families were asked to return them after they were filled in. The Preschool Self-Regulation Scale was administered to the children of the families in the experimental and control groups who returned the form, and the Parental Concern Scale was administered to the parents of the children as a pre-test at the beginning of the 2019–2020 academic year. After the necessary environment was prepared, individual practices began and the researcher administer Preschool Self-Regulation Scale. After the training program, the Preschool Self-Regulation Scale was administered to both the experimental and control groups as a post-test. To determine whether the education given was permanent or not, the Preschool Period Self-

Regulation Scale was applied to the children who were in the experimental and control groups one month after the post-test by the researcher, and their retention was evaluated with the retention test.

After the implementation of the training program for the parents was completed, the Parental Concern Scale was administered to the parents of the children in the experimental and control groups as a post-test. Furthermore, one month after the post-test, the Parental Concern Scale was reapplied to the parents of the children in all groups, and their permanence was evaluated using the retention test.

### *Data Analysis*

The General Information Form, in which general information about the children and their parents was collected, and children's pre-test, post-test, and retention test scores from the Preschool Period Self-Regulation Scale and their parents from the Parental Concern for Children Scale were entered into the computer environment, and appropriate statistical analyzes were performed. In the study, two groups, experimental and control, were studied, and the data obtained were analyzed with the SPSS 26 package program using software.

## FINDINGS

In this stage of the study, the findings obtained in accordance with the research questions are presented.

### *Findings for the First Sub-Problem*

To reach the findings related to the study's first sub-problem, the "Scale of Parental Interest in Children" was administered to the mothers. The findings obtained from the scale applied to the mothers are shown below in Table 4, 5, and 6.

**Table 4**

*Pretest and Posttest Maternal Concern Scale Scores of Mothers in the Experimental and Control Groups*

		Number	Average Rank	Total Rank	U	p
Before Training –	Experiment	20	15.95	319.00	175.00	0.013
	Control	20	25.05	501.00		
After Training	Experiment	20	28.65	573.00	37.00	0.000
	Control	20	12.35	247.00		

According to the results given in Table 4, a significant difference is observed between the interest levels of the mothers of the children who were in the experimental group before and after receiving training on parental interest ( $p > 0.05$ ). The training increased the level of the mother's interest. According to these results, the training provided to improve parental interest had a significant effect on improving maternal interest. However, when Table 4 is examined, it is seen that a significant difference is present between the pretest and posttest scores of the interest levels of the mothers of the children who were in the control group ( $p >$

0.05). Mothers who were in the control group did not receive training on improving parental interest can be resulted as conclusion.

**Table 5**

*Posttest - Retention Test Maternal Concern Scale Scores of Mothers in the Experimental and Control Groups*

Group	Rank Sign	N	Rank Average	Rank Total	Z	p
Experimental Group	Negative Ranking	12	9.71	116.50	-3.25	0.000
	Positive Ranking	23	22.33	513.50		
	Neutral	5				
Control Group	Negative Ranking	20	17.48	349.50	-2.91	0.004
	Positive Ranking	9	9.50	85.50		
	Neutral	11				

When Table 5 is analyzed, it is seen that a significant difference is present between the posttest and retention test scores of the mothers of the children who were in the experimental group according to the Wilcoxon signed rank test results ( $p > 0.05$ ). These results show that the training given to improve parental interest was effective in increasing the interest levels of the mothers of the children in the experimental group and that the effect continued in the measurements one month later. In other words, the training permanently increased the level of maternal interest. A significant difference was present between the post-test and retention test scores of the mothers of the children in the control group ( $p > 0.05$ ). When the rank averages and rank sums of the difference scores are examined, it is seen that this difference supports the negative ranks, that is, the post-test scores. This result confirms the findings in Table 4 and can be interpreted because the mothers in the control group did not receive training on improving parental interest.

**Table 6**

*Pretest –Posttest–Persistence Test Maternal Concern Scale Scores of Mothers in the Experimental and Control Groups*

	Group	Average Rank	U	p
Pre-Test	Experiment	15.95	109.00	0.014
	Control	25.05		
The Final Test	Experiment	28.65	37.00	0.000
	Control	12.35		
Persistence Test	Experiment	30.15	9.00	0.000

As seen in Table 6, when the relationship between the experimental and control groups in the pre-test, post-test, and retention test of maternal interest levels was analyzed according to the Mann –Whitney U test results, a statistical difference was observed between the experimental and control groups ( $p < 0.05$ ).

## Findings for the Second Sub-Problem

To reach the findings related to the study's second sub-problem, the "Scale of Parental Interest in Children" was administered to the fathers. The findings obtained from the scale applied to the fathers are shown in Tables 7, 8, and 9.

**Table 7**

*Pre-Test and Post-Test Father Interest Scale Scores of Fathers in the Experimental and Control Groups*

		Number	Average Rank	Total Rank	U	p
Before Training –	Experiment	20	20.70	414.00	196.00	0.925
	Control	20	20.30	406.00		
After Training	Experiment	20	28.33	566.50	43.50	0.000
	Control	20	12.66	253.50		

According to the results given in Table 7, a significant difference is observed between the fathers' interest levels of the children who were in the experimental group before and after receiving training on parental interest ( $p < 0.05$ ). The training increased the father's interest. According to these results, the training provided to improve parental interest had a significant effect on improving father interest. However, when Table 7 is examined, a significant difference is observed between the pre-test and post-test scores of the interest levels of the fathers of the children who were in the control group ( $p < 0.05$ ). As far as the rank median and rank sum of the difference scores, it is seen that this difference is in favor of the negative ranks, that is, the pretest score. This result can be interpreted because the fathers in the control group did not receive training on improving parental interest.

**Table 8**

*Posttest - Retention Test Father Interest Scale Scores of Fathers in the Experimental and Control Groups*

Group	Rank Sign	N	Rank Average	Rank Total	Z	p
Experimental Group	Negative Ranking	8	18.81	150.5	-3.48	0.000
	Positive Ranking	30	20.92	669.00		
	Neutral	0				
Control Group	Negative Ranking	10	20.10	201.00	-2.81	0.005
	Positive Ranking	30	20.63	619.00		
	Neutral	0				

When Table 8 is examined, a significant difference is observed between the posttest and permanence test scores of the fathers of the children who were in the experimental group according to the Wilcoxon signed rank test results ( $p > 0.05$ ). These results show that the training permanently increased the father's interest. A significant difference was present

between the post-test and permanence test scores of the fathers of the children in the control group ( $p > 0.05$ ). This result that father interest affects the fathers in control group positively.

**Table 9**

*Pretest –Posttest–Persistence Test Father Interest Scale Scores of Fathers in the Experimental and Control Groups*

	Group	Average Rank	U	p
Pre-Test	Experiment	20.30	196.00	0.915
	Control	20.70		
The Final Test	Experiment	28.33	43.50	0.000
	Control	12.68		
Persistence Test	Experiment	23.03	49.50	0.039
	Control	17.93		

As seen in Table 9, when the relationship between the experimental and control groups in the pre-test, post-test and permanence tests of father's interest levels was analyzed according to the results, no statistically significant difference was found between the experimental and control groups in the pre-test ( $p > 0.05$ ). Table 9 shows a statistically significant difference between the experimental and control groups in the post-test and permanence tests ( $p < 0.05$ ). According to the final the post-test and permanence test mean scores, the experimental group 's score was higher than that of the control group.

### Findings for the Third Sub-Problem

To reach the findings related to the third sub-problem of the study, the "Preschool Self-Regulation Scale" was applied to the children. The findings obtained from the scale applied to the children are shown in Tables 10, 11, and 12.

**Table 10**

*Pre-Test and Post-Test Self-Regulation Scale Scores of Children in the Experimental and Control Groups*

Group	Rank Sign	N	Rank Average	Rank Total	Z	p
Experimental Group	Negative Ranking	15	20.38	305.70	3,49**	0,001***
	Positive Ranking	25	32.42	810.50		
	Neutral	0				
Control Group	Negative Ranking	18	19.36	348.5	-0,319*	0.749
	Positive Ranking	20	19.63	393.5		
	Neutral	2				

\*Negative Ranking

\*\*Positive Ranking

\*\*\* $p < 0,01$

According to Table 10, a significant difference is observed between the scores of the experimental group children's self-regulation skills before and after receiving training to improve their parents' parental interest ( $p < 0.01$ ). With regard to these results, parental interest has a significant effect on developing children's self-regulation skills. However, when Table 10 is examined, a significant difference is observed between the pre-test and post-test scores of the children's self-regulation skills in the control group ( $p < 0.01$ ). As far as the rank median and rank sum of the difference scores, it is seen that this difference supports the negative ranks, that is, the pretest score. This result can be attributed to parental interest development were not given to the parents whose children were in the control group.

**Table 11**

*Posttest Retention Test Self-Regulation Scale Scores of Children in the Experimental and Control Groups*

Group	Rank Sign	N	Rank Average	Rank Total	Z	p
Experimental Group	Negative Ranking	17	10.10	50.50	-3.54	0.000
	Positive Ranking	19	15.46	355.50		
	Neutral	4				
Control Group	Negative Ranking	5	15.65	266.00	-1.59	0.292
	Positive Ranking	23	21.05	400.00		
	Neutral	12				

As seen in Table 11, a significant difference was present between the children's self-regulation skills in the experimental group after their parents participated in the training to improve parental interest and one month after the program ended ( $p > 0.01$ ). These results showed that the training given to parents to improve parental interest was effective in increasing children's self-regulation skills in the measurements 1 month later. Likewise, a significant difference was present ( $p < 0.01$ ) between the children's self-regulation skills in the control group ( $p < 0.01$ ) and the scores of the children in the experimental group after participating in the training and one month after the end of the training ( $p < 0.01$ ). The fact that the difference in the control group favored the post-test scores can be interpreted as a result of the lack of training for parents in this group.

Table 12 shows the findings of the pretest –posttest–permanence self-regulation scale scores of the children in the experimental and control groups.

**Table 12**

*Self-Regulation Scale Scores of Children in the Experimental and Control Groups in the Pre-Test-Post-Test-Persistence Test*

	Group	Average Rank	U	p
Pre-Test	Experiment	13.10	52.00	0.00
	Control	27.90		



The Final Test	Experiment	28.58	38.50	0.00
	Control	12.43		
Persistence Test	Experiment	30.10	8.00	0.00
	Control	10.90		

When the relationship between the experimental and control groups in the pre-test, post-test, and permanence test of children's self-regulation levels was analyzed according to the Mann-Whitney U test results in Table 12, there was a statistical difference between the experimental and control groups ( $p < 0.05$ ).

### Findings for the Fourth Sub-Problem

Relationship between findings of "Preschool Self-Regulation Scale" administered to children and the "Parental Concern for Children Scale" administered to mothers are presented in Table 13 for reaching the fourth sub-problem of the study.

**Table 13**

*Relationship between Maternal Interest Score and Child Self-Regulation Skills Score*

Sub Dimensions	Number (n)	Average	Mann Whitney U			
			St. Divergence	Row Avg	MWU	p
Mother's Interest	40	147.875	13.37	60.50	0.000	0.00
Self-Regulating	40	31.95	4.47	20.50		

According to Table 13, a statistically significant difference was found between the maternal interest score and children's self-regulation score ( $p < 0.05$ ). In other words, Table 13 can be interpreted as indicating that maternal interest affects self-regulation skills.

**Table 14**

*Correlation Test between the Maternal Interest Score and Child Self-Regulation Skills Score*

Correlation	Self-Regulation Skills	
Mother's Interest Score	r	0.667
	p	0.000
	n	40

When Table 14 is examined, according to the correlation analysis between maternal interest and child's self-regulation skill scores, there is a positive relationship between maternal interest and self-regulation score. This result can be interpreted as, level of maternal interest significantly affect the self-regulation skills of 48–66-month-old children who have just started preschool education.

### Findings for the Fifth Sub-Problem

The relationship between the "Preschool Self-Regulation Scale" administered to children and the "Parental Interest Scale for Children" administered to fathers is given in Table 15 for reaching findings related to the fifth sub-problem of the study.

**Table 15***Relationship between Father Interest Score and Child Self-Regulation Skills Score*

Sub Dimensions	Number (n)	Average	Mann Whitney U		MWU	p
			St. Divergence	Row Avg		
Father's Interest	40	155.3	23.38	60.5	0.000	0.00
Self-Regulating	40	31.95	4.47	20.5		

As seen in Table 15, a statistically significant difference was found between the father's interest score and the children's self-regulation score ( $p < 0.05$ ). In other words, level of interest of fathers affect the children 's self-regulation skills.

**Table 16***Correlation Test between Father Interest Score and Child Self-Regulation Skills Score*

Correlation	Self-Regulation Skills
Father's Interest Score	r
	0.639
	p
	0.000
	n
	40

According to the correlation analysis between father 's interest and child's self-regulation skill scores, there is a positive relationship between father 's interest and self-regulation score. This result can be interpreted as father's interest level affects children's self-regulation skills.

## CONCLUSION, DISCUSSION AND RECOMMENDATIONS

A summary of the results obtained based on the findings and recommendations based on these results are given.

### Conclusion and Discussion

The study, which aims to examine the effect of parental interest on the self-regulation skills of preschool children and to determine how much the parental education program to improve parental interest, which was tried to be prepared by the researcher, increases parental interest and how much the increased parental interest affects the child's self-regulation skills, sought answers to five questions.

#### *Conclusion and Discussion of the First Sub-Problem*

Because of the analysis, a statistically significant difference was discovered between the post-test scores of the mothers who received training to increase parental interest and against other mothers who did not. According to this result, the training on parental interest was effective in increasing maternal interest in the experimental group. It was also found that a significant difference was in the groups ' maternal interest permanence test scores. Based on this result the education provided to increase parental interest is effective in increasing maternal interest. It is expected that a significant difference is present in the test findings of the mothers who were in the experimental group who participated in the

training program aimed at increasing parental interest compared with the mothers who did not participate in this training. It is thought that the explanations and practices given to the mothers and fathers who were in the experimental group were effective in the mothers' ability to manage their interests toward their children correctly.

It is possible for parents to develop desirable attitudes toward child development and education and to develop a conscious environment for their children only through training (Kaya, 2002). When the literature was examined, different studies examining the effect of training given to parents on child development were encountered. Bedel's (2017) study investigated whether the mother training program had an effect on the relationship of children with special needs with their children and child-rearing styles. Because of the research, it was observed that mothers' democratic attitudes and mother-child relationship increased after the training. In Landy and Menna's study (2006), the effectiveness of group training given to mothers of aggressive children aged 3–6 years was examined. According to the results obtained; while an increase was observed in mothers' self-efficacy skills and knowledge level, a decrease was observed in children's behavioral problems. In a study in which the effect of this training program on the attitudes and behaviors of parents was examined by providing training on different subjects needed by parents with children in the 5-6 age group; a statistically significant difference was observed in some sub-dimensions of the parents as teachers inventory (Bolat, 2011). In light of all this information and the results of the research analysis, it is thought that the training provided to enhance parental interest is effective in improving the interest level of mothers.

### *Conclusion and Discussion of the Second Sub-Problem*

Because of the analysis, it was concluded that a significant difference was present between the scores of the fathers of the experimental group before and after receiving training to increase parental interest. According to these results, the training given to increase parental interest had a significant effect on increasing fathers' interests. A significant difference was found between the pre-test and post-test scores of the fathers in the control group. However, this difference is interpreted as a decrease in the father's level of interest. This result may be because the fathers in the control group did not receive training to increase father interest.

It was concluded that a significant difference was present between the scores of the fathers in the experimental group after receiving the training and one month after the training ended. In other words, the training given to improve parental interest was effective in increasing parental interest and that it showed its effect in the measurements 1 month later. However, a significant difference was present between the post-test and permanence test results of the fathers in the control group. While there was no increase in the level of interest of the fathers who were in the control group after the experiment, there was an increase in the level of interest of the fathers one month after the end of the experiment. This result that in post-experimental period, factors of parental interest affects fathers in a positive way.

With the training to be given to parents, their self-confidence can be strengthened and they can be provided with the necessary information and abilities to establish healthy communication with their children (Bolat, 2011). When the literature was examined, it was seen that there were studies examining the effectiveness of the trainings given to parents. In Taşkın and Erkan's (2009) study, fathers were given training and the effect of the training

on the fathers' level of caring for their children aged 2-9 years was aimed to be revealed. According to the results obtained, it was observed that the training was effective. Fathers who participated in the study increased the frequency of participating in their children's games, verbally communicating with them, going out together, teaching them something new, taking care of their daily care, and taking care of their children at special times. Gunderson (2004) examined the effects of education and stress management training for parents of preschool children and found that the family education program improved children's positive behaviors, while the stress management program helped reduce parents' stress. In addition, it was revealed that parents felt more competent after the training. Some of the above studies also supports parenting trainings are effective. Therefore, it is thought that the training provided to improve parental interest within the scope of the research is effective in improving the interest level of fathers.

### *Conclusion and Discussion of the Third Sub-Problem*

Because of the analysis, it was concluded that a significant difference was present between the scores of the children's self-regulation skills in the experimental group before and after their parents participated in the training to increase parental interest. To conclude, a significant difference in children's test results is expected. According to this result, it can be interpreted that an increase in the level of parental interest is effective in the development of self-regulation skills of their children. In addition, the education given to increase parental interest was also effective in measuring the children's self-regulation skills in the experimental group one month later. In the children's self-regulation skills in the control group, there was no significant difference between the scores before and after the training given to the parents. However, a significant difference was observed between their scores 1 month after the end of the experiment. There was a halo effect in the control group. In other words, learning that participants are involved in research may cause positive changes in their behaviors and skills (Başal, 2014). In addition, because this result was in favor of the pretest scores, parents in the control group were not given training to increase parental interest. Vardar's (2015) study observed that most mothers responded positively to the items in the sub-dimensions of maternal interest in school and interest in control, and this positively affected children's achievement. The fathers who participated in the study encouraged their children to do better and showed their satisfaction with their children's success. This is a situation that positively affects the child's success. The father's presence in the family and taking an active role in the child's life positively affects children's intellectual development and academic success, as well as developing internal control along with many skills in social and emotional development (AÇEV, 2017).

### *Conclusion and Discussion of the Fourth Sub-Problem*

According to the correlation analysis between maternal interest and children's self-regulation skill scores, there is a positive relationship between the two. In other words, the two results support each other. According to the results obtained from the analysis, the level of maternal interest affect the self-regulation skills of 48-66-month-old children who have just started preschool education. In addition, it is thought to show the importance of the education given to improve parental interest.

The baby's early interaction with its environment starts from birth, in other words, its experiences directly affect brain development (De Bellis, 2001). According to Nelson and

Bloom (1997), early experiences are effective in the formation of synapses, whereas lack of experience is thought to be related to the failure of synapses to develop. In the brain of a newborn baby, there are one hundred billion neurons, most of which are not connected to each other. These neurons begin to connect to each other with stimuli such as sound, touch, sight, taste, and smell during the 0–3 years of age. As the baby's relationship with its environment increases and as it becomes more connected to the mother, father, family members, and other caregivers who take care of it, the connection and strengthening of neurons increases. The number of connections between brain cells may increase or decrease depending on the baby's environment and the stimuli it receives from its environment. Neurons connected to each other by small gaps called synapses from clusters that fulfill various functions of the brain. Synapse connections, which are formed in the early period and strengthened by repeated experiences, affect the child's lifelong learning capacity as well as their physical and mental development. Children's brain development can be helped by touching, talking, singing, and reading to them (Akdağ, 2015). Therefore, the most decisive factor in this process is the parents (Nelson & Bloom, 1997). The relationship with adults who assume the role of care can affect brain development positively or negatively. When the literature was examined, studies examined the effect of parental behaviors on child development. Relevant, supportive, and warm parental behaviors have a positive effect on children's development (Bayındır, 2016). Insensitive mothers who exhibit indifferent and punitive behaviors may negatively affect their children's self-regulation skills (Eisenberg et al., 2001). Children who interact with their parents develop their own emotion regulation by modeling their emotion regulation behaviors (Calkins & Fox, 2020). When research on the nature of the relationship between mother and child and their child-rearing behaviors is examined, it is noteworthy that the focus is on the effects of mothers on children in emotion regulation. When the studies conducted in Turkey are examined, it is seen that maternal attention has a positive effect on children's emotion regulation skills (Altan, 2006; Metin, 2010). Based on these explanations, it is thought that maternal attention also has a positive effect on children's self-regulation skills.

### *Conclusion and Discussion of the Fifth Sub-Problem*

According to the correlation analysis between father's interest and children's self-regulation skill scores, a positive relationship was concluded between them. Based on these results, the self-regulation skills of 48–66-month-old children who have just started preschool education are affected by the level of father's interest. It is thought that this result also shows the effect of the education provided to improve parental interest.

According to researchers, parenting is accepted as a predictor of self-regulation skills (Olson et al, 2002). The quality of early care has a very important role in the development of children's self-regulation skills. The social environment of a newborn infant is usually defined as the interaction with a caregiver called a parent or caregiver (Kopp, 1982). The quality of the home environment and caring parents positively affect the success of their children, and children learn what to pay attention to in their environment with the guidance of parents. This support can enable children who take responsibility for self-regulation to transition from someone else's regulation to self-regulation in independent tasks. In particular, the positive support given to a newborn baby until the age of 2 positively affects the acquisition of self-control skills that develop between the ages of 2 and 4 (Bayındır, 2016).

Based on these explanations, it is thought that the father's interest has a positive effect on the child's self-regulation skills.

### Recommendations

According to the results obtained from this study, it was determined that the self-regulation skills of 48-66-month-old boys and girls who have recently started preschool education were positively affected by parental interest. In this direction and in light of the information in the literature, the following recommendations were made for parents, teachers, and researchers.

#### *Recommendations for Parents*

- Children develop in a healthy family environment. Therefore, parents should first strengthen communication among themselves and seek support from family counseling when needed.
- Parents should see their children as part of the team and should always talk to them about everything. For this, parents should organize weekly family meetings and share ideas about the issues that are needed.
- Parents should give the same amount of attention to their children.
- A child who feels that attention has gone away from him/her tries to attract attention again by showing a change in behavior. Therefore, instead of praising their children, parents should observe them well and provide feedback when they perform the desired behavior.
- Parents should manage parental attention in the right way to support self-regulation. For this, parents should participate in training programs on parental interest organized by experts.
- Parents should believe in their children's innate potential and create environments that will enable them to manage their interests correctly and allow their children to explore the world. Therefore, parents should enable their children to participate in demos of various activities such as sports, music, etc. to manage their interests and allow them to progress in line with their own preferences.

#### *Recommendations for Teachers*

- Preschool teachers should prioritize parent education by directing the educational institutions where they work. They should prepare programs that will enable parents to take care of their children both at school and at home and work to increase parental interest.
- Pre-school teachers should include topics related to self-regulation skills when reporting their requests and demands for in-service training from the educational institutions where they work.
- Preschool teachers should prepare and implement programs that include self-regulation in educational activities after receiving expert training. Teachers should include activities that will contribute to the development of children's self-regulation and 21st century skills, including methods that enable children to organize and develop their own learning processes, and organize the classroom environment with appropriate materials accordingly.

- Preschool teachers should benefit from the measurement tools they will use to assess children's self-regulation skills after the expert training they will receive and should ensure that parents are aware of their children's development by providing interviews.

### *Recommendations for Researchers*

- This study was conducted with children aged 48–66 months. Studies examining the effect of parental interest on different concepts or skills of children at different age periods should be conducted.
- A qualitative study should be conducted to examine the views of teachers on the applicability of the comprehensive training program prepared to improve parental interest in schools, and the applicability of the training program should be expanded.
- A study examining the effect of the frequency of technology use on parental interest and the effect of this effect on children's behaviors should be conducted.
- The data of this study were collected before the COVID-19 pandemic. A similar study should be conducted to examine the effect of the pandemic on parents' interest and children's self-regulation skills.
- A study should be conducted to examine the effect of the family environment created by the process of working from home due to the pandemic on parental interest and the change of this effect on children's behavior.

As seen in this study, which examines the effect of parental attention on the self-regulation skills of 48–66-month-old children who have just started preschool education, parents have a great influence on the life of a baby, which begins like a story. Therefore, it is extremely important to ensure that prospective parents receive training to strengthen their motherhood and fatherhood roles before establishing a home, a family, or having a child. Because although life begins like a story, it is possible to see the traces of parents on how this story ends.

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# Literacy in Indian Akshara and Other Transparent Orthographic Languages - Teacher Education Considerations

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## Abstract:

Alphabet-based languages are more often researched in literacy acquisition and education than akshara languages. Languages that use alphasyllabaries including symbols, called aksharas, represent a large portion of the world's languages, including the languages of the second most populous country, India. This conceptual research paper addresses teacher education in literacy related to the akshara languages. Using the theory and research base of existing letter and akshara acquisition, with teacher education standards for literacy in alphabet-based languages, this paper presents a model for teacher education in literacy for akshara languages. This framework provides teacher education standards and other considerations, such as evaluation of teacher education curriculum and performance, to enable data-based decision making in literacy instruction. The premise of this paper is to approach the problem of dismal literacy rates by drawing into the robust research in alphabetic language literacy education by using a systematic approach to target the source – pre-service teacher education. While this paper addresses examples of languages in India, other transparent orthographies that use symbols or aksharas can draw from this to inform their teacher education in literacy

## Keywords:


Teacher education, Literacy, Standards, Akshara languages; Transparent orthography; India.


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## INTRODUCTION

Literacy skills are one of the topmost priorities in most education systems around the world and are emphasized in education policies, curriculum frameworks, and mandates. However, attention to literacy acquisition has largely focused on alphabet-based systems of reading, such as in English, while language systems that follow alphasyllabaries or aksharas (symbols) have limited research and recommendations (Landerl, Castles & Parrila, 2022), especially for teacher education.

The origin of orthographies of South and Southeast Asia have been attributed to the ancient Brahmi script and are referred to as Indic alphasyllabaries. The symbol units of Indic alphasyllabaries are called aksharas. Vowels (/V/) and consonants (/C/) are represented by different aksharas. Aksharas, which represent syllables and phonemes (hence named alphasyllabary), could include just the vowels, consonants, as well as consonants with an inherent or marked vowel (e. g. /Ca/, /CV/, called *mathras* in Hindi) and consonant clusters with the inherent or marked vowels (e. g. /CCa/, /CCV/, /CCCV/; called *samyukthaksharas* in Hindi) (Nag, 2014). The markers for consonant-vowel pairs and consonant-consonant clusters may be nonlinear but are largely in predictable locations (Nag, 2017), making the orthography transparent. Several Indian languages, such as Kannada, Hindi, Marathi, Bengali, Telugu, Tamil, Gujarati, and Odiya, use this largely transparent orthography, with an extensive system of aksharas. Several global languages such as Spanish, Turkish, Latin, Italian, Finnish, and Lithuanian use similar transparent orthographies.

Research confirms that poor readers struggle with decoding the akshara (Nag-Arulmani, 2003) and that the visuospatial nonlinear arrangements of markers in the akshara also influence reading (Wali, Sproat, Padankannaya & Bhuvaneshwari, 2009). Evidence shows that specific akshara knowledge training improves reading levels in alphasyllabaries (Nag-Arulmani, 2003). However, the differences between alphabet and alphasyllabaries have not been factored into teacher education in South Asia, especially in India. Studies involving large data sets, such as the Literacy Research in Indian Languages by Menon et al. (2017) and Nakamura and de Hoop (2014), point to a lack of awareness of the knowledge and skills that teachers need to successfully teach early literacy and '*an urgent need to equip teachers with a sound knowledge base related to the teaching of early literacy*' (Menon et al., 2017).

The purpose of this article is to examine the foundational skills for literacy instruction to achieve the goals of national and international initiatives in alphasyllabaries or akshara-based languages, such as those in South Asia. This article examines existing standards for teacher education in literacy, analyzes them in the context of differences in alphabet-based and akshara-based languages, and proposes other considerations for teacher education for literacy instruction in alphasyllabaries.

### Literature Review

India, like many developing countries, is yet to achieve the goal of literacy for all. In 2017, the National Council for Educational Research and Training (NCERT) conducted a nationwide National Achievement Survey (NAS), which showed deterioration in achievement of reading competencies as students advanced from the 3rd to the 8th grades.

Further analysis by state shows an increasing number of students achieving below 50% as the grade advances in almost all states in language achievement (NCERT, 2023). According to the Annual Status of Education Report (ASER Center, 2022), in India, more than 51% of the students in Grade 5 are unable to read 2<sup>nd</sup> grade level textbooks and only 20.5% of Grade 3 Indian students can read a Grade 2 level textbook. Furthermore, there is notable disparity in gender and social classes, with literacy rates in females and the lower social classes being significantly lower (Chauhan, 2008).

Consequently, it is not surprising that the recent National Education Policy (NEP) (2020) of India places the highest importance on the achievement of Foundational Literacy and Numeracy (FLN), stating, “*The rest of this policy will become relevant for our students only if this most basic learning requirement (i. e., reading, writing, and arithmetic at the foundational level) is first achieved*”. To realize the goal of FLN, an implementation strategy, the ‘National Initiative for Proficiency in Reading with Understanding and Numeracy’ (NIPUN) (Ministry of Education, 2021), was developed, which aims to achieve foundational literacy and numeracy skills for all by the year 2026-27. NIPUN recommends curricular revisions based on scientific principles of learning, revamping of the assessments with focus on competency-based assessment for learning, among other measures such as teacher education, to ensure maximum gains for early graders (Ministry of Education, 2021).

To begin the journey toward these goals, the processes determined to be effective for teaching akshara-based languages were examined in this study. Most students in India are bilingual or multilingual, which prompts consideration of effective literacy approaches for multilingual students, which differs from monolingual literacy development (Escamilla, Olsen and Slavick, 2022). Although limited in number and focusing on one or a few of the akshara-based languages, research has pointed to some key components and differences in literacy instruction compared with alphabetic instruction, serving to draw some basic conclusions on the content of instruction and pedagogy. One similarity is that phonological awareness skills, which are the precursor and an established pre-requisite in alphabetic literacy, have also been correlated with proficiency in reading in akshara-based literacy (Nag & Snowling, 2012). A distinction is that syllable awareness appears to be correlated to akshara knowledge and akshara orthography more than phoneme awareness (Nakamura, Joshi & Ji, 2017). In addition, akshara-based languages use syllabification with orthographic syllables rather than phonological syllables (E. g. Mohanan, 1989; Murty, Otake, & Cutler, 2007, Sailaja, 2007). Unlike in alphabetic literacy emergence, phonemic awareness does not occur for all aksharas before reading begins. It appears that increasing orthographic experiences and fluency is associated with greater phonemic processing skills, which shows that phonemic processing continues to grow over the years of literacy instruction and fluency development (Nag & Snowling, 2012). With regard to language features, an important difference in akshara languages is the presence of inflectional morphemes such as postpositions, negation, and question markers, which occur as word endings to the noun or verb, changing the form of the word and conveying grammatical and semantic information. Another feature distinctive to the akshara language is the sandhi (morpho-phonologically combined words) and samas (compound words), which follow certain phonological rules that determine the combined resulting sound (in sandhi) and word (samas). Research shows that the relationship between morphology acquisition and literacy

suggest reciprocity, with more literacy awareness leading to better morphological awareness, especially with higher order forms and nuances (Nag, 2017).

The processing of aksharas appears to be influenced by their visual arrangement, particularly non-linear arrangements and other visuo-spatial factors (Vaid & Padakannaya, 2004; Wali et al., 2009). Therefore, it is not surprising that greater analytical skills for phonemic markers and fine-grained phonological processing appear to define the akshara learning system (see Nag & Snowling, 2012). Since aksharas increase in complexity, word recognition grows as better insights into the principles of the writing system and recognition of cues from the lexical context are improved (Nag, 2017).

In conclusion, aspects of akshara literacy learning that concur with research in alphabetic languages are that they both emphasize the same cognitive-linguistic foundational factors: vocabulary, visual memory, phonological processing skills, phonological memory, and rapid automatized naming (RAN) (Nag & Snowling, 2012; Marasinghe et al., 2018). In addition, the conscious mapping of akshara to oral language aids word recognition (Nag & Snowling, 2011). As with alphabetic literacy, strong associations between word decoding, akshara knowledge, phonological skills, and analytical approach to word identification have been found to improve word-naming accuracy and fluency (Nag, 2007; Vaid & Gupta, 2002), pointing to the importance of teaching awareness about phonemic markers and multiple levels of mapping to phonology to make the processing of words more analytic and strategic (Nag, 2017). Furthermore, Nag (2017) hypothesizes that increasing akshara knowledge may increase akshara-based syllabification. For effective decoding in the akshara languages, the 'alphasyllabic principle' of the writing system (rules for aksharas, *mathras* and *samyuktaksharas*) must be mastered (Nag & Snowling, 2012). Alphasyllabic competence may start with breaking the akshara code, but complex akshara decoding results in the greatest gains in RAN, which highlights the importance of building akshara knowledge systematically while considering orthographic knowledge of akshara acquisition (Nag, 2014). In addition, linguistic knowledge about syllabification, etymology,, and morphology seems to provide insights into mastering these complex akshara orthographies.

Oral language plays a crucial role in word identification in aksharas, beyond just phonological acquisition, with strong associations with phrase repetition and word identification. Using lexical repertoire to gain complex akshara knowledge facilitates processing (Nag, 2017). Spelling in akshara languages confirms that the more complex visual features and multiple phonemic markers are more difficult to acquire than shorter aksharas that only have an inherent vowel (/Ma/, /Pi/). In addition, phonologically close neighbors are prone to spelling as in reading (Nag, Treiman & Snowling, 2010). Another complexity of akshara languages is the occurrence of dialects of languages involving phonological and morpho-phonological alterations, which may translate to writing and spelling differences. With regard to reading comprehension, the findings mirror alphabetic languages, with reading accuracy, phonological processing, knowledge of vocabulary, and inflectional morphology positively correlated with reading comprehension (Nag & Snowling, 2012).

Nag (2017) outlines several implications for instruction based on the analysis of current research in akshara acquisition:



- 1) The explicit instruction of a synthetic phonics scheme, with attention to similarities and variations in the visual, auditory,, and oral production, with explicit attention to phonemic markers.
- 2) The sequence for teaching the aksharas needs to be re-examined, with high frequency akshara, particularly those akshara that help construct words that are common in early vocabulary, being taught first.
- 3) The explicit instruction of parts of an akshara helps in abstracting the combining rules and thereby in decoding and printing the akshara.
- 4) The separation of symbol sets (/V/, /Ca/, /CV/ and /CVV/) is artificial, requiring the teaching of some common complex akshara that occur in phonological patterns of the spoken language and are familiar to younger grade readers (ex. /mma/ as in /amma / (mother).
- 5) A robust oral language program must accompany akshara practice, even when the language of instruction is the child's native/home language.
- 6) Considering the sheer number and complexity of aksharas, repeated reading of the same book severely limits opportunities for implicit akshara learning.
- 7) Introduce children of all ages to variety and complexity in narratives, both spoken and written language.

However, these recommendations for akshara literacy have yet to seep into the curriculum and teacher education. Several agencies, including both governmental and non-profit organizations, are involved in literacy initiatives at local, state, and national levels, with initiatives in curriculum development and creating materials and tools for literacy assessment and instruction. More importantly, the multilingual and socio-cultural diversity in the second most populous country in the world requires a collaborative synchronized approach toward achieving literacy for all. Teachers at the foundational stage of literacy can be empowered to move the dream of literacy for all into reality by unifying teacher education in the country with guided outcome-based standards for literacy instruction. Several researchers have recommended reform in teacher education programs addressing literacy (Nakamura & de Hoop, 2014; Menon et al., 2017, Nag, 2017), with strengthening the early literacy component in training programs designed for preschool and early grade teachers. The considerations required for such effective teacher education are therefore the focus of this conceptual research.

### *Theoretical and Conceptual Foundations*

Literacy instruction in the alphabet system is based on the five core reading skills identified by the National Reading Panel (2000) – phonemic awareness, phonics, fluency, vocabulary, and comprehension, which are essential foundational requirements for literacy proficiency. The National Curriculum Framework for foundational stage (NCF, 2022) in India and the UNICEF Guidelines for Design and Implementation of Early Learning Programmes (UNICEF, 2019) underscore the importance of these five domains of reading skills for literacy instruction at the foundational stage. These core areas of reading are combined with decades of accumulated knowledge on the process of reading acquisition to inform the Science of Reading (SOR), which has been validated over the past several years of research in interdisciplinary areas including neuroscience, psychology, and education. SOR can be applied to students who are linguistically diverse and speak/read English as a

second language, with attention to oral language development (Goldenberg, 2020). In studying language variations across languages and writing systems, Kim, Boyle, Zuilkowski, and Nakamura (2016) suggest explicit instruction depending on the features of the language and orthographic symbol for print awareness, teaching orthographic symbol knowledge, manipulating phonological units, and recognizing morphemes in oral and written languages. Using the SOR framework covering the five core reading components and evidence-based reading instruction in alphabetic languages as the theoretical basis, this conceptual research examined them in the context of alphasyllabic, akshara-based languages. The principles of literacy instruction from research in akshara-based languages that were analyzed and evaluated by researchers (e. g. Nag, 2011; Nag & Snowling, 2012; Nag, 2017) also inform the theoretical base for this study.

The varied components of word recognition and language comprehension in alphabet-based literacy acquisition are visually depicted as strands by Scarborough (2001) as a reading rope to show how they are strategically developed and integrated into skilled reading. Figure 1 shows the application of the reading rope to akshara-based languages based on the studies on akshara language acquisition.

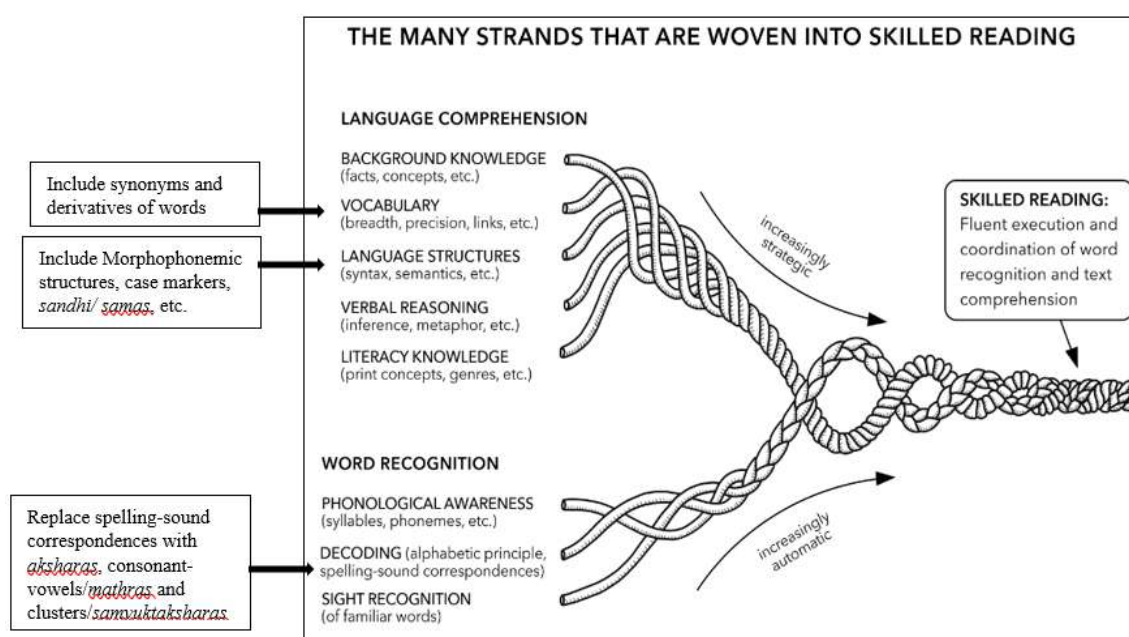


Figure 1. Reading rope by Scarborough (2001) adapted to akshara-based languages. (Printed with written permission from the author and Guilford Press).

While the reading rope informs the components of reading to target for instruction, the key to improving literacy skills lies in empowering teachers with the language and pedagogy related to teaching literacy skills in oral language, reading, and writing. Therefore, using the components in the reading rope for alphasyllabic languages as the base, the best practices for teacher education in literacy (e. g. Joshi, Binks, Hougen, Dahlgren, Ocker-Dean & Smith, 2009; Spear-Swerling, 2007; Kosnik & Beck, 2008; Kilpatrick, 2015) were analysed to study the intersection between the components of reading instruction and teacher education requirements. Teacher standards developed by two leading associations in literacy- the International Literacy Association (ILA) (2017) and the International Dyslexia

Association (IDA) (2018), guided the development of standards for teacher education in akshara languages in this study. These include foundational knowledge of language components such as phonology, morphology, semantics, syntax, and pragmatics, relationships between the components, knowledge about variations in language structure, and rules that govern written script of languages. Teachers of literacy must also be familiar with how to assess students' reading skills in each of these component areas and how to use assessment to inform literacy instruction. In addition, teachers must be familiar with explicit and structured reading instruction for all students who do not learn language in the conventional incidental format (International Literacy Association, 2017; International Dyslexia Association, 2018). These recommended standards and practices for teachers were analyzed in the context of linguistic and research foundations underlying the acquisition of alphasyllabic languages to inform this conceptual research outlining considerations for teacher education.

### *Considerations for Teacher Education for Literacy in the Akshara languages*

While most teacher education programs in India address teaching reading, what needs clarification are the knowledge and skills in literacy instruction that every teacher at the foundational stage of schooling needs to be equipped with. National level policies such as NIPUN (Ministry of Education, 2021) and NCF (2022) and researchers (Nakamura & de Hoop, 2014; Menon et al., 2017) have reiterated the importance of reading instruction in the foundational stage to be guided by research-based practices. To realize this goal, teacher education should incorporate standards to guide training and address the varied components of literacy instruction. A clear set of standards for each of the areas that every literacy teacher needs to master and implement that could be applicable both to English and akshara-based languages is foremost.

Teaching literacy to school-age students involves considering multilingual communities and their language abilities in local languages and English, since English is also one of the languages taught in Indian schools. Teacher education in India can accelerate progress by imbibing and adapting research-based materials and applying them to akshara-based and multi-linguistic socio-cultural contexts. Drawing from the wisdom of decades of progression in reading and teaching of reading research in alphabet-based languages, India can leap into successful practices and accelerate growth in reading instruction. In addition, the vast cultural assets, human resources, infrastructure, and socio-cultural assets will help India make the transformation to teacher education, leading to achieving the goals of NIPUN. The standards for teachers of literacy presented here will address a means to achieve these goals for foundational literacy.

The following questions were targeted in this study, to draw considerations for teacher education in literacy:

- 1) Can standards be established in teacher education for Akshara-based languages that address all the scientific components of reading instruction while considering akshara language acquisition and other akshara-based literacy research?
- 2) How can these standards be used to inform the coursework in teacher education in literacy?

- 3) How can these standards be used to assess outcomes and facilitate data-based decision making in teacher education in literacy?

### *Standards for Teachers of Literacy (SToL)*

To address the first question, four essential teacher preparation standards that all teachers of literacy in the foundational stage of literacy development should know and practice are proposed. These reflect the International Dyslexia Association (IDA, 2018) and International Literacy Association (ILA, 2017) standards:

- Standard 1: Foundations of Language and Literacy Acquisition
- Standard 2: Assessment of Literacy
- Standard 3: Structured Literacy Instruction
- Standard 4: Professional Dispositions and Ethical Practices.

Each standard is subdivided into several benchmarks that outline the component areas under each overarching standard. These four key areas are used as a foundation to create and adapt the benchmarks under each standard to suit akshara-based literacy education. These Standards for Teachers of Literacy (SToL) serve as a broad outline of what teachers who teach 3-8 year-old students in the foundational stage of learning should *know* and *demonstrate* to teach literacy effectively. These standards are deliberately broad to facilitate simplicity and ease of transfer to varied contexts. The *Discussion* section provides additional details for benchmarks under each standard, which would need clarification and examples. Tables 1 through 4 outline these four standards and the corresponding benchmarks under each standard.

**Table 1**

*SToL Standard 1 and Benchmarks - Foundations of Language and Literacy Acquisition*

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<b>Standard 1: Foundations of Language and Literacy Acquisition</b>
<b>Benchmarks:</b>
1.1 Explain the 5 language domains: Phonology, morphology, syntax, semantics, and pragmatics
1.2 Determine how the 5 language domains affect reading and writing outcomes.
1.3 Understand that phonemes differ among languages and know the difference in sounds in English and the local Indian language being taught, in contrast to the native/home language.
1.4 Understand the differences in morphology, syntax, semantics,, and pragmatics of the language in context (Ex. English, Hindi, other languages)
1.5 Understand that explicit instruction in reading and writing requires attention to the variation between spoken and read/written forms and dialectal differences in home and school languages.
1.6 Understand the relationships among phonemic awareness, rules and exceptions for

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consonant vowels (CV) *mathra* and clusters or combined letters (CCV) *samyuktakshara*, decoding, word recognition, spelling, and vocabulary knowledge.

1.7 Understand that features in the language script that vary with each Indian language may cause reading difficulties.

1.8 Understand that vocabulary must be developed during the stage of word and *akshara* level identification through read-alouds and classroom conversations.

1.9 Focus on language comprehension (including listening comprehension) at all levels of readers.

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**Table 2**

*SToL Standard 2 and Benchmarks – Assessment of Literacy*

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**Standard 2: Assessment of Literacy**

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**Benchmarks:**

2.1 Know about different types of assessments in literacy and their use

2.2 Understand the basic principles of test construction and formats (e.g., reliability, validity, criterion, normed) for all assessments in Indian languages.

2.3 Understand how to interpret the NAS and other assessments survey results of literacy.

2.4 Understand how to create curriculum-based assessments for each language domain, administer them, and summarize how to use the results to monitor progress.

2.5 Create informal diagnostic surveys of phonological and phonemic awareness, decoding skills, oral reading fluency, comprehension, spelling, and writing.

2.6 Teachers should use psychological test results and reports to determine the implications for the classroom instruction. Teachers should use test results for instructional decisions and communicate the results and progress regularly to all involved (other teachers and parents).

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**Table 3**

*SToL Standard 3 and Benchmarks – Structured Literacy Instruction*

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**Standard 3: Structured Literacy Instruction**

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**Benchmarks:**

3.1 Use a systematic and explicit approach to literacy instruction to suit students' linguistic and sociocultural backgrounds.

3.2 Understand the progression of phoneme and *akshara* (including *mathras* and *samyuktaksharas*) development and logically sequence them according to ease of sounding, frequency of occurrence, and difficulty levels.

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3.3 Know and apply the rules for *mathras* and *samyuktaksharas* during word reading and writing

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**Table 4**

*SToL Standard 4 and Benchmarks – Professional Dispositions and Ethical Practices*

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**Standard 4: Professional Dispositions and Ethical Practices**

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**Benchmarks:**

- 4.1 Perform the role in the best interest of every student toward acquiring literacy.
  - 4.2 Provide literacy instruction using the following approaches that have research evidence
  - 4.3 Promote literacy development among children from socio-cultural deprivation as a priority by considering the uniqueness of all learners as assets.
  - 4.4 Use learner difference or deviation as a resource to nurture literacy skills
  - 4.5 Take responsibility for developing literacy among everyone, irrespective of the origin of birth and background
  - 4.6 Strive to engage learners of diverse backgrounds with the same enthusiasm, without bias, in activities to nurture literacy skills
  - 4.7 Respect the cultural and social status of a child and preserve the same while planning literacy instruction and performing activities to promote literacy
- 

## DISCUSSION

The foundational pillars of the quality of education lies in the adequacy of teacher training. It is apparent that the solution to raising literacy lies in improving the quality of teacher education. The dearth of research in the area of teacher education for akshara-based languages warrants attention, based on careful research on the nuances of language and research in acquisition of literacy. The conceptual framework of teacher education practices for literacy presented in this article provides innovative ways to utilize literacy acquisition research while carefully analyzing the nuances and research in akshara-based language studies. While the teacher education standards presented apply to almost all akshara-based transparent orthographies, the following section provides additional details of skills under each standards to facilitate identification of course content for teacher education and elucidate implementation. This section also includes examples to guide teachers in applying the standards to linguistic variants and dialects across diverse populations. The discussion section concludes with a proposed framework for teacher education coursework and using the standards for developing evaluation methods of teacher preparation, to complete the data-based decision-making process.

### Standard 1: Foundations of Language and Literacy Acquisition

In this foundational standard 1 of SToL, benchmark 1.5 *Understand that explicit instruction in reading and writing requires attention to variation between spoken and read/written forms and dialectal differences in home and school languages*, can be achieved by considering literacy experiences varied by social/cultural factors and differences in home and school dialects and languages. For example, the western part of Odisha speaks the same state language- Odiya, but uses a different dialect. Similarly, Kannada, the language of Karnataka, has several dialects in different regions of the state. These dialectal variations occur worldwide in most languages, even alphabetic ones. In addition, cultural differences that occur within regions and states, such as differences in traditions, habits, and experiences; should be factored into vocabulary and usage instruction.

Similarly, for benchmark 1.6, to facilitate *Understanding of the relationships among phonemic awareness, rules and exceptions for consonant-vowel (CV) mathras and clusters or combined letters (CCV) samyuktaksharas, decoding, word recognition, spelling, and vocabulary knowledge*, coursework that includes the following relationships, rules, and exceptions can be included in teacher education:

- Articulate relationships in aksharas, consonant-vowel (CV)(*mathras*) and clusters (CCV) (*samyuktaksharas*), specific to language(s) of instruction. Teachers should also be able to identify differences in phonemes in home and school languages and dialects. For example, Kodava, a language spoken in the state of Karnataka in India, does not use the sound /sh/, which is common in Kannada, the official state language of Karnataka. When teachers understand these language and dialectal phonemic differences, they can relate to students' challenges and identify interventions.
- Attention to rules underlying clusters (*samyuktaksharas*) pronunciation/reading and sequence of sounding out written letter clusters. For example, the visual arrangement of akshara clusters (*samyuktaksharas*) generally correlates with the auditory sequence of phonemes. Similarly, the *mathras* are one symbol for one sound in most languages, except for the long vowel sound 'kee' and 'koo' in Kannada, which have two symbols.
- Teachers should know the rules for clusters (*samyuktaksharas*) and the exceptions to these rules. Most aksharas retain the visual features as in the /C/ when they occur in clusters /Cc/ or /CcV/ or /CvC/. However, those that visually differ from the letters they represent should be explicitly addressed, drawing attention to the visual differences.

For benchmark- 1.7 *Understand that reading difficulties can also be caused by features in language script that vary with each Indian language*. Examples include samyuktakshara sequence changes from language to language and within language. These difficulties may also be complicated by visual-spatial processing difficulties related to similarity in *mathras*, for example, in Hindi 'pi' and 'pī'; 'pu' and 'pṛ' and aksharas. See *Figure 2* for a sample of these visual differences. Specific attention should be paid to teachers' knowledge of the following akshara-based nuances

- Understand the developmental progression of *mathras* (Does introducing them together cause confusion to the student(s)? Will student(s) learn better when introduced separately for all letters? Does using letter charts to show the similarity in vertical columns between the *mathras* and the letters help make explicit the relationships and similarities?).
- Similarly, with *samyuktaksharas*, the sequence to teach should be developed based on visual similarities, simple to complex (same *samyuktakshara* as the letter to different *samyuktakshara*/letter combinations), frequency of occurrence and use, etc.

Primary vowels	Short		Long		Diphthongs	
	Initial	Diacritic	Initial	Diacritic	Initial	Diacritic
	Unrounded low central	अ a	प pa	आ ā	पा pā	
Unrounded high front	इ i	पि pi	ई ī	पी pī		
Rounded high back	उ u	पु pu	ऊ ū	पू pū		
Syllabic variants	ऋ ṛ	पृ pṛ	ॠ ṝ	पृ̄ pṝ		
	ऌ ḷ	प्ल pl̄	ॡ ḹ	प्ल̄ pl̄̄		
Secondary vowels						
Unrounded front			ए e	पे pe	ऐ ai	पै pai
Rounded back			ओ o	पो po	औ au	पौ pau

Figure 2. Sample vowel-consonant combinations in Hindi aksharas highlighting visual features  
(Source: <https://omniglot.com/writing/devanagari.htm>)

In targeting the benchmark, 1.9 - *Focus on language comprehension (including listening comprehension) at all levels of readers*, opportunities for children to listen to narration by others in school language (which may be different from home) on topics that are culturally relevant and of common interest must be considered. This would help develop listening comprehension skills and gain pre-reading skills such as phonological awareness, phonics, familiarity with complex aksharas, and making visual-auditory connections. Repeated exposure to print materials and oral narratives also helps in vocabulary development.

### Standard 2: Assessment of Literacy

The second standard of SToL discusses knowledge and practice in relation to the assessment procedures, including all literacy assessments. The benchmark, 2.1 *Know about different types of assessments in literacy and their use* includes screening assessments that identify students at risk for falling behind in reading and those with reading difficulties and to address subskills such as - Akshara, *mathras* and *samyuktakshara* naming, phoneme



isolation and identification, segmentation, blending, and/or manipulation, phonics correspondences (sound-symbol relationships), spelling and phonetic accuracy of spelling attempts, word reading, real and/or nonsense words, oral reading fluency (timed reading of short passages), and reading comprehension. Similarly, the other types of assessments - diagnostic and progress monitoring assessments determine domains of language strengths and needs. (See *Conclusion and Limitations* section for information on assessment requirements).

Benchmark 2.5 *Create informal diagnostic surveys of phonological and phonemic awareness, decoding skills, oral reading fluency, comprehension, spelling, and writing*, can be achieved by having the following assessment knowledge and practice fostered in teachers for pinpointing students' strengths, weaknesses, and instructional needs in the component literacy areas:

- Phonological sensitivity (manipulate sounds, understanding rhymes, etc.)
- Phonemic awareness (sounds that letters/aksharas represent)
- Accuracy and fluency of akshara naming/distinguishing similar aksharas, *mathras*, and *samyuktakshara* naming, and distinguishing
- Using aksharas, *mathras*, and *samyuktakshara* for word reading and spelling/writing
- Reading an oral passage with fluency and comprehension
- Silent reading of passages with comprehension and recall
- Listening comprehension and recall
- Morpheme recognition
- Automatic recognition of commonly used words (high-frequency)
- Writing performance (punctuation, the order of aksharas and *samyuktakshara*, syntax, organization, content, spelling, vocabulary)

### **Standard 3: Structured Literacy Instruction**

SToL Standard 3 targets a systematic approach to teaching literacy. Under this standard, to achieve benchmark 3.1 *Use a systematic and explicit approach to literacy instruction to suit students' linguistic and sociocultural backgrounds*. Teaching should include procedures such as the following:

- Introduce simple picture story books that can build vocabulary and listening comprehension (before the students learn to read). These books, when also read aloud by adults, can introduce complex forms and reinforce aksharas, *mathras* and *samyuktaksharas*. Other decodable books that introduce aksharas in progression, such as books that use certain aksharas, *mathras* and *samyuktaksharas*, can be used for decoding and fluency. While teaching decoding,
  - Use decodable books that align with the progression of aksharas, *mathras* and *samyuktaksharas* (gradually increasing in complexity and building on the previous concepts) and progress to a complex text as the student internalizes the aksharas and builds fluency.
  - Differentiate instruction based on the acquisition of students into akshara, *mathra* and *samyuktakshara* levels.
  - Become sensitive to and aware of text complexity (Are varied *mathras* introduced randomly and not in the sequence of acquisition? Are complex

*samyuktaksharas* introduced before students can master the *mathras*?). Are structured literacy materials used? Are practices structured on the basis of the science of reading?

- Become aware of the cultural and social relevance of reading materials and vocabulary.
- Use multiple modalities (audio, visual, kinesthetic) to facilitate familiarity with the visual and auditory features of aksharas. In addition to multimodalities, sociocultural factors such as pairing vocabulary with culturally familiar terms and in their first/home language are imperative.
- Be sensitive to differences in vocabulary, representing food, objects, and fruits that are familiar to students (ex. Vegetables of the region, cuisine, dress habits, and art forms).

For benchmark 3.2 *Understand the progression of phoneme and akshara (including mathra and samyuktakshara) development and logically sequence them according to ease of sounding, frequency of occurrence, and levels of difficulty. Teacher education coursework should include pedagogy and research on literacy instruction that applies to alphabet- and akshara-based languages and should know and practice the following:*

- Teach decoding and writing using simple aksharas before teaching *mathras* and *samyuktaksharas* to build on the simple vowels /V/ and consonants /C/ akshara foundational knowledge. Note that complex forms (*mathras* and *samyuktaksharas*) can be introduced orally and referred to in written text to familiarize the reader with the visual sequence and complexity and facilitate acquisition.
- Introduce the progression of aksharas, *mathras*, and *samyuktaksharas* from simple to complex with reference to familiarity of meaning, frequency of occurrence in local cultural context, auditory and visual features, and order of acquisition. Some complex forms may be more frequent in occurrence and use than simple forms.
- Use charts and visuals to explicitly show the visual similarities and contrasts between aksharas.
- Work collaboratively with speech/language pathologists and audiologists to identify the progression of teaching phonemes in varied languages with specific attention to the nature of difficulty and the gradual increase in complexity
- Distinguish between sounds such as /l/ and /L/ and /s/, and /sh/. The phonology of specific language and similarities/differences must be clarified.
- Explicit instruction in phonemes that do not occur in the home language, with attention to distinguishing features and how to pronounce (ex. where the tongue should be positioned, etc.)
- Provide practice distinguishing the new phoneme from similarly articulated phonemes (e.g., for children who speak Tamil, the state language in Tamil Nadu, classifying spoken words in Kannada as starting with /sh/ or with /s/).
- Deliberately choose wide (e.g., /m/, /z/) or narrow (e.g., /m/, /n/) phoneme contrasts during instruction, depending on the students' phase of phonemic awareness development.
- Attention to distinguishing features of script occurrence with pronunciation (ex. Order of written aksharas/*samyuktaksharas* versus the order of pronunciation)

should be explicitly taught so that it translates to writing fluency.

- Attention to the sequence of phoneme acquisition in Indian languages (listening and production).
- Identify word lists in Indian languages that have rhyming words according to the number of syllables/aksharas. Choose wide contrasts for the beginning rhyme tasks
- Isolate individual sounds in *mathras* and in *samyuktaksharas*.
- Use phonological awareness activities involving *mathras* and *samyuktaksharas*.
- Use various activities for each level of aksharas, *mathras* and *samyuktaksharas* awareness.
- Align phonological awareness, akshara, *mathra*, and *samyuktakshara* instruction with reading and spelling goals.
- While instructing on reading, spelling, and vocabulary, use akshara awareness, *mathra* and *samyuktakshara* instruction
- Use tactile and kinesthetic aids, such as blocks, chips, sound boxes, body mapping, finger tapping, and left-to-right hand motions, in learning a variety of early, basic, and more advanced phonological awareness activities

For benchmark, 3.3 *Know and apply the rules for mathra and samyuktakshara during word reading and writing*, the following components should be addressed in teacher education:

- Know and let students know that once students master the rules underlying *mathras* and *samyuktakshara*, reading becomes easier.
- Cumulatively build on the *mathra* and *samyuktakshara* knowledge, progressing from simple to complex, while introducing complex forms to build familiarity.
- Correct student errors in word reading and writing by providing the rules that govern *mathra* and *samyuktakshara* pronunciations. Point to the structure of *mathras* and *samyuktaksharas*; indicating the order of the pronunciation of *samyuktaksharas*.
- Teach word roots and commonalities among languages. Ex. 'Jal' in Hindi/'jala' in Kannada
- Teach words that have the same meaning. For example, *adavi*, *kaadu*, and *vana* all refer to the word 'forest' in Kannada; *jal*, *paani*, and *neer* all mean 'water' in Hindi. Teach usage norms that are context specific and govern the use of words.
- Explicitly teach students how to identify the root word, case markers, PNG (Person, Noun, Gender) markers, and affixes. Teach affixes and how they vary (ex. In Hindi, by using 'laa' as a prefix to the word 'waris', it becomes the opposite of 'laawaris', while prefixing 'be' to *sharam*, the word 'besahram' is the opposite of 'sharam'). Teach rules (if any) for making opposites/antonyms in relation to the language (and how they differ from their first language, whenever possible).
- Compound words (*Sandhi* and *samas*) must be explicitly taught, with rules underlying the combination.
- Affixes that change words (ex. Plurals, and possessives) need to be taught explicitly. Many variations exist between and within Indian languages. (Ex- the suffix 'galu' makes the plural form of some words as in 'bandhugalu' or 'ru' as in 'janaru' in Kannada. There are many such suffixes that make plural forms of

words in Kannada, while it changes for other languages)

#### **Standard 4: Professional Dispositions and Ethical Practices**

Certain ethical beliefs and professional dispositions essential for teachers are the focus of SToL Standard 4. Under this standard, for benchmarks 4.3 and 4.4, beliefs such as the child's lack of potential or background as a hindrance for acquiring literacy skills should be replaced with a philosophy of belief in their potential to learn and requiring novel means of teaching literacy. Teachers of literacy should try varied approaches to literacy instruction to take on the responsibility of achieving foundational literacy in all.

#### **Using Standards to focus on Coursework in Teacher Education**

The SToL can provide a systematic approach to teacher education by focusing on teacher preparation knowledge and skills to achieve foundational literacy goals. Teacher education programs can evaluate their courses against these literacy standards to ensure that they are addressing each of them at varied stages of teacher preparation within their programs. A sample table that could be used for this purpose is provided for a few of the benchmarks under Standard 1 as an overview of such a cross-walk between the standards and the coursework (see Table 5). This alignment would help determine the scope and sequence of courses and corresponding assessments within courses that would target the specific standard under SToL and the benchmark.

**Table 5**

*Cross-walk between coursework and benchmarks within standards identifying coverage and proficiency levels.*

<b>SToL Standard and Benchmark</b>	<b>Core Courses</b> <i>(Include course name and where this competency is assessed below)</i>	<b>Enhancing Professional Competencies</b> <i>(Include course name and where this competency is assessed below)</i>	<b>Curriculum and Pedagogy Courses</b> <i>(Include course name and where this competency is assessed below)</i>	<b>Field Engagement</b> <i>(Include course name and where this competency is assessed below)</i>
Standard 1	X*		X	
Benchmark 1.1	[Course name & corresponding assessment name]  [I/D/M]**		[Course name & corresponding assessment name]  [I/D/M]	
Standard 1		X		
Benchmark 1.2		[Course name & corresponding		

	assessment name]
	[I/D/M]
Standard 1	X
Benchmark 1.3	[Course name & corresponding assessment name]  [I/D/M]

\*X determines whether the benchmark is addressed in the course

\*\*I/D/M designates if the benchmark is introduced (I), developed (D), or mastered (M)

### *Using Standards to focus on Outcomes Assessment and Data-Based Decision Making*

SToL standards can also be used to evaluate teacher education quality. One measure is to adopt the designation of coursework and assessment that moves the student teacher from a beginning level where the knowledge and/or skill is introduced (I), developed (D), or mastered (M). This designation by the assessments in Table 5 will help identify course-level progression in literacy knowledge and skills. The goal is to have the student teacher involved in at least one course assessment that involves evaluating mastery (M) of content. Using such data will help inform course-level changes guided by SToL benchmarks.

Another assessment that could be built using the standards are checklists based on the SToL benchmarks that could be used as an evaluation tool for student teachers during their internships or field experiences. An example is given in Table 6 for SToL Standard 3. The appendix provides a checklist for all the standards and benchmarks of SToL, which could be used to assess the quality of teacher training and the quality of teachers. Proficiency level indicates the ability to demonstrate the benchmarks during teaching and may be assessed during student teaching or other such opportunities. Data gathered at this level would indicate where teacher education programs have attained proficiency and where to target resources and additional training.

**Table 6**

*SToL checklist for Standard 3 and benchmarks indicating proficiency levels*

<b>Standard 3: Structured Literacy Instruction</b>	<b>Level of Proficiency</b>
3.1 Use a systematic and explicit approach to literacy instruction to suit students' linguistic and sociocultural backgrounds.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
3.2 Understand the progression of phoneme and akshara (including <i>mathras</i> and <i>samyuktaksharas</i> ) development and logically sequence them according to	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging

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ease of sounding, frequency of occurrence, and difficulty levels.  Not proficient

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3.3 Know and apply the rules for *mathras* and *samyuktaksharas* during word reading and writing  Proficient  
 Emerging  
 Not proficient

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## CONCLUSIONS AND LIMITATIONS

A systematic approach for building a strong foundation for literacy is required at the teacher education stage for akshara-based languages. The state report on Foundational Literacy and Numeracy (FLN) draws attention to inadequate research on foundational literacy skills, especially on the quality assessment of component reading skills and application in multilingual classrooms (Kapoor et al., 2021). Several key considerations for training teachers for instruction in literacy emerged in this study. First and foremost, the SToL, standards for teacher education that targets knowledge and skills in literacy acquisition, is based on akshara-based research and literacy acquisition. These standards addressing foundational knowledge, skills, pedagogy of literacy instruction, and professional dispositions can be used to assess teacher education quality and inform changes to teacher education in literacy. This approach will provide a systematic data-based decision-making opportunity for teacher education and will create opportunities to establish uniformity in teacher education endeavors across the multi-linguistic states of India and other akshara-based countries. The considerations proposed in this article, for assessing teachers' knowledge and practical skills in teaching literacy, will help move the needle toward achieving the literacy goal outlined in several national (Ministry of Education, 2021) and international efforts (UNICEF, 2019).

However, a few considerations limit this study. The standards may not encompass all the nuances of the diverse languages in India and represent the major languages as understood by the authors' research and other available literature and research in akshara-based languages. Dialects and languages may vary from those represented in the SToL standards and need to be factored in. In addition, to achieve the standards in assessment and pedagogy in the proposed teacher education standards, there is a dearth of research in akshara-based languages in several areas such as in

- Developing and culturally validating assessments in akshara-based languages for all reading foundational components. Organizations such as FABLE (Misquitta & Ghosh, 2021) are involved in some promising work in this field.
- Developing interventions based on the sequence of akshara acquisition
- Establishing research evidence for interventions in reading in all foundational components.
- Creating books for readingaloud and reading that are decodable, and developmentally and culturally appropriate.

The goal of literacy for all in India can be achieved with a collaborative approach that requires consolidation of several efforts by different sectors, public and non-profit organizations. This article serves to provide a starting point for teacher education in literacy in akshara-based languages and calls for using this systematic approach to empower

teachers with the knowledge and skills required to bring the much-needed boost in literacy rates.

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## Appendix

### Evaluation Tool for Teachers of Literacy

Standards and Benchmarks for Teachers of Literacy (SToL)	Level of Proficiency
<b>STANDARD 1: Foundations of Language and Literacy Acquisition</b>	
1.1 Explain the 5 language domains: Phonology, morphology, syntax, semantics and pragmatics	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
1.2 Determine how the 5 language domains affect reading and writing outcomes.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
1.3 Understand that phonemes differ among languages and know the difference of sounds in English and the local Indian language being taught, with contrast from native/home language.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
1.4 Understand the differences in morphology, syntax, semantics and pragmatics of the language in context (Ex. English, Hindi, other languages)	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
1.5 Understand that explicit instruction in reading and writing requires attention to variation between spoken and read/written form and dialectal differences in home and school languages.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
1.6 Understand the relationships among phonemic awareness, rules and exceptions for consonant vowels (CV) <i>mathra</i> and clusters or combined letters (CCV) <i>samyuktakshara</i> , decoding, word recognition, spelling, and vocabulary knowledge.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
1.7 Understand that reading difficulties can also be caused by features in language script that vary with each Indian language.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient

1.8 Understand that vocabulary must be developed during the stage of word and <i>akshara</i> level identification through read-alouds and classroom conversations.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
1.9 Focus on language comprehension (including listening comprehension) at all levels of readers.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
<b>STANDARD 2: Assessment of Literacy</b>	
2.1 Know about different types of assessments in literacy and their use	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
2.2 Understand basic principles of test construction and formats (e.g., reliability, validity, criterion, normed) for all assessments in Indian languages.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
2.3 Understand how to interpret NAS and other assessment survey results pertaining to literacy.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
2.4 Understand how to create curriculum-based assessments for each domain of language, administer them and summarize how to use the results for monitoring progress.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
2.5 Create informal diagnostic surveys of phonological and phonemic awareness, decoding skills, oral reading fluency, comprehension, spelling, and writing.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
2.6 Teachers should use psychological test results and reports to determine implications for classroom instruction. Teachers should use test results for instructional decisions and communicate the results and progress regularly to all involved (other teachers and parents).	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
<b>Standard 3: Structured Literacy Instruction</b>	
3.1 Use a systematic and explicit approach to literacy instruction to suit student's linguistic and sociocultural backgrounds.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
3.2 Understand the progression of phoneme and <i>akshara</i> (including <i>mathras</i> and <i>samyuktaksharas</i> ) development and logically sequence them according to ease of sounding, frequency of occurrence and levels of difficulty.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient

3.3 Know and apply the rules for <i>mathras</i> and <i>samyuktaksharas</i> during word reading and writing	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
<b>Standard 4: Professional Dispositions and Ethical Practices</b>	
4.1 Perform the role in the best interest of every student towards acquiring literacy.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
4.2 Provide literacy instruction by following approaches that have research evidence	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
4.3 Promote literacy development among children from socio-cultural deprivation as a priority by considering the uniqueness of all learners as assets.	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
4.4 Use learner difference or deviation as a resource to be nurtured towards building literacy skills	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
4.5 Take responsibility to develop literacy among everyone irrespective of the origin of birth and background	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
4.6 Strive to engage learners with diversities with same enthusiasm, without bias, in activities to nurture literacy skills	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient
4.7 Respect the cultural and social status of a child and preserve the same while planning literacy instruction and performing activities to promote literacy	<input type="checkbox"/> Proficient <input type="checkbox"/> Emerging <input type="checkbox"/> Not proficient

### Biographical notes:

**Srimani Chakravarthi:** Srimani Chakravarthi conducted research in Kannada, a South Indian language, with a focus on oral language acquisition in an Indian language and remediation. She has over 20 years of experience in teaching children with LD, ADHD and as a teacher educator.

**Gowamma Ittira Poovaiah:** Gowamma Ittira Poovaiah has several years of experience with students with exceptional needs and teacher education. She was a Fulbright Fellow,

studying socio-cultural practices in early childhood and their impact on reading skills at Florida State University.

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# Effect of Teaching Mathematics Supported by Problem-posing Strategies on Problem-posing Skills

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## Abstract:

*This study investigates the effects of teaching mathematics supported by problem-posing strategies on fourth-grade students' problem-posing skills. This study also seeks to determine students' views about the process. To this end, the study employed an explanatory sequential design, a mixed method that incorporates collecting quantitative and qualitative data. The study group consisted of fourth-grade students studying in two different classrooms of a public school in the west of Türkiye in the 2021–2022 academic year. Data were collected through a "Problem-Posing Skills Test" and a "Semi-Structured Interview Form." The research concludes that teaching mathematics supported by problem-posing strategies improves students' problem-posing skills. In addition, this method was more effective than the one used in the control group in developing students' structured, semi-structured, and free problem-posing skills. At the end of the interviews, it was determined that teaching mathematics supported by problem-posing strategies was an innovative, student-centered, and emotionally stimulating technique. It was also found that the students had more difficulty in the semi-structured and free problem-posing tasks.*


## Keywords:

Problem-posing strategies, problem-posing skills, student views, primary school, mixed methods

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## INTRODUCTION

Achieving mathematical competence depends on the systematic and logical presentation of several complex processes (Turkish Ministry of National Education [MoNE], 2018). Therefore, designing effective mathematical activities and teaching effective mathematics are as important as content. Effectively conveying mathematical activities requires designing learning environments equipped with various features (Cobb vd., 1992; Erdem & Soylu, 2019).

Today's curriculum emphasizes the need to conduct lessons with methods that present every subject effectively and permanently (MoNE, 2018; National Council of Teachers of Mathematics [NCTM], 2000). Studies show that permanent learning is more easily achieved in learning environments where students play an active role and have fun (Güneş et al., 2011; Karasu Avcı & Ketenoğlu Kayabaşı, 2019). In this context, important studies have been conducted recently using different methods (Erdem & Soylu, 2019; Güneş vd., 2011; Şengül & Dereli, 2013), such as digital content applications (Nuha et al., 2018; Özgen et al., 2019; Papadakis et al., 2021), game-supported studies (Başün & Doğan, 2020; Bilgin, 2021; Çilingir Altınır, 2018), and interdisciplinary approaches (Akben, 2018; 2019; Macun, 2019). These studies show that lessons conducted using different methods that address students' cognitive and affective domains are essential for developing students' mathematical skills.

Problem-posing is a unique mathematical activity that helps improve cognitive and affective competencies (Cai & Leikin, 2020). Problem-posing is defined as reformulating a given problem or producing new problems or questions (English, 1997; Silver, 1994) and is considered an important intellectual activity that constitutes an integral part of school mathematics and a balanced mathematics curriculum (Hansen & Hana, 2015).

In traditional teaching settings, students solve problems given in textbooks using methods introduced by teachers. Students are rarely asked to pose problems and solve them (Korkmaz & Gür, 2006). However, the problem-posing skill, which is at the center of curricula implemented in many countries such as the USA, Australia, China, and Türkiye, is seen as an important mathematical skill that students should develop (Australian Education Council [AEC], 1991; Ministry of Education of the People's Republic of China [MoE], 2011; MoNE, 2018; NCTM, 2000). In addition, researchers stated that students' success in problem-solving was related to their problem-posing abilities, and they used problem-posing as a measure of such learning outcomes (Cai & Hwang, 2020; Cai et al., 2013; Silver & Cai, 1996).

Problem-posing becomes a learning activity when students pose problems according to their own interests, whereas it becomes a teaching method when teachers pose a problem for students to solve (Stoyanova, 2003). In this context, Silver (1994) stated that problem-posing can be applied in three different ways in fulfilling the problem-posing tasks given to students: a) before solving a problem (different and unique problems from the existing

problem are posed), b) during problem-solving (a solved problem is reformulated), and c) after solving the problem (objectives and terms of the current problem are changed). Stoyanova and Ellerton (1996) group these tasks into three groups: structured, semi-structured, and free problem-posing tasks. Christou et al. (2005), based on the findings of Stoyanova and Ellerton (1996), created a problem-posing model that includes four processes: editing, selecting, understanding, and translating. According to the classification of Stoyanova and Ellerton (1996), in the structured problem-posing strategy, students are given a well-structured problem or a problem solution, and they are asked to create a new problem related to the given problem or its solution. In the semi-structured problem-posing strategy, students are given an open-ended situation; then, they are asked to construct new problems using their knowledge, skills, previous mathematical experience, and concepts. In the free problem-posing strategy, students are given a real-life situation and asked to pose problems without any limitations.

It is seen that three aspects of problem-posing, namely 'construct,' 'variable,' and 'intervention,' have been addressed in studies on problem-posing. Problem-posing as a structure is related to what a problem-posing activity includes, its type, and what features it should contain to be considered an activity (Cai & Hwang, 2020; Cansız Aktaş, 2022). For example, in a problem-posing activity, the data collected in the problem sentence, its subject, context, expression, whether it is solvable or not, and whether the problem can be reformulated or not, in short, the elements related to the nature of the problem constitute the structure of problem-posing (Koichu, 2010). The class teacher's reformulation of a problem to include a more challenging feature based on an issue they have solved is related to the structure of problem-posing. For this, the teacher should think of a structure that includes more complex processing steps. In studies considered as a structure, problem-posing is observed and defined using various methods, interviews, and discourse analysis (Kılıç, 2014). How teachers understand, learn, and pose problem-posing is investigated by examining the problems they pose (Koichu & Kontorovich, 2013). It is tried to understand what the students think while posing a problem. The relationship between teachers' problem-positings and students' problem-positings is investigated.

Problem-posing as a variable can be defined as a well-defined and measurable feature that allows for comparison with other variables (e.g., creativity, problem-solving). In problem-posing as a variable, features such as the number, originality, and difficulty levels of the problems posed by students can be used as criterion to determine the level of other skills (Ayvaz & Durmuş, 2021; Cansız Aktaş, 2022; Cai & Hwang, 2020; Mallart et al., 2018). In literature, there are more studies in which problem-posing is considered a variable. In these studies, measurements related to problem-posing are made, and the relationship of these measurements to other skills is explained. For example, the effect of problem-posing on variables such as problem-solving, creativity, and mathematics achievement is examined. In these studies, it was found that students' problem-solving and problem-posing skills improved in lessons that continued with problem-posing tasks (Akay, 2006;



Silver & Cai, 1996; Turhan & Güven, 2014; Xie & Masingila, 2017). Problem-posing is the best tool to observe the three indicators of mathematical creativity (fluency, flexibility, and originality) (Roble et al., 2021; Silver, 1994). Students who deal with different problems have reduced dependance on textbooks (Çomarlı & Gökkurt Özdemir, 2019) and have a positive impact on mathematical literacy and self-efficacy beliefs (Geçici & Aydın, 2019; Liu et al., 2020; Özgen, 2019). It has developed a positive attitude toward mathematics as it strengthens conceptual understanding (Akay & Boz, 2010; Katrancı & Şengül, 2019).

Finally, in studies that address the 'intervention' aspect, problem-posing tasks are included in the learning process (Cai & Hwang, 2020; Liljedah & Cai, 2021). Including problem-posing as a teaching method in the lesson plan aims to develop and expand the understanding of problem-posing (Cai & Hwang, 2020; Cansız Aktaş, 2022; Li et al., 2020; Zhang & Cai, 2021). This includes problem-posing in course practice as a teaching method, such as question and answer, discussion, lecture, and drama. Changing the current teaching method and integrating problem-posing to develop students' creativity will create new learning opportunities, and its results will be effective (Leikin & Elgrably, 2020). In studies where problem-posing is addressed as an intervention, problem-posing improves digital skills, such as computer programing, by increasing cooperation. In addition, it has been observed to enable students to have higher self-efficacy and lower cognitive load (Wang & Hwang, 2017). It has been determined that teacher training can be conducted through problem-posing (Cai & Hwang, 2020; Li et al., 2020; Passarella, 2021), and integrating these activities into primary school mathematics teaching can improve mathematical creativity (Bicer et al., 2020). However, difficulties encountered by teachers through problem-posing (organization, designing, evaluation, quality problem-posing, negative impact on exams) and students (low-quality problem-posing, lack of experience, language use, lack of confidence) were also revealed (Li et al., 2020; Xie & Masingila, 2017). When these studies are examined, the task of integrating problem-posing as an intervention into mathematics lessons is seen by researchers as a new phenomenon, and there are studies in the world that try to include problem-posing in various educational levels (Bicer et al., 2020; Brown & Walter, 1983; Li et al., 2020; MoE, 2011; Zhang & Cai, 2021).

As can be understood from the studies dealing with different aspects of problem-posing, problem-posing is an important activity that contributes to students' mathematical skills as both a skill and a method. Based on these findings, mathematics teaching should incorporate the problem-posing method. However, there are a limited number of studies in the literature in which problem-posing is used as an instructional model. Örnek and Soylu (2021) developed a six-step problem-forming learning model. This model was designed to create a common approach in learning environments to teach problem-posing and develop problem-solving skills. The model was tested on pre-service elementary mathematics teachers using a pretest-posttest comparison group design. At the end of the application, it was determined that this model improved conceptual learning, positively affected the solvability of problems, and ensured the correct use of mathematical language and grammar

rules. Zhang and Cai (2021) examined 22 teaching practices of teachers who used problem-posing as a teaching method to support students' mathematics learning. The findings obtained at the end of the study are remarkable. First, problem-posing did not sufficiently penetrate the intended curriculum level (textbooks and materials). Second, it is related to how to organize the problems constructed by students. Students create problems related to the topic and unexpected problems that arise. Third, teachers who learned to teach using problem-posing could develop problem-posing teaching practices even after two years. According to the results obtained, more detailed research is needed to identify relevant and irrelevant problems, the difficulty levels of relevant problems, and how teachers handle these problems. Cai et al. (2020) investigated the impact of a problem-posing workshop on mathematics teachers' understanding of problem-posing and lesson design. While none of the teachers used any problem-posing components in their lesson plans before the seminar, they included them in more than 80% of their lesson plans after the workshop. Jia and Yao (2021) analyzed six versions of Chinese textbooks to identify how problem-posing has emerged in these materials over the years. According to the results of this study, problem-posing activities have only been systematically and purposefully incorporated into textbooks recently. However, even now, it is stated that books contain very few problem-posing activities. In another study, problem-solving, and problem-posing skills of sixth-grade children on "decimal fractions were improved with the problem-posing approach. According to the results, this approach improved students' problem-solving success and problem-solving skills (Turhan, 2011). Fifth-grade students engaged in structured and semi-structured problem-posing activities prepared for the acquisition of "solving and constructing problems requiring operations with natural numbers" for five weeks. It was determined that problem-posing activities increased students' success in problem-posing and solving (Şakar, 2018). Teachers who learned to teach mathematics through problem-posing improved their situation-posing performance and beliefs about teaching through problem-posing after participating in three workshops (Li et al., 2020). Using 101 pre-service teachers, the effects of the problem-posing approach used in science education on students' problem-solvings and metacognitive awareness were investigated. The study results showed that structured, semi-structured, and free problem-posing activities improved students' problem-solving skills and metacognitive awareness (Akben, 2018). A quasi-experimental study conducted with 83 pre-service primary school teachers determined that problem-posing-based practices in teaching the concept of mole effectively increased both the problem-solving skills and academic achievement of pre-service teachers. Because of these studies, it was seen that the problem-posing approach can also be used in science teaching (Akben, 2019). Therefore, although there are extensive studies on problem-posing strategies in various educational settings, there are a limited number of studies focusing on the effects of mathematics teaching supported by problem-posing strategy, especially in the primary school context, and revealing students' perspectives on the process. In this study, a quasi-experimental research was designed, and mathematics instruction supported by problem-posing strategies was conducted. The effect of this instruction on the problem-

posing skills of fourth-grade elementary school students was examined, and a second qualitative phase was designed for this method. In this qualitative phase, we presented the findings by considering students' opinions.

### **Problem of the Study**

In this context, this study examines the effect of teaching mathematics supported by problem-posing strategies on the problem-posing skills of primary school fourth-grade students and analyzes the students' views on this method. The research questions were as follows:

1. Does teaching mathematics supported by problem-posing strategies significantly affect students' problem-posing skills?
2. What are the students' views on teaching mathematics supported by problem-posing strategies?

## **METHOD**

### *Research Model*

This study employed one of the mixed research methods, the "Explanatory Sequential Design," which includes collecting quantitative data and then collecting qualitative data to elaborate on the quantitative data. In this design, quantitative data are more important than qualitative data, and the aim is to support quantitative results with qualitative findings. (Creswell & Plano-Clark, 2018).

In line with this design, in the first stage of the research, one of the quasi-experimental designs, the "nonequivalent control group pretest-posttest design," was used (Büyüköztürk et al., 2014). In this design, which is used in many studies, especially in the field of education, which of the groups will be the experimental group and which will be the control group is decided by random assignment. The design includes an experimental and a control group. At first, a pretest was applied to the experimental and control groups. In this study, the experimental group was taught mathematics supported by problem-posing strategies, whereas the control group received no additional application. After the application, a posttest was applied to both groups, and the study ended (Lodico et al., 2006).

In the second stage, the "Case Study Design," one of the qualitative research designs, was used. A case study seeks to explore one or more phenomena, settings, programs, social groups, or interconnected systems in depth (McMillan, 2000). In this context, after completing the teaching of mathematics supported by problem-posing strategies, interviews were conducted with the students to obtain their views on the effectiveness of the process.

### *Participants*

The school where the application would be conducted was determined using the convenience sampling method, one of the purposive sampling methods. Because many experimental studies have to use already formed groups or volunteers, it is only possible to use the convenience sampling method (Creswell, 2013). Convenience or accessible sampling is based on items that are entirely available, quick, and easy to reach. Convenience sampling is the method in which the researcher turns to the most accessible items that the researcher can obtain to form the sample from the target population, and most studies in the literature prefer this method (Baltacı, 2018). For convenience sampling, the researcher determines sufficient items from the existing items as a sample (Singleton & Straits, 2005).

The school where the study was conducted is a public school in Afyonkarahisar province in western Türkiye, which is attended by students with average academic performance and from similar socio-economic backgrounds. When deciding on the school where the study would be conducted, the researcher considered several factors, such as the school's physical features, the number of teachers and students, and whether the school administration and teachers volunteered for the study. The study included fourth graders studying in two classrooms in this school in the second semester of the 2021–2022 academic year. These two classrooms, equivalent in terms of possibilities and characteristics, were randomized into two groups (experimental and control). The research was conducted with 34 students, 17 in both groups. In both groups, 10 (58.8%) students were girls and 7 (41.2%) were boys. Therefore, the numbers of students in the experimental and control groups were very close.

The qualitative study group consisted of 8 students determined by the maximum variation sampling method, a purposive sampling technique. When using maximum variation sampling, the researcher selects some units or cases to maximize the diversity relevant to the research question. Maximum variation sampling does not seek to make generalizations; instead, it aims to capture and describe any shared theme and thus reveal different dimensions of the research problem (Yıldırım & Şimşek, 2006). To ensure diversity, the researcher identified variables such as students' mathematics achievement and gender as sources of diversity. As a result, four female and four male students in the experimental group with different mathematics achievement levels were included in the interview process.


### *Data Collection Tools*

***Problem-Posing Skills Test:*** The test developed by the researcher consisted of 15 problem-posing tasks. The tasks were evenly distributed as structured (5 tasks), semi-structured (5 tasks), and free (5 tasks) problem-posing tasks (Table 1). The purpose of including all three problem-posing tasks was to measure students' problem-posing skills in all three sub-dimensions. Stoyanova and Ellerton (1996) categorized problem-posing into three groups and stated that problem-posing skills can be better observed. Including these

three types in the test is essential for students to recognize all variations of problem-posing types and to observe all skills called problem-posing.

**Table 1**

*Examples of Questions in the Test*

Strategies	Examples
Structured	<p>Pose a new problem by changing the numbers, expressions, and information in the given problem or adding new information to the given problem.</p> <p>For a soccer match, 2524 tickets were sold on the first day and 3489 tickets on the second day. How many tickets were sold in these two days?</p>
Semi-Structured	<p>Using the information in the picture below, pose a problem involving subtraction.</p>
	
Free	<p>Pose a problem with the length measurement units (mm, cm, m) in it.</p>

The problem-posing skills test was prepared to observe the development of knowledge, concepts, and understanding of students who received formal education. To realize this purpose, an item pool was created by preparing a specification table for the gains that best measure the students' skills in all three sub-dimensions. The item pool included 38 questions (10 structured, 18 semi-structured, 10 free) covering the sub-learning areas of "Addition of Natural Numbers," "Subtraction of Natural Numbers," "Multiplication of Natural Numbers," "Division of Natural Numbers," "Length Measurement" and "Data Collection and Evaluation", considering the 4th grade learning outcomes specified by the Ministry of National Education in the mathematics curriculum.

In the development of problem situations in the question pool, mathematics textbooks belonging to public and private publishing houses, various supplementary sources (workbooks, test books, etc.), and previous studies in the literature were used (Akay, 2006; MoNE, 2018; Özgen et al., 2017; Silver & Cai, 1996). These 38 questions were sent to three faculty members who are experts in the field of mathematics teaching. Experts chose 15 questions according to the determined teaching areas (4 in addition for natural numbers, 3 in subtraction for natural numbers, 2 in multiplication for natural numbers, 2 in division for natural numbers, 3 in measuring length, 1 in data collection and evaluation), considering the cognitive development levels of 4<sup>th</sup>-grade students. In addition, these selected questions were distributed evenly according to the sub-dimensions of problem-posing. The distribution of the questions is as follows: In the structured problem-posing sub-dimension, addition, subtraction, multiplication, division, and length measurement. In the semi-structured problem-posing sub-dimension, addition (2), subtraction, length measurement,

and data collection and evaluation. In the free problem-posing sub-dimension, there are questions about the sub-learning areas of addition, subtraction, multiplication, division, and length measurement. Later, these 15 problem-posing situations were submitted to eight classroom teachers who had previously taught and are still teaching fourth graders, who were asked to assess these questions in terms of their suitability for purpose. Because of the teachers' feedback, some revisions were made to the items.

Then, to test the reliability of the test, it was applied to 155 students, 75 girls (48%) and 80 boys (52%), who had characteristics similar to those of the students in the study group. Students were given two class hours to complete the test. The students' answers were scored by the researcher and two classroom teachers with at least 12 years of teaching experience based on the rubric developed by Özgen et al. (2017). Thus, interrater reliability was ensured. Then, item analysis of the test was conducted. The item difficulty index and discrimination index ranged between 0.38 and 0.75 and 0.32 and 0.59, respectively. The closer the difficulty index is to 0, the more difficult the item is, whereas the closer it is to 1, the easier it is. An item difficulty index of 0.50 indicates that the problem is moderately difficult. Items with an item discrimination index between 0.30 and 0.39 are considered quite good, while those with 0.40 and above are considered excellent (Atılğan et al., 2006; Yurdabakan, 2008). Therefore, the items in the test are moderately difficult items with good discrimination power. On the other hand, the items with item discrimination power between 0.30 and 0.39 were edited for students to better comprehend. The face validity of the test was ensured by revealing the name of the test, including sufficient descriptions for the items, and leaving enough space under the items. The Cronbach's alpha value of the test was found to be 0.89. In the problem-posing skills test, the highest and lowest scores that students can get from each item are 3 and 0, respectively. The highest and lowest scores obtained from the entire test were 45 and 0, respectively.

**Semi-structured Interview Form:** The form consisted of two open-ended questions to determine the participating students' views on teaching mathematics supported by problem-posing strategies. When designing the form, expert opinions were obtained from a faculty member with expertise in mathematics teaching and two classroom teachers enrolled in postgraduate education. The form was finalized by considering the experts' feedback on the questions' quality and intelligibility. In preparing the form, studies on student and teacher views on different methods used in mathematics lessons were examined. Because of the review, five questions that could be included in the interview form emerged. A faculty member working in mathematics teaching and two classroom teachers continuing their graduate education reviewed these five questions. The experts stated that two questions were out of their scope. Therefore, these two questions have been removed from the form. It was decided to use the remaining three questions in the student interviews. However, because it was observed that one question was answered by detailing the other question during the interview, this question was also removed from the test, and the interviews continued over two questions. The questions included in the form were as

follows: 1. “What do you think about teaching mathematics supported by problem-posing strategies? In what way do you think it differs from traditional mathematics teaching?” 2. “In what stages/situations did you have difficulty teaching mathematics supported by problem-posing strategies?”

### *Data Collection*

In the quantitative stage of the study, the Problem-Posing Skills test was applied as a pretest and posttest to the experimental and control groups. Students were given two class hours, and no additional time was given to any student. Before the students answered the test, they were informed that it was not intended to grade or evaluate the students; the results would be used in the study. In addition to that, students were told that they were given two class hours to answer the questions in the problem-posing test so that they would not feel time pressure. Because there were three different types of problem-posing questions in the test, students were given two class hours after answering the first questions to avoid getting bored or giving empty answers when they came to the following questions. To prevent researcher bias and not disrupt the class order that students were already accustomed to, the teachers administered the tests in both classrooms. Since the applications were decided to be carried out by the classroom teachers, a seminar on teaching mathematics supported by problem-posing strategies was given to the teacher of the experimental group for two weeks before the applications started. Then, two pilot implementations were conducted on different days to detect and correct any possible failures that may arise in the implementation of the research plan. A pilot implementation allows the researcher to control the independent variables, observe overlooked developments, recognize the changes that may occur in the application process, observe the steps of the experimental activity to be implemented, and find alternative solutions for possible problems (Teddlie & Tashakkori, 2015). In the next stage, the application process started in the experimental group (Table 2).

**Table 2***Information Related to the Experimental Group Application Process*

Week	Total Lessons	Strategies	Learning Outcome
Week 1	5 lessons		- Defines proper, improper, and mixed fractions and expresses them in mathematical notations.
Week 2	5 lessons	Structured Problem-Posing Strategy	- Compares and order unit fractions.
Week 3	5 lessons	Semi-Structured Problem-Posing Strategy	- Determines the specified proper fraction of a quantity.
Week 4	5 lessons		- Compares up to three fractions with equal denominators.
Week 5	5 lessons	Free Problem-Posing Strategy	- Adds and subtracts fractions with equal denominators.
Week 6	5 lessons		- Solve problems requiring addition and subtraction with fractions.

As can be inferred from Table 2, the six-week teaching of mathematics supported by the problem-posing strategies process lasted 30 class hours, one lesson per day, and five lessons per week. The application was planned for six weeks and 30 class hours because the Ministry of National Education's mathematics curriculum defines this amount of time for the objectives of the fractions subject. Therefore, because only fractions were taught, the teaching lasted six weeks. Each week, a specific learning outcome was taught to the students. Three different problem-posing strategies were used to teach these learning outcomes. The teaching of the learning outcomes with these strategies was completed in three stages: introduction, development, and evaluation. During these stages, the teachers used structured, semi-structured, and free problem-posing tasks depending on the content and presentation of the subject.

For example, in the introduction stage, after teaching the subject, the teachers asked the students to pose new problems by changing the data, information, conditions, context, etc., in the problems used in the presentation of the subject and thus completed the structured problem-posing teaching. In the development stage, semi-structured problem-posing teaching was completed by performing the problem-posing tasks in the textbook or establishing new problems using an unfinished problem situation. In the evaluation stage, free problem-posing teaching was completed by performing the problem-posing tasks developed by the teacher in advance or by performing free problem-posing tasks without any restrictions on the subject learned. A general review and evaluation of the teaching was conducted in the evaluation phase. The mistakes made by the students were identified, and necessary improvements were made. The problem-posing tasks performed by the experimental group students during the application process are shown in Table 3.



Table 3

## Problem-posing Tasks Produced by Students in the Experimental Group

## Examples

Çetin had 125 hazelnuts. Çetin ate  $\frac{1}{5}$  of his hazelnuts. How many hazelnuts did Çetin eat?

Pose new problems by changing the information given or requested in the above problem, adding new information to the question, changing the topic, or changing the conditions (Structured).

Çetin'in 125 tane fındığı vardı. Çetin fındıkların  $\frac{1}{5}$ 'ini yemiştir.

$$\begin{array}{r} 125 \overline{) 5} \\ \underline{10} \phantom{0} \\ 25 \phantom{0} \\ \underline{25} \\ 000 \end{array}$$

25 tane fındık yemiştir.

Benim problemim Ali'nin 130 tane cevizini vardı. Ali cevizinin  $\frac{1}{5}$ 'ini ablasına vermiştir.  $\frac{1}{5}$ 'ini de kendisi yemiştir. Ali'nin kaç tane ceviz kalmıştır.

$$\begin{array}{r} 130 \overline{) 5} \\ \underline{10} \phantom{0} \\ 30 \phantom{0} \\ \underline{25} \\ 50 \\ \underline{50} \\ 000 \end{array}$$

$\frac{1}{5} \rightarrow 26$   
 $\frac{1}{5} \rightarrow 26$

$26 + 26 = 52$

$$\begin{array}{r} 130 \\ \underline{52} \\ 78 \end{array}$$

78 tane ceviz kalmıştır.

Ali has 130 walnuts. Ali gave  $\frac{1}{5}$  of his walnuts to his sister. He ate  $\frac{1}{5}$  of them himself. How many walnuts does Ali have now?

Ms. Ayten planted potatoes in  $\frac{1}{5}$  of her field and onions in  $\frac{2}{5}$  of her field.

Pose new problems by adding new data to the unfinished problem statement (Semi-structured).

Ayten Hanım tarlasının  $\frac{1}{5}$ 'ine patates,  $\frac{2}{5}$ 'ine soğan ekmiştir.

Yukarıda yarım bırakılmış problem cümlesine yeni veriler ekleyerek problem kurup çözümünü yapın.

Problemim: Ayten Hanım tarlasının  $\frac{1}{5}$ 'ine patates,  $\frac{2}{5}$ 'ine soğan ekmiştir. Ayten Hanımın tarlası 200 metre kareseyse geri kalan kısmı kaç metre karedir?

$$\begin{array}{r} 200 \overline{) 5} \\ \underline{20} \phantom{0} \\ 000 \end{array}$$

40 (Patates)

$40 \times 2 = 80$  (Soğan)

$40 + 80 = 120$

$200 - 120 = 80$  metre kare kalan kısmı

Patates Soğan

$\frac{1}{5}$   $\frac{2}{5}$  80 metre kare

Ms. Ayten planted potatoes in  $\frac{1}{5}$  of her field and onions in  $\frac{2}{5}$  of her field. Since Ms. Ayten's field is 200 square meters, how many square meters are the rest of Ms. Ayten's field?

Pose new problems with unit fractions (Free).

İçinde birim kesir olan arbedasının çözmesi için yeni problemler yazınız.

Problemim

Annem pazardan 20 kg zırsuluk biber aldı. Biberin  $\frac{1}{4}$ 'ünü Ayşe teyzeye verdi,  $\frac{2}{4}$ 'ünü kendisi tava yaptı. Buna göre annemde kaç kg biber kaldı?

$$\begin{array}{r} 20 \overline{) 4} \\ \underline{20} \\ 00 \end{array}$$

$5 \times 2 = 10$  ( $\frac{2}{4}$ )

$10 + 5 = 15$  (kg kullanılmış biber)

$20 - 15 = 5$  (kg kalan biber)




My mother bought 20-kg pepper from the market. She gave  $\frac{1}{4}$  of the peppers to Aunt Ayşe. She pickled  $\frac{2}{4}$  of the peppers. How many kilograms of pepper does my mother have now?

As can be inferred from Table 3, in structured problem-posing tasks, after solving a problem presented by the teacher, S1 (student 1) posed a new problem similar to this problem. The student added new data to this problem and solved the new problem. In semi-structured problem-posing tasks, S8 (student 8) added new information to a problem statement left unfinished by the teacher, posed a new problem, and solved this problem. S4 (student 4) posed a new problem with unit fractions and new information in free problem-posing tasks. While problem-posing activities were carried out in accordance with all three strategies, short explanations were provided to make students understand in which cases these activities were structured, in which cases they were semi-structured, and in which cases they were free problem-posing activities. For example, when problem-posing was practiced on a solved problem, this activity was considered a structured problem-posing activity. When there is a photograph, picture, graphic, or unfinished expression in the textbook, we are told that it is a semi-structured problem-posing activity when we complete these incomplete activities. Finally, when the students reached sufficient knowledge about the subject and considered their previous problem-posing experiences, they were told that they could construct the problems they wanted. The teacher shared these explanations when necessary.

Meanwhile, traditional mathematics teaching based on textbooks continued in the control group. Apart from the problem-posing tasks in the textbook, no other task was given to the students. Some examples of problem-posing tasks in the textbook are shown in Table 4.

**Table 4**

*Examples of Problem-posing Tasks in the Textbook*

Examples	Translation										
<p> Yandaki tabloda yazılı verilerden yararlanarak bir problem kuralım.</p> <p><b>Tablo: Evde Beslenmek İstlenen Hayvanlar</b></p> <table border="1"> <thead> <tr> <th>Hayvan Adı</th> <th>Kedi</th> <th>Kuş</th> <th>Köpek</th> <th>At</th> </tr> </thead> <tbody> <tr> <td>Öğrenci Sayısı</td> <td>68</td> <td>83</td> <td>124</td> <td>76</td> </tr> </tbody> </table> <p><b>Problem</b> Evde köpek beslemek isteyenlerin sayısı, kuş beslemek isteyenlerin sayısından ne kadar fazladır?</p> <p>Bu problemi defterinize çözünüz. Siz de tablodan yararlanarak defterinize bir problem kurunuz ve çözünüz.</p>	Hayvan Adı	Kedi	Kuş	Köpek	At	Öğrenci Sayısı	68	83	124	76	<p>Let us pose a problem using the data in the table on the side.</p> <p>How many more people want to have a dog at home than the number of people who want to have a bird?</p> <p>Solve this problem in your notebook. Using the table, you can pose a problem in your notebook and solve it.</p>
Hayvan Adı	Kedi	Kuş	Köpek	At							
Öğrenci Sayısı	68	83	124	76							
<p>6. Yandaki verilerden yararlanarak içinde çarpma işlemi de olan bir problem kurunuz. Kurduğunuz problemi defterinize çözünüz.</p> 	<p>Using the data on the side poses a problem that includes multiplication. Solve your problem in your notebook.</p>										
<p>6. Yandaki resimden yararlanarak bir problem kurunuz. Kurduğunuz problemi defterinize çözünüz.</p> 	<p>Pose a problem using the picture on the right. Solve your problem in your notebook.</p>										

As seen in Table 4, the control group students also performed activities with different problem-posing strategies. In these activities, we posed new problems by reconsidering a problem or using the data in pictures, tables, and graphics. In addition, the problems were written using a amount of data and information.

Following the quantitative research process, interviews were conducted with students using the interview form. Appropriate physical conditions and sufficient time were provided for the students to express their views comfortably. One student per day was interviewed during noon breaks. The teachers of the interviewed students informed their parents in advance. Each interview took about 20-30 minutes. Before the interviews were conducted, the students were informed why this interview was being conducted and that notes would be taken during the interview. When the students were ready for the interview, they were asked to answer the questions in the interview form. While providing their answers, the students benefited from the examples in practice. The researcher noted the statements made by the students during the interview and the students confirmed them by stopping at some points during the interview. In the parts where the students did not understand or had difficulty answering, the researcher helped them explain their feelings and thoughts by providing reminder information.

### *Data Analysis*

Quantitative data were analyzed using SPSS 26 statistical software. Parametric or non-parametric tests were applied to determine whether a statistically significant difference existed between the data obtained from different groups and two consecutive measurements of the same group. To decide on the tests to be used in the study, the normality results of the data were first examined, and the results are presented in Table 5.

**Table 5**

*Normality test results of the tests*

Test	Group	n	Shapiro-Wilk			Skewness	Kurtosis
			Statistic	df	Sig.		
Pretest	Experimental	17	0.936	17	0.269	-0.674	-0.290
	Control	17	0.893		0.053	-0.988	0.263
Posttest	Experimental	17	0.969	17	0.797	0.058	-0.610
	Control	17	0.928		0.202	-0.597	-0.390

When Table 5 is examined, it is seen that the number of students in the experimental and control groups is below 30. In cases where the number of participants is less than 30, the normality of the data is determined using the Shapiro-Wilk test (Can, 2019). The pretest values (0.269; 0.053) and posttest values (0.797; 0.202) of the experimental and control groups showed that the data were normally distributed ( $p > 0.05$ ). The distribution of skewness and kurtosis coefficients of the pretest and posttest scores of the experimental and control groups ranged -0.988 to 0.263. The skewness and kurtosis coefficients between -1 and +1 indicate

the data's normal distribution (Morgan et al., 2004). Based on this information, it was decided to use t-tests, one of the parametric tests, to analyze the data because the score distributions showed a normal distribution. Whether there was a significant difference between the pre-test and post-test scores of the experimental and control groups was analyzed by independent samples t-test for the comparison of unrelated measurements and dependent samples t-test for the comparison of related measurements. In the data analysis, the significance level ( $p$ ) was set at 0.05.

Qualitative data obtained from interviews with students were analyzed by content analysis. The main purpose of content analysis is to capture concepts and relations that can explain the collected data. To do this, similar data are collected under certain concepts and themes, and these are organized and interpreted in a way that the reader can understand (Patton, 2002; Yıldırım & Şimşek, 2006). The reason for conducting content analysis in the research is that it is desired to obtain some codes from the raw data obtained after the interviews with the students and to create categories from the codes. Content analysis is conducted in such cases because there are no pre-established categories. Thus, qualitative data were analyzed in four stages: coding, generating themes, reviewing themes, and defining and naming themes. In the first stage, the students' responses to each question in the interview form were analyzed to determine the conceptual meaning of their expressions, and codes were obtained. In the second stage, themes were generated on the basis of the determined codes to provide insight into the data. In the third stage, the data obtained in the first two stages were presented to the reader without including the researcher's views and comments. In the final stage, the data were interpreted, and some conclusions were made. To support the obtained data, direct excerpts from the interviews were included. The students' names in the excerpts are coded as S1, S2, S3, ..., S8. In the first stage of this four-stage cycle, determining codes from student expressions was time-consuming. Although there were sometimes dilemmas, this problem was overcome by consulting the opinions of teachers who continued their postgraduate education. The second stage can be considered the most challenging stage of this cycle because it is time-consuming for the author to reach the categories that best explain the codes. Finding and choosing the best concept to explain the codes at this stage requires intensive thinking skills. After focusing on certain concepts in this section, the best concept was reached during the article writing and editing stages. Placing the data into the categories obtained in the third stage was relatively more straightforward than that in the second. At this stage, the data were prepared in an organized manner. In the fourth stage, the meaning of the categories obtained was interpreted and presented systematically.

### *Validity and reliability*

Internal validity refers to the degree to which observed changes or differences in the dependent variable are attributable to the independent variable. In contrast, external validity refers to the extent to which the study results can be generalized (Büyüköztürk et al., 2014). For the study results to be interpreted meaningfully, internal and external validity

must be provided. For internal validity, several factors should be considered, such as history, maturation, experimental mortality, instrumentation, testing, selection bias, regression to the mean, social interaction, and attrition (Christensen et al., 2015; Creswell, 2013). Randomly selecting participants in experimental studies helps eliminate threats (Creswell, 2012).

Due to the physical conditions of the schools in Türkiye, it is often not possible to randomly assign the participants to the experimental and control groups. Therefore, in this study, the selection of experimental and control groups was performed randomly. Nevertheless, the classrooms comprise students from similar socioeconomic backgrounds. In addition, the two classrooms' first-semester mathematics grade point averages and mean scores from the pretest problem-posing skill test are very close. By including two classrooms close to each other in terms of student characteristics, selection bias and regression to the mean were controlled. No participant dropped out of school during the research, so there was no experimental mortality. The history factor was controlled because both groups did not receive any additional training during the application process. Biological and psychological changes within subjects during the research process pose a maturation threat. The careful selection of participants with similar developmental characteristics (for example, students at the same grade level) for the experimental and control groups may eliminate this problem (Creswell, 2012). The inclusion of students at the same grade level and with similar demographic characteristics in the experimental and control groups and similar developments and changes seen in both groups throughout the research indicate no maturation threat. Because of the interaction between the participants or teachers in the experimental and control groups, students in the control group may learn about the experimental process. This situation may affect the participants' scores in both groups (Creswell, 2013). To eliminate this threat, the teacher of the control group was not informed about the content of the experimental treatment. In addition, it was ensured that the experimental group's teacher did not share any information or material with the control group's teacher. The control group may feel less valuable as the experimental procedure was not applied to their groups. In this case, measures can be taken to reduce the expectations of the presumed benefits of the experimental treatment (Creswell, 2012). The control group was not informed about teaching mathematics supported by problem-posing strategies. Since the lessons in both classrooms were taught by their teachers in the order students were already accustomed to, the threats of 'diffusion of treatments' and 'compensatory rivalry' were controlled. The last threat to internal validity is testing and instrumentation. Using different instruments, such as pretests and posttests, affects participants' scores, thus threatening the experiment's internal validity (Creswell, 2013). To eliminate this threat, the same instruments were used throughout the experiment. In addition, the researcher applied instruments under similar conditions. Because the researcher did not conduct the teaching process in the groups, the researcher bias (i.e., the researcher influencing the results) was controlled. Including three types of problem-posing

in the problem-posing test to increase internal validity can be added to the factors that increase internal validity. Lessons were conducted using three different problem-posing activities, and assessments were made to measure these three skills. However, the fact that the students selected for the groups were not selected impartially in the selection of the participants and that the studies were conducted only on fractions can be considered factors that reduce internal validity. In controlling this effect, the fact that the groups' previous mathematics achievements and the test's pretest scores are similar increases the internal validity. In addition, in future studies, conducting studies at different grade levels using various subjects can be considered as measures to strengthen internal validity.

Threats to external validity include the interaction of selection and treatment, setting and treatment, and history and treatment (Creswell, 2013). To eliminate the first threat, the groups to which the research results could be generalized were limited, and care was taken to ensure that the students in the groups had similar characteristics in terms of socioeconomic background and academic performance. The study was conducted in a public school with two classrooms with similar physical features. In addition, applications in the experimental and control groups started and ended simultaneously. Classes in both groups were held in the morning. Although the fact that the study lasted six weeks and was not a complete experimental study is a factor that reduces external validity, the fact that fourth-grade students who have experienced all the achievements of primary school are included in the study minimizes this effect. In addition, the fact that the number of participants was close to each other is considered an important factor, and conducting complete experimental studies with large study groups at different grade levels in the future will make it possible to generalize.

More than one researcher measuring a phenomenon in the same way over the same period is defined as an indicator of internal reliability, whereas measuring the phenomenon over the same period is defined as an indicator of external reliability (Yıldırım & Şimşek, 2006). To ensure the internal and external reliability of the quantitative research, a model, participants, and data collection tools suitable for the research questions were determined. The researcher and an expert collaborated to score the collected data. In addition, the application process and data analysis steps are described in detail. Allocating two class hours for the pre-test and post-test and using the same test as both the pre-test and post-test can be listed as factors that increase internal reliability. However, the fact that two class hours are too much for a measurement process for students in this age group is an issue that needs to be considered. This is because there were three types of questions in the test and five questions from each type. Therefore, it is thought that preparing tests with fewer questions or focusing on a single type in future studies would be measures to increase internal reliability. In addition, the fact that the researcher provided training on the problem-posing approach to the teacher of the applied class and conducted a pilot study increases the external reliability.

In qualitative research, credibility instead of internal validity, transferability instead of external validity, consistency instead of internal reliability, and confirmability instead of external reliability are used (Yıldırım & Şimşek, 2006). Credibility refers to the trustworthiness of inferences drawn from data related to the studied phenomena or concepts. The researcher analyzed the data of two classroom teachers enrolled in postgraduate education to ensure credibility. Then a faculty member with expertise in mathematics teaching examined the analysis results. For example, the student who coded S4 said, "*It was enjoyable to solve the problem my friend posed.*" This view was included in the "emotion-stimulating" category with coded words such as "fun, enjoyable, not bored"; however, it was discussed why this expression was not included in the "innovative" category. Since in the "innovative" category, the attachment to materials such as textbooks, notebooks, and projection devices was more prominent than students' emotions, it was decided to include this opinion, which appeals to students' emotions, in the "emotion-stimulating" category. This process (creating codes and categories together) can be considered an important objective criterion that increases credibility by reducing researcher bias. Transferability in qualitative research refers to the extent to which qualitative research findings can be generalized or transferred to other studies. To ensure transferability, the interview process was described in detail, and the students' views were included in the findings. Transparent disclosure of the duration and setting of the interviews and the necessary guidance contributed significantly to the transferability of the research results. Consistency deals with the extent to which the data reach the same conclusions as those in other research. To this end, the researcher and the two experts worked together to generate themes based on the codes inferred from the interviews. In cases of disagreement, reaching a common decision contributed to obtain consistent data. Finally, confirmability refers to the extent to which the study findings are free from the researcher's bias and align with other studies. To ensure confirmability, the preparation of the qualitative data collection tool, data collection, and data analysis were explained in detail, and a faculty member supervised the entire process. The fact that a faculty member and two classroom teachers continuing their postgraduate education participate in the study process is considered an important element that strengthens confirmability.

### *Ethical considerations*

In this study, all rules stated to be followed within the scope of "Higher Education Institutions Scientific Research and Publication Ethics Directive" were followed. None of the actions stated under the title "Actions Against Scientific Research and Publication Ethics", which is the second part of the directive, were not taken.

Ethical review board name: Afyon Kocatepe University Social and Humanity Sciences Scientific Research and Publication Ethics Committee

Date of ethics review decision: 15.10.2021

Ethics assessment document issue number: 2021/329

## RESULTS

### Findings in the First Stage of the Research

The results of the independent samples t-test conducted to determine whether there was a significant difference between the pre-test and post-test mean scores of the problem-posing skills of the experimental and control groups are shown in Table 6.

**Table 6**

*Analysis of the Problem-posing Skills Pretest and Posttest Scores*

Situation	Group	Test	n	M	sd	df	t	p
Structured	Experimental	Pretest	17	10.47	3.16	32	-0.615	0.543
	Control		17	11.05	2.35			
	Experimental	Posttest	17	13.88	0.99	32	4.611	0.000*
	Control		17	11.82	1.55			
Semi-Structured	Experimental	Pretest	17	10.64	3.69	32	-0.172	0.865
	Control		17	10.88	4.27			
	Experimental	Posttest	17	13.47	1.58	32	3.267	0.003*
	Control		17	11.23	2.33			
Free	Experimental	Pretest	17	10.23	3.21	32	0.091	0.928
	Control		17	10.11	4.22			
	Experimental	Posttest	17	13.05	1.51	32	2.954	0.006*
	Control		17	10.76	2.81			
Total points	Experimental	Pretest	17	31.35	8.20	32	-0.233	0.817
	Control		17	32.05	9.43			
	Experimental	Posttest	17	40.41	2.85	32	4.809	0.000*
	Control		17	33.82	4.87			

\* $p < 0.05$

In Table 6, no statistically significant difference was observed between the pretest scores of the experimental and control groups regarding the sub-dimensions and total score [ $t(32) = -0.615$ ;  $t(32) = -0.172$ ,  $t(32) = 0.091$ ;  $t(32) = -0.233$ ,  $p > 0.05$ ]. According to these findings, the problem-posing skills of the students in the experimental and control groups were similar before the application.

In the analysis of posttest scores, a statistically significant difference was observed between the data of the experimental group and the data of the control group [ $t(32) = 4.611$ ;  $t(32) = 3.267$ ,  $t(32) = 2.954$ ;  $t(32) = 4.809$ ,  $p < 0.05$ ]. These findings show that teaching mathematics supported by problem-posing strategies effectively develops students' problem-posing skills.

Table 7 shows the dependent samples' t-test results to determine whether there is a significant difference between the problem-posing skills pre-test mean score and the post-test mean score of the experimental and control groups.



**Table 7***Analysis of the Experimental and Control Group Pretest and Posttest Scores*

Situation	Group	Test	n	M	sd	df	t	p
Structured	Experimental	Pretest	17	10.47	3.16	16	-5.010	0.000*
		Posttest	17	13.88	0.99			
	Control	Pretest	17	11.05	2.35	16	-1.176	0.257
		Posttest	17	11.82	1.55			
Semi-Structured	Experimental	Pretest	17	10.64	3.69	16	-3.699	0.002*
		Posttest	17	13.47	1.58			
	Control	Pretest	17	10.88	4.27	16	-0.466	0.647
		Posttest	17	11.23	2.33			
Free	Experimental	Pretest	17	10.23	3.21	16	-3.447	0.003*
		Posttest	17	13.05	1.51			
	Control	Pretest	17	10.11	4.22	16	-1.009	0.328
		Posttest	17	10.76	2.81			
Total points	Experimental	Pretest	17	31.35	8.20	16	-5.667	0.000*
		Posttest	17	40.41	2.85			
	Control	Pretest	17	32.05	9.43	16	-1.078	0.297
		Posttest	17	33.82	4.87			

\*p&lt;0.05

In Table 7, a statistically significant difference was observed between the pretest and posttest scores of the experimental group for the subdimensions and total score [ $t(16)=-5.010$ ;  $t(16)=-3.699$ ,  $t(16)=-3.447$ ;  $t(16)=-5.667$ ,  $p<0.05$ ]. No significant difference was observed between the pretest and posttest scores of the control group [ $t(16)=-1.176$ ;  $t(16)=-0.466$ ,  $t(16)=-1.009$ ;  $t(16)=-1.078$ ,  $p>0.05$ ].

These findings show that the activities carried out in the experimental group were effective in improving the problem-posing skills of the students. Teaching mathematics supported by problem-posing strategies significantly affected all three sub-dimensions and the total score.

### Findings on the Second Stage of the Research

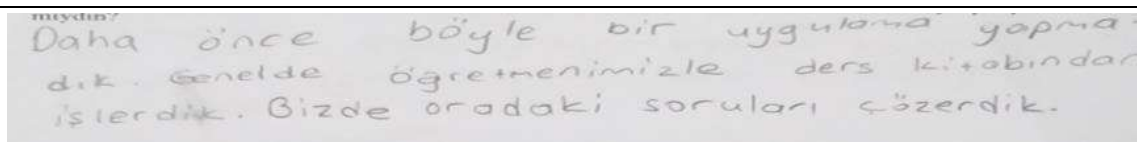
According to the first question in the interview form, students expressed opinions in three different categories (innovative, student-centered, and emotionally stimulating) about different aspects of teaching mathematics supported by problem-posing strategies. The findings are presented in Table 8.

**Table 8**

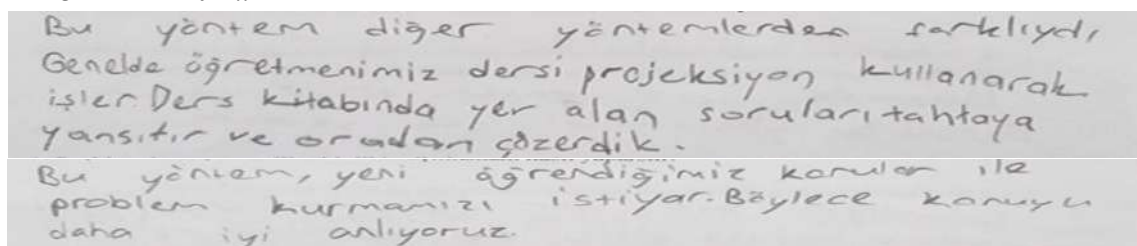
*The Ways Teaching Mathematics Supported by Problem-posing Strategies Differs from Traditional Mathematics Teaching according to Students*

Category	Code	Students
Innovative	Not traditional, no dependance on teaching materials	S2, S3, S4, S6, S7, and S8
Student-centered	Students taking an active role in learning, assuming the role of a teacher	S1, S4, S5, and S6
Emotionally stimulating	Fun, not boring	S1, S2, S3, S4, S5, S7, S8

According to Table 8, students whose views fell under the “innovative” category stated that they had not done such an application before. They noted that this method, unlike traditional applications, could be applied without relying on materials such as textbooks, notebooks, and projectors. (Figure 1).



S2: “We have not done such activities before. Usually, our teacher uses the textbook to teach us a subject. We would do the tasks in the textbook. But this process (teaching Mathematics supported by problem-posing strategies) was very different.”



S3: “This method is different from other methods. Usually, our teacher uses a projector. We project the problems in the textbook onto the board and solve them in this way. In this method, we are expected to produce new problems using the new things we have learned. Thus, we can learn the subject better.”

**Figure 1.** Student Views of the Innovative Category

Students whose views fell under the “student-centered” category stated that, unlike the previous methods, they freely posed and solved problems using this method. Since they felt like teachers and asked each other questions, they took an active role in the process and assumed the role of the teacher (Figure 2).

Bu yöntemde öğretmen gibi biz de soru hazırladık. Yeni öğrendiğimiz konuyu soru hazırlayarak daha iyi anladık.

S1: "In this method, we produced problems like our teacher. We better learn new subjects by solving problems."

Daha önceki yöntemlerden farklı olarak bizde problemler kurduk ve o problemleri çözdük. Yapılandırılmış problem kurmada verilen problemde değişiklikler yaptık. Yarı yapılandırılmış problem kurmada verilen verilerle problem kurduk. Serbest problem kurmada kendim problem kurdum.

S5: "Unlike previous methods, we produced problems and solved them. In the structured problem-posing tasks, we made changes to the structured problems. In the semi-structured problem-posing tasks, we posed problems with given data. In free problem-posing tasks, we posed our own problems."

Figure 2. Student Views of the Student-centered Category

Students whose views fell under the "emotionally stimulating" category stated that they had fun because they prepared problems and asked each other about them. Unlike traditional practices (teacher writing questions on the board, students solving the problems on the board or in the textbook), they participated in the lesson without getting bored. They had fun because they were active (Figure 3).

Kendimin de soru hazırlamasına çok sevindim. Kendi hazırladığım soruyu çözmek çok eğlenceliydi.

S1: "I was very glad to produce a problem. It was very fun to solve the problem that I had produced."

Konuyu daha iyi anladım. Eğlenceliydi. Arkadaşımın kurduğu soruyu çözmek eğlenceliydi. Ben de ona sordum o da benim sorduğum problemi çözüncüye çok eğlendik.

S4: "I learned the subject better. It was fun. It was fun to solve the problems posed by my classmates. Then, I posed a problem for them to solve; we fun."

Figure 3. Student Views of the Emotionally Stimulating Category

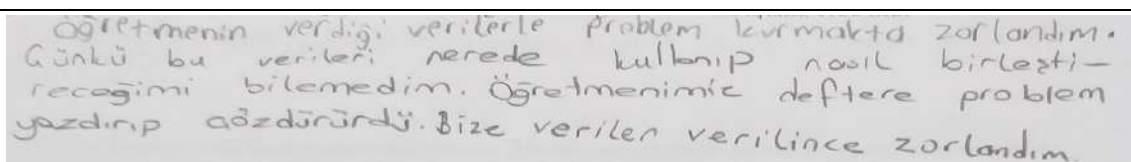
According to the second question in the interview form, students expressed their opinions in a single category regarding their difficulties while learning and teaching mathematics supported by problem-posing strategies. The findings are presented in Table 9.

**Table 9**

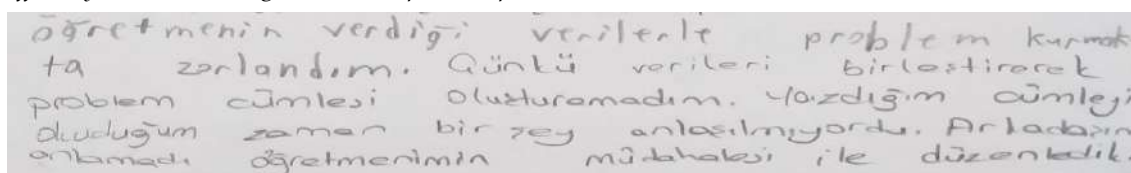
*Stages/situations the students had difficulty with during teaching mathematics supported by problem-posing strategies*

Category	Code	Students
Using strategies	Semi-Structured Problem-Posing Tasks	S7, S8
	Free Problem-Posing Tasks	S1, S4, and S6

According to Table 9, two students stated that they had difficulties combining the teacher's data and creating a meaningful problem sentence from these data because of the feature of the semi-structured problem-posing strategy. They said that their teachers always asked them to write problems in their notebooks. Therefore, they had difficulty combining data and information because they actively participated in this process. When they read the problems they wrote, they found them meaningless, irregular, or incomplete. With their teachers' intervention, they could transform the data and information into meaningful, solvable mathematical problems with rules (Figure 4).



S7: "I had difficulty posing a problem using the data given by the teacher. because I did not know where to use the data. (In the past), our teacher would have us write problems in our notebooks and solve them. I had difficulty when we were given data to produce problems."

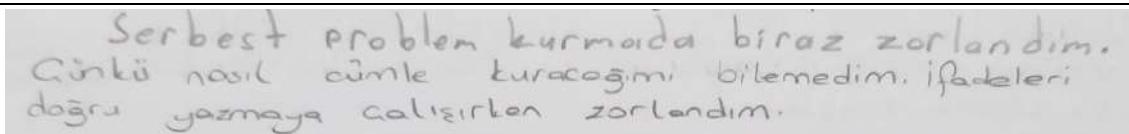


S8: "I found it difficult to produce problems with the data given by the teacher. Because I could not use the data properly to write a problem statement. When I read my problem statement, it was not understandable. My friend also did not understand it, so we edited it with my teacher's help."

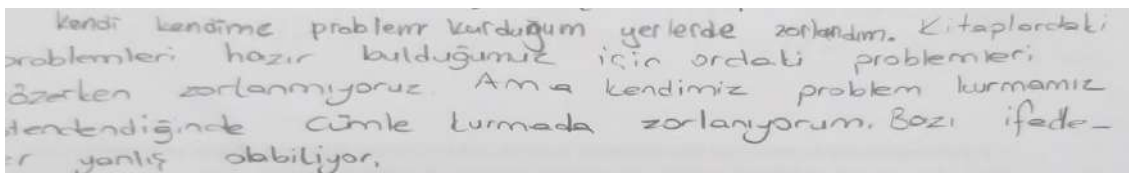
**Figure 4.** Students' Views on Semi-structured Problem-posing Strategies

Three students stated that due to the nature of the free problem-posing strategy. In contrast, the students were left free to pose problems, and they had difficulty in combining the statements in the problem sentence in a meaningful way because they had no experience in how to form problem sentences other than the problem-solving and posing actions they were used to while posing problems. Because they were used to solve problems in textbooks, they had difficulty posing problems regarding a particular subject. Some students made ambiguities in their posed problems and could not use realistic data. They saw that the problems they had set up were unsolvable. They made the necessary

corrections by obtaining help from their teachers so that the problems they formed were consistent with the mathematical principles and language. (Figure 5).



S4: "I had a little difficulty with the free problem-posing tasks. Because I did not know how to write problem statements. I had a hard time writing the statements."



S6: "I had difficulties with free problem-posing situations. We do not have any difficulties (with the tasks) in the textbook because it instructs us about what to do. However, I had a hard time when we were asked to pose problems ourselves. Some statements were wrong."

Figure 5. Student Views on the Free Problem-posing Strategy

## DISCUSSION and RESULTS

This study was conducted to reveal the effect of mathematics teaching supported by problem-posing strategies on the problem-posing skills of fourth-grade students and to obtain students' opinions about this method.

The first stage of the research concluded that teaching supported by problem-posing strategies was more effective in developing students' problem-solving skills than the control group. In addition, while the teaching supported by problem-posing strategies in the experimental group improved students' problem-posing skills, the teaching based on the current curriculum in the control group did not improve students' problem-posing skills. The emergence of this success in the experimental group can be attributed to the planned and qualified integration of problem-posing into mathematics lessons. The problem-forming learning model designed by Örnek and Soylu (2021) improves conceptual learning, ensuring the solvability of problems. It encourages the correct use of mathematical language and grammar rules and demonstrates the need for such models. Baumanns and Rott (2022) conducted 36 task-based interviews with pre-service elementary and secondary mathematics teachers who were given two structured problem-posing tasks to describe and analyze structured problem-posing processes. At the end of the study, they defined five types of activities (situation analysis, variation, generation, problem-solving, and evaluation). It was determined that this definition provided a better understanding of problem-posing processes in general. Turhan and Güven (2014) found that the problem-posing approach conducted with sixth-grade middle school students improved students' problem-posing skills, supporting our study's results. In addition, related studies have revealed that problem-posing-based teaching has a positive effect on the problem-solving success of students with different levels of number perception (Işık et al., 2012) and

academic success in teaching integers (Özdemir & Şahal, 2018). However, Güzel and Biber (2019) found that the problem-posing approach to teaching inequalities did not significantly affect academic achievement. Despite this result, Cantürk Günhan et al. (2019) revealed in their meta-analysis that problem-posing-based mathematics teaching positively and significantly affects student achievement. In addition, it has been concluded that problem-posing approaches supported by digital environments contribute to the development of students' problem-solving, problem-posing, and creative thinking skills (Kanbur Tekerek & Argün, 2019; Nuha et al., 2018; Suarsana et al., 2019; Sung et al., 2016). Akben (2018; 2019) determined that the problem-posing approach used in science teaching increased pre-service teachers' problem-solving skills and academic achievement. In addition, he found that pre-service teachers became aware of their level of knowledge about this approach and stated that it would contribute to their professional development. The results of these studies show that the problem-posing approach is effective in improving students' problem-solving, problem-posing, academic achievement, and creative thinking skills in both mathematics and other courses, which shows how important it is to be aware of and use the problem-posing approach in every grade and level. However, the few studies in which problem-posing is considered a method reveal that more research should be conducted to guide teachers in effectively performing this method. In addition, it should not be forgotten that studies should be conducted to include problem-posing more in curriculum content (Divrik et al., 2020; Jia & Yao, 2021; Zhang & Cai, 2021). It would also be helpful to conduct studies that focus on the different skills of students using this method at the primary school level, include teacher training, and provide guidance to classroom teachers on how to incorporate this method into their lesson plans.

When an evaluation was made regarding the three sub-dimensions of problem-posing, both in the inter-group comparison and the intra-group evaluation, the teaching supported by problem-posing strategies carried out in the experimental group was effective in the development of the experimental group's problem-posing skills in all three sub-dimensions. The lack of significant improvement in the control group can be attributed to the teacher's continued teaching based on the textbook. The fact that fifth-grade students' success in problem-posing was positively affected by the structured and semi-structured problem-posing activities prepared for the acquisition of "solving and constructing problems requiring operations with natural numbers" supports the results of our study. (Şakar, 2018). However, there are studies in the literature that reveal that teachers, pre-service teachers, and students have difficulty with different problem-posing strategies (Köken & Gökkurt-Özdemir, 2018; Kubanç & Ayaz, 2019; Ngah et al., 2016; Özgen et al., 2017; Silber & Cai 2016; Ulusoy & Kepceoğlu, 2018). For example, Silber and Cai (2016) found that pre-service teachers were more successful in revealing mathematical concepts in structured problem-posing activities than in free. However, there are also studies in the literature that reveal that teachers and pre-service teachers have the most difficulty in structured problem-posing activities (Köken & Gökkurt-Özdemir, 2018; Kubanç & Ayaz,

2019). Another study determined that pre-service teachers had more difficulty with semi-structured problem-posing activities than free problem-posing activities. Pre-service teachers were more successful in free problem-posing because they could construct free problems specific to their desired context without any restrictions. However, they had difficulty posing problems in semi-structured problem-posing activities because they were partially restricted (Mersin & Akkaş, 2023). These studies show that different problem-posing strategies have unique characteristics and should be systematically practiced. However, the insufficient number of objectives (Özgen et al., 2017), limited time, textbook content limitations, and teachers' inability to perform problem-posing activities (Lee et al., 2018) present some difficulties. This approach can be integrated into teachers' professional development courses to overcome the difficulties of using different strategies and make more precise distinctions (Bicer et al., 2020; Passarella, 2021). The results of this study concluded that problem-posing strategies can be integrated into elementary school mathematics courses.

In the second stage of the current research, because of analyzing the students' responses to the first question, it was determined that teaching mathematics supported by problem-posing strategies is an "innovative, student-centered, and emotionally stimulating" application. As is known, we encounter math at every stage of our lives, either directly or indirectly. Understanding and using math is becoming increasingly important every day because we need math to solve many problems encountered in everyday life. Recent changes in curricula emphasize the need to develop learning environments that help students learn math more easily (MoNE, 2017; 2018). In addition, relevant studies have underlined the importance of promoting innovative, student-centered, and fun learning environments that improve students' math skills (Divrik, 2019; Güneş et al., 2011; Karasu Avcı & Ketenoğlu Kayabaşı, 2019; Keklik, 2018). In this sense, in contrast to classical learning methods, the study participants thought that teaching mathematics supported by problem-posing strategies was innovative. Kontorovich (2020) found that problem-posing triggers a sense of innovation in producing good problems, which supports the results of this study. Similarly, the study by Turhan and Güven (2014) found that the problem-posing method was more effective than traditional textbook-based teaching. Furthermore, the participants of this study actively participated in performing problem-posing tasks, which resulted in their assessment of the method as a student-centered method. Likewise, Erdem and Soylu (2019) found that learning environments incorporating various teaching-learning materials (computer-aided applications, educational games, concrete teaching materials, cartoons, and discussion in collaborative groups relating to everyday life) boosted student engagement, which is consistent with our findings. Kilpatrick (1987) found that the mathematical tasks performed by students consisted of problems produced by their teachers or included in textbooks. However, when the students posed their problems, solved the problems produced by their classmates, and realized that they, too, could pose problems, they started to have more fun. In addition, the students who produced their problems

enjoyed solving the problems produced by themselves and their classmates. However, when the studies on the emotional effects of problem-posing recently are examined, it is emphasized that more research should be conducted on this issue (Cai & Leikin, 2020; Guo et al., 2020; Parhizgar et al., 2021; Schindler & Bakker, 2020). Therefore, emotional reactions are also important in cognitive skills, and more studies have investigated emotional reactions in problem-posing processes (Cai & Leikin, 2020).

The analysis of the students' responses to the second interview question revealed that students had the most difficulty in "semi-structured and free problem-posing" strategies while teaching mathematics supported by problem-posing strategies. Similarly, Kırnap-Dönmez (2014) revealed that prospective primary school mathematics teachers were more successful in structured problem-posing tasks than in semi-structured and free problem-posing tasks, which is consistent with our findings. Because structured problem-posing activities are more accessible, understandable, and doable than other problem-posing activities, they can easily construct problems by changing the information, data, and statements on the problem or adding new information. Studies in the relevant literature supported this result (Divrik, 2019; Kılıç, 2014; Kırnap-Dönmez, 2014; Tertemiz & Sulak, 2013).

In the semi-structured problem-posing strategy, students had difficulty combining data and information into meaningful mathematical problems in accordance with the rules. The conclusion of Ulusoy and Kepceoğlu (2018) that middle school mathematics teacher candidates made similar mistakes (mathematical language or ambiguities) supports the results of this study. Divrik et al. (2020) found that semi-structured problem-posing activities were the most common in primary school mathematics textbooks. According to this finding, students engage in semi-structured problem-posing activities more than other problem-posing strategies. However, this finding is not a result that can be effective in developing students' semi-structured problem-posing skills on its own. There are other variables that teachers (organization, designing, evaluation, quality problem-posing, negative impact on exams) and students (low-quality problem-posing, lack of experience, difficulty using language, lack of confidence) have to overcome in problem-posing tasks (Li et al., 2020; Xie & Masingila, 2017). Therefore, when conducting semi-structured problem-posing activities, the teacher should first pose sample problems, encourage the students, and provide a road map on what to do, which may help the students to pose more qualified problems.

It was revealed that students had difficulty in free problem-posing activities because they did not have previous experience in topic selection, determining data, determining skills, determining the number of operations, determining the limitations of the problem, and bringing together all data in accordance with mathematical principles. Although eighth-grade students feel comfortable in free problem-posing activities, and this reflects positively on their problem-posing success (Karahana Doğuz & Genç, 2023), studies have revealed that teachers give more space to structured and semi-structured problem-posing



activities during the lesson (Işık & Kar, 2012) and that free problem-posing situations are a more challenging task compared to other strategies (Nghah et al., 2016; Özgen et al., 2017). Lack of experience, lack of content knowledge, lack of curriculum knowledge, not recognizing students' cognitive levels, and difficulties in writing problem texts are cited as the reasons for difficulties in free problem-posing tasks (Şengül & Katrancı, 2015). In this context, the fact that students had difficulty in free problem-posing activities is consistent with the results of these studies. In future studies, quantitative studies can be conducted to reveal which strategies students have more difficulty with at the primary school level, and longitudinal studies to overcome these difficulties will make important contributions to the literature.

### LIMITATIONS AND RECOMMENDATIONS

This study was limited to 34 4<sup>th</sup>-grade students and 8 interviewees studying in a public school in Türkiye. The sample size was too small to draw a general conclusion that teaching mathematics supported by problem-posing strategies can improve students' problem-posing skills. because it was conducted with a quasi-experimental design. In addition, the application of the study was limited to 6 weeks and 30 lessons. This period is also not enough to make a general assessment that problem-posing-based teaching always increases students' problem-posing skills. Because in these six weeks, only lessons on fractions were conducted. Research over a more extended period, including other subjects, may eliminate this limitation in this respect. One final limitation of the current research is related to the subject taught in the process. The researcher used the studied method only in the subjects of "Fractions" and "Fraction Operations." In addition, the teacher's prejudice toward going beyond the teaching practices they are used to at first can be considered an uncontrollable limitation.

Considering these limitations, we can make some suggestions. We found that teaching mathematics supported by problem-posing strategies had a positive effect on students' problem-posing skills. However, students still had difficulty in the semi-structured and free problem-posing tasks. Therefore, we recommend that teachers use all three problem-posing strategies effectively. For this purpose, it may be helpful to first provide in-service training to teachers about problem-posing pedagogy and to conduct practical studies. Teachers can follow a path from simple to more complex applications while conducting classroom problem-solving activities. First, new problems can be constructed on a problem already solved, such as changing data or adding further information. Then, problem sentences that are left incomplete can be completed, or problems can be constructed using data such as tables, figures, and graphs. When a certain level of competence is reached in these applications, problems involving selected topics and operations can be constructed. Teachers who apply this process in their classes, for example, can enable their students to solve problems in accordance with this stage. In addition, future studies should focus on the effects of teaching mathematics supported by problem-posing strategies on the

mathematical skills of students at different grade levels. Since it was evaluated that integrating the problem-posing strategy into subjects (measurement, data collection, numbers) that require four operations would be more effective, studies covering these learning areas, as well as studies to be conducted in the field of geometry learning, can shed light on the related literature. It would be more appropriate to design these studies using accurate experimental designs. Creating these experimental studies as longitudinal studies may be more qualified to observe the development over time. In addition, by studying with larger study groups and achieving a longer implementation period may generalize this positive effect. It is also important to conduct studies that reveal the emotional impact of problem-posing activities.

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## Satisfaction Levels of Social Studies Teacher Candidates with Regard to Distance Education

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### Abstract:


*This study aimed to examine the satisfaction levels of pre-service social study teachers regarding distance education. Based on this purpose, survey and causal comparison models, which are among the quantitative research approaches, were preferred together. The study population consists of students in the Social Studies Teaching undergraduate program. The sample consisted of 238 pre-service Social Studies teachers studying in the Social Studies Teacher Education program at İnönü University, who were selected from the population using the simple random sampling method. The data of the study were obtained by using the "satisfaction scale" developed by Ilgaz (2008). The data collected with the satisfaction scale used to determine the satisfaction of pre-service social studies teachers with distance education were examined for normality before being analyzed. In this direction, skewness and kurtosis values were examined (Gürbüz & Şahin, 2017). It was determined that the skewness and kurtosis values obtained because of the analysis were within the " $\pm 1.5$ " range determined according to Tabachnick and Fidell (2013). The determined values show that the scale data meet the normal distribution criteria. Therefore, unrelated samples t-test and ANOVA, which are parametric tests, were used in the analysis because of the research, it was concluded that the satisfaction levels of pre-service teachers regarding distance education were high.*

**Keywords:** Education , distance education, social studies, teacher candidate.

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## INTRODUCTION

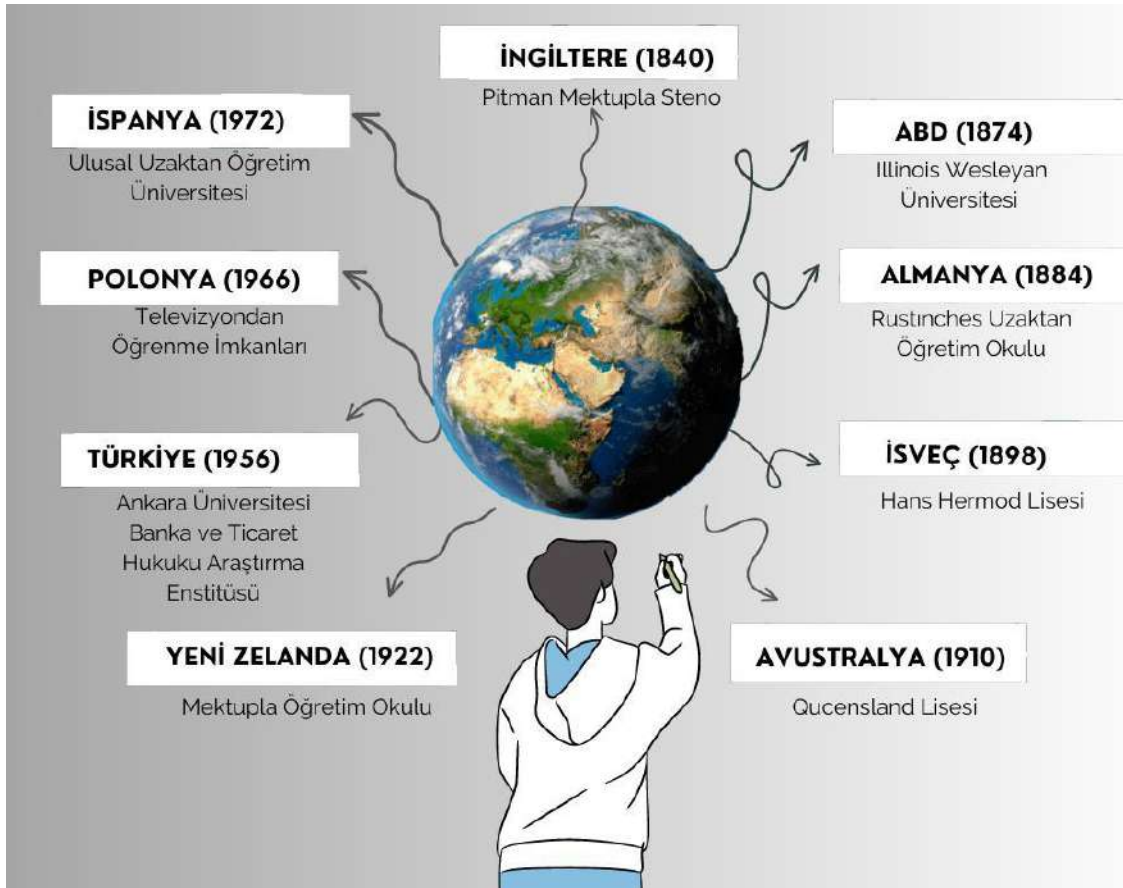
Contrary to what is known today, distance education has a long history. In fact, the first distance education studies in the world date back to the 18th-century. From this point of view, looking at the historical development processes of distance education, it can be seen that the first distance education practices started through letters and newspapers. In fact, the concept of "distance education", which was the first to mention in the catalog of the US-based University of Wisconsin in 1892 (Rumble, 1986; Raymond, 2000), was the first to see on a note taken by William Lighty, the director of the same university, in 1906. In the following years, this concept was introduced in Germany and given the name of newly established distance education institutions in France (Verduin & Clark, 1994; Akyürek, 2020). Although some sources state that the first distance education practices in the world started with Teno lessons in Boston Newspaper in 1728 (Çoban, 2013; Akyürek, 2020), this process was initiated by Isaac Pitman in England in 1840 (Keegan, 1996; Kaya, 2002; Hüseyin & Kocasarac, 2022; Uzaktan Eğitim Net, 2023). It is known that the advertisement of the Boston Gazette dated 1728 was a one-sided advertisement and there was no two-way communication. In addition, a similar advertisement was found in Sweden close to this date, and we observed that there was no mention of mutual communication or a practice for grading. On the other hand, Pitman, a stenographer, started teaching shorthand by letter in England and evaluated the success of students with grades during this teaching process (Kaya, 2002; Hüseyin & Kocasarac, 2022; Uzaktan Eğitim net, 2023). In this respect, Pitman's effort is considered a milestone for distance education. Ultimately, all these processes constitute the first steps toward the development of distance education and are of great importance in the beginning of this practice.

The first steps of distance education applications around the world were taken through newspapers and letters for nearly two centuries. In this context, the University Correspondence Collage and some commercial institutions began teaching by letter in 1843 (Akyürek, 2020). Then, in 1874, distance education studies began at Illinois Wesleyan University in the USA, and this was followed by a distance education school opened in Germany in 1884 to train university preparatory students. In 1898, a secondary school implementing a distance education program was established in Sweden (Hüseyin & Kocasarac, 2022). In addition women were given "composition lessons by letter" in the 19th-century. During these periods, many adults wanted to receive an education. However, they could not continue their education due to many factors such as location, age, and job. For this reason, Letter Teaching Universities were established and became widespread during these periods (Akyürek, 2020). In the 20th century, with the development of technology and the increase in human needs, new transformations in education began to be experienced, and distance education applications found wider spreading areas. In this context, at the beginning of the 20th century, in the 1920s, the first educational radio broadcasts by the BBC (British Broadcasting Corporation) began in the USA (Gökbulut, 2021). Subsequently, broadcasts were not delayed in other countries, and in 1922, the UK, France, and the Soviet

Union started similar remote radio broadcasts. In addition, since the 1930s, educational television broadcasts, especially in the USA, England, and Italy, have been included in distance education practices in a more comprehensive and planned manner (İşman, 1998; Uşun, 2006; Bates, 2015; Akyürek, 2020).

Distance education in Turkey was first discussed in 1927 at a meeting where educational problems were discussed, and it was thought that illiterate people would benefit from education in this way. However, this idea, which was planned as distance education by letter, could never be implemented (Alkan, 1987; Kaçan & Gelen, 2020). The fact that ninety percent of the people were illiterate and the lack of instructors had a great impact on the implementation of the idea of distance education in this period. Thus, the idea of distance education by letter, which was first proposed in 1927, remained an idea for a long time (Kaya & Odabaşı, 1996). However, in the second half of the 20th century, distance education studies were seriously valued in the Republic of Turkey, and in 1960, for the first time, the "Letter Teaching Center" was established within the Directorate of Statistics and Publication (Özarslan & Ozan, 2014). Thus, the idea of distance education, which continued as an idea for about half a century, entered a new phase from thought to practice with the establishment of distance education centers by letter. However, with the influence of technology in the following years, distance education practices in Turkey have been conducted in a more comprehensive and planned manner. Today, distance education activities in Turkey in many fields and levels are conducted in a multidimensional manner with the help of many technological devices such as radio, television, computer, mobile devices; TV channels, open education faculties, and EBA programs affiliated to the Ministry of National Education.

As a result, distance education in the 20th century, except for the last quarter of this century, has continued mainly through radio and television broadcasts with the influence of technological developments. Distance education has a long and comprehensive historical process. However, only some important points are summarized here. In this context, the development of distance education is also shown in Figure 1 (Distance education net, 2023):



*Figure 1.* Start dates and first applications for some distance education applications around the world.

Distance education, which has a long history in the traditional sense but has evolved into a new dimension with technological developments and has revealed a new understanding, is widely preferred all over the world today. Distance education, which emerged as an alternative teaching method to formal education, sometimes as a supportive and sometimes as an alternative teaching method to formal education with technological devices and applications such as radio, television, computer, internet, mobile technologies, and Google, has been unstoppably included in our educational life since the end of the 20th century and the beginning of the 21st century. It is a fact that the pandemic (Covid 19), which we characterize as a great disaster, has had a great impact on the spread of distance education understanding in recent times, as well as technological progress. The pandemic, which emerged in China in 2019 and then spread almost all over the world, has led to changes in many routines in our daily lives. One of the most important areas affected by pandemic conditions is education. The higher risk of contamination in crowded environments has led to the closure of human-based activity areas such as educational environments, partially limiting their activities. This situation necessitated the transition to distance education applications worldwide. In fact, in a short time, educational institutions have shifted their educational activities from face-to-face environments to online education environments by determining the road maps of the transition to distance education. Thus,

distance education applications have started to be used more frequently as an indispensable alternative, a supportive, and basic teaching method in education.

Undoubtedly, one of the biggest shares in the worldwide progress of distance education in a short time at the end of the twentieth century and the beginning of the twenty-first century belongs to technological developments. As a matter of fact, with the inevitable inclusion of global communication networks and technological tools in our lives, the perception of distance between people and countries has been largely broken through communication tools (internet, TV, social media, etc.) and the perception of time and space has changed. Educational planners, who cannot remain indifferent to this rapid change, have created more modern, virtual educational environments by integrating mass media into educational environments. Among virtual education environments, the most popular one today is distance education applications in which individuals in different places are involved in education at the same time using technological devices. Distance education, which dates back to ancient times in the traditional sense but constantly changes and develops with technology, is gaining more and more place in educational activities every day depending on the development status and technological infrastructure of countries (Kaya, Özkul, & Kırbaç, 2021; Kırbaç, Kaya, & Özkul, 2023). In particular, the pandemic conditions experienced by the whole world and the major earthquakes experienced in our country have paved the way for a better understanding of the importance of distance education by directing face-to-face and in the same place educational activities toward the digital field.

Since the early ages, education has been continuing in limited spaces (schools, classrooms, homes, libraries, etc.) where students and teachers share the same physical (face-to-face) environment (Kırbaç, Kaya, & Özkul, 2023). However, with the inclusion of technology in our lives and many other factors, online or distance education applications have come to the fore. From this viewpoint, when we look at the definitions in the literature on distance education, which constitutes the main theme of our subject, we see that most of them converge on certain common points. In general terms, distance education refers to education that occurs when students and teachers are in physically separate environments (Akdemir, 2011). In Anadolu University Open Education resources, which have significantly contributed to the establishment and development of distance education in our country, distance education is described as "a contemporary application that enables students to learn by using communication technologies". Uşun (2006) defined distance education as "an up-to-date educational technology application in which sources and receivers are located in environments far from each other, individuality, flexibility and independence features, and communication and interaction are provided by technical means". It can also be defined as the distribution of instructional materials through both printed and electronic media, especially with the introduction of computers into the educational environment (Moore, 1990; Moore et al., 2010). According to Moore and Kearsley (2011), it can be described as a planned teaching activity in which communication



is provided through technological tools and teaching occurs in different environments in addition to traditional educational activities. In general terms, distance education is an educational activity in which there is an organized educational plan, students and teachers are in different places, but face-to-face meetings are held when necessary (Gunawardena & McIsaac, 2001). In this respect, one of the most fundamental elements of distance education is the implementation of the learning and teaching process in different contexts (Yenilmez, Balbağ, & Turgut, 2017). In addition, when the literature on distance education is reviewed, it is seen that distance education is used together or synonymously with concepts such as "web-based education, internet-based learning, and e-learning" (Turgut & Yenilmez, 2011).

Looking at the position of distance education from past to present, distance education is generally considered as an alternative to face-to-face education, and this understanding continues. However, when we look at the studies in the literature, it is thought that distance education is a more effective model than face-to-face education (Simonson, Schlosser & Orellana, 2011) and can be used as an independent teaching model when necessary. Distance education has the opportunity to reach people of all ages without time and space limitations and to perform educational activities. From this point of view, it provides equality of opportunity to many people without the chance of face-to-face education and provides individuals with lifelong learning opportunities due to its independence from time and space. In addition, the development of technological opportunities in the last century has increased the interest and need for distance education. In addition, natural disasters such as the COVID-19 pandemic and the February 6 earthquake in Turkey reveal the importance of distance education. Education is one of the indispensable fields of endeavor for individuals and states. In this context, in today's conditions, distance education is used in educational environments as an alternative or supportive element of face-to-face education under certain conditions. The importance of the research increases one more time at this point.

Today, the importance of distance education in educational environments is increasing. Accordingly, studies on distance education continue to increase daily. Based on this problem, the research was conducted to determine the satisfaction levels of Social Studies Teacher Candidates regarding distance education. It is thought to contribute to the field today, when distance education is included in every aspect of our lives. In this context, the literature examines teacher (Demir & Özdaş, 2020; Kurnaz, Kaynar, Barışık, & Doğrukök, 2020; Balaman & Tiryaki, 2021) and student views on distance education (Kıralı & Alcı, 2016; Birişçi, 2013), problems experienced in distance education (Kürtüncü & Kurt, 2020; Saygı, 2021), and the general framework of distance education (Bozkurt, 2021; Devran & Elitaş, 2017; Kurtdaş, 2021). However, there is no research to date on the satisfaction levels of pre-service Social Studies teachers in distance education. From this point of view, the main problem of the study was determined as "the satisfaction levels of pre-service social studies teachers with distance education". Based on this main problem, the subproblems of the study are listed as follows:

### *Sub-problems*

**H1:** What is the level of pre-service social study teachers' satisfaction with distance education?

**H2:** Does pre-service social study teachers' satisfaction with distance education show a statistically significant difference according to gender?

**H3:** Does pre-service social study teachers' satisfaction with distance education show a statistically significant difference according to the grade of education?

**H4:** Does pre-service social study teachers' satisfaction with distance education show a statistically significant difference according to the place of residence?

**H5:** Do pre-service social study teachers' satisfaction with distance education show a statistically significant difference according to their preference for face-to-face and distance education?

## METHOD

### *Research Model*

In the study, survey and causal comparison models, which are among the quantitative research approaches, were preferred. In studies using the survey model, it is aimed to collect data to determine certain characteristics of a group. The causal comparison model, on the other hand, aims to determine the causes and consequences of differences between groups of people without any intervention on conditions and participants (Büyüköztürk et al., 2023). In this context, this study determined the satisfaction of pre-service social study teachers regarding distance education.

### *Participants*

The population of the research consisted of pre-service social studies teachers studying at İnönü University in the 2021–2022 academic year, while 238 pre-service teachers (169 female and 69 male) were determined as the sample of the study. While determining the sample, "Simple Random Sampling" method was used. Simple random sampling is a method in which selected units are sampled by giving each sampling unit an equal probability of selection (the selected unit is put back into the pool so that the probability of selection does not change for the remaining units) (Büyüköztürk et al., 2023).

### *Data Collection Tools*

The first part of the measurement tool used in the study consists of demographic information about the participants. In the second part, the "Scale of Student Satisfaction in Distance Education" developed by Ilgaz (2008), consisting of 34 items and 6 dimensions, was used.

*Student Satisfaction Scale in Distance Education:* This scale was developed by Ilgaz (2008) and consists of 34 items and 6 sub-dimensions. The Cronbach 's alpha reliability coefficient calculated because of the reliability studies of the original form of the 7-point Likert-type scale was determined to be ".96" and this value was calculated as ".96" in this study. The fact that the Cronbach 's alpha value obtained is in the range of .80–1.00 shows that the scale used in the research is highly reliable (Kalaycı, 2017).

*Demographic Information Questionnaire:* The demographic information questionnaire was developed and used by the researchers, in which the participants ' information such as gender, class of study, place of residence, and preference for face-to-face/distance education was obtained.

### *Data Analysis*

In this study, the normality of the data was examined before analyzing the data collected with the satisfaction scale used to determine the satisfaction of pre-service social studies teachers with distance education. In this direction, skewness and kurtosis values were examined (Gürbüz & Şahin, 2017). The skewness and kurtosis values obtained because of the analysis were determined to be within the " $\pm 1.5$ " range determined according to Tabachnick and Fidell (2013). The determined values show that the scale data meet the normal distribution criteria. Therefore, unrelated samples t-test and ANOVA, which are parametric tests, were used in the analysis

**Table 1**

#### *Findings Related to Normality*

<b>Dimensions</b>	<b>Skewness</b>	<b>Kurtosis</b>
Student-Student Interaction	-.080	-.928
Student-Teacher Interaction	-.411	-.823
Online Courses	-.522	-.318
Technical Support	-.221	-.969
Printed Materials	-.359	-.198
Face-to-Face Events	-.591	-.193
Level of Satisfaction with Distance Education (Overall)	-.210	-.444

### *Ethical considerations*

During this research, we paid scrupulous attention to ethical guidelines, ensuring that the integrity and reliability of the study were never compromised.

For the quantitative phase, data were meticulously harvested electronically, ensuring the privacy and anonymity of the respondents. The absence of demographic data collection further cemented this confidentiality. Moving on to the qualitative portion, every interviewee was formally apprized of the research 's objectives, methodologies, and potential implications. Importantly, they were reassured in writing about their right to

withdraw from the study without any repercussions. All data acquired, including the interview tools and participants' consent documents, were securely housed on the researcher's personal computer, fortified by stringent password protection measures.

In alignment with the overarching commitment to ethics, this study stringently adhered to all provisions delineated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive." It is imperative to note that there were zero instances of activities that might infringe upon the clauses stated under the "Actions Against Scientific Research and Publication Ethics."

Ethical Review Board: İnönü University Social Sciences and Humanities Scientific Research and Publication Ethics Committee

Date of Ethics Review Decision: 08-04-2021

Ethics Assessment Document Issue Number: 25

## FINDINGS

### *Findings on pre-service social study teachers' satisfaction levels with distance education*

The findings obtained because of the analysis conducted for the problem of "What is the level of satisfaction of pre-service social studies teachers regarding distance education?" are presented in Table 2:

**Table 1**

*Findings Related to Normality*

Dimensions	$\bar{x}$	sd
Student-Student Interaction	4,07	1,745
Student-Teacher Interaction	4,62	1,814
Online Courses	4,75	1,533
Technical Support	4,20	1,888
Printed Materials	4,60	1,462
Face-to-Face Events	4,91	1,424
Level of Satisfaction with Distance Education (Overall )	4,56	1,253

When Table 2 is examined, it is seen that the satisfaction level of Social Studies teacher candidates regarding distance education is at the level of "Fully Agree ( $\bar{x}=4.56$ ). On the basis of sub-dimensions, in the sub-dimension of "Student-Student Interaction" "Agree ( $\bar{x}=4.07$ ), in the sub-dimension of "Student-Teacher Interaction" "Totally Agree ( $\bar{x}=4.62$ ), in the sub-dimension of "Online Courses" "Totally Agree ( $\bar{x}=4.75$ ), "Fully Agree ( $\bar{x}=4.20$ ) in the "Technical Support" sub-dimension, "Fully Agree ( $\bar{x}=4.60$ ) in the "Printed Materials" sub-

dimension, and "Fully Agree ( $\bar{x}=4,91$ ) in the "Face-to-Face Activities" sub-dimension. This situation can be evaluated as indicating that the satisfaction levels of Social Studies teacher candidates regarding distance education are high.

### *Analysis findings of pre-service social study teachers' satisfaction levels with distance education according to gender*

The findings obtained because of the analysis conducted for the problem of the study "Do the satisfaction of pre-service social studies teachers with distance education show a statistically significant difference according to gender?" are presented in Table 3:

**Table 3**

*Data on the Gender Variable of Satisfaction Levels Regarding Distance Education*

<b>Dimensions</b>	<b>Gender</b>	<b>n</b>	<b><math>\bar{x}</math></b>	<b>sd</b>	<b>t</b>	<b>df</b>	<b>p</b>
Student-Student Interaction	Woman	169	4,05	1,678	-,189	236	,85
	Male	69	4,10	1,911			
Student-Teacher Interaction	Woman	169	4,54	1,753	-1,099	236	,27
	Male	69	4,82	1,953			
Online Courses	Woman	169	4,67	1,481	-1,279	236	,20
	Male	69	4,95	1,650			
Technical Support	Woman	169	4,18	1,890	-,276	236	,78
	Male	69	4,25	1,897			
Printed Materials	Woman	169	4,58	1,417	-,355	236	,72
	Male	69	4,65	1,575			
Face-to-Face Events	Woman	169	4,93	1,406	,285	236	,77
	Male	69	4,87	1,474			
Level of Satisfaction with Distance Education (Overall)	Woman	169	4,53	1,186	-,632	236	,52
	Male	69	4,64	1,410			

Table 3 shows the results of the unrelated samples t-test conducted to determine whether the satisfaction levels of pre-service Social Studies teachers with distance education differ significantly according to gender. When the t-test data were examined, it was determined that the satisfaction levels of pre-service Social Studies teachers with distance education did not differ significantly according to the gender variable ( $t= -,632$ ;  $p>,05$ ). This situation was also realized on the basis of subdimensions.

### *Analysis findings of pre-service social study teachers' satisfaction levels with distance education according to the class of study*

The findings obtained because of the analysis conducted for the problem of the study "Do the satisfaction of pre-service social studies teachers with distance education show a statistically significant difference according to the class of study?" are presented in Table 4:

**Table 4**

*Data on Satisfaction Levels Regarding Distance Education with Respect to the Study Variable*

Dimensions	Class	n	$\bar{x}$	sd	Source of Variance	Sum of Squares	df	Mean Square	F	p
Student-Student Interaction	1	75	4,48	1,890	Between Groups	50,329	3	16,776	5,844	,00 1-2 2-4
	2	62	3,38	1,786	Within Groups	671,686	234	2,870		
	3	48	3,91	1,464	Total	722,015	237			
	4	53	4,43	1,466						
	Total	238	4,07	1,745						
Student-Teacher Interaction	1	75	4,91	1,801	Between Groups	42,070	3	14,023	4,446	,00 1-2 2-4
	2	62	4,01	1,992	Within Groups	738,024	234	3,154		
	3	48	4,45	1,677	Total	780,093	237			
	4	53	5,08	1,540						
	Total	238	4,62	1,814						
Online Courses	1	75	5,04	1,457	Between Groups	38,020	3	12,673	5,707	,00 1-2 2-4
	2	62	4,17	1,691	Within Groups	519,650	234	2,221		
	3	48	4,57	1,408	Total	557,670	237			
	4	53	5,17	1,350						
	Total	238	4,75	1,533						
Technical Support	1	75	4,55	1,844	Between Groups	20,960	3	6,987	1,983	,11
	2	62	3,80	1,990	Within Groups	824,447	234	3,523		

	3	48	4,33	1,674	Total	845,407	237		
	4	53	4,06	1,956					
	Total	238	4,20	1,888					
Printed Materials	1	75	4,86	1,327	Between Groups	21,568	3	7,189	
	2	62	4,11	1,578	Within Groups	485,117	234	2,073	
	3	48	4,69	1,345	Total	506,685	237		3,468 ,01
	4	53	4,74	1,503					1-2
	Total	238	4,60	1,462					
Face-to-Face Events	1	75	4,94	1,368	Between Groups	3,336	3	1,112	
	2	62	4,99	1,467	Within Groups	477,261	234	2,040	
	3	48	5,02	1,477	Total	480,597	237		,545 ,65
	4	53	4,70	1,418					
	Total	238	4,91	1,424					
Level of Satisfaction with Distance Education (Overall)	1	75	4,82	1,218	Between Groups	19,738	3	6,579	
	2	62	4,11	1,383	Within Groups	352,617	234	1,507	
	3	48	4,53	1,091	Total	372,355	237		4,366 ,00
	4	53	4,75	1,160					1-2
	Total	238	4,56	1,253					2-4

Table 4 shows the results of ANOVA to determine whether the satisfaction levels of pre-service social study teachers with distance education differ significantly according to the grade level variable. When the ANOVA data were utilized, it was determined that the satisfaction levels of pre-service social studies teachers with distance education differed significantly ( $F= 4,366$ ;  $p<.05$ ) according to the grade of education. A significant difference

was observed between pre-service social study teachers studying in the second grade and those studying in the first and fourth grades. This result was found to be in favor of the first and fourth graders. The significant difference between the groups was also determined in the sub-dimensions of "Student-Student Interaction", "Student-Teacher Interaction", and "Online Courses". In the sub-dimensions of "Printed Materials", there was a significant difference only between second-year pre-service social study teachers and first-year pre-service social study teachers.

*Analysis findings of pre-service social study teachers' satisfaction levels with distance education according to their place of residence*

The findings obtained because of the analysis conducted for the problem of the study "Do pre-service social studies teachers' satisfaction with distance education show a statistically significant difference according to the place of residence?" are presented in Table 5:

**Table 5**

*Data Regarding the Place of Residence Variable of Satisfaction Levels with Distance Education*

Dimensions	Settlement	n	$\bar{x}$	sd	Source of Variance	Sum of Squares	df	Mean Square	F	p
Student-Student Interaction	1. Village	54	3,51	1,695	Between Groups	35,392	2	17,696	6,057	,001-2
	2. District	47	4,70	1,579	Within Groups	686,623	235	2,922		
	3. Provincial Center	137	4,07	1,756	Total	722,015	237			
	Total	238	4,07	1,745						
Student-Teacher Interaction	1. Village	54	4,06	1,838	Between Groups	22,887	2	11,444	3,552	,031-2
	2. District	47	4,93	1,606	Within Groups	757,206	235	3,222		
	3. Provincial Center	137	4,73	1,837	Total	780,093	237			
	Total	238	4,62	1,814						



Online Courses	1. Village	54	4,32	1,51 8	Between Groups	13,096	2	6,548		
	2. District	47	4,83	1,62 6	Within Groups	544,575	235	2,317		
	3. Provincial Center	137	4,89	1,48 6	Total	557,670	237		2,826	,06
	Total	238	4,75	1,53 3						
Technical Support	1. Village	54	3,77	1,95 8	Between Groups	13,290	2	6,645		
	2. District	47	4,26	2,11 9	Within Groups	832,117	235	3,541		
	3. Provincial Center	137	4,35	1,76 1	Total	845,407	237		1,877	,15
	Total	238	4,20	1,88 8						
Printed Materials	1. Village	54	4,21	1,48 7	Between Groups	13,545	2	6,773		
	2. District	47	4,92	1,40 8	Within Groups	493,140	235	2,098		
	3. Provincial Center	137	4,65	1,44 6	Total	506,685	237		3,227	,04 1-2
	Total	238	4,60	1,46 2						
Face-to-Face Events	1. Village	54	4,87	1,46 1	Between Groups	2,322	2	1,161		
	2. District	47	5,11	1,26 9	Within Groups	478,274	235	2,035		
	3. Provincial Center	137	4,86	1,46 2	Total	480,597	237		,571	,56
	Total	238	4,91	1,42 4						
Level of Satisfaction with Distance	1. Village	54	4,17	1,21 8	Between Groups	12,426	2	6,213	4,056	,01 1-2

Education (Overall)	2. District	47	4,84	1,21 4	Within Groups	359,929	235	1,532
	3. Provincial Center	137	4,62	1,25 2	Total	372,355	237	
	Total	238	4,56	1,25 3				

Table 5 shows the results of the ANOVA conducted to determine whether the satisfaction levels of pre-service social studies teachers with distance education differ significantly according to the residential area variable. When the ANOVA data were analyzed, it was determined that the satisfaction levels of pre-service social studies teachers with distance education differed significantly ( $F= 1,390$ ;  $p<.05$ ) according to the place of residence variable. It is seen that a significant difference exists between pre-service social studies teachers whose place of residence is village and pre-service social studies teachers whose place of residence is district center.

The significant difference on the basis of sub-dimensions is between the pre-service social studies teachers whose settlement is a village and the pre-service social studies teachers whose settlement is a district center on the basis of "Student-Student Interaction", "Student-Teacher Interaction" and "Printed Materials" sub-dimensions.

*Analysis findings of pre-service social study teachers' satisfaction levels with distance education according to their preference for face-to-face and distance education*

The findings obtained because of the analysis conducted for the problem of the study "Do pre-service social studies teachers' satisfaction with distance education show a statistically significant difference according to their preference for distance and face-to-face education?" are presented in Table 6:

**Table 6**

*Data on Satisfaction Levels Regarding Distance Education and Preference for Distance or Face-to-Face Education*

Dimensions	States	n	$\bar{x}$	ss	t	sd	p
Student-Student Interaction	Face to face	167	3,70	1,667	-5,266	236	<b>,00</b>
	Remote	71	4,93	1,623			
Student-Teacher Interaction	Face to face	167	4,27	1,801	-4,769	236	<b>,00</b>
	Remote	71	5,44	1,572			
Online Courses	Face to face	167	4,43	1,522	-5,206	236	<b>,00</b>
	Remote	71	5,50	1,285			
Technical Support	Face to face	167	3,87	1,898	-4,294	236	<b>,00</b>

	Remote	71	4,98	1,628			
Printed Materials	Face to face	167	4,34	1,409	-4,393	236	<b>,00</b>
	Remote	71	5,22	1,406			
Face-to-Face Events	Face to face	167	5,08	1,383	2,811	236	<b>,00</b>
	Remote	71	4,52	1,449			
Level of Satisfaction with Distance Education (Overall)	Face to face	167	4,33	1,219	-4,589	236	<b>,00</b>
	Remote	71	5,11	1,165			

Table 6 shows the results of the unrelated samples t-test conducted to determine whether the satisfaction levels of pre-service social studies teachers with distance education differ significantly according to the variable of preference for distance and face-to-face education. When the t-test data were examined, it was determined that the satisfaction levels of pre-service social studies teachers with distance education differed significantly according to the variable of preference for distance or face-to-face education ( $t = -4,589$ ;  $p < .05$ ). It was determined that the significant difference was high in favor of pre-service social study teachers who preferred distance education. This situation was also realized on the basis of subdimensions.

## DISCUSSION, CONCLUSION AND RECOMONDATIONS

In this study, which examined the satisfaction levels of pre-service Social Studies teachers with distance education, it was observed that the satisfaction levels of pre-service Social Studies teachers with distance education were at the level of "completely agree". This result shows that pre-service social studies teachers prefer distance education over face-to-face education. In this respect, the results of the research reveal that pre-service social studies teachers prefer distance education to face-to-face education.

Social Studies is a curriculum that requires multiple and rich learning areas in terms of its content. In this context, it is important to determine whether Social Studies teaching, which is based on the richness of materials, active learning content by doing and experiencing instead of traditional knowledge transfer, and individual differences, has achieved its purpose in the distance education process. When evaluated within the historical development process, the direct addressee of distance education is the student. For this reason, to make a healthy determination, it is imperative to address the perceptions of prospective Social Studies teachers about distance education. As a matter of fact, many studies have been conducted on distance education in the field of social studies. However, these studies have mostly focused on the opinions of teachers and pre-service teachers, and there is no study on the relationship between distance education and pre-service teachers' satisfaction levels. However, it is thought that there is a more linear relationship between distance education and students' satisfaction levels in social studies teachings. In these studies (Yalman, 2013; Özkul, Kırbaç, & Kaya, 2021), no significant difference was found. In

this respect, the research results revealed different results. However, it is thought that there is a more linear relationship between distance education in social studies teaching and students' satisfaction levels.

In this study, which examined the satisfaction levels of pre-service social studies teachers with distance education, it was observed that the satisfaction levels of pre-service teachers with distance education were at the level of "completely agree". When Social Studies teaching, which corresponds to multiple learning environments, is evaluated in detail in terms of the sub-dimensions of student-student interaction, student-teacher interaction, online courses, technical courses, printed materials, and face-to-face activities, it is observed that the satisfaction level of pre-service teachers is predominantly at the level of "completely agree". These data show that pre-service social studies teachers prefer distance education over face-to-face education. This result also indicates that pre-service Social Studies teachers are satisfied with the distance education process. There are also studies supporting this result. Seyhan's study titled "Distance education experiences and opinions of pre-service Social Studies teachers during the COVID-19 pandemic" (2021) reveals that the distance education process has advantages such as learning independent of time and space, research, reading, and developing learning skills. On the other hand, the same study also reveals that pre-service social studies teachers experience difficulties such as access to the internet, material supply, providing a learning environment, and learning difficulties. In fact, it can be stated that this difference is due to the individual differences and experiences of the sample in the two studies.

In addition to the views of pre-service Social Studies teachers on distance education, both positive and negative aspects of distance education have been revealed in many studies conducted on pre-service teachers and teachers in the Faculty of Education. In this regard, the COVID-19 process has served as an important educational laboratory for revealing the advantages and disadvantages of distance education for students and teachers. In this context, in the study by Kurtdaş (2021), some negative aspects of distance education due to the digitalization process were emphasized. In the study, these negativities are mostly focused on the loss of meaning and disappointment experienced by young individuals because of spatialization and damage to the sense of belonging, although university education is a way of life. In addition, it was concluded that distance education creates inequality of opportunity. On the other hand, the study also revealed many advantages of distance education. Controlling individual learning as opposed to mass learning, providing mobility by liberating individuals from time and space, the ability to watch video recordings again, and creating a comfort zone for individuals in terms of economics (accommodation, transportation, nutrition, etc.) are the reasons that make distance education desirable. In this context, these advantages are in parallel with the factors that increase the satisfaction levels of pre-service social studies teachers with distance education.

In the literature, studies revealing the positive and negative aspects of distance education aimed at social studies teachers have also been conducted (Özdoğan & Berkant, 2020; Yeşilyurt, 2021; Uyar, 2020; Korkut & Memişoğlu, 2021). In these studies, teachers stated that some problems arose in socialization and teacher-student communication, technical and infrastructure problems negatively affected students' attendance, and the predominantly domestic environment made distance education difficult by preventing students' mental motivation. These negative comments expressed by the teachers do not support the results obtained in this study. On the other hand, the Social Studies teachers' statements that distance education saves time, provides a lifelong sustainable, flexible, and functional educational environment, and creates an economic comfort zone support the results of this study. In other words, it can be argued that these factors also determine pre-service teachers' satisfaction levels with distance education.

The second sub-problem examined within the scope of the research is the variable "whether the satisfaction levels of pre-service Social Studies teachers with distance education differ according to gender". The results of the analysis conducted in this context showed that the satisfaction levels of pre-service Social Studies teachers regarding distance education did not differ significantly according to gender. This result can be considered positive in the sense that there is no difference in the use of computers and technological tools according to gender. This result obtained in the research overlaps with the result of the study by Krali and Alc (2016). However, it is a wrong attitude to see distance education only as the use of computers and technological tools. In this context, the study also reveals that self-study and learning motivation, i.e., self-directed learning skills, do not change depending on gender. The lack of gender differentiation in this regard is a desired and necessary result. However, some studies have found that this idea is not supported. For example, in the studies conducted by Başar, Arslan, Günsel, and Akpınar in 2019 and Graham and Jones in 2011, it was observed that while men had a more positive attitude toward distance education, women were more distant. This result can be interpreted as a form of inequality caused by gender roles. In fact, the upbringing of women as limited to the domestic sphere and men as free in the public sphere may reveal a differentiation, especially in the use of computers and technological tools. However, the fact that the satisfaction levels of pre-service teachers in the study did not differ according to the gender variable is a positive result when evaluated in the context of gender.

The third sub-problem addressed in the research is to examine the satisfaction levels of pre-service social study teachers with distance education according to the grade of education. In this context, when the results of the analysis were examined, it was determined that the satisfaction levels of pre-service Social Studies teachers regarding distance education showed a significant difference according to the grade of education variable. A significant difference was found between pre-service Social Studies teachers studying in the second grade and pre-service Social Studies teachers studying in the first and fourth grades. The research data obtained in this regard indicate that the satisfaction levels of pre-service

teachers in the first and fourth grades regarding distance education are higher than those in the second grade. This result is meaningful in the context that the sample consists of university students in general and Faculty of Education students in particular. As a matter of fact, university students enter a new and different environment from their family the first year. Therefore, they have a more distant attitude toward university life. For example, while they go to their families more frequently in the first grade, this rate decreases toward the upper grades due to getting used to the university environment. Therefore, it is expected that first-year students will prefer distance education for both economic and socio-psychological reasons. Satisfaction level increases toward the 2nd grade. However, the level of satisfaction with distance education increases again in the fourth grade. This situation can be explained by the fact that the sample is a member of the Faculty of Education, and they are more focused on the KPSS exam and their anxiety increases. As a matter of fact, in the last year, pre-service teachers have reduced the time they spend at school and concentrate on exams. In this context, it can be stated that pre-service teachers' preference for distance education directly affects their satisfaction levels. Although studies with significant results on this subject are not frequently encountered, Gedik and Erol (2022) did not find a significant difference according to the class variable in their study on the attitudes of prospective classroom teachers toward distance education.

The fourth sub-problem addressed within the scope of this research is to examine the satisfaction levels of pre-service social studies teachers regarding distance education according to the variable of settlement. When the results of the analysis obtained in this context are evaluated; it is seen that the satisfaction levels of pre-service Social Studies teachers regarding distance education vary significantly according to the residential area variable. In fact, the study concluded that pre-service Social Studies teachers residing in villages have higher satisfaction levels with distance education compared to pre-service teachers residing in the district center. On the other hand, it is noteworthy that no significant difference was observed according to the provincial center. The most significant reasons for the higher satisfaction levels of pre-service teachers residing in the village compared with those residing in other settlements are the difficulty of transportation due to the distance of the village to the education and training places and the fact that it has less comfort in terms of material terms. Therefore, it can be argued that prospective teachers residing in the village prefer distance education because of economic concerns such as transportation, housing, dressing, and eating and drinking, and accordingly, their satisfaction levels with distance education are high. This conclusion has been reached in many studies revealing the advantages of distance education (Özdoğan & Berkant, 2020; Yeşilyurt, 2021; Uyar, 2020; Korkut & Memişoğlu, 2021). These data show that there is a linear relationship between the place of residence or residence address and the advantages and disadvantages of distance education.

The last sub-problem addressed within the scope of the research is to determine whether the satisfaction levels of pre-service social studies teachers with distance education

vary according to the variable of preference for distance or face-to-face education. In this context, when the research data were analyzed, it was determined that the satisfaction levels of pre-service social studies teachers regarding distance education differed significantly according to the variable of preference for distance or face-to-face education. According to the research, pre-service teachers who prefer distance education are expected to have higher levels of satisfaction with distance education. Otherwise, it would be contradictory for the sample with low satisfaction levels with distance education to prefer this form of education. The results of the study by Türküresin (2020) on this subject also support the data obtained in the study. In Türküresin 's study, a significant portion of the sample stated the ability to always prefer face-to-face education because they received instant feedback from the lecturer and communicated better with eye contact, but they were deprived of this during the pandemic period and expressed their dissatisfaction with distance education. This result reveals a linear relationship between the level of preference for distance education and the level of satisfaction with distance education. In addition, it is observed that this linear relationship exists in many studies revealing the positive and negative aspects of distance education. However, when the literature is examined, there is no direct study that reveals the relationship between the independent variable of teachers ' or prospective teachers ' preference for distance education and their satisfaction level with distance education. In this sense, this research is unique in many aspects.

When the results of the research are considered in general terms, it is seen that the satisfaction levels of pre-service social studies teachers regarding distance education are high. When the sub-problems are evaluated separately, it is concluded that while the satisfaction levels of the prospective teachers regarding distance education do not differ significantly in terms of gender variable, they differ significantly according to the place of residence, the grade studied, and the preference for distance or face-to-face education. Based on these results, some suggestions were made. These suggestions are as follows:

- The research was conducted to determine the satisfaction levels of prospective Social Studies teachers regarding distance education. To make a more general judgment about distance education, similar studies can be conducted on a larger and different sample at the scale of other departments or faculties.
- This research uses a quantitative method. In this context, the number of studies on distance education can be increased with qualitative and mixed studies. Thus, more scientific inferences can be made.
- Because of this research, it was observed that the satisfaction levels of pre-service teachers regarding distance education were high. Based on this result, the field of distance education can be expanded in teaching starting from faculties or distance education can be used as a form of supportive education.

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**Ethics statement:** We hereby declare that research/publication ethics and citing principles have been considered in all the stages of the study. We take full responsibility for the content of the paper in case of dispute.

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# Views of Parents of a Child Diagnosed with Autism Spectrum Disorder on Burnout: A Meta-Synthesis Study

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## Abstract:

This research aims to analyze the views of parents of children diagnosed with autism spectrum disorder (ASD) regarding their burnout using a meta-synthesis method. A total of 456 articles published between 2010 and 2023, using qualitative methodologies, were analyzed, examining 10 studies. Google Scholar, DergiPark, ERIC, EBSCO, EBCSCO Academic Search Ultimate, Elsevier, SCOPUS, Web of Science (WOS), and Wiley databases were used for study selection. The subject headings and keywords used in the searches were: 'autism spectrum disorder, parent, family, burnout, child, perspective, qualitative research. Content analysis was the preferred method during the data analysis. Using content analysis, the sampling methods, research purposes, data collection tools, and results obtained in the studies were examined. The identified data were interpreted based on frequency and occasionally presented using tables and graphs. The findings were categorized under identified themes based on the collected data. The studies examined within the scope of the research were evaluated as a whole, and five themes were reached: getting support, isolation, disruption of daily routine, anxiety, and emotional outbursts. The study's conclusions also provide recommendations for educators, parents, and future research directions.


## Keywords:

Autism Spectrum Disorder (ASD), Parent, Mother, Father, Burnout, Meta-Synthesis


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## INTRODUCTION

Autism Spectrum Disorder (ASD), which emerges in early childhood, is characterized by difficulties in behavior, communication, and child socialization (American Psychiatric Association, 2000). The definition of ASD in DSM-5 is as follows: abnormal social approach and reciprocal lack of speech; inability to share interests, emotions, or affect; failure to initiate or engage in social interaction; experiencing social-emotional confusion, inadequacy in verbal and nonverbal communication, abnormalities in eye contact and body language, lack of understanding and use of gestures, minimal facial expressions and nonverbal communication for social interaction, difficulties in adjusting behavior according to different social situations, difficulties in sharing imaginary play or making friends, lack of interest in peers, deficits in forming, maintaining, and understanding relationships (American Psychiatric Association, APA, 2014). These individuals often follow routines of observing spinning objects, tend to play with spinning objects, create unique internal worlds for themselves, have established routines, and experience behavioral problems when their routines are disrupted. They are individuals who do not enjoy hugging and avoid being touched (Koca, 2019).

Autism spectrum disorder, first defined by American psychiatrist Leo Kanner in 1943, is a neurodevelopmental disorder that appears in early childhood (Goldson, 2016; Verhoeff, 2014). In 2012, when the Centers for Disease Control and Prevention (CDC) published data from 2008, ASD was observed in 1 out of 88 children among all ethnic and socioeconomic groups (CDC, 2012). While the World Health Organization stated in March 2022 that approximately 1 in 100 children has ASD (WHO, 2022), according to the 2009 data from Guidance and Research Centers (RAM), 10,811 individuals in Turkey were diagnosed with ASD (Tüfek & Sarı, 2016). Approximately 80% of children diagnosed with ASD can obtain scores of 70 or below on the Wechsler Intelligence Scale for Children (WISC-R), and some individuals with ASD may excel in various fields (music, mathematics, etc.) (Bodur & Soysal, 2004). Individuals with ASD persistently repeat actions that give them pleasure and happiness in various areas (Çolak et al., 2016). Although these individuals are similar to their peers in terms of physical development, they may exhibit behaviors such as walking on tiptoes, spinning around themselves, and grinding their teeth while showing inadequacy in situations requiring fine motor skills such as holding eating utensils and using scissors. Because of their weak imitation skills, they may learn certain movements related to gross motor skills (e.g., dancing and swimming) later (Kurşun, 2018; Karacasu, 2019).

In accordance with the diagnostic criteria provided in DSM-5, it is important to implement necessary measures and intervention plans for these individuals from early developmental stages. Early diagnosis is crucial in reducing problem behaviors, enhancing social communication, facilitating school adjustment, and improving peer relationships among individuals diagnosed with autism (Kal, 2020). To establish an early diagnosis, the primary caregivers of the child, usually the parents, play a vital role. Learning that their

child has ASD can lead family members to experience stress, burnout, helplessness, and depression, negatively affecting family harmony and making it difficult to accept the diagnosis (Akbec & Kalaycı, 2016; Akmanış, 2010; Kaya, 2017).

Families providing care for individuals with ASD can experience emotional and informational gaps and struggle with depression, confusion, obligatory sacrifices, and marriage problems (Arslan, 2020). After receiving a diagnosis of ASD for their child, parents begin to develop various concerns about their child's future. Stress and anxiety increase in family members, and as the child's behavioral problems become evident in social settings, a decrease in social relationships begins, and loneliness emerges. On the other hand, according to the findings of various studies, some families try to develop themselves more to support their children's problems and find happiness in small things (Foo et al., 2015; Yassibaş, 2015). Research conducted with parents of children diagnosed with ASD reveals that due to the physical differences of ASD children compared to their peers, as well as their different behaviors in social situations, parents experience labeled, anxious, and depressive feelings (Yassibaş, 2015). A meta-analysis study conducted by Green et al. (2013) also identified that parents of children with disabilities experienced problems such as stress, lack of support services, and labeling. When examining the conducted research, it can be seen that parents of children with ASD experience different problems and may need support services to overcome these challenges. Although various studies provide information to practitioners and researchers about support and intervention services for families of individuals with disabilities, there is a scarcity of research specifically targeting families of individuals with ASD. In this context, analyzing research conducted with parents of children with ASD is important for both parents and researchers to understand how these studies are conducted. Therefore, this study aims to analyze articles conducted with parents of children diagnosed with autism in Turkey between 2010 and 2022 regarding methodology, findings, and conclusions. The relevant literature shows that parents, especially mothers, fathers, and primary caregivers, of individuals with ASD experience significant disruptions in their lives. The most significant impact is stress. If this stress is not managed, it can adversely affect caregivers' health. Many studies have shown that caregivers are at risk in this regard (Montes & Halterman, 2007). Studies in the relevant literature indicate that as stress levels increase, burnout also increases (Biçki, 2016; Çengelci, 2009; Yüzer et al., 2010; Kurşun, 2018).

Caregivers of children with ASD may experience burnout symptoms due to stress. In a study conducted by Tunçel (2017) with mothers of children diagnosed with ASD, significant differences were found in emotional burnout levels according to the degree of autism and the rate of autism symptoms. In a study conducted by Valenti et al. (2014), therapists providing care to children diagnosed with ASD, who were selected as participants, were reported to experience more intense burnout than those providing care outside this field.



### *Purpose of the Research*

Due to the diagnosis of ASD in children, parents may experience burnout. To reduce and alleviate burnout in these families' daily lives and enhance their quality of life, there is a need for various interventions and supportive plans. Therefore, it is essential to identify the extent of burnout experienced by parents of children diagnosed with ASD. When examining the international and national relevant literature, the significance of qualitative research in determining the burnout of parents with children diagnosed with ASD is increasingly recognized in this research. To gain a general understanding of the burnout experienced by these parents, it is necessary to evaluate the differences and similarities among these studies within the context of qualitative research. Qualitative research is primarily exploratory research used to uncover trends in thought and opinions and dove deeper into the problem.

Upon reviewing the relevant literature, no meta-synthesis study has been found concerning the burnout of parents of individuals with ASD. A detailed analysis of the criteria expressed in the study is expected to shed light on future research in this area. This research combines and evaluates qualitative studies on parents of individuals with ASD to comprehensively understand their burnout. The meta-synthesis method is preferred for this purpose. Meta-synthesis research involves a systematic, in-depth examination of qualitative studies on a specific topic (Polat & Ay, 2016). In this study, by examining the burnout of parents with children diagnosed with ASD in detail, the sense of burnout related to having a child with ASD can be explained. Exploring and explaining this feeling from various angles will reveal the experiences that parents undergo during this process. This will assist practitioners in the field in understanding parents' experiences and thus contribute to developing family education programs and parental intervention-support programs.

Synthesizing different qualitative studies related to the burnout of parents with children diagnosed with ASD from a broad perspective will provide diverse insights to professionals working in this field. In this meta-synthesis study, the objectives are identifying studies related to the burnout of parents with children diagnosed with ASD in the relevant literature, examining the identified studies according to predetermined criteria, and synthesizing the findings obtained from these studies. In the scope of this general objective, the following questions have been attempted to be answered:

1. How are the distributions of these studies in terms of the type of index in which they were published
2. What is the chronological distribution of these studies?
3. How are these studies distributed based on research methods?
4. How are these studies distributed based on sampling methods?
5. What data collection tools were used in these studies?
6. What are the common themes identified across these studies?

7. What are the common findings in the results of these studies?
8. What are the differences in the findings of these studies?

## METHOD

### *Research Design*

In this study, a method known as meta-synthesis (thematic content analysis), a type of content analysis, has been chosen. Meta-synthesis involves bringing together groups of studies centered around a particular context, analyzing and synthesizing them to develop a new conceptualization based on the primary factors explored in the research (Schreiber et al., 1997). Dinçer (2018) emphasizes that content analysis is both a research method and an analysis technique, and it is important to detail the process in studies employing it.

Meta-synthesis is considered a research method within the domain of content analysis. It involves examining and interpreting qualitative studies related to a specific topic or chosen field using a qualitative understanding (Çalık & Sözbilir, 2014; Gül & Sözbilir, 2015; Polat & Ay, 2016; Walsh & Downe, 2005). Polat and Ay (2016) mention that terms like 'meta-study,' 'thematic content analysis,' 'meta-ethnography,' and 'qualitative meta-analysis' can describe meta-synthesis studies. In meta-synthesis studies, qualitative research studies on the same topic are systematically examined and interpreted using templates, tables, and diagrams to highlight their similarities and differences (Gül & Sözbilir, 2015). Meta-synthesis studies aim not to produce a single conclusion but to reconcile the conflicting situations identified in the studies. Rich and in-depth interpretation of the examined studies is essential; hence, limiting the number of articles to around 10-12 is recommended (Bondas & Hall, 2007).

Due to the increasing number of qualitative research studies in education, the need to evaluate these studies collectively has led to the emergence of meta-synthesis studies in education (Polat & Ay, 2016). Although there are a substantial number of qualitative studies in the field of special education, there is a lack of meta-synthesis studies (Boshoff et al., 2016; Corcoran et al., 2015)

According to Clemmens (2003), while meta-analysis reduces and interprets quantitative research results through averages, meta-synthesis works conversely by interpreting the uniqueness of individual studies and integrating them to make qualitative research results more comprehensive. This study aimed to synthesize and interpret information about the burnout of parents with children diagnosed with ASD to achieve a higher-level understanding. Therefore, meta-synthesis was chosen as the method for this research.

Boshoff et al. (2016) conducted a study synthesizing qualitative articles on families' experiences in advocacy. This meta-synthesis study involves three important steps: (a) screening studies, describing identified results, identifying most frequently used themes, (b) synthesizing similar findings beneath these themes, and (c) labeling and defining the synthesis appropriately and comprehensively presenting the findings. Noblit and Hare proposed seven steps for the meta-synthesis process (as cited by Mohammed et al., 2016).

These steps are

- a) Identifying the Focused Topic of the Research
- b) Deciding on Relevant Studies for the Topic
- c) Reading and re-reading Selected Studies in Detail
- d) Establishing Relationships among Selected Studies
- e) Identifying the Similarities and Differences Among Selected Studies
- f) Synthesizing Common and Diverse Aspects
- g) Interpreting the Synthesized Data

This study considers the systematic meta-synthesis stages proposed by Noblit and Hare (1988).

*a. Identifying the Focused Topic of the Research*

Within the scope of the study, the focus topic and its framework were initially determined. The research topic was identified as burnout experienced by parents of individuals with ASD after their children 's diagnosis. The sample group included only parents (mothers and fathers), and the study did not include other caregivers or family members, such as siblings, grandparents, or other relatives.

*b. Deciding on Relevant Studies for the Topic*

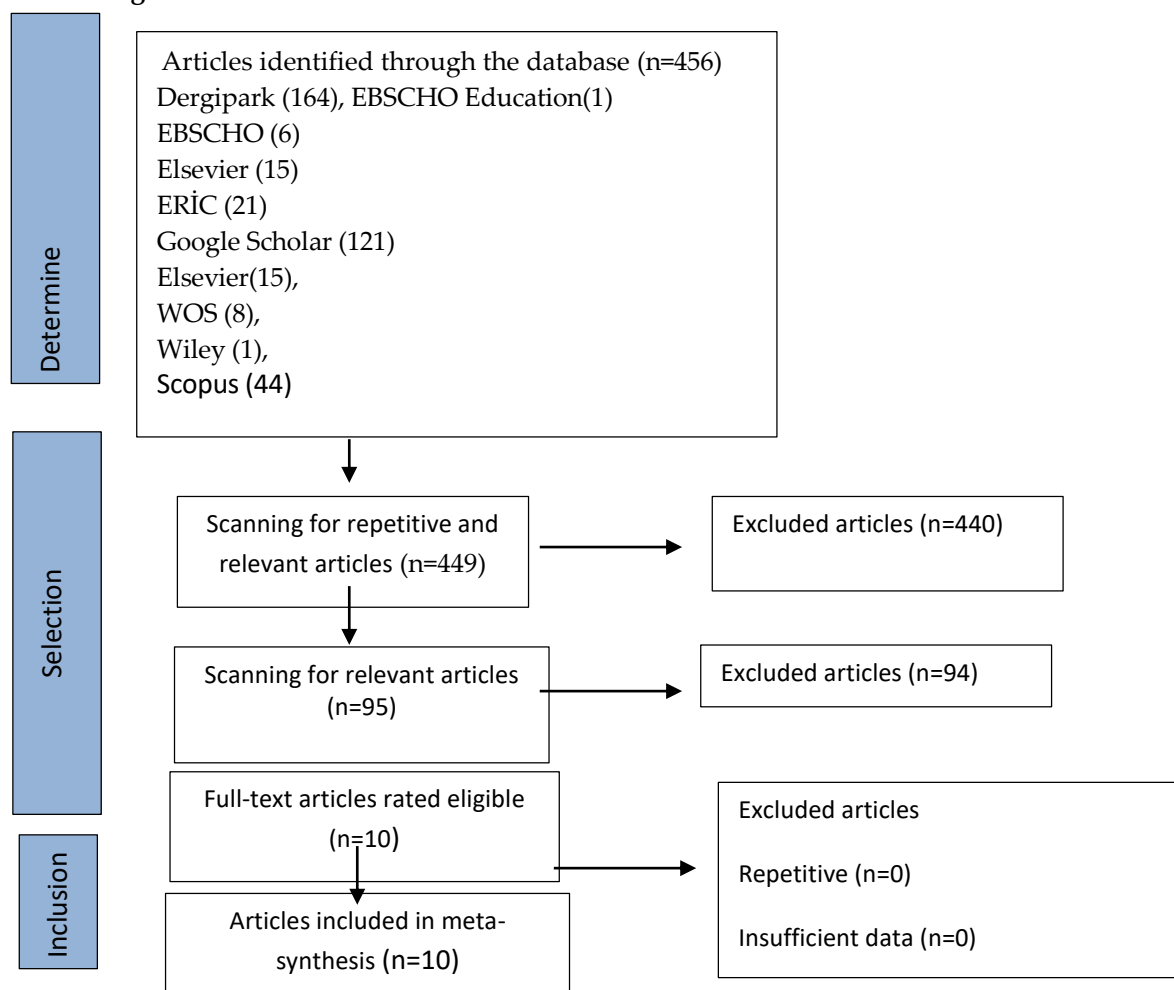
After determining the research topic, searches were conducted in Google Scholar, DergiPark, ERIC, EBSCO, EBCSCO Academic Search Ultimate, Elsevier, SCOPUS, Web of Science, and Wiley. During the database search, both Turkish and English keywords were used, including the phrases "autism mother," "autism father," and "autism parent burnout,". After reading the abstracts of the 456 studies between 2010 and 2023, 10 articles were selected for inclusion based on predetermined criteria. After determining the inclusion criteria of the articles, the researchers identified the articles. The inclusion criteria for the articles are given in Table 1.

**Table 1.** Inclusion criteria for articles

CRITERIA	INDICATORS
<b>Scope of this article</b>	Burnout of parents whose children have ASD
<b>Participants</b>	Mother, father, and parent
<b>Content</b>	Parents ' feelings of burnout about their children diagnosed with ASD
<b>The research method</b>	Application of the qualitative research methods in research (phenomenology, case study)

*c. Reading and re-reading Selected Studies in Detail*

Then, the researchers read the selected articles in detail. The entire process of reading and excluding articles is depicted in Figure 1, and the PRISMA flow diagram was used to illustrate the detailed steps of the meta-synthesis process (Moher et al., 2009).

**Figure 1.** PRISMA flowchart

Following this process, 456 articles were identified, and their methodology sections were closely examined. Articles that were conducted using phenomenological and case study methods were included in the research scope. During the detailed reading process, the researchers encountered instances where they had differing opinions regarding certain concepts in the methodology section. The conflicting article was re-read and thoroughly examined in such cases, considering the differing perspectives. After this thorough examination, consensus was reached on the inclusion of 10 articles that aligned with the predetermined inclusion criteria. These 10 articles were subsequently read and examined in detail to ensure their suitability for the research.

#### *d. Establishing Relationships among Selected Studies*

The researchers designed a template to analyze and compare the selected articles systematically. This template encompassed the research title, aim, questions, sampling methods, participant characteristics, data collection tools, data analysis methods, findings (similar themes/different themes), and quotations. The researchers manually coded the articles using this template, and inter-coder agreement was established through comparison and consensus. The consistency between the researchers' and the expert's (special education specialist) comparisons was examined. The reliability of the research was calculated using

the formula  $\text{Reliability} = \frac{\text{agreement}}{\text{agreement} + \text{disagreement}} * 100$ , which was recommended to be at least 80% by Miles and Huberman (1994). In this study, the inter-coder agreement was 90%.

*e. Identifying Similarities and Differences among Selected Studies*

After coding the articles based on the established template, the researchers compiled and examined their similarities and differences. Table 2 illustrates the template used for this purpose.

**Table 2. Template used to identify similarities and differences**

Source	Data collection	Data analysis	Sampling	Method	Participant
Lamba, et al., 2022	Semi-structured interview form	Content analysis (Thematic analysis)	Purposeful and a snowball	The case study	17
Ghanouni, et al., 2021	Semi-structured interview form	Content analysis using NVIVO	Purposeful	The case study	22
Keville, et al., 2021	Semi-structured interview form	Thematic analysis	Purposeful	Phenomenology	6
Sulaimani, et al., 2022	Semi-structured interview form	Content analysis (Thematic analysis)	Purposeful	Phenomenology	15
Tümlü, et al., 2021	Semi-structured interview form	inductive analysis	Criteria sampling	Phenomenology	9
Anclair et al., 2014	Semi-structured interview form			Single-Subject	2
Koydemir et al., 2010	Semi-structured interview form	Content analysis	Snowball	The case study	13
Efeoğlu, et al., 2020	Semi-structured interview form	Content analysis using NVIVO	Snowball and Criteria	Phenomenology	8
Tooper, et al., 2021	Semi-structured interview form	Content analysis using Maxqda 2020	Purposeful	Phenomenology	10
Yamoah, et al., 2022	Semi-structured interview form	Content analysis	Snowball	Cross-case analysis	5

*f. Synthesizing Common and Diverse Aspects*

Using the template created in Table 2, the researchers marked similarities and differences among the selected articles. The researchers examined and classified the articles' distinctive and shared characteristics based on this template. These classifications helped identify themes, which were further analyzed to determine common themes. Two special education experts and the researchers coded the data collected. The agreement between the researchers' and experts' coding was examined, and it was found that the agreement rate increased from 80% to 90% after discussions and agreements. After the coding process, the codes were integrated into the templates, and the templates were finalized based on the analysis process of the articles by the authors.

#### *g. Interpretation of Synthesized Data*

The findings section extensively elaborates on the final step of interpreting the synthesized data.

## RESULTS

The articles included in the research were examined within the scope of the criteria determined within the scope of this research. While examining the articles, similarities, and differences in terms of the purpose of the research, the participating group, data collection techniques and tools, and the techniques preferred in data analysis and findings were revealed. Each of them is explained under a separate heading in the Findings section. Within the scope of this research carried out with meta-synthesis, the articles discussed within the scope of the research were evaluated as a whole, and themes were formed.

### *Study Purposes*

**Table 3.** Purpose of the studies included in the study

<b>Purpose of this research</b>	<b>Research</b>
To reveal the experiences of children of mothers with ASD regarding labeling.	Sulaimani, et al., 2022
To reveal the parenting experiences of parents of children with ASD	Keville, et al., 2021
To reveal the experiences of individuals with ASD regarding receiving health services	Ghanouni, et al., 2021
Exploring the difficulties and support mechanisms of mothers of children with ASD	Lamp, et al., 2022
To reveal the burnout of families with children with ASD and examine cognitive behavioral therapy's effect.	Anclair et al., 2014
Investigating the effect of having a child with ASD on children	Koydemir et al., 2010
To reveal the psychological experiences of families with children with ASD	Tumlu, et al., 2021
To reveal the changes in themselves and their children because of the employment of these children through their families' experiences.	Efeoglu, et al., 2020
To reveal the experiences of families with children with ASD regarding their psychological and social difficulties	Tooper, et al., 2021

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To reveal the role of social support in reducing burnout in parents of children with medical complexity. Yamoah, et al., 2022

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### *Analysis of the Participants in the Study*

When the studies included in the research are examined, it is seen in Table 4 that the number of participants is between 2 and 22. It is also observed that there are mothers who undertake primary care among the participants in the study.

**Table 4.** Number of participants in the studies

<b>Research</b>	<b>Number of participants</b>	<b>Parent</b>
Lamp et al., 2022	17	Mom
Ghanouni et al., 2021	22	Mom
Keville et al., 2021	6	Mom
Sulaimani et al., 2022	15	Mom
Tumlu et al., 2021	9	Mother and father
Anclair et al., 2014	2	Mom
Koydemir et al., 2010	13	Mom
Efeoglu, et al., 2020	8	Mother and father
Tooper et al., 2021	10	Mother and father
Yamoah et al., 2022	5	Mom

### *Data Collection Tools and Data Analysis Methods of Studies*

As seen in Table 5, a semi-structured interview form was used because data were collected through interviews, one of the qualitative research methods. In addition to the semi-structured interview form, some studies also have a demographic information form (Ghanouni et al., 2021; Koydemir et al., 2010; Sulaimani et al., 2022; Tooper et al., 2022; Yamoah et al., 2022). When we look at the data analysis methods of the studies, we see that content analysis methods are used in most of the studies. Content analysis programs such as NVIVO and MAXQDA have been used in some research while performing content analysis (Efeoglu et al., 2020; Ghanouni et al., 2021; Tooper et al., 2021).

**Table 5.** Data collection tools and analysis methods of the studies

Research	Data collecting tools	Data Analysis Method
Lamp et al., 2022	Semi-structured interview	Content analysis (Thematic analysis)
Ghanouni et al., 2021	Demographic information	Content analysis using NVIVO
Keville et al., 2021	Semi-structured interview	Thematic analysis (Interpretive phenomenological analysis)
Sulaimani et al., 2022	Demographic information Semi-structured interview	Content analysis (interpretive phenomenological analysis)
Tumlu et al., 2021	Semi-structured interview	inductive analysis
Anclair et al., 2014	Interview form	
Koydemir et al., 2010	Demographic information Semi-structured interview	Content analysis
Efeoglu et al., 2020	Semi-structured interview	Nvivo 12 Plus
Toper et al., 2021	Demographic information	Maxquda 2020
Yamoah et al., 2022	Semi-structured interview Demographic information Semi-structured interview	Content analysis

The data collection technique, the interview method, is very effective in revealing the participants' perspectives, experiences, feelings, and perceptions about the researched subject (Patton, 1987). The research shows that the interview method is preferred to understand the psychological processes and burnout of the parents because their children are diagnosed with ASD.

### *The sampling method of the studies*

The sampling methods used in the studies are given in Table 6. When the sampling methods of the studies are examined, the purposeful sampling method is preferred in most studies.

**Table 6.** The sampling method of the studies

Research	Sampling Method
Lamp, et al., 2022	Purposeful and snowball sampling
Ghanouni, et al., 2021	Purposeful, convenient sampling
Keville, et al., 2021	Purposeful sampling
Sulaimani et al., 2022	Purposeful sampling
Tumlu et al., 2021	Purposeful sampling
Anclair et al., 2014	Convenience sampling
Koydemir et al., 2010	Snowball sampling



Efeoglu, et al., 2020	Snowball sampling and criterion sampling
Tooper, et al., 2021	Purposeful sampling
Yamoah , et al ., 2022	Snowball sampling

The purposeful sampling method is the random inclusion of participants in the research according to certain criteria (Patton, 1990). Depending on the purpose of the research, this type of sampling was mostly preferred because it allows for in-depth research by selecting information-rich situations.

### *Common Points Regarding the Findings of the Studies*

When the findings of the articles included in the research were examined, the common findings in the 10 studies that examined parent burnout were determined and made into themes. When the articles included in the study are examined in Table 7, there are five common findings.

**Table 7.** Common findings of the articles

<b>Articles</b>	<b>Common findings</b>
Yamoah et al., 2022; Tumlu et al., 2021; Lamp et al., 2022	Getting support
Yamoah et al., 2022; Tumlu et al., 2021; Tooper et al., 2021; Efeoglu et al., 2020; Sulaimani et al., 2022	Isolation
Tumlu et al., 2021; Tooper et al., 2021; Efeoglu et al., 2020; Anclair et al., 2014	Disruption of the daily routine
Efeoglu et al., 2020; Ghanouni et al., 2021; Sulaimani et al., 2022; Anclair et al., 2014	Anxiety
Keville et al., 2021; Efeoglu et al., 2020; Ghanouni et al., 2021; Anclair et al., 2014	emotional outbursts

The parents of children diagnosed with ASD experienced burnout and witnessed different life experiences along with this feeling. These life experiences were thematized by reading the articles in the context of common findings.

### *Getting support*

The first theme determined after reading the studies is 'getting support'. Individuals with ASD receive support to protect their psychological resilience because their parents experience burnout (Lamba et al., 2022; Tümlü et al., 2021; Yamoah et al., 2022).

In the study by Lamba et al., 2022, many participants mentioned the support they received from therapeutic services. It was stated that they received support from support groups and that they did not feel alone at this point. It also stated that they can share their experiences and ideas through support groups. Below is a quote from a participant:

*"...These people have really helped and supported us emotionally, at least, emotional support knowing there is someone else out there, you are not alone... I would go and try and get advice and try to do the same. So it really helps a lot..."*

There are different preferences in terms of support groups among the participants of the research conducted. For example, some mothers stated that they felt supported through online groups on Facebook or by establishing close bonds in private groups (Lamba et al., 2022).

Tumlu, et al. (2021) showed that parents share their experiences as support and use social support as support teams. There is a similar finding in the study by Lamba et al., 2022, it shows that parents prefer social support groups more than support. At the same time, the need for financial support was emphasized in this study. State policies and economic conditions also appear to affect parents significantly in burnout. Below is an excerpt from one of the participants in the study:

*"If the situation of these special children is good financially and socially, you can take these children for a walk and take them everywhere. . .However, people are sad because they don't exist... our disabled people have no rights; they have no legal rights. They do not give them anything, that is. . . Wherever you go, they close the door for you."*

Yamoah et al. (2022) divided the types of social support into four subcategories: church support, practical support, mental health support, and rest/childcare support. The study's findings showed that active participation in the types of social support is critical in alleviating parental burnout and feelings of isolation. Participants underlined the importance of receiving mental health support at various stages of their parenting journey. In addition, the participants stated that they sought mental health support to address parental burnout. Participant 3 talked about how much the counseling services helped him. She realized how easily she could get an appointment whenever she wanted. An excerpt from Participant 3 is as follows:

*"Even though we have not used the service recently, I know I can easily set up an appointment and talk to them, which has been a huge help'.*

### **Isolation**

Efeoglu et al. (2020) stated that a factor that triggers burnout in parents is that they experience isolation in shock, denial, and acceptance processes after being diagnosed with ASD. In addition, in this process, it is seen in a quote from one of the participants that the most affected in the family are the mothers:

*"...with autism, the mothers are the most affected in the family. Fathers are still out and about during the day, but women are more oppressed under this burden. They are disconnected from their surroundings. Because people do not understand you, they are not doing exactly what you are suffering from, they are not aware of it. In the meantime, the woman has to stay home; she cannot take her child anywhere easily."*

Topper et al. (2021) stated that there are serious changes in the daily routines of parents of children diagnosed with ASD. These changes in daily life and the changes in some

usual situations lead to burnout in parents. Here is an excerpt from one participant's interview:

*"I finished my work life instantly. I finished my social life, so I had no social life until I founded this association. So I was with my son 24 hours a day."*

Tumlu et al. (2021) stated that parents engage in avoidance behavior because of the anxiety of experiencing social exclusion due to their children with ASD. The study concluded that these parents experienced social isolation with avoidance behavior, which negatively affected their burnout.

Sulaimani et al. (2022) reported that the parents included in the study experienced isolation because they experienced avoidance and embarrassment after the diagnosis.

Yamoah et al. (2022) concluded that the dominant theme related to parental burnout was the isolation experienced by the parents. Most participants stated that they felt lonely, sad, unable to receive social support, and thus experienced isolation.

### ***Disruption of Daily Routine***

Anclair et al. (2014) concluded that children and mothers with ASD lead a routine and social life at home, and the mother's burnout was seriously affected by the disruption of daily routine.

Efeoglu et al. (2020) concluded that as individuals with ASD grow up and their educational life ends, the increase in closure and the onset of introversion have negative effects on the daily routine of these individuals and their families. It has been found in the study that the routines of the families of these individuals who experience tantrums are disrupted, and their care becomes more difficult. The direct quotes of some participants because of the interviews are as follows:

*"Children, you get through that period somehow at a young age, but when they become adults, everything becomes much more difficult" (A1, Dad)*

*...when he is closed at home, the children 's obsessions increase and their irritability and tantrums increase." (A5, Mother)*

Tumlu et al. (2021) revealed that parents of individuals with ASD avoid social environments because they fear that their children will display ambiguous negative behaviors and therefore will be ostracized by others. For this reason, they disrupt their daily routines. Here is an excerpt from the interviews of a participant:

*"We no longer have the concept of guests; we don't go to visit friends. Something breaks during the visit when we go, and he does not stay silent. It will sound; maybe you won't do anything with the fear that something will happen, but you don't go with the anxiety that you will; you stay at home."*

### ***Anxiety***

Efeoglu et al. (2020) stated that one of the biggest concerns of the parents of individuals with ASD is that they do not know how their children can sustain their own

lives after their death due to the excessive dependence of the autistic child on the family. A1 and A8 expressed their concerns about the future of children as follows.

*"...everyone's biggest fear is what will this child be after me, to whom will he entrust it? Even if it is a sibling, it carries it to a certain extent. That is people's biggest fear." (A1, Father)*

*"...I used to think every night when I went to bed. I wonder what will happen in the future. For example, I am still affected [cries]. Maybe it's us today, but what will happen tomorrow...it's a very difficult thing." (A8, Mother)*

Ghanouni et al. (2021) reported that participants did not receive financial, social, or psychological support while living with the diagnosis of ASD and that this created anxiety for both adult children with ASD and themselves.

In the study by Anclair et al. (2014), it was concluded that they experienced anxiety because of their children's behavioral problems. It is stated in the research that they experience burnout along with negative emotions such as anxiety, worry, and sadness.

Sulaimani et al. (2022) revealed that after the diagnosis of ASD, their children experienced cultural stigma, difficulty in accessing resources, and anxiety due to reactions to the child's diagnosis, which triggered mothers' anxiety. Research participant mothers said they were worried about their children's underdeveloped language skills. At the same time, mothers stated that their children's lack of attention triggered their anxiety. One of the mothers:

She stated this point clearly when she said that *"seemed as if she was unaware of what was going on around her, as if she had not heard, and was not even aware of the danger"*. Seven of the fifteen mothers interviewed were concerned that their children's inability to develop appropriate behavior hindered their social and emotional development. mother 5 claimed she was worried because her son *"moved his head strangely, turned quickly, and moved excessively"* (Sulaimani et al., 2022).

### ***Emotional Outbursts***

It is seen that parents experience emotional outbursts because of the burnout they experience with their children. It is possible to encounter mothers who commit suicide because of severe family conflicts, family break-ups, divorce, and burnout syndrome (Efeoğlu et al., 2020). Participant A7 expressed this situation as follows:

*"...many of our mothers have reached the level of suicide and committed suicide. This rejection and, of course, some fathers did not accept it; divorces were difficult, families were broken because such things were always too heavy for families." (A7, Mother)*

## **DISCUSSION and CONCLUSION**

This study aims to evaluate the studies conducted with the phenomenology and case study design, which is one of the qualitative research methods, on the burnout of parents with a child diagnosed with ASD in the national and international literature, with the meta-synthesis method covering 2010–2023. The studies examined within the scope of the

research were evaluated as a whole, and five themes were identified: getting support, isolation, disruption of daily routine, anxiety, and emotional outbursts.

Families with a child diagnosed with autism spectrum disorder (ASD) often face significant challenges that can lead to burnout. Seeking support is essential for these families as it can provide them with the necessary resources, guidance, and emotional relief. However, finding the appropriate support can be quite challenging. Navigating through various therapies, interventions, and educational options is time-consuming and emotionally tiring for parents. In addition, financial constraints and limited access to special services further increase the stress of seeking support (Akbey & Kalaycı, 2016; Anclair & Hiltunen, 2014). Raising a child with ASD often comes with significant financial burdens. The costs of therapies, interventions, residency training, and medical treatments can accumulate quickly. These financial pressures can cause additional stress and anxiety for families struggling to provide the best care for their children while managing their financial responsibilities.

Burnout experienced by families with children with ASD can significantly affect parental well-being. Constant demands on giving care, managing behavior, and advocating for children's needs can lead to physical and mental fatigue. Parents may neglect their self-care, leading to health problems and emotional tension. Stress associated with burnout can affect marital relationships, parenting dynamics, and overall family functioning (Clemmens, 2003; Kal, 2020).

Isolation is a common experience for families with children with ASD. The unique needs and behaviors associated with ASD can make it difficult for families to attend social events and meetings or even perform simple daily chores. As a result, parents feel isolated from their friends, extended family, and society, leading to loneliness and disconnection. It was concluded that others' lack of understanding of the requirements of raising a child with ASD contributed to this isolation by depriving parents of a support network. Families with children with ASD may face stigma and judgment by society. Strangers may misinterpret compulsive behavior because of inadequate parenting, leading to feelings of shame and isolation. This social misunderstanding may contribute to burnout by preventing parents from seeking help or discussing their struggles openly (Lamba et al., 2022; Keville et al., 2021; Kurşun, 2018).

Routine is often a cornerstone for managing the needs of children with ASD. Disruption of daily routines can cause increased stress for both the child and the family. Simple tasks, such as switching from one activity to another or dealing with unexpected changes, can trigger increased anxiety. This deterioration contributes to parental burnout by creating a continuous cycle of stress and unpredictability (Montes & Halterman, 2007; Sarcan, 2019). Anxiety is a common problem in families of children with ASD. Parents may worry about their child's future, education, social interactions, and general well-being. The

need to anticipate and manage potential anxiety triggers in their children can negatively impact their mental health. The uncertainty surrounding the effectiveness of various treatments and interventions can lead parents in a constant state of anxiety. Parents may also experience emotional outbursts because of the overwhelming stress and frustration they face. These emotional moments can strain family dynamics and lead to feelings of guilt or helplessness.

Burnout experienced by families with children with ASD is a multifaceted and complex issue. Seeking support is vital, but it comes with its own set of challenges. Addressing isolation requires increased community awareness and empathy. Managing disruptions to routines requires creative solutions and flexibility. Anxiety must be acknowledged and supported through mental health resources. Emotional outbursts require effective coping strategies and mutual understanding within the family. Families, professionals, and communities must work collaboratively to meet these challenges and provide holistic support. By improving access to specialized services, promoting inclusive environments, and fostering understanding, we can reduce the burnout experienced by families raising children with ASD.

## RECOMMENDATIONS

In line with the results of the research, implications were made for educators, parents, and further research.

Recommendations for educators;

- While working with the parents of students with ASD, parents should be provided with the necessary support by an educator in case they have experienced a feeling of burnout. In this context, educators and therapists working with individuals with ASD should inform them that parents can benefit from mental health services when needed.

- Because parents see their children as inadequate in terms of skills, individuals with ASD who have special abilities can be supported in this sense and their families' burnout in this regard can be prevented.

- Parents who undertake primary care should be encouraged to participate in various activities to reduce their burnout by spending time with themselves, and in this context, the types of support should be increased.

- Better quality mental health and psychological counseling services should be provided to these parents by providing more opportunities for guidance and psychological counseling services in schools where their children are educated. Group psychological counseling services should be provided to these parents to share their negative experiences and prevent them from feeling alone in this regard.

Recommendations for further research;

- This research was carried out using the meta-synthesis method. In the meta-analysis method, qualitative research is synthesized. In this context, research can be conducted on this subject by choosing the research method meta-analysis. Thus, the interpretation of the quantitative research findings can be provided.
- In this research, articles were synthesized and interpreted. A systematic review study can be conducted on the same subject, and research that will include theses can be conducted.

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## Data Availability Declaration

No Primary Data Utilized:

This study is conceptual in nature and does not rely upon primary data collection. As such, there are no datasets directly associated with the presented findings. The discussions and conclusions drawn are based on an extensive review of existing literature and analytical insights put forth by the authors.

## Author Contributions

All authors, Fatih Koçak, Özge Çevik, and Hasan Kızılkaya, contributed equally to this work. They handled the conceptualization, methodology design, data acquisition, and analysis collaboratively. Each author played a significant role in drafting and revising the manuscript, ensuring its intellectual depth and coherence. All authors have thoroughly reviewed, provided critical feedback, and approved the final version of the manuscript. They jointly take responsibility for the accuracy and integrity of the research.

### *Author(s)' statements on ethics and conflict of interest*

**Ethics statement:** We hereby declare that research/publication ethics and citing principles have been considered in all the stages of the study. We take full responsibility for the content of the paper in case of dispute.

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## Impact of Social Media on Global Citizenship According to Social Studies Teachers

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### Abstract:

Many events that occur in the world affect not only the place where they occur but also many regions in the world. This situation necessitates the evaluation of the developments and changes in the world from a universal perspective rather than considering the national interests of each country. The universal evaluation of the problems experienced has led to the emergence of global citizenship. With global citizenship, individuals interact with other people and become sensitive to different events. The individual's interaction with other people and forming public opinion about the events that occur can be realized more quickly and easily with social media, which is preferred by all societies globally. For this reason, the aim of the research was to determine 'the impact of social media on global citizenship' in line with the views of social studies teachers. Phenomenology, a qualitative research method, was preferred in this study. The participants of the study were 22 social study teachers working in secondary schools in the city center. To obtain the data, a semi-structured interview was developed by the researcher after consulting expert opinions. The research concluded that the use of social media has a strong impact on global citizenry, as evidenced by a range of petite responses gathered from the varied related dimensions of importance, awareness, and effect about the subject.


### Keywords:

Social Media, Global Citizenship, Teachers

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## INTRODUCTION

Today, changes in technological developments have facilitated interactions between individuals and societies. With the reflection of these developments on transportation opportunities, individuals have been able to get to know and communicate not only with their own societies but also with communities with different cultural characteristics. At the same time, today, migration events, which are intensively experienced at the international level for different reasons (war, economic, political, etc. reasons), have affected many countries. The increase in interactions between countries for different reasons has led to the situation of being a citizen of the world as well as a citizen of a state (Cesairo, 2017; Kan, 2009; Levinson, 2014; Parekh, 2003; Stromquist, 2009; Şahin, 2011; Şahin & Çermik, 2014). This situation necessitates that while evaluating the developments and changes in the world, all the events that arise should be handled with a universal perspective, not by considering country-based national interests. The universal evaluation of the problems experienced has led to the emergence of global citizenship. Global citizenship is not a formal citizenship legally bound to a state; it refers to the universal citizenship of individuals regardless of their legal citizenship (Ekici, 2008; Kan, 2009; Levinson, 2014; Osler & Starkey, 2005; Wintersteiner et al., 2015).

Morais and Ogden (2011) state that global citizenship has three overarching dimensions social responsibility, global competence, and global civic engagement. In the social responsibility dimension, the individual examines different perspectives and respects differences by empathizing. Simultaneously, they become aware of the global effects of local behaviors. In addition, the individual evaluates social problems in the context of global justice and inequalities. In the global competency dimension, individuals show interest in world issues and events by recognizing their own limitations and capabilities. The individual should be unprejudiced when interacting with different cultures. Global civic engagement is defined as recognizing local, national, and global community issues and demonstrating action and disposition to respond through activities such as community engagement, political activism, and volunteering. Individuals help and contribute by volunteering in global civic organizations (Morais & Ogden, 2011).

The global citizenship approach is primarily considered criticizing international crises, various problems, and different problems that occur all over the world. Wars, famines, climate change, human rights problems, and unequal conditions in world trade affect all societies in the world. The solution to these problems can be realized through international political understanding and an appropriate citizenship approach. In addition, global citizens should have knowledge about social, cultural, political, and economic problems in the world. At the same time, global citizens should be conscious people who respect different religious, social, cultural, and national identities. Global citizens should use their global knowledge to achieve their goals in transferring universal values (respect, equality, and justice) (Wintersteiner et al., 2015). Individuals should also share their

knowledge with people in different communities. Today, it is possible to reach millions of people globally and share information with them through social media (Boyd & Ellison, 2007; Dickson & Holley, 2010; Greenhow, 2011; Parekh, 2003). With the use of web-based and mobile technologies in social media, people can interact with each other more (Akarsu, 2016; Dickson & Holley, 2010; Elitaş, 2020).

Social media is a broad-based platform that allows people to express their views and opinions on the internet without time and place limitations, provides unlimited use of multimedia features offered by the internet, and realizes the existence of an interactive environment based on mutual sharing and exchange of views with different people (Bulunmaz, 2011). On social media, individuals can share their information and thoughts online in the form of words, pictures, videos, and sounds (Safko & Brake, 2009).

Social media, which has a functional structure compared to traditional media tools, is a different mass communication tool. First social media derives its power from individuals. Because messages on social media are developed by users. At the same time, social media is cost-effective and open to everyone. Therefore, social media is more easily accessible than traditional media, and it also has the power to create a more functional public opinion and agenda. In addition, because social media is constantly evolving, it will soon become the primary means of communication (Akarsu, 2016; Alav, 2014). Since social media is a widely preferred communication tool worldwide, people want to spend more time on social media. Since social media is preferred globally and affects societies, it is also important in terms of global citizenship. For this reason, the aim of the study is to determine 'the effect of social media on global citizenship' in line with the views of social studies teachers. Within the framework of this purpose, answers to the following questions were sought:

1. Do you think societies today attach importance to global citizenship?
2. According to social studies teachers, how can individuals acquire global citizenship awareness?
3. According to social study teachers, how do social media affect society?
4. What is the effect of social media use on the formation of global citizenship awareness among individuals?

## METHOD

### *Research Model*

In line with the purpose of the research, this study was conducted in accordance with qualitative research, an approach that tries to examine and understand social phenomena and events according to the environment in which they are located. The main purpose of qualitative research is to perceive social life holistically situated within the perspectives of the individual and how he /she benefits from them. At the same time, to explain the changes and events that occur in society (Hancock, 1998; Yıldırım & Şimşek, 2011). Phenomenology,

one of the qualitative research methods, was preferred in this study. Phenomenology explores how people make sense of their experiences and how they transform their experiences into consciousness, both individually and as shared meaning. In addition, phenomenological research reveals the results of our experiences and the reasons for our perceptions and behaviors (Ersoy, 2017; Patton, 2014).

### *Participants*

The study group consisted of a total of 22 social studies teachers working in secondary schools in the city center. The study group was determined by a purposeful criterion sampling method, and social studies teachers working in secondary schools were selected. Social study teachers were preferred as participants because social study education utilizes different disciplines and includes topics related to global citizenship. The demographic characteristics of the social study teachers who participated in this study are presented in Table 1.

**Table 1.**

#### *Demographic Characteristics of Participating Teachers*

Demographic Characteristics		Participating	
		n	%
<b>Gender</b>	Female	14	64
	Male	8	36
<b>Age</b>	30 or less	2	9
	approximately 31-40	14	64
	41 and above	6	27
<b>Professional Seniority</b>	1-5 year(s)	1	5
	6-10 years	8	36
	11-15 years	9	41
	16 and above	4	18
<b>Educational Level</b>	Bachelor's Degree	21	95
	Master's Degree	1	5

From the demographic characteristics of the teachers presented in Table 1, 64% of the participants, in terms of gender, were women and 36% were men. Looking at the age of the teachers in Table 1, it is seen that 9% of them are 30 years old and below, 64% are between 31 and 40 years old, and 27% are 41 and over. Looking at Table 1, in terms of professional seniority, it is seen that 5% of the participating teachers are 1–5 year- experienced, 36% are 6-10 year-experienced, 41% are 11-15 year-experienced, and 18% are 16 and above. Looking at Table 1 regarding the education level of the participants, it is seen that 95% of the participating teachers are bachelors and 5% are postgraduates.



### *Data Collection Tools*

After being developed by the researcher and consulting expert opinions, a semistructured interview form consisting of 4 questions was prepared to determine the views of social studies teachers on the effect of social media on global citizenship. First, the theoretical dimension was established in the research. The researcher then prepared the questions in the interview form because of the literature review and consulted the opinions of four Social Studies education experts regarding the suitability of the prepared questions for the study. The researcher conducted validity and reliability studies of the semi-structured interview form by consulting experts.

### *Data Analysis*

In the study, a semi-structured interview form was used to reveal the views of social studies teachers on the impact of social media on global citizenship. Content analysis was used to analyze the data obtained from the teachers' opinions. Some opinions obtained from the participants were included in the content analysis. The data obtained during the analysis process were first sub-coded by examining the views expressed by the participants. While subcoding, all interview forms (Teacher 1) were numbered as T1, T2, T3.....T22. Additionally, opinions and sub-themes were coded as G1, G2....G10. Since more than one sub-coding could be reached from the answers given by the participant teachers, numbers were given for each sub-code. All codings (including subcodings) were coded by considering the answers given by the teachers. After subtheme coding, the themes were formed through inductive analysis. All subcoding occurred without a break in the data analysis process. Two weeks were waited after the creation of the themes. The data obtained from the participants were then coded again. Thus, we checked whether a different result emerged because of both coding. The reliability of the data was ensured with this comparison.

### *Ethical considerations*

During this research, we paid scrupulous attention to ethical guidelines, ensuring that the integrity and reliability of the study were never compromised.

In alignment with the overarching commitment to ethics, this study stringently adhered to all provisions delineated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive." It is imperative to note that there were zero instances of activities that might infringe upon the clauses stated under the "Actions against Scientific Research and Publication Ethics."

Ethical Review Board: Dicle University Social Sciences and Humanities Scientific Research and Publication Ethics Committee

Date of Ethics Review Decision: 27.08.2020

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## FINDINGS

### Views on the importance of global citizenship in societies today

To determine the views on the importance of global citizenship in societies, teachers were asked the question "Do you think that societies today attach importance to global citizenship, explain?". The data obtained from the answers given by the participants to this question are given in Table 2.

**Table 2.**

*The extent to which societies view global citizenship as important*

	Sub Themes	Participating	f
<b>G.1. Yes</b>	G.1.1. Inclusion in the education program	T3, T8, and T21	3
	G.1.2. Multicultural education	T8, T21	2
<b>G.2. No</b>	G.2.1. Increasing wars	T1, T4, T6, T7, T11, T13, T14, and T18	8
	G.2.2. Economic inequality in the world	T4, T7, T9, T10, T12, T17, and T22	7
	G.2.3. Spread of racism	T2, T6, T9, T15, T16, and T20	6
	G.2.4. Anti-immigrant feelings	T1, T2, T5, T15, T16, and T19	6
	G.2.5. Insensitivity to problems in different societies	T2, T5, T10, T17, T19, and T22	6
	G.2.6. Individual life being at the forefront	T4, T11, and T18	3

Table 2 shows that the teachers gave different answers to the question "Do you think that today's societies attach importance to global citizenship?". While some teachers who expressed different opinions expressed 'yes' to this question, some of them expressed 'no'. The teachers who expressed 'yes' opinions expressed their opinions on the sub-themes of inclusion in education programs (f: 3) and multicultural education (f: 2). The teachers who stated 'no' among the participants expressed their opinions on the sub-themes of increasing wars (f:8), economic inequality in the world (f:7), spread of racism (f:6), anti-immigrant feelings (f:6), insensitivity to problems in different societies (f:6), and individual life being at the forefront (f:3).

Some answers to the question "Do you think that societies today attach importance to global citizenship?" are given below:

"Global citizenship only exists as a concept. Because today there are many wars, such as the Ukraine-Russia war. These wars seriously affect not only these two countries but also other countries. But we do not see a serious reaction of people against the war. People start to show their reactions when they are influenced by the war. In other words, when the war starts to affect their own lives, they show their reactions. This situation shows that societies do not attach

importance to global citizenship, and the important thing is to maintain their own lives comfortably." (T4)

"I think global citizenship is given importance; otherwise, it would not be included in education programs. There are also many studies on multicultural education." (T8)

"Absolutely not. Because there is great economic inequality in the world. There are very rich countries on one side and very poor countries on the other side, and rich societies are not interested in the problems of poor communities."(T22)

### Views on the acquisition of global citizenship awareness

To determine the views on the acquisition of global citizenship consciousness, the teachers were asked the question "Explain how global citizenship consciousness can be acquired by the individual?". The data obtained from the answers given by the participants to this question are given in Table 3.

**Table 3.**

*Opinions on the acquisition of global citizenship awareness*

Sub Themes	Participating	f
G.1. Formal education	T2, T4, T5, T6, T9, T11, T12, T14, T16, T19, T20, and T21	12
G.2. Taught by the family	T1, T2, T7, T8, T10, T13, T14, T17, and T20	9
G.3. Social learning	T1, T3, T6, T9, T10, T15, T18, and T19	8
G.4. Through social media	T3, T5, T7, T13, T15, T18, T19, and T22	8
G.5. Educational programs on television	T2, T4, and T22	3

Table 3 shows that the teachers gave different answers to the question "How can the individual gain global citizenship awareness?" The participants expressed their opinions on this question as formal education (f: 12), taught by education (f: 9), social learning (f: 8), through social media (f: 8), and educational programs on television (f: 3).

Some answers given to the question "How can an individual gain global citizenship awareness?" are given below:

"Global citizenship awareness should be given to the person primarily in the family, and then it should be gained through education at school. In addition, television programs should be aimed at creating global citizenship awareness." (T2)

"I think it can be best acquired at school. Of course, people can also learn by looking around them, from their friends and social media." (T19)

"Creating global citizenship awareness in a society depends on the education to be given at school and in the family." (T20)

### Views on the impact of social media on society

To determine the views on the impact of social media on society, the teachers were asked the question "How does social media affect society?" The data obtained from the answers given by the participants to this question are given in Table 4.

**Table 4.**

*Opinions on the impact of social media on society*

	Sub Themes	Participating	f
<b>G.1. Positive impact</b>	<b>G.1.1.</b> Socialization of Individuals	T2,T4,T6,T8,T11,T13, and T18	7
	<b>G.1.2.</b> Interaction with people	T3, T9, T10, T14, T16, and T22	6
	<b>G.1.3.</b> Being a communication tool	T2, T9, T10, T13, T15, and T20	6
	<b>G.1.4.</b> Contributing to social change	T2, T6, T8, T12, T19, and T21	6
	<b>G.1.5.</b> Reaching the society in general	T3, T4, T11, T12, and T20	5
<b>G.2. Negative impact</b>	<b>G.2.1</b> Damage to moral values	T1, T17, and T7	3
	<b>G.2.2.</b> Cultural degeneration	T1, T17, and T7	3
	<b>G.2.3.</b> Distancing from real life	T5, T1	2

Table 4 shows that the teachers gave different answers to the question "How do social media affect society?" Some of the participants stated that social media affects society positively and united under the sub-themes of socializing individuals (f:7), interaction with people (f:6), being a communication tool (f:6), contributing to social change (f:6), and reaching the society in general(f:5); while according to Table 4, some of the participants stated that social media has a negative impact on society and united in the sub-themes of damage to moral values (f:3), cultural degeneration (f:3), and distancing from real life (f:2).

Some answers given to the question "How do social media affect society?" asked the participant teachers are given below:

"Social media causes people to lose their moral and cultural values. With social media, people are more influenced by foreign culture, and because of this influence, they lose their own values." (T1)

"Today, communication is mostly established through social media. Because communication is easy, people interact more." (T9)

"The most important feature of social media is that it is accessible to everyone. Since any innovation can reach the whole society through social media, it contributes to social change."(T12)

### Views on the Effect of Social Media Use on Global Citizenship Awareness in individuals

To determine the views on the effect of social media use on global citizenship awareness in individuals, teachers were asked the question "What is the effect of social

media use on the formation of global citizenship awareness in individuals?". The data obtained because of the answers given by the participants to this question are given in Table 5.

**Table 5.**

*Opinions on the effect of social media use on global citizenship awareness among individuals*

Sub Themes	Participating	f
G.1. Awareness of differences	T1, T4, T7, T9, T12, T13, T15, T17, and T18	9
G.2. Reaching the whole world	T2, T3, T5, T8, T10, T11, T14, T19, and T21	9
G.3. Combating social inequalities	T1, T6, T9, T10, T16, and T21	6
G.4. Interacting with different cultures	T2, T9, T10, T11, T13, and T20	6
G.5. Producing solutions to social problems	T4, T12, T14, T17, and T22	5
G.6. Greater awareness	T1, T9, T12, T22,	4
G.7. Being sensitive	T4, T8, and T16	3
G.8. Facilitating information sharing	T3, T8, and T14	3
G.9. Critical thinking	T5, T18	2
G.10. Creating a sense of trust	T4, T20	2

Table 5 shows that the teachers gave different answers to the question "What is the effect of social media use on the formation of global citizenship awareness in individuals?". The participants responded to this question by stating their opinions as being aware of differences (f:9), reaching the whole world (f:9), combating social inequalities (f:6), interacting with different cultures (f:6), producing solutions to social problems (f:5), greater awareness (f:4), being sensitive (f:3), facilitating information sharing (f:3), critical thinking (f:2), and creating a sense of trust (f:2).

Some of the answers given to the question "What is the effect of social media use on the formation of global citizenship awareness in individuals?" are given below:

"Since people can reach the whole world through the use of social media, they can create awareness for any social problem and strive for the solution of that problem worldwide. Information about emerging problems and solutions can be quickly shared with others through social media. Therefore, the use of social media develops global citizenship awareness among people." (T14)

"Through the use of social media, people have become aware of inequality anywhere in the world. Being aware of inequalities and being sensitive contributes to global citizenship awareness. In global citizenship, not only the problems in one country but also the problems experienced all over the world are considered." (T16)

"The individual becomes aware that he is not alone with social media. Interaction with different cultures makes them respect people all over the world. Thus, the individual becomes a global citizen." (T20)

## CONCLUSION, DISCUSSION AND RECOMMENDATIONS

When we look at the results obtained regarding the importance of global citizenship in today's societies, some of the teachers stated that they considered global citizenship important, while some of them stated that they did not consider it important by saying 'yes' and some of them said 'no'. While some of the teachers who stated 'yes' about the importance of global citizenship stated that it should be included in education programs, others stated that multicultural education should be given importance. The teachers who expressed 'no' opinions stated that the increase in wars, economic inequality in the world, the spread of racism, anti-immigrant sentiment, insensitivity to the problems in different societies, and individual life were at the forefront. When societies raise their citizens, they not only want them to be responsible for their own countries but also to be sensitive to global developments. In addition, educational institutions try to teach individuals their own culture while teaching them to respect different cultures. Thus, the individual will act not only nationally but also globally (Osler & Starkey, 2005; Wintersteiner et al, 2015). Regarding this situation, Kan (2009) recently stated that education systems have been focusing on raising citizens who have global citizenship awareness and adopt more universal values. However, many negative events such as wars, economic inequalities, and racism in the world show that societies do not give enough importance to global citizenship. To find solutions to the problems in the world, individuals need to be raised in accordance with the understanding of global citizenship. Preventing inequalities between societies is possible only if all societies take these problems into consideration and act jointly (Faist, 2009; Levinson, 2014; Morais & Ogden, 2011; Parekh, 2003).

When the results on the acquisition of global citizenship awareness by individuals are examined, it is concluded that according to the teachers, global citizenship awareness can be acquired through formal education, family education, social learning, social media, and educational programs on television. A person is primarily influenced by the family in which he or she was born and raised. The information conveyed to the child by the family plays an important role in the development of the child's mindset. The attitudes and behaviors of parents shape the development of the child's mental process (Arslan & Ulaş, 2021; Çiftçi, 1991; Kır, 2011). Therefore, the family's perspective on global citizenship affects the formation of global citizenship awareness in the individual. The individual also receives effective and systematic education at school. The knowledge and skills that students are expected to gain in the education process should be aimed at creating global citizenship awareness in individuals. The information that individuals have previously learned will be reinforced in the school environment, and individuals will become equipped with new

information (Kan, 2009; Wintersteiner et al, 2015). In addition, learning new information from an individual's social circle of friends, the television programs they watch, and the social media they use contributes to an individual's understanding of global citizenship. It is obvious that the content of the programs watched on television and the information on social media will change an individual's ideas (Grandy & Mavin, 2011; Zafer & Vardarlier, 2019) and enable him/her to approach events from a critical perspective. Again, regarding this situation, Arslan (2006) stated, television has a very effective power in dominating the "symbolic environment" of individuals.

Considering the results obtained regarding the impact of social media on society, the teachers concluded that social media positively affects society in terms of socializing individuals, interacting, being a means of communication, contributing to social change, and reaching society in general, and negatively in terms of damage to moral values, distancing from real life, and cultural degeneration. After today's technological developments, people have started to use technology more and more, and with this use, social media has entered the lives of societies and has increased its impact on society day by day. Because individuals spend most of their time on social media, the impact of social media on people has also increased (Akarsu, 2016; Çalapkulu & Alp, 2020; Egüz & Kesten, 2018; Karaboğa, 2019; Şener & Yiğit, 2021). Because of individuals using social networks, they can communicate with different people. Individuals socialize at the same time by communicating with different people (Akarsu, 2016; Calap & Çebi, 2020; Mital et al., 2010). Regarding this situation Çalışkan and Mencik (2015) stated that the use of social media, which has become a habit almost like eating and drinking by many users, brings together crowded masses from every culture, society, and almost every segment of society in a wide socialization denominator. At the same time, the communication opportunities brought by social media enable civil society organizations and other organizations to reach target audiences that they have difficulty reaching, to take action easily, and to spread their messages easily and quickly.

Societies also undergo rapid change thanks to interactions on social media. However, social media, which affects individuals and acts as a social control mechanism on societies, can negatively affect societies that do not have sufficient knowledge in terms of technological production and use (Çalışkan & Mencik, 2015). If society does not have sufficient knowledge about social media and cultural values are not fully adopted by individuals, it may be exposed to cultural degeneration by being under the negative influence of foreign cultures. At the same time, the values that keep society together may lose their importance due to negative information and examples on social media. In addition, individuals who want to be accepted on social media and to be in constant interaction with other people may become depressed and face social exclusion if they cannot achieve what they want or if their success is not sustained (Akarsu, 2016).

When the results obtained regarding the effect of social media use on global citizenship awareness in individuals are examined, it is concluded that according to the

teachers, social media use affects global citizenship awareness in terms of being aware of differences, reaching the whole world, combating social inequalities, interacting with different cultures, producing solutions to social problems, greater awareness, being sensitive, facilitating information sharing, critical thinking, and creating a sense of trust. With the individual's use of social media, the individual will primarily interact with people in different countries. Recognizing people from different cultures will make the individual tolerant toward them (Harchekar, 2017; Koçođlu, 2017; Mital et al., 2010; Parlak Yorđancı, 2018; Saki & Yazıcı, 2022). Regarding this situation alıřkan and Mencik (2015) stated, people will be able to contribute to the globalization of the world by having different beliefs and identities through social media tools. According to the understanding of global citizenship, individuals will not only value their own culture more highly but also accept other cultures as wealth and respect them. At the same time, thanks to social media, individuals will be able to realize and communicate with people who advocate global citizenship in different countries. Therefore, it is clear that individuals will learn that they are not alone and their belief in world citizenship will increase.

In addition, thanks to social media, people can become aware of events and developments occurring anywhere in the world and have information about the local and global impact of these situations. For example, events such as the Ukraine-Russia war, the Arab Spring, and the Covid 19 epidemic disease were not only informed by political administrations but also by people from different countries sharing information about these issues (Aktař, 2018; Batur & Bostancı, 2022; Baydili, 2021; Durmuř, 2023; Kırık, 2012; Koçođlu & Danyal, 2020; Mertođlu, 2021; Ruhrmann & Daube, 2021). Regarding this situation Aktař (2018) stated, in the Arab Spring process, social media played a major role in announcing the events to international media, while regional and international media played an important role in the effective reporting of the conduct of the ongoing protests and uprisings. Global citizenship involves empathy, critical evaluation of events, and finding solutions to problems. According to Wintersteiner et al. (2015), individuals should critically evaluate a national or international event to become global citizens. Evaluations made from different perspectives can contribute more to awareness and possible solutions related to the event and make the world a more livable place. In this way, global citizens become aware of the international activities they have done and become aware of the activities and their impact. Again, Yıldırım (2020), in his research on the Covid 19 pandemic process, concluded that people actively used social media in this process to follow the agenda, access accurate information, interact with people, and participate in cultural activities and information exchange. Thanks to social media, people were able to understand and comprehend different global problems and enter solidarity of action and thought. The right to information, which is a fundamental human right, was obtained by people through social media during the pandemic. At the same time, since individuals are equal all over the world in the use of social media (being open to different interactions, reaching everyone, using it at any time, etc.), therefore people will respect differences by adopting universal



values (equality, freedom, respect, independence, etc.) in accordance with the understanding of global citizenship. Sensitivity to different problems in global citizenship can be realized through interaction with social media. Thus, while people gain sensitivity to events, they also gain a sense of responsibility as world citizens.

According to the results obtained in the research, the following suggestions can be made in order to use social media correctly and to affect the awareness of global citizenship in individuals; the recommendations can be made such as giving more importance to teaching social media in schools, including more social media-related topics in textbooks, providing teachers with in-service training on social media, and encouraging students to use social media under the supervision of their parents.

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### Author(s)' statements on ethics and conflict of interest

**Ethics statement:** I declare that research/publication ethics and citing principles are taken into consideration at all stages of the study. In case of dispute, I take full responsibility for the content of the article.

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# Teachers' instructional design for e-learning for deaf and hard of hearing students<sup>1</sup>

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## Abstract:

The purpose of this study was to examine teachers' e-learning instructional design and practices for deaf/hard of hearing students during the COVID-19 period. For this reason, this study is assumed to serve as a reference point for the development of accessible e-learning instruction for teachers of deaf/hard of hearing students. This study is a quantitative research in survey design. During the COVID-19 pandemic, education and communication were maintained thanks to e-learning, which has become an integral part of education. Since it was intended to establish the attitudes, thoughts, and behaviors of the sample over a specific time period, a cross-sectional design was used. The data collection tool was an online survey developed by the researcher. The participants of the study were 138 teachers. However, neither before nor throughout the COVID-19 period, 13 of the participating teachers had no experience with e-learning. Therefore, they did not answer the questions related to e-learning in the third part of the survey. Descriptive statistics were used to analyze the data. As a result, it was determined that teachers of deaf/hard of hearing students were unprepared for the e-learning process. They require assistance with the instructional design for e-learning.

## Keywords:


Deaf, hard of hearing, students with special education needs, e-learning, instructional design.

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## INTRODUCTION

The pandemic process has had a devastating impact on people's physical and psychological well-being, as well as on the need for flexible and accessible learning opportunities for students and educators (Themelis, 2023). Thus, e-learning, a form of synchronous or asynchronous learning conducted through the Internet, computer networks, and technological devices, has taken its place in education systems worldwide (Arshavskiy, 2017; Slade, 2020). Even if the pandemic process ends, it will not be possible to ignore the e-learning experience and continue in traditional classrooms as if nothing has happened because e-learning has been an important catalyst for the spread and development of digitalization. At the same time, many students have met and adapted to e-learning (Rapanta et al., 2021). However, regarding education, focusing only on digitalization and technology is not enough. Many aspects of technology pedagogy should be addressed in a way that will serve lifelong learning. The first is the examination of instructor and student experience regarding the emergency e-learning process. In line with these examinations, the development of e-learning designs that will allow educators and students to learn effectively, enjoyably, and long-term in e-learning networks should be considered (Themelis, 2023). This abrupt transition in the field of education has led researchers to rethink accessible e-learning instructional designs for students with different characteristics.

### E-Learning and Instructional Design

E-learning is teaching and learning supported by technological devices such as computers, tablets, smartphones, and digital technologies (Brown & Voltz, 2005; Gülbahar, 2018). E-learning is carried out in two forms as synchronous and asynchronous. Synchronous e-learning is conducted through mutual interaction by considering the learning performance of students under the leadership of an instructor, similar to a normal classroom (Arshavskiy, 2017). Asynchronous e-learning, in contrast to synchronous learning, offers students the opportunity to learn on their own at a time and at an individual pace (Slade, 2020). In this context, what is learned by watching a YouTube video, taking an online course, or attending a live webinar can be called e-learning (Arshavskiy, 2017; Gülbahar, 2018; Slade, 2020; Themelis, 2023). Learners can participate in e-learning from anywhere in the world as long as they have a computer, internet connection, and audio or video conferencing (Arshavskiy, 2017). Although traditional face-to-face learning is still very popular and widely used, e-learning is preferred by an increasing number of organizations and individuals as it offers many advantages (Garrison & Anderson, 2003; Gülbahar, 2018; Slade, 2020). The change in the learning context also affects the relationship between teachers, who are the mentors of the learning process, and students (Brown & Voltz, 2005). To meet the individual learning needs of the students, teachers should design the e-learning instruction by considering the

characteristics and learning styles of the students in the group. Effectively designed e-learning courses facilitate the achievement of targeted learning outcomes for students (Arshavskiy, 2017; Brown & Voltz, 2005; Fox, 2003). E-learning's ability to be as good as classroom learning depends on a good design.

Instructional design is a body of knowledge about instructional practices that guides teachers in achieving desired learning outcomes (Reigeluth, 1999). Mager (1984) explained instructional design based on answers to three basic questions. The first question is what the instructional objectives are. Then comes the question of which teaching strategies will be used to achieve these objectives. Finally, how to assess the level of achievement of the objectives should be considered. Today, interest in instructional design has shifted to digital literacy and pedagogy because of evolving technology and changing methods of accessing information (Gülbahar, 2018; Themelis, 2023; Zaharias & Pylygmenakou, 2009). Accordingly, e-learning instructional design has begun to be emphasized (Piskurich, 2009). There are many elements that distinguish e-learning instructional design from traditional instructional design. However, the most important aspect is that it is much more difficult to attract students' attention and maintain their interest in an e-learning process than in a traditional instructional design. In an e-learning environment, it may not be possible for teachers to notice and eliminate students' inattention, apathy, or other problems that they may exhibit. Simultaneously, if effective instructional design is not realized, it is much easier for participants to leave the e-learning application than to leave the physical classroom environment (Fox, 2003). Therefore, teachers who design e-learning instruction should anticipate the problems that may arise by considering the student characteristics and take precautions. At this point, teachers' competencies in using both learning and educational theories and related technological equipment and applications have gained importance (Garrison & Anderson, 2003; Steen, 2008).

### Students Who Are Deaf and Hard of Hearing and E-Learning

The impact of rapidly developing digital technology in supporting the learning of individuals with different abilities and needs is increasing. E-learning offers accessibility to content by making adaptations according to the individual needs of learners due to its advantages such as its versatility in adapting to every discipline (Brownell et al., 2010; Garrison & Anderson, 2003; Slade, 2020). Teachers, the leaders of the teaching process, can largely eliminate the barriers in the education of students with special educational needs such as hearing, vision, or intellectual disabilities by taking advantage of such advantages of e-learning (Fichten et al., 2009; Sandars & Morrison, 2007). For this, teachers need to design the teaching process well, considering student characteristics (Brownell et al., 2010; Fox, 2003; Johnson & Semmelroth, 2014). Deaf/hard of hearing (D/HH) students' preference for language and communication approaches and literacy skills differ depending on many factors such as age and degree of hearing loss, use of hearing-assistive



technology, education methods, family education, and socio-cultural and economic characteristics of the family (Marschark et al., 2002). Teachers have a responsibility to make interdisciplinary inquiries into ideas and best practices that will respond to the needs of the target audience while designing instruction. Successful teachers are known to have expertise in terms of subject area knowledge and knowledge about the learning styles of D/HH students (Spencer & Marschark, 2010). In this context, communication preferences, special educational needs, and learning styles are important issues that need to be considered to support the learning of D/HH students (Guardino, 2015; Pappas et al., 2018). According to Long et al. (2011), the quality of interaction between teachers and students in synchronous e-learning for D/HH students significantly affects their success. Effective e-learning instructional design offers the opportunity to eliminate the communication and interaction barriers that D/HH students may encounter in the physical world. E-learning instructional designs, including subtitles, videos, pictures, and sign language, have positive effects on the learning of D/HH students (Bueno et al., 2007; Pappas et al., 2018; Yoon & Kim, 2011).

### Literature Review

In a study conducted by Drigas and Kouremenos (2005), the effectiveness of an e-learning design that provides D/HH students with access to information through written texts, sign language, and visualization was examined. The e-learning design in this study was found to support the learning of D/HH students by enabling them to learn with their peers. Similarly, Al-Osaimi et al. (2009) created effective e-learning design guidelines in line with the feedback of D/HH students and teachers on the grounds that existing e-learning designs are not age-appropriate and create difficulties in interaction. It was observed that the accessible and interactive e-learning instructional design positively affected the performance of the students. In the literature, research on effective e-learning applications for D/HH students has increased even more with the sudden and rapid transition to e-learning all over the world during the COVID-19 pandemic. In the study conducted by Alsadoon and Turkestani (2020), it was determined that teachers working with D/HH students faced technical and sign language translation deficiencies while conducting synchronous lessons. Similarly, Karasu and Kaya (2021) examined the COVID-19 distance education process of D/HH students in vocational colleges. This research revealed that students with D/HH face various difficulties due to the limitations of their language skills and instructors face various difficulties related to e-learning instructional design. A similar result regarding educators was also encountered in the study by Elivera et al. Accordingly, special education teachers who teach D/HH students were not prepared for synchronous e-learning (Elivera et al., 2022). Atış and Doğaner (2022) conducted semi-structured interviews with teachers about teaching mathematics to D/HH students and obtained similar findings. Because of this research, it was concluded that digital materials have positive effects on student motivation, but teachers lack knowledge in preparing digital materials. Considering all these research results, this led to a comprehensive

investigation of e-learning instructional design and the experience of teachers who suddenly started to implement e-learning applications with D/HH students during the COVID-19 process. Thus, it is hoped that the future e-learning experiences of D/HH students and their learning with the help of in-class educational technologies will become more qualified. It is assumed that this research will guide the design of accessible e-learning instruction for learners working with D/HH students. In addition it is thought that it will also make important contributions to classroom educational technologies and instructional designs.

### Research Objective

The aim of this study was to examine teachers' e-learning instructional design and practices for D/HH students during the COVID-19 period. For this purpose, answers the following questions were sought:

#### *Sub-problems*

- Q1:** How is the technical infrastructure used by teachers in e-learning?
- Q2:** How does the teacher use language and communication modes in e-learning?
- Q3:** What are teachers' attitudes toward the reorganization of instructional objectives in e-learning?
- Q4:** Did teachers use different teaching methods in e-learning than in face-to-face lessons?
- Q5:** What are the e-materials used by teachers in e-learning and the problems related to e-material design?
- Q6:** How do teachers use assessment methods and e-assessment tools in e-learning?
- Q7:** What are the subjects in which teachers want to gain knowledge and experience in e-learning?

## METHOD

### Research Model

In this study, which was conducted to examine the e-learning instructional design and the practices of teachers for D/HH students during the COVID-19 pandemic period, a quantitative survey design was used. During the COVID-19 pandemic, education and communication were maintained thanks to e-learning, which has become an integral part of education. Since it was intended to establish the attitudes, thoughts, and behaviors of the sample over a specific time period, a cross-sectional design was used (Creswell, 2012).

### Participants

The population of this research is teachers in schools working with D/HH students with primary, secondary, and high school levels in Turkey. There are no schools for D/HH students in any of the 81 provinces of Turkey. Accordingly, there are 32 primary and secondary schools and 20 vocational high schools for D/HH students in Turkey (MoNE, 2022). In this context, considering that the pandemic period has not yet ended and the

voluntary nature of the participants, the convenience sampling method was preferred (Patton, 2005). An online survey call was sent to 138 teachers who agreed to participate in this study. However, 13 of the participating teachers had no e-learning experience either prior or throughout the COVID-19 period. Therefore, they did not answer the questions related to e-learning in the third part of the survey. As shown in Table 1, the presentation of participant demographic information was given.

**Table 1.**

*Demographic Information of the Participants (n=125)*

	Frequency (f)	Percentage (%)
<b>The type of school (deaf/hard of hearing)</b>		
Primary School	36	26
Middle School	74	54
Special Education Vocational High School	28	20
<b>Gender</b>		
Male	70	51
Female	68	49
<b>Age</b>		
20-30	8	6
31-40	40	29
41-50	51	37
51 and over	39	28
<b>Professional working time (years)</b>		
0-5	6	4
6-10	14	10
11-15	29	21
16-20	23	17
21 and over	66	48
<b>Education Level</b>		
Associate degree	4	3
Undergraduate degree	112	81
Master's degree	22	16
<b>Branch</b>		
Biology	1	1
Chemical	1	1
Geography	3	3
Guidance and Psychological Counseling	3	3
Handicrafts	6	4
History	5	4
Information Technologies	6	4
Mathematics	9	7
Music	4	3
Physical Education	2	2
Religious Culture and Moral Knowledge	6	4
Science	10	7
Social Science	6	4
Special Education	48	34
Technology and Design	4	3

Turkish Language and Literature	18	12
Visual Arts	6	4
<b>Conducting E-Learning prior to or throughout COVID-19</b>		
Yes	125	91
No	13	9
<b>Total</b>	<b>138</b>	<b>100</b>

As seen in Table 1, teachers working in schools for the D/HH at the secondary school level (f=74, 54%) participated the most. This was followed by teachers working in schools for the D/HH at the primary school (f=36, 26%) and vocational high school (f=28, 20%) levels. Considering the gender of the participants, it is seen that the number of male teachers (f=70, 51%) is slightly higher. Considering the age range, the number of participants was higher among teachers aged 31-40 (f=40, 29%) and 41-50 (f=51, 37%). At the same time, the number of teacher participants aged 51 and over is high (f=39, 28%). The least number of teachers who participated were between the ages of 20 and 30 (f=8, 6%). Regarding teachers' working time in the profession, teachers with 21 years or more experience (f=66, 48%) participated the most. The least number of teachers who have 5 or fewer years of experience participated (f=6, 4%). Most of the participating teachers had an undergraduate degree (f=112, 81%). In addition, special education teachers (f=48, 34%) and teachers from different branches participated the most. Thirteen of the participating teachers (9%) did not conduct e-learning prior to or throughout COVID-19. Accordingly, they did not respond to the following questions. The branches of these teachers are special education (f=8), guidance and psychological counseling (f=2), religious culture and ethics (f=2), Turkish language and literature (f=2) and science (f=2).

### Data Collection Tools

In this study, the data collection tool was an online survey developed by the researcher. The online survey was developed following the methods described in the literature to support communication and learning of D/HH students (Bruce & Borders, 2015; Lederberg et al., 2013; Marschark et al., 2011; Yoshinaga-Itano et al., 1998) and models of e-learning instructional design (Gagné et al., 1992; Keller, 2010; Koohang, 2009; Rose & Meyer, 2002). To increase the content validity of these survey items, the opinions of two researchers with doctoral degrees in the field of education of the D/HH students were obtained. As a result, an open-ended question about teachers' knowledge and practice requirements regarding e-learning was added in the last section. Simultaneously, a pilot study was conducted with 6 teachers working with D/HH students to measure the comprehensibility of the survey. These pilot applications were excluded from the research findings. A participation consent form was added to the link of the online survey. Accordingly, the online survey comprised eight sections. The first section includes the purpose of the research and the consent section. The second section includes demographic information about the participants. In the third section, there are questions about the technical infrastructure related to e-learning. The fourth section includes language and

communication, the fifth section includes instructional objectives and teaching methods, the sixth section includes e-material usage and design, and the seventh section includes various question types in the subject areas of teaching assessment. In the last section, there is an open-ended question about teachers' knowledge and practice needs related to e-learning.

### **Data Analysis**

Descriptive statistics were used to analyze the data. The data were analyzed using the Microsoft Excel infrastructure of Google Forms, which was used to collect the data. Google Forms presents the responses of the people filling out the form as statistics such as frequency and percentage through Microsoft Excel. At the same time, Microsoft Excel provides the opportunity to perform many calculations such as mean and standard deviation calculations. The data were transferred unchanged and checked by another professional. Accordingly, frequency, percentage, mean, and standard deviation values were calculated for the third question of this study. For the other questions of the study, only frequency and percentage values were calculated.

### **Ethical considerations**

In alignment with the overarching commitment to ethics, this study stringently adhered to all provisions delineated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive." It is imperative to note that there were zero instances of activities that might infringe upon the clauses stated under the "Actions Against Scientific Research and Publication Ethics."

Ethics committee and Turkish Ministry of National Education permissions were obtained, and the online survey link was sent to the schools. The data of this research were collected between January and July 2022. Data were meticulously harvested electronically, ensuring the privacy and anonymity of the respondents.

Ethical Review Board: Bursa Uludag University

Date of Ethics Review Decision: May 28, 2021

Ethics Assessment Document Issue Number: 2021-05

## **RESULTS**

The findings related to the data collected through the online survey are presented under subheadings in accordance with the subproblems of the research.

### **Findings Related to the Technical Infrastructure Related to E-Learning**

The data related to the technical infrastructure regarding e-learning are presented in Table 2 as the physical environment where e-learning is conducted, the tools used to access e-learning, the platforms on which e-learning is conducted, and the subject areas of past knowledge-experience related to e-learning. Participants were given the opportunity to tick more than one option while answering these questions.

**Table 2.***Technical Infrastructure Related to E-Learning*

	<i>f</i>	<i>%</i>
<b>Physical Environment in which E-learning occurs</b>		
Home	125	60,4
School	57	27,5
Outside	25	12,1
<b>Tools Used to Access E-learning</b>		
Computers smartphones/	106	43,5
Smartphones/tablets	105	43,0
Smartboards	33	13,5
<b>Platforms used in e-learning</b>		
Zoom	121	81,7
Google Meet	9	6,1
Teams	9	6,1
Whatsapp	8	5,4
Teamlink	1	0,7
<b>Background Knowledge and Experience of E-learning</b>		
No	115	92,0
Yes	10	8,0
Adult education		
Project meetings in eTwinning		
Interest in technology		

As seen in Table 2, participant teachers mostly conduct e-learning applications from home ( $f=125$ , 60.7%). At the same time, it is seen that they also conduct e-learning applications from school ( $f=57$ , 27.5%) and outside ( $f=25$ , 12.1%). they mostly use tools such as computers ( $f=106$ , 43.5%) and smartphones/tablets ( $f=105$ , 43%) to access e-learning. In addition, it was determined that some teachers accessed e-learning via the smart board in the classrooms ( $f=33$ , 13.5%). teachers mostly use platforms such as Zoom ( $f=121$ , 81.7%), to a lesser extent Google Meet ( $f=9$ , 6.1%), Teams ( $f=9$ , 6.1%), Whatsapp ( $f=8$ , 5.4%), and Teamlik ( $f=1$ , 0.7%) in e-learning. Finally, it was determined that most of the teachers ( $f=115$ , 92%) had no past knowledge or experience about e-learning. It was understood that some teachers ( $f=10$ , 8%) who had previous knowledge and experience had e-Twinning project meetings and an interest in technology and adult education.

### Findings Related to Language and Communication in E-Learning

Under this heading, the findings related to the language and communication modes that the participant teachers think are effective in e-learning, as well as the language and communication problems caused by teachers and students, are presented (see Table 3). Participant teachers were given the opportunity to tick more than one option while answering questions about teacher- and student-induced language and communication problems.

**Table 3.***Language and Communication in E-Learning*

	<i>f</i>	<i>%</i>
<b>Language and Communication Mode Used in E-Learning Courses</b>		
Both spoken and sign language together	93	74,4
Only sign language	15	12,0
only written communication	7	5,6
Others	10	8,0
Sign language-oral language-writing together		
<b>Teacher-related Language and Communication Problems in E-Learning</b>		
Not being able to use sign language correctly and functionally	59	33,3
Lack of knowledge and experience in alternative communication systems	40	22,6
Lack of sign language interpretation	37	20,9
Not being able to use spoken language effectively according to the level of the student	31	17,5
Others	10	5,7
No answer given		
No problems		
Technical issues		
<b>D/HH Students' Language and Communication Problems in E-Learning</b>		
Lack of eye contact and shared interest	61	21,9
Not being able to use sign language correctly and functionally	52	18,7
Limited oral language and communication skills	47	16,9
Failure to match hearing aids with distance learning tools	46	16,6
Lack of knowledge and experience in alternative communication systems	38	13,6
Lack of sign language interpretation	26	9,4
Others	8	2,9
Dropping out of class		
Not attending class		
Tecnical issues		

As seen in Table 3, most of the teachers stated that they used both oral and sign language together in e-learning ( $f=93$ , 74.4%). The remaining teachers used only sign language ( $f=15$ , 12%), sign language-oral language-writing together ( $f=10$ , 8%), and only written communication ( $f=7$ , 5.4%)

In addition teachers' inability to use sign language correctly and functionally ( $f=59$ , 33.3%) is one of the problems arising from e-learning. There are also problems arising from lack of knowledge and experience in alternative communication systems ( $f=40$ , 22.6%). In addition, it was found that a considerable number of teachers experienced problems due to the inability to interpret sign language ( $f=37$ , 20.9%) and the inability to use oral language effectively in accordance with the level of the student ( $f=31$ , 17.5%). Some teachers ( $f=10$ , 5.7%) stated that there were language and communication problems due to technical problems. Eye contact and lack of common interest ( $f=61$ , 21.9%) were the main language and communication problems caused by students. This was followed by

problems arising from students' inability to use sign language correctly and functionally (f=52, 18.7%), limitations of their oral language and communication skills (f=47, 16.9%), and inability to match hearing aids and distance education tools (f=46, 16.6%). In addition students reported problems due to a lack of knowledge and experience with alternative communication systems (f=38, 13.6%) and a lack of sign language interpretation (f=26, 9.4%). Some students (f=8, 2.9%) had language and communication problems such as technical problems, dropping out, and not attending the course.

### Findings Related to Attitudes toward the Reorganisation of Instructional Objectives in E-Learning

Teachers' attitudes toward setting instructional objectives in e-learning are presented in Table 4.

**Table 4.**

*Attitudes toward the Reorganisation of Instructional Objectives in E-Learning*

Attitudes toward the reorganization of instructional objectives in e-learning (n=125)	Strongly disagree		Disagree		Undecided		Agree		Strongly agree		Mean	Standard Deviation
	f	%	f	%	f	%	f	%	f	%		
	Instructional objectives for e-learning courses should be reorganized by considering the needs of students.	1	0,8	2	1,6	16	12,8	30	24	76		
Instructional objectives for e-learning courses should be reorganized according to 1 group or individual education.	1	0,8	3	2,4	21	16,8	33	26,4	67	53,6	4,30	0,889
Instructional objectives for e-learning courses should be reorganized by considering teaching time.	0	0	3	2,4	25	20	33	26,4	64	51,2	4,26	0,862

As can be seen in Table 4, most of the teachers (agree + strongly agree, f=106, 84.8%) stated that the instructional objectives for e-learning courses should be reorganized by considering the needs of the students. It was understood that there were teachers who were undecided (f=16, 12.8%) on this issue, as well as some teachers who thought that there was no need for reorganization (disagree + strongly disagree, f=3, 2.4%). Another finding is the high rate (agree + strongly agree, f=100, 80%) of teachers' attitudes toward the reorganization of instructional objectives for e-learning courses according to whether they are individual or group education. However, some teachers were undecided (f=21, 16.8%), while others (f=4, 3.2%) disagreed and strongly disagreed. Finally, most of the teachers (agree + strongly agree, f=97, 78.6%) expressed their attitudes toward reorganizing



the instructional objectives for e-learning courses by considering the teaching time. While some teachers were undecided ( $f=25$ , 20%), very few teachers ( $f=3$ , 2,4%) disagreed with this idea. In addition to the attitudes toward the determination of instructional objectives in e-learning, findings were obtained regarding the teaching methods used by teachers in e-learning, which are different from those used in face-to-face education (see Table 5).

### Findings Related to Teaching Methods in E-Learning

Findings regarding the teaching methods used in e-learning differently from face-to-face courses are presented in Table 5.

**Table 5.**

*Teaching Methods Used in E-Learning Courses*

	<i>f</i>	<i>%</i>
Yes	102	81,6
*EBA contents		
e-book		
Web 2.0 tools		
No	23	18,4
<b>Total</b>	<b>125</b>	<b>100</b>

\*EBA (Eğitim Bilişim Ağı [Education Information Network])

As seen in Table 5, it was determined that most of the teachers ( $f=102$ , 81.6%) used teaching methods different from face-to-face education in e-learning courses. These tools are EBA content, e-books, and Web 2.0 tools. It was understood that the other part of the participant teachers ( $f=23$ , 18,4%) did not use teaching methods different from face-to-face education in the lessons with e-learning.

### Findings on E-Material Usage and Design

The findings regarding the use and design of e-materials by teachers working with D/HH students are presented in Table 6. Participants were given the opportunity to tick more than one option while answering these questions.

**Table 6.**

*E-Material Usage and Design Issues*

	<i>f</i>	<i>%</i>
<b>E-materials Used in E-Learning Process</b>		
Videos	107	32,5
Power Point	78	23,7
Word and pdf documents	53	16,1
Digital drawing and writing programs	52	15,8
Oral presentations	33	10,1
Other	6	1,8
Web 2.0 tools		

### Problems in the E-material Design

Internet access and its limitations	75	17,5
Insufficient technological devices	71	16,6
Insufficient motivation	63	14,7
Insufficient support and cooperation of the parents	52	12,1
Insufficient experience in using applications related to e-material design	50	11,7
Not knowing which programs can be used in e-material design	46	10,7
Lack of support and cooperation from other experts in e-material design	34	8,0
Time limitation	34	8,0
No problems	3	0,7

As seen in Table 6, teachers mostly use videos (f=107, 26,4%) and PowerPoint (f=78, 19,2%) in the e-learning process. These were followed by Word and PDF documents (f=53, 13.1%), digital drawing and writing programs (f=52, 12.8%), and oral presentations (f=23, 8.2%). Some teachers (f=6, 1.4%) stated that they used web 2.0 tools. In addition it is also among the findings that most of the teachers (f=76) use traditional tools such as paper, notebook, and pen in the e-learning process.

Teachers face many problems in e-material design. These are, respectively, internet access and limitations (f=75, 17.7%), insufficient technological devices (f=71, 16.6%), insufficient motivation (f=63, 14.7%), insufficient support and cooperation of parents (f=52, 12.1%), insufficient experience in the use of applications related to e-material design (f=50, 11,7%), not knowing what programs can be used in e-material design (f=46, 10,7%), lack of support and cooperation of other experts in e-material design (f=34, 8%) and time limitation (f=34, 8%). Very few teachers (f=3, 0.7%) stated that they had no problems designing e-materials.

### Findings Related to Assessment of Teaching in E-Learning

The findings regarding the assessment methods used by the teachers in e-learning and their use of e-assessment tools are presented in Table 7.

**Table 7.**

#### *Assessment of E-Learning*

	<i>f</i>	<i>%</i>
<b>Assessment Methods Used in E-Learning Courses</b>		
Question-answer	55	44,0
Exams consisting of different question types	38	30,4
Observation	17	13,6
Not used	15	12,0
<b>Use of E-Assessment Tools</b>		
Yes	110	88,0
EBA assessment tools		
Web 2.0 tools (Kahoot, Quiziz, learningApps, Mentimeter, wooclap)		
No	15	12,0
<b>Total</b>	<b>125</b>	<b>100</b>

As seen in Table 7, teachers used assessment methods such as question-answer (f=55, 44%), exams consisting of different question types (f=38, 30.4%), and observation (f=17, 13.6%) in e-learning courses. Some teachers (f=15, 12%) stated that they did not use any assessment and evaluation techniques. In addition, most of the teachers (f=110, 88%) used e-assessment tools. It was determined that these tools were EBA assessment and web 2.0 tools.

### Findings Related to Subjects Teachers Want to Gain Knowledge and Experience about E-Learning

In this study, the attitudes and practices of teachers who have e-learned experiences with D/HH students were analyzed. Finally, the findings related to the subjects in which teachers would like to gain knowledge and experience about e-learning are presented in Table 8.

**Table 8.**

*Subjects Teachers Want to Gain Knowledge and Experience about E-Learning*

	<i>f</i>	<i>%</i>
<b>Subjects Teachers Want to Gain Knowledge and Experience about E-Learning</b>		
E-learning material design	13	15
E-learning content preparation	12	13,8
Interactive course design	11	12,7
Effective use of e-learning platforms	9	10,4
E-öğrenmede değerlendirme yöntemleri	6	6,9
Video and image processing programs	6	6,9
Technological education knowledge	6	6,9
Using web 2.0 tools	5	5,8
Effective communication in e-learning	3	3,4
E-learning motivation techniques	3	3,4
Efficient use of time in e-learning	3	3,4
Sign language training	3	3,4
Preparing e-learning content using sign language	3	3,4
All type of training on e-learning	2	2,3
Not want (did not find e-learning useful for the D/HH students)	2	2,3
<b>Total</b>	<b>87</b>	<b>100</b>

As seen in Table 8, there are many subjects in which teachers want to gain knowledge and experience about e-learning. It is understood that e-learning material design (f=13, 15%), e-learning content preparation (f=12, 13,8%), interactive course design (f=11, 12,7%), and effective use of e-learning platforms (f=9, 10,4%) are the main topics.

Other subjects that are desired to gain knowledge and experience are assessment methods in e-learning (f=6, 6,9%), video and image processing programs training (f=6, 6,9%), technological education knowledge (f=6, 6,9%) and using web 2.0 tools (f=6, 5,8%). In addition to these, effective communication in e-learning (f=3, 3,4%), e-learning motivation techniques (f=3, 3,4%), efficient use of time in e-learning (f=3, 3,4%), efficient use of time in e-learning (f=3, 3,4%), 4%), sign language training (f=3, 3,4%), and preparing e-learning contents with sign language (f=3, 3,4%). Some teachers stated that they wanted to receive all type of training (f=2, 2,3%), while others stated that they did not want to receive any training (f=2, 2,3%) on the grounds that they did not find e-learning useful for the D/HH students.

## DISCUSSION

Because of the analysis of the data collected through the questionnaire to examine the teachers' e-learning instructional design and practices for D/HH students during the COVID-19 period, important results that will contribute to the literature were obtained.

In this study, it was determined that the participant teachers mostly conducted synchronous e-learning applications from home. At the same time, they sometimes conducted them from school and outside. One of the strengths of e-learning is that it offers flexibility in accessing education (Arshavskiy, 2017; Garrison & Anderson, 2003; Gülbahar, 2018; Slade, 2020; Themelis, 2023). Another result was that teachers mostly access e-learning applications using tools such as computers, smartphones and tablets. Some teachers accessed e-learning applications via a smart board. Besides, almost all of the teachers used the Zoom platform. Some teachers used Teams, Google Meet, and Teamlink. In addition teachers continued to use e-learning applications via WhatsApp. It was concluded that the majority of the teachers had no previous experience with the platforms they used. On the other hand, very few teachers had previous experiences related to the platforms they used in this process through adult education, e-twinning project meetings, and interest in technology. In line with the results obtained, the fact that most of the teachers used the Zoom platform and some teachers used different platforms can be explained by the fact that EBA, the educational information network prepared by the Turkish Ministry of National Education, used the Zoom platform as an infrastructure in this process. Another result is that teachers do not have experience with e-learning, which suddenly entered their lives, they may have been caught unprepared. Similarly, Toquero (2020) stated that teachers had difficulties in planning, implementing instruction, and assessing student performance due to the sudden transition to e-learning. However, it is thought that teachers who have developed technological literacy and the ability to design instruction in accordance with student needs can adapt to this process in a shorter time.

Most of the teachers related to the subject area of language and communication in e-learning stated that they use both oral and sign language together in e-learning. In addition, it was understood that some teachers prefer only sign language and others prefer

only written communication. Some teachers used sign-written-oral language with all three communication systems in e-learning. On the other hand, it was concluded that no teacher preferred to use only oral language. There are similar findings in the literature that effective e-learning applications for D/HH students are sign language and text-supported (Beal-Alvarez & Cannon, 2014; Debevc et al., 2014; Keser & Özdemir, 2018; Pappas et al., 2018). It was concluded that the problems related to language and communication during synchronous e-learning stemmed mostly from teachers' inability to use sign language correctly and functionally. Other language and communication problems arising from the teachers were determined to be the inability to interpret sign language, inadequate knowledge and experience of other alternative communication systems, and inability to use spoken language effectively according to the level of the student. The findings of this study regarding communication problems in e-learning applications due to educators' inability to use sign language functionally and the lack of sign language interpretation support are supported by other research results in the literature (Aljedaani et al., 2021; Atış & Doğaner, 2022; Karasu & Kaya, 2021; Lynn et al., 2020; Schafer et al, 2020). Considering the teacher-related results in language and communication in this study and the literature together; developing the competencies of teachers working with D/HH students regarding sign language and alternative communication systems is an urgent necessity not only for e-learning but also for traditional classroom education. The main language and communication problems arising from the students are eye contact and lack of common interest. This was followed by problems arising from the students' inability to use sign language correctly and functionally, limitations of oral language and communication skills, and inability to match hearing aids and distance education tools. In addition it was concluded that there were problems arising from students' lack of knowledge and experience with alternative communication systems and their inability to interpret sign language. Some student-related language and communication problems, such as technical problems, dropping out of the course, and not attending the course were identified. In this study, it is thought that other problems underlie the problems arising from students' inability to establish eye contact and common interest in e-learning applications. Not receiving clear auditory input due to the mismatch between hearing aids and distance learning tools and not receiving visual language input due to the lack of sign language interpretation directly limit communication. On the other hand, the limited oral language skills of the students and the inability of the teachers to use oral language effectively according to the level of the student may have made it difficult for D/HH students to establish a common interest. In addition, as Kear et al. (2012) stated, deaf/hard of hearing students may not establish eye contact and joint interest despite the screen, thinking that the teacher is not directed toward them. At the same time, it is known that D/HH students' fatigue increases, their performance decreases, and they cannot participate effectively in e-learning courses (Rodrigues et al, 2022).

Most of the teachers revealed their attitudes toward the redetermination of instructional objectives in e-learning, considering student needs, whether it is an individual or group lesson, and instructional time. Similar to the findings of this research, there are similar research results that most of the teachers in Turkey benefit from EBA content in e-learning (Demir & Özdaş, 2020; Çiftçi & Aydın, 2020; Tartuk & Turan, 2023). In addition, it was determined that most of the teachers used different teaching methods than face-to-face education in e-learning courses. They stated these as EBA content, e-books, and Web 2.0 tools. It is pleasing that the teachers' attitude toward the reorganization of instructional objectives for e-learning courses is positive. As stated by Filiz and Güneş (2020), conducting e-learning in line with the objectives determined in face-to-face education may have many negative consequences. On the other hand, the result that teachers used different teaching methods from face-to-face education by using EBA contents, e-books, and web 2.0 tools can be interpreted as an attitude toward conducting effective e-learning courses.

Regarding the e-materials used in the e-learning process, videos and PowerPoint are mostly used. In addition, Word and PDF files, digital drawing and writing programs, oral presentations, and Web 2.0 tools were used by the teachers. In addition, it was also determined that most of the teachers used traditional tools such as paper, notebook and pen in the e-learning process. Materials containing visual and auditory information in both e-learning and traditional classroom teaching support the learning, motivation, and development of language skills of D/HH students (Beal-Alvarez & Cannon, 2014). E-learning provides access to teaching material to suit their various needs, including high-level visualization, bilingual information, and. (Pappas et al., 2018). In this study, it was concluded that teachers had problems with e-material design due to the lack of internet access and technological devices, motivation, time, parents' support, and cooperation. In addition, problems arising from a lack of experience in e-material design and expert support were reported. Although it is easy to access e-materials prepared today, teachers' ability to design or adapt their own e-materials is an important requirement in a rapidly changing and digitalized world. In this context, arrangements from the individual to the institutional level should be made to solve problems such as internet and technological device access, motivation, and expert support for teachers to design e-materials.

Regarding the evaluation of e-learning, it was determined that teachers used measurement and evaluation techniques such as question-answer, exams consisting of different question types, and observation in synchronous lessons. At the same time, it was found that most of the teachers made e-assessments through EBA assessment and web 2.0 tools. According to these results, the assessment and evaluation techniques and tools used by teachers in the e-learning process do not vary. There are similar results in the literature that limited assessment and evaluation techniques and tools were used in e-learning during the COVID-19 period (Alshawabkeh et al., 2021; Sani-Bozkurt et al., 2022). The importance of assessment and evaluation in determining the effectiveness of e-learning

courses and the level of achievement of learning outcomes cannot be discussed. In this context, teachers' knowledge and skill development regarding different types of assessment and evaluation methods and tools suitable for student characteristics should be supported.

Finally, it was understood that there are many subjects in which teachers want to gain knowledge and experience about e-learning. The most important are e-learning material design, e-learning content preparation, interactive course design, and effective use of e-learning platforms. In addition there are topics such as evaluation methods in e-learning, video, image processing programs training, technological education knowledge, and the use of web 2.0 tools. At the same time, it was concluded that they would like to receive training on effective communication in e-learning, e-learning motivation techniques, efficient use of time in e-learning, sign language training, and preparing e-learning contents with sign language. Today, digitalization has brought about a very rapid change and transformation. Its effects on all areas of our lives are inevitable. Digital transformation has become much more evident in education with COVID-19. The issue of digitalization in education has become increasingly important. With digitalization in education, more comfortable, accessible and flexible time-based learning opportunities have emerged (Kocaman-Karoğlu et al., 2020). Accordingly, it is inevitable that this change will not affect teacher qualifications. To meet changing student needs, teachers need to be prepared to include digital student-centred practices in the teaching process (Arshavskiy, 2017; Fox, 2003; Garrison & Anderson, 2003; Robertson, 2020).

### LIMITATIONS AND RECOMMENDATIONS

The main limitation of this study is related to the structure of the survey and the areas of instructional design that were not addressed. Given that this is a cross-sectional survey on the pandemic, the survey instrument was reviewed by professionals before dissemination to ensure its reliability and validity. Secondly, for the pilot study, six teachers working with the D/HH students completed the online survey. As a result of these procedures, the survey was finalised and used. Overall, this study conducted with teachers working with only one group of students with special education needs. It is important to conduct studies using different research methods and designs with teachers working with students with different special education needs.

### CONCLUSION

When the results obtained in this study regarding the instructional design of teachers who conducted e-learning with D/HH students were evaluated, it was understood that the teachers were unprepared for e-learning. It was understood that teachers faced various problems in e-learning instructional design related to language and communication. The most important of these problems is the inability of teachers and students to use sign language correctly and functionally, as well as the inability of

students to establish eye contact and common interest. Considering that the primary need of D/HH students is language and communication, both teachers and students should be trained to use sign language correctly and functionally to benefit from both e-learning and traditional classroom environments. Although teachers' attitudes toward the reorganization of instructional objectives for e-learning courses are positive, whether they have attempted to implement this is an issue that needs to be further investigated.

In addition to these, although the teachers stated that they used different materials, teaching, and evaluation methods than traditional classroom education in the e-learning process, the examples given are not as extensive as it is thought. It was understood that they mostly used ready-made materials and had limited knowledge and skills in designing e-materials. In addition, they mostly benefited from EBA content in the teaching method and the e-assessment process.

Finally, it was found that teachers need support in designing e-learning instructions and materials, e-learning content preparation, interactive course design, and effective use of e-learning platforms. In this context, more in-service training is needed to enable the development of teachers on e-learning to keep up with the rapid digitalization

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**Ethics statement:** We hereby declare that research/publication ethics and citing principles have been considered in all the stages of the study. We take full responsibility for the content of the paper in case of dispute.

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# Adaptation of the Questionnaire on Attitudes toward Disability in Higher Education into Turkish: Validity and Reliability Study

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## Abstract:

The aim of this study was to adapt the Turkish version of the Questionnaire on Attitudes towards Disability in Higher Education (QAD-HE) developed by Fuentes, Pérez-Padilla, Fuente, and Aranda (2021) into the national literature by conducting validity and reliability studies. In this context, this study included findings related to the validity and reliability of the adapted scale. A total of 606 individuals from a state university participated in this study. Of the participants, 535 were students and 71 were teachers. The findings revealed that the Questionnaire on Attitudes toward Disability in Higher Education (QAD-HE), which was adapted within the scope of the research, contains 27 items and has a two-dimensional structure as "egalitarian attitudes" and "prejudiced attitudes." The findings showed that the Questionnaire on Attitudes toward Disability in Higher Education can be used to determine attitudes toward individuals with disabilities studying or working in higher education in Turkey.

## Keywords:

Attitudes, higher education, individuals with disabilities, physical disabilities, sensory disabilities.

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## INTRODUCTION

With the adoption of the social model in the United States and Europe, and with the consideration of special education based on human rights, radical changes have been made in the general education system within the framework of inclusive education. Along with the social model, inclusive education is an educational philosophy and practice that aims to ensure that all students learn and actively participate in educational activities (Morina, 2016). Simultaneously, positive changes in laws and regulations for individuals with disabilities are observed directly at all levels of education (from pre-school to higher education). The fact that students with disabilities receive education in the same environment as their typically developing peers and participate in cultural and social activities in their university life plays an important role in the formation of their peers' perceptions of and attitudes toward these students (Kauffman, Anastasiou et al., 2023). Attitudes guide individuals in improving their quality of life, developing friendships, and making academic progress. According to data from the Council of Higher Education (YÖK, 2020), 51,647 students with disabilities are studying at state and foundation universities in Turkey. Of these, 27,782 had associate degrees, 23,581 had bachelor's degrees, 236 had master's degrees, and 48 had doctoral degrees. 89% of students with disabilities are enrolled in open education programs (YÖK, 2020). Depending on the nature and degree of their disability, these students require adaptations in terms of materials, assistive technology, lecture notes, and accessibility to physical and social spaces (Brown and Wolf, 2021). Therefore, students with disabilities who continue their university education face difficulties in social, cultural, spatial, and educational aspects (Fajardo, 2017; Pace & Kuh, 1998). For a successful inclusive practice in universities, students' special needs should be considered by differentiating and specializing in teaching materials, methods, and settings.

The adaptations that need to be made for students with disabilities vary, and in this context, students with disabilities face negative attitudes from peers and staff that result in negative outcomes on their development and educational achievements (Garabal-Barbeira 2015). Understanding the scope, content, and direction of attitudes is important for preventing, eliminating, and positivizing prejudice against individuals with disabilities (Fuentes et al., 2021). There is a significant amount of literature on different attitude scales that have been developed for individuals with disabilities. Commonly used scales are the "Attitude toward Disabled People Scale (ATDP)" (Yuker et al., 1966), "Scale of Attitudes toward Disabled Persons" (Antonak, 1982), "The Educators' Attitudes toward Disability Scale" (EADS) (Freer, 2018), "Multidimensional Attitudes Scale toward Persons with Disabilities" (MAS) (Findler et al., 2007). In the Turkish literature, it is seen that scales named "Attitude scale towards the education of individuals with disabilities" (Kösterelioğlu, 2013), "Attitude scale towards individuals with special needs" (Yaralı, 2015) were developed. However, there is a lack of a scale that determines attitudes toward individuals with disabilities in higher education. Therefore, the adaptation of the (QAD-HE) into Turkish inclusive education research will provide comparable results in the international context.

In this study, the Questionnaire on Attitudes toward Disability in Higher Education (QAD-HE), which was developed to determine the attitudes of university students and academic staff toward individuals with disabilities at the university, was adapted to Turkish. Therefore, the results of the adaptation of the Questionnaire on Attitudes towards Disability in Higher Education (QAD-HE) developed by Fuentes, Pérez-Padilla, Fuente, and Aranda (2021) are analyzed. In line with this scale planned to be adapted, the direction and scope of attitudes towards students with special needs in higher education can be determined, and attitude change studies can be carried out accordingly.

## METHOD

This was a scale adaptation study. Information about the characteristics of the study group and the data collection tool, the adaptation process of the scale to Turkish, and the data analysis are detailed below

### *Participants*

A total of 606 individuals from a state university participated in this study. Of the participants, 535 were students and 71 were university lecturers. Of these students, 369 (68.97%) were female and 166 (31.03%) were male. The average age of students was 23 years (22.84; SD = 4.13). 67 (12.52%) students were in the 1st grade, 149 (27.85%) were in the 2nd grade, 193 (36.07%) were in the 3rd grade, 120 (22.43%) were in the 4th grade, three (0.56%) were in the 5th grade, one (0.19%) was in the 6th grade, and two students did not specify their grade. According to the opinions of the student participants, the mean level of knowledge about disability (scored from 1 to 4) was 2.95 (ss = 0.95). Among the lecturers, 45 (63.38%) were female and 26 (36.62%) were male. The average age of the lecturers was 38 years (38.32; SD = 6.39). According to the opinions of the participants, the average level of knowledge about disability was 3.30 (SD = 0.72).

### *Data Collection Tools*

#### **Sociodemographic Questionnaire**

For the demographic characteristics of the participants, the sociodemographic questionnaire developed by the researchers was used. This form was prepared to determine the participants' gender, age, employment status, and type and frequency of contact with individuals with physical and sensory disabilities.

The data obtained are listed in Table 1.



**Table 1**

The type and frequency of contact with individuals with physical and sensory disabilities

	Students		Teachers	
	Frequency N(%)	Average frequency of communication M (SD)	Frequency N(%)	Average frequency of communication* M (SD)
To meet someone close to you with a physical disability	212 (%39,63)	2,99 (1,69)	39 (%54,93)	3,54 (1,76)
Meet a classmate with a physical disability	116 (%21,68)	2,22 (1,55)	21 (%29,58)	2,56 (1,82)
To meet someone close to you with a sensory disability	160 (%29,91)	2,59 (1,66)	34 (%47,89)	3,20 (1,87)
Meet a classmate with a sensory disability	110 (%20,56)	2,14 (1,56)	20 (%28,17)	2,49 (1,80)

\* On a scale from 1 to 6: 1 = hardly ever, 6 = constantly.

### **Questionnaire on Attitudes toward Disability in Higher Education (QAD-HE)**

The Questionnaire on Attitudes towards Disability in Higher Education (QAD-HE) was developed by Fuentes, Pérez-Padilla, Fuente, and Aranda (2021). This scale consists of two sub-sections and 27 items that examine the attitudes of university students and academic staff toward individuals with disabilities. A Likert-type scale was used to score each item (1 = strongly disagree, 2 = somewhat disagree, 3 = slightly agree, 4 = somewhat agree, 5 = agree, 6 = strongly agree). Internal consistency coefficient ( $\alpha > .90$ ).

Some items of the questionnaires are as follows: "I feel proud to have a friend who is disabled", "Sensory disabled people (blind/deaf) are unable to do most things", "I think hanging out with someone disabled is very complicated".

### **The adaptation process of the Questionnaire into the Turkish**

For a reliable adaptation, the Questionnaire on Attitudes towards Disability in Higher Education (QAD-HE) is culturally considered to adapt to the Turkish language and culture (Çapık, Gözümlü, & Aksayan, 2018; Deniz, 2007; Hambleton & Patsula, 1999).

1) First, the authors were contacted via e-mail, and permission was obtained for the adaptation of the scale to Turkish.

2) The scale structure was examined in detail in both cultures, the similarity of the scale items was confirmed, and it was decided to use the scale with this information.

3) The scale was presented to five faculty members working on individuals with disabilities, special education, and adult education in higher education to be examined in terms of its adequacy to serve the purpose. The faculty members stated that they found the scale adequate and culturally appropriate.

4) Studies were also conducted to ensure the language, construct, and criterion validity of the scale, and the reliability of the Turkish version of the scale was analyzed.

5) The scale was translated from English, the original language, into Turkish, the target language, by three academicians who are experts in the field, fluent in both languages, and have a good understanding of Turkish culture. The measurement tool was translated into Turkish by an expert group, the Turkish form was translated into English by another expert group, and the original and translated English forms were compared.

6) For the translation into English to be linguistically simple, comprehensible, clear, and concise, studies were conducted to determine the Turkish terms, definitions, and expressions that best meet the English expressions, and the Turkish form of the scale was created.

7) For clarity and comprehensibility of the final form of the scale, the opinion of a Turkish language expert was obtained, and the final form was created.

### *Data Analysis*

Within the scope of the research, before the analysis, the dataset was examined for incorrect data entry and missing data. In line with the examination, no incorrect data entry or missing data were found in the dataset; thus, the analysis was conducted. Confirmatory factor analysis was conducted to determine the structure of the adapted Questionnaire on Attitudes toward Disability in Higher Education (QAD-HE). To determine the appropriate estimation method for confirmatory factor analysis, the univariate and multivariate normal distributions of the variables were examined (Appendix A). Because the Mardia test was greater than three, it was determined that the assumption of multivariate normal distribution was not met. Therefore, robust maximum likelihood estimation was used as the estimation method for confirmatory factor analysis. Cronbach's alpha was calculated to determine the reliability of the scores on the adapted scale.

### *Ethical considerations*

In this study, the regulations of the Higher Education Institutions Scientific Research and Publication Ethics Directive" were followed. The regulations of the section of "Actions Against Scientific Research and Publication Ethics" were strictly followed to ensure ethical research conduct.

Ethical review board name: Akdeniz University

Chairmanship of the Social and Humanities Scientific Research Ethics Committee

Date of ethics review decision: 03.04.2023

Ethics assessment document issue number: 08/157

## RESULTS

The Questionnaire on Attitudes towards Disability in Higher Education (QAD-HE) with 27 items has a two-dimensional structure. The Egalitarian Attitudes dimension includes 11 items and the Prejudiced Attitudes dimension includes 16 items. Confirmatory factor analysis was conducted to determine whether the adapted scale exhibits a two-dimensional structure in Turkish culture. During confirmatory factor analysis, model– data fit was evaluated by examining fit index values, factor loadings, and error variances. Because of the confirmatory factor analysis conducted within the scope of the research, it was determined that the factor loading of the 15th item under the prejudiced attitudes dimension was 0.03 and the error variance was 1.00. Factor loadings lower than 0.30 and error variance higher than 0.90 are accepted as indicating that the item does not make a valid measurement in the relevant dimension (Tabachnick, & Fidell, 2007, p.587, 614). When the fifteenth item is examined, it is as follows: "I don't think disabled people should receive any special treatment at university." The rationale for why this item does not work in Turkish culture is the possibility that distance education offers anyone with internet access and a suitable device the opportunity to actively participate in education from a convenient location without having to go to school. This situation has eliminated the need for many adaptations or regulations regarding access to space and education, especially for individuals with disabilities. Although distance education creates the need for different adaptations and arrangements in the education of students with disabilities, since distance education is a new situation experienced intensively for the first time throughout the country, the participants may have thought that anyone with internet access and technological devices can participate in the lessons, prepare their homework, presentations, and upload them to the system. Therefore, they may not have found it appropriate to provide special treatment to individuals with disabilities. Therefore, this item is not suitable for Turkish culture and the item was removed from the dataset and the analyses were repeated. The fit index values, factor loading values (max-min), and error variance (max-min) values obtained because of the confirmatory factor analysis are presented in Table 2.

**Table 2**

Confirmatory Factor Analysis Results of the Questionnaire on Attitudes toward Disability in Higher Education (QAD-HE)

	$\chi^2$	$\chi^2/sd$	p	CFI	NFI	NNFI	RMSEA	Factor Loading Values		Error Variances	
								max	min	max	min
Scale	1273,09	4,29	0,000	0,93	0,91	0,93	0,074	0,72	0,37	0,86	0,49
Recomm.		$\chi^2/sd \leq 3$		$\geq 90$	$\geq 90$	$\geq 90$	$\leq 0,080$	$\geq 0,30$		$\leq 0,90$	

When Table 1 is examined, it is seen that the  $\chi^2/sd$  value is between 3 and 5 accordingly, it can be said that the model shows a moderate fit to the data. The CFI value is 0.93, the NFI value is 0.91 and NNFI value is 0.93. These values being above 0.90 means that the model fits the data very well. When evaluated in terms of the RMSEA index, it was found that this index was 0.074 for the model, and since this value is less than 0.080, it can be said that the model fits the data well according to this index. When the fit indices are evaluated in general, the two-dimensional model fits the data. The factor-loading values of all items on the scale are higher than 0.30. Accordingly, it can be interpreted that all items serve their purpose. The measurement model obtained because of the analysis is presented in Figure 1.

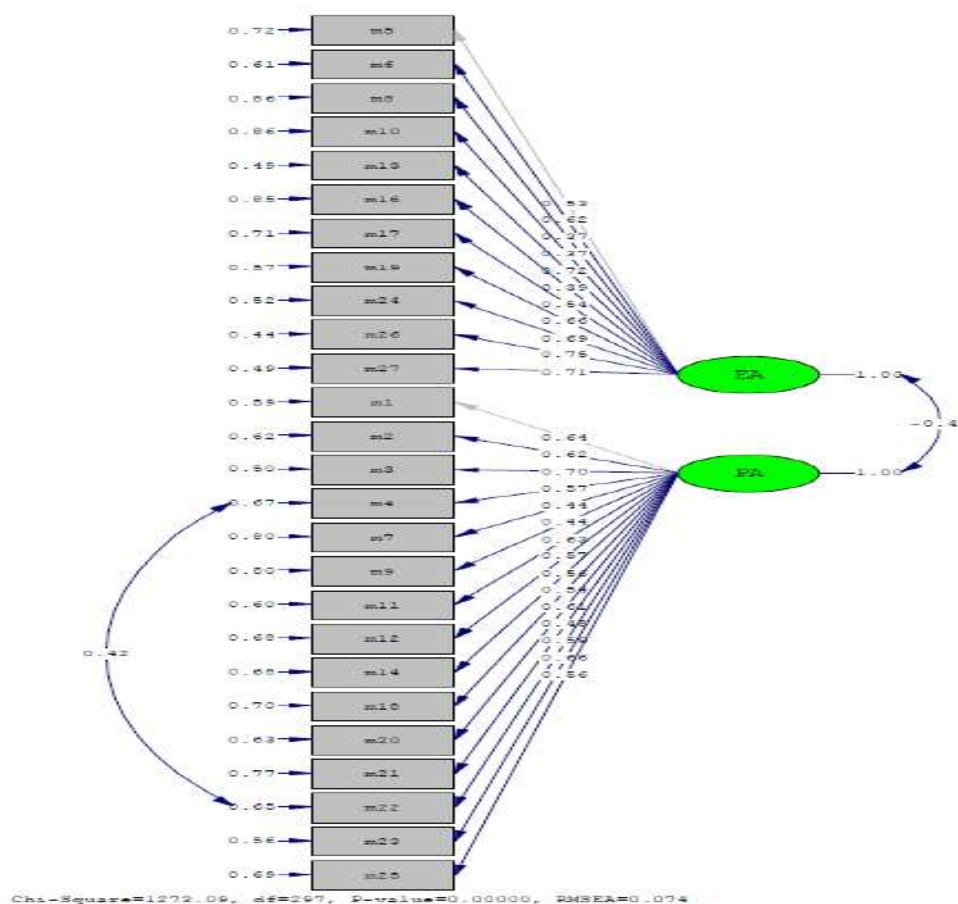


Figure 1. Model Questionnaire on Attitudes toward Disability in Higher Education

Cronbach’s alpha and McDonald’s omega coefficients were calculated to determine the reliability of the Attitudes toward Disability Scale scores in higher education. The results are presented in Table 3.

Table 3

Reliability of the Questionnaire on Attitudes toward Disability in Higher Education Scale Scores

Sub Dimensions	Number of Items	Cronbach Alfa	McDonald Omega
Egalitarian Attitudes	11	0,83	0,85
Prejudiced Attitudes	15	0,88	0,89

According to Table 2, the Cronbach's alpha value calculated for the egalitarian attitude dimension of the Questionnaire on Attitudes towards Disability in Higher Education was 0.83, the McDonald Omega reliability was 0.85, the Cronbach's alpha value calculated for the prejudiced attitude dimension was 0.88, and the McDonald Omega reliability was 0.89. For reliability measurements, values below 0.50 are considered low reliability, values between 0.50 and 0.80 are considered moderately reliable, and values above 0.80 are considered highly reliable (Salvucci, Walter, Conley, Fink, & Saba, 1997). Accordingly, the questionnaire scores on attitudes toward disability in higher education are highly reliable.

## CONCLUSION AND DISCUSSION

The aim of this study was to adapt the Questionnaire on Attitudes towards Disability in Higher Education (QAD-HE) developed by Fuentes, Pérez-Padilla, Fuente, and Aranda (2021) into Turkish and bring it into the national literature by examining the validity and reliability of the scale. In this study, it was determined that one item did not fit the adaptation of the Questionnaire on Attitudes towards Disability in Higher Education to Turkish culture. The rationale considered within the scope of the relevant item may be that the participants did not consider the situations related to adaptations for their peers and/or students with disabilities because of reasons such as the fact that the participants continued distance education for a long time, the trainings were online and distance, and they thought that everyone was equal in accessing education (Dayı & Basık, 2022). Since all courses are online in the distance education process and course materials are systematically uploaded to the computer environment, it facilitates physical, social, and educational adaptations for students with disabilities. After removing this item from the scale, it was determined that the two-dimensional structure had the desired characteristics, and the scale scores were reliable and valid. The two dimensions included 27 items : "egalitarian attitudes" and "prejudiced attitudes".

The Cronbach's alpha value calculated for the Questionnaire on Attitudes toward Disability in Higher Education for the egalitarian attitude dimension was 0.83, the McDonald Omega reliability was 0.85, the Cronbach's alpha value calculated for the prejudiced attitude dimension was 0.88, and the McDonald Omega reliability was 0.89. For reliability measurements, values below 0.50 are considered low reliability, values between 0.50 and 0.80 are considered moderately reliable, and values above 0.80 are considered highly reliable (Salvucci et al., 1997). The scale is graded on a 6-point Likert scale as "1-Strongly disagree", "2-Somewhat disagree", "3- Undecided", "4-Somewhat agree", "5- Agree", "6-Strongly agree". Accordingly, the Questionnaire on Attitudes toward Disabilities in higher education can be used to determine attitudes toward individuals with disabilities studying or working in higher education in Turkey. Determining the attitudes of individuals on this issue is a necessary step in developing, implementing, and evaluating inclusion practices, attitude change activities, and social acceptance programs for students with disabilities.

## LIMITATIONS AND RECOMONDATIONS

Because this study is a scale adaptation study, the differences regarding the demographic information of the participants, such as gender, age, and the departments they study/work in, were not examined. Therefore, in future studies, the relationships between the demographic information of university students and teachers and the scores they obtained from the Questionnaire on Attitudes towards Disability in Higher Education (QAD-HE) can be examined. A significant limitation of the study is that the data were collected from a single university and during the distance education process. The reliability and validity of the scale should be tested repeatedly when face-to-face education is introduced.

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## Data Availability Declaration

Data Availability Upon Formal Request:

While the primary datasets utilized in this study are not publicly accessible due to certain constraints, they are available to researchers upon a formal request. The authors have emphasized maintaining the integrity of the data and its analytical rigor. To access the datasets or seek further clarifications, kindly reach out to the corresponding author. Our aim is to foster collaborative academic efforts while upholding the highest standards of research integrity.

## Author Contributions

The sole author of this research, Adile Emel SARDOHAN YILDIRIM, was responsible for the conceptualization, methodology formulation, data collection, analysis, and interpretation. Furthermore, Adile Emel SARDOHAN YILDIRIM took charge of drafting the initial manuscript, revising it critically for vital intellectual content, and finalizing it for publication. The author has read and approved the final manuscript and takes full accountability for the accuracy and integrity of the work presented.

### *Author(s)' statements on ethics and conflict of interest*

**Ethics statement:** I hereby declare that research/publication ethics and citing principles have been considered in all the stages of the study. I take full responsibility for the content of the paper in case of dispute.

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## Biographical notes:

**Adile Emel SARDOHAN YILDIRIM<sup>1</sup>:** She completed her undergraduate, graduate and doctoral studies in special education. Her research areas special needs education, teacher training, inclusive education, children with multiple disabilities. She is working as an assistant professor at Akdeniz University.



**Appendix-A. Normality Results**

<b>Variable</b>	<b>min</b>	<b>max</b>	<b>skew</b>	<b>c.r.</b>	<b>kurtosis</b>	<b>c.r.</b>
m25	1,000	6,000	2,449	24,613	5,759	28,941
m23	1,000	6,000	,942	9,464	,163	,818
m22	1,000	6,000	,565	5,682	-,804	-4,041
m21	1,000	6,000	,151	1,520	-1,230	-6,182
m20	1,000	6,000	1,970	19,803	3,742	18,801
m18	1,000	6,000	1,654	16,620	2,286	11,485
m15	1,000	6,000	,374	3,756	-,840	-4,221
m14	1,000	6,000	1,154	11,598	,753	3,785
m12	1,000	6,000	,856	8,602	-,542	-2,723
m11	1,000	6,000	2,007	20,170	3,659	18,384
m9	1,000	6,000	,939	9,440	-,297	-1,492
m7	1,000	6,000	1,804	18,128	1,957	9,832
m4	1,000	6,000	,853	8,571	-,471	-2,366
m3	1,000	6,000	2,579	25,920	6,371	32,015
m2	1,000	6,000	2,562	25,748	6,491	32,616
m1	1,000	6,000	,946	9,503	-,085	-,428
m5	1,000	6,000	-1,684	-16,920	2,224	11,176
m6	1,000	6,000	-2,152	-21,627	4,290	21,558
m8	1,000	6,000	-,739	-7,424	-,543	-2,727
m10	1,000	6,000	-1,659	-16,670	1,660	8,341
m13	1,000	6,000	-2,889	-29,035	8,367	42,043
m16	1,000	6,000	-,512	-5,149	-,701	-3,525
m17	1,000	6,000	-1,318	-13,241	1,139	5,725
m19	1,000	6,000	-1,191	-11,972	,974	4,896
m24	1,000	6,000	-2,147	-21,579	4,226	21,237
m26	1,000	6,000	-2,008	-20,176	4,097	20,587
m27	1,000	6,000	-2,786	-27,997	7,521	37,794
<b>Multivariate</b>					<b>296,647</b>	<b>92,268</b>

## Bibliometric and content analysis of meta-analysis studies in STEM education

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### Abstract:


The research aims to analyse the most current (2015-2023) literature on STEM education to gain a deeper understanding of current trends, priorities and developments in the field of STEM education. Scientific studies determined within the scope of the study were examined using bibliometric and content analysis methods, which are among the systematic compilation methods. First, access to the WoS database was gained, and a subject-based search was conducted using the keywords "STEM education" and "Meta-analysis." In this context, 38 scientific studies containing these relevant keywords were found in the search. The collected data were initially analyzed on the basis of descriptive attributes in the WoS. Subsequently, the listed publications were analyzed using the bibliometric analysis tool VOSviewer for bibliographic attributes, including citation counts, co-citation, co-authorship, co-occurrence, and bibliographic coupling analysis types, based on authors, institutions, and countries. Finally, 18 articles from these scientific publications were evaluated through content analysis in terms of various characteristics of following the PRISMA flowchart. The most prominent keywords associated with the examined concepts included technology-related terms like "computer-based learning," "digital game-based learning," "academic achievement," "active learning," and "problem-centered instruction." Furthermore, the general focus of scientific studies appears to be on determining the impact of a STEM education method on student performance.

**Keywords:** STEM education, meta-analysis, bibliometric analysis, content analysis

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## INTRODUCTION

Scientific and technological advancements in the field of education signify a transformation of learning processes. In this transformation, the role of digital technological tools surpassing traditional classroom environments is significant (Johnson et al., 2016). These digital technological resources can guide the learning process in a more effective and personalized manner by providing students with personalized learning experiences (Means et al., 2013). In particular, technological and interactive tools are transforming teaching methodologies by allowing students to learn at their own pace (Hew & Brush, 2007; Malik & Shanwal, 2015). These developments increase the importance of interdisciplinary and interactive practices. In this direction, science, technology, engineering, and mathematics (STEM) education is shaped considering these technological advances. This approach aims to create a more holistic learning process by encouraging students to make connections between the fields of science, technology, engineering, and mathematics and to use their skills in these fields in an integrated way (Barakos et al., 2012; Wang et al., 2011). STEM education, characterized as a learning-teaching approach based on interdisciplinary integration and requiring 21st-century skills, focuses on cultivating innovative generations (Bybee, 2010; Honey et al., 2014; Riechert & Post, 2010; United States Department of Education, 2016). As a result, students can develop interdisciplinary thinking skills and effectively guide the learning process through interactive tools offered by technology (Honey et al., 2014; National Research Council (NRC), 2011). This new educational approach is effective in cultivating individuals equipped to meet the needs of the future (Bardak & Polat, 2019; Kanadli, 2019).

While STEM education constitutes one of the leading areas of change in education (Suwarma & Kumano, 2019), it provides students not only with basic knowledge and skills but also vital skills such as analytical thinking, decision-making skills, creativity, and cooperation (Corlu et al., 2014; Dogan & Kahraman, 2021; NRC, 2011; Pekbay, 2023; Sahin et al., 2014). In this context, STEM education offers students the opportunity to develop skills such as problem-solving and critical thinking, reflecting its potential to prepare them for complex and multifaceted issues of the future (Pekbay & Kahraman, 2023; Sanders, 2009; Wang et al., 2011). In addition, STEM education can enable students to cope with the technological challenges they will encounter in their daily lives and make effective contributions in these fields (Honey et al., 2014). Therefore, STEM education has the potential not only to shape learning processes but also to shape the future workforce (McPherson & Anid, 2014).

Countries, in line with the developments in recent years, should make reforms in education systems to be included in global competition and to raise qualified individuals. It implements new education models for education reforms and works to spread these new education models to all segments of society. The most important of these models is the STEM education mentioned above (Bircan et al., 2019). In today's world where technological

developments are advancing without slowing down, STEM education not only trains individuals who are experts in these fields but also supports social development. Therefore, the effective implementation of STEM education and the evaluation of its results have attracted the attention of educational researchers and practitioners. Therefore, this study aims to gain a deeper understanding of current trends, priorities, and developments in the field of STEM education by examining scientific studies conducted using a meta-analysis method through bibliometric analysis and content analysis.

In recent years, the importance of the STEM education approach in educational practices has been examined in many studies. Studies have shown that STEM education increases students' field knowledge success (Acar et al., 2018; Akdag, 2017; Aydin Gunbatar & Tabar, 2019; Judson, 2014; Olivarez, 2012; Tasci & Sahin, 2020; Wade Shepherd, 2016; Wosu, 2013), and interest in STEM fields and learning are positively affected (Antink Meyer & Meyer, 2016; Becker & Park, 2011). Problem-solving skills can be gained by students through STEM activities (Fortus et al., 2005; Meyrick, 2011; Pekbay, 2017; Saleh, 2016; Sahin et al., 2014; Tasci & Sahin, 2020; Wosu, 2013). In addition, studies have shown that STEM education positively affects students' scientific process skills (Gokbayrak & Karisan, 2017), attitudes toward STEM subjects (Azgin & Senler, 2019; Bircan, 2019; Canbazoglu & Tumkaya, 2020; Yilmaz et al., 2017), STEM competencies (Murphy & Mancini Samuelson, 2012), STEM perceptions (Cinar et al., 2016; Guler et al., 2017; Radloff & Guzey, 2016), and engineering thinking (Aydin Gunbatar & Tabar, 2019). At the same time, research focuses on eliminating students' conceptual misconceptions (Antink Meyer & Meyer, 2016), awareness levels (Bakirci & Karisan, 2018; Tezsezen, 2017), conceptual understanding (Breiner et al., 2012; Radloff & Guzey, 2017), perceptions (Nadelson et al., 2013; Pimthong & Williams, 2018), and orientation and intentions (Haciomeroglu, 2018; Li et al., 2019). These studies emphasize that STEM education contributes to various student development and plays an important role in shaping future educational approaches.

Within the scope of this study, as the importance and effects of STEM education are increasing, it is desirable to understand in more detail how research in this field has developed as a whole and which themes stand out. In this context, meta-analysis studies on STEM education within the study provide the opportunity to examine different studies collectively and to evaluate the results of these studies from a general perspective. In the academic context, meta-analysis studies are preferred as a source of data because they can make scientific evidence stronger, reliable, and generally valid by bringing together data from different studies. Meta-analyses systematically combine data from multiple independent studies on a specific topic or research question into a larger and more representative sample, allowing researchers to draw stronger conclusions and make more precise scientific inferences. Meta-analyses also offer the advantage of analyzing heterogeneity and inconsistency across studies, which allows for a deeper understanding of why results may differ (Rosenthal & DiMatteo, 2001). Furthermore, meta-analyses have been used to examine the effects of interventions in various fields. Overall, meta-analysis

studies are frequently used in the academic world to provide strong scientific evidence and enrich the research literature by synthesizing data from multiple studies, analyzing heterogeneity, and drawing more robust conclusions (Nascimento et al., 2018; Rosenthal & DiMatteo, 2001). Therefore, meta-analysis studies are frequently used in the academic world to provide strong scientific evidence and enrich the research literature. Therefore, examining the studies carried out in the field of STEM education using the meta-analysis method will enable us to understand the trends, approaches, and results in this field more deeply. In addition, the bibliometric analysis and content analysis methods used in this article are important in terms of presenting an overview of the literature in the field of STEM education and understanding the scope of studies in this field. The aim of this research is to analyse the most current (2015-2023) literature on STEM education to gain a deeper understanding of current trends, priorities and developments in the field of STEM education. A comprehensive review of studies in the field of STEM education will contribute to a better understanding of trends and emphases in STEM education. These analyses can guide the direction and focus of future research in STEM education and contribute to the development of education policy in this area. In this context, the sub-problems of the research are as follows:

1) How is the distribution of scientific studies conducted using the meta-analysis method in the field of STEM education according to their descriptive characteristics (years, languages of publication, authors, institutions/universities and countries)?

2) How is the distribution of scientific studies conducted using the meta-analysis method in the field of STEM education according to bibliometric features (co-citation network, co-authorship network and common key concepts)?

3) What is the status of the content analysis of scientific article studies conducted using the meta-analysis method in the field of STEM education?

## METHOD

### *Model of Research*

In this study, scientific studies carried out with the meta-analysis method in the field of STEM education were examined using bibliometric and content analysis, which are among the systematic compilation methods. A systematic review is a comprehensive examination of the studies conducted in that field to find an answer to a research question or problem, and evaluation and analysis according to the determined criteria (Burns & Grove, 2007; Higgins & Green, 2011). This approach was used to systematically summarize and provide a critical review of the existing scientific literature in the field of STEM education. This study aims to synthesize current knowledge in the field and present key findings to guide future researchers.

### *Data Collection*

The bibliometric analysis of the study was carried out according to the systematic compilation method. First, by accessing the Web of Science (WoS) database, which is frequently used and preferred by scientists (Meho & Yang, 2007), a search was made with "STEM education " and "Meta-analysis " keywords. The limitation of the survey to two key words is due to the examination of meta-analysis studies in the field of STEM education. In this context, it has been seen that there are 38 studies in total, including the relevant key words, since 2015, in the survey conducted on 14.08.2023. Since meta-analysis studies in the field of STEM education began to be conducted in 2015, this was determined as the starting date. Accordingly, 38 scientific studies were included in the bibliometric analysis sections of the study, and the inclusion criteria of scientific studies related to screening are presented in Table 1.

**Table 1**

#### *Inclusion Criteria*

<b>Database</b>	<b>WoS (Web of Science Core Collection)</b>
Index	All of them
Date	14.08.2023
Years	All of them
Publication Type	All of them
Key Concepts	"STEM education" and "Metaanalysis" in the title
Result	38 Publication

Within the scope of the content analysis carried out according to the systematic compilation method, studies that meet the inclusion– exclusion criteria of the study's data. In this research, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guide was used to conduct a systematic review (Liberati et al., 2009). The full text in English, which explores the key concepts of "STEM education and meta-analysis in the subject area of scientific studies in the research, was chosen from among the meta-analysis studies published in peer-reviewed journals. This selection was made from the WoS database. The main selection criteria in the research, such as excluding studies that do not comply with the PRISMA flowchart, excluding academic studies without full text, and exclusion of review studies, theses, books, interviews, and commentary articles, are given in Figure 1.

In the survey conducted on 14.08.2023, it was seen that there were 38 scientific studies including the relevant key words since 2015 without any year limitation. When the related studies were limited to the "article" category, content analysis within the scope of the study was carried out with 18 scientific studies.

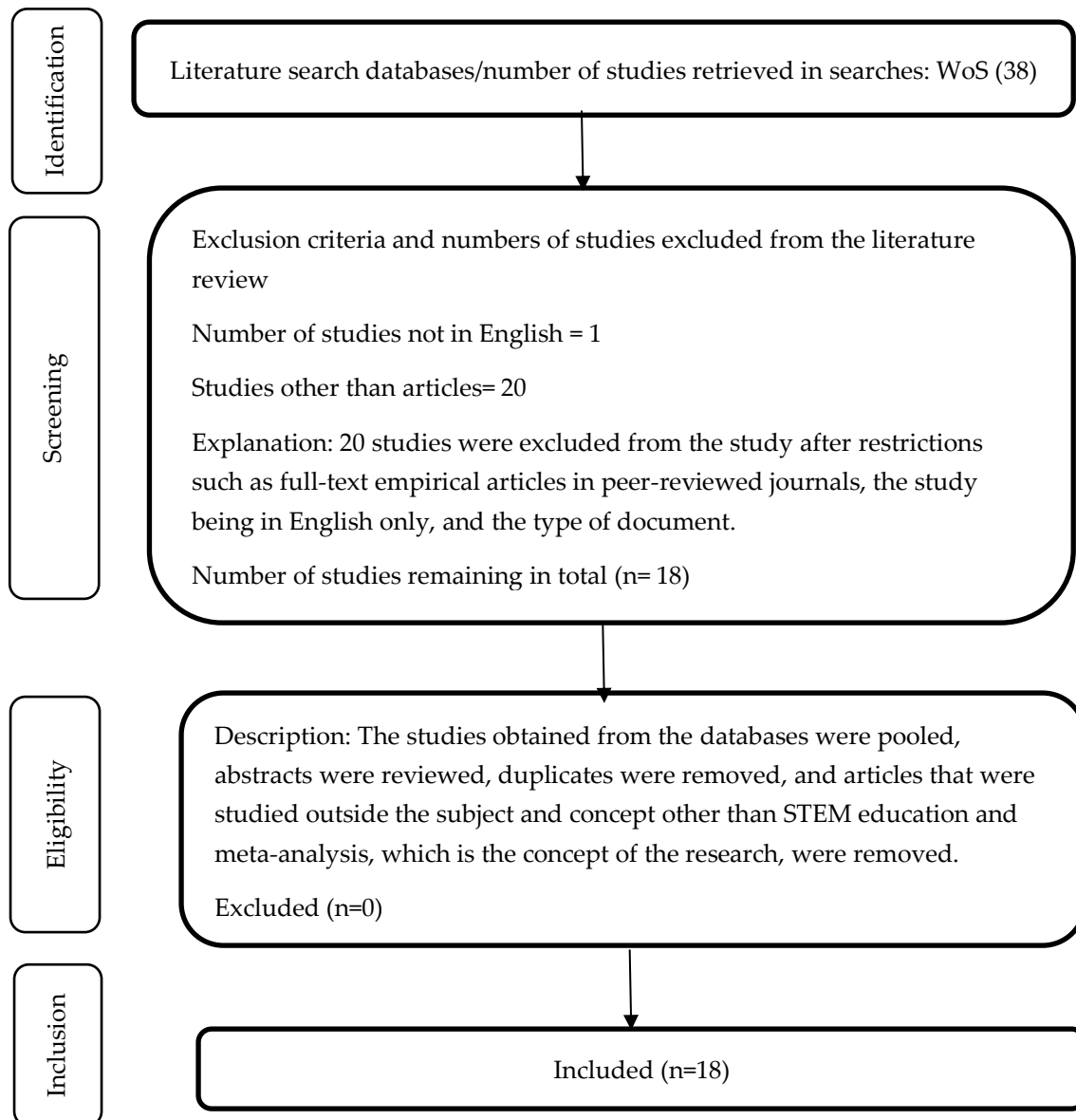


Figure 1. PRISMA Flowchart

### *Analysis of the Data*

The data were examined using bibliometric and content analyzes. Bibliometric analysis reveals the general characteristics of publications in a particular subject or field using statistical methods. Bibliometric analysis is a statistical evaluation of scientific publications that measures and quantitatively describes their influence over time (Felice & Polimeni, 2020). This analysis method is used to identify features such as the most frequently cited publications, the influence of authors, and the frequency of studies (Pritchard, 1969). Ensuring a solid foundation of bibliometric studies results in the emergence of well-structured works that are original and meaningful (Donthu et al., 2021). Content analysis, another analysis preferred within the scope of the study, examines the contents of the studies in detail and helps us to understand which topics are discussed more frequently,

which concepts stand out, and which learning objectives these studies emphasize (Calik & Sozibilir, 2014). It can provide qualitative insights into the topics and themes in a body of literature (Ellili, 2022). Therefore, both bibliometric and content analysis methods were preferred in this study.

Following the specified criteria, 38 studies accessed from the WoS database were initially subjected to descriptive analysis. Based on the analysis results in the WoS database, these scientific studies were analyzed according to the identified descriptive research problems and explained with visual support. Then, the obtained data were recorded and analyzed on the basis of author, institution/universities in terms of citation counts, co-citation, co-authorship, co-existence, and bibliographic matching analysis types, which are called bibliographic features, using the VOSviewer program. In this framework, the analysis type, analysis unit, and counting method used in the analysis of the data are presented in Table 2.

**Table 2**

*The type of Analysis, Units, and Counting Methods Used in Data Analysis*

Analysis Type	Analysis Unit	Counting Method
	Authors	
Co-authorship	Countries	
	Organizations	Full counting
Co-citations	Cited authors	
	Cited references	
Co-occurrence	Keywords	

Then, content analysis of 18 articles published in the Web of Science database, which was carried out using the determined method, was carried out. While conducting content analysis, the studies were examined in the context of author/authors, year, purpose, and findings/results, and the results were tabulated.

### *Ethical considerations*

Because the research has only one author, there is no conflict of interest in the study, and the author has declared that he complies with all ethical rules. In addition, because this study was not conducted on any living thing, it does not require an ethics committee approval certificate.



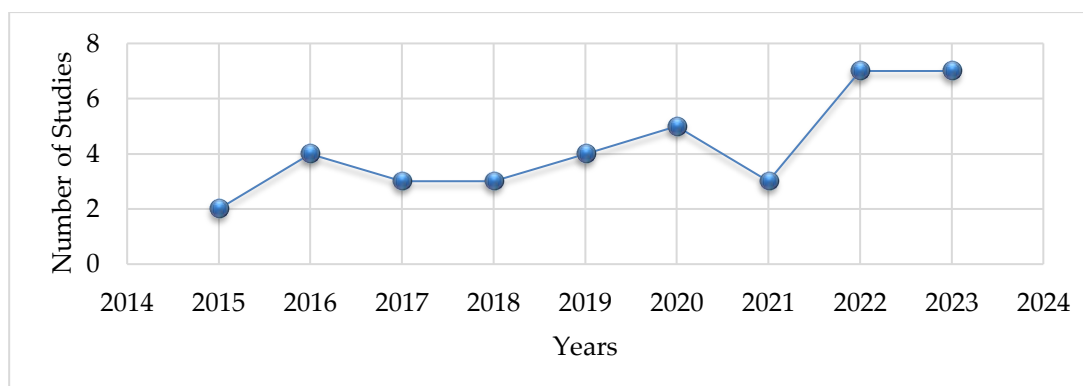
## RESULTS

In this section, the scientific studies that are the subject of the research are examined in terms of bibliometric and content features, answers to the research questions are sought, and the findings are presented below.

*The First Subproblem: How is the distribution of scientific studies conducted using the meta-analysis method in the field of STEM education according to their descriptive characteristics (years, languages of publication, authors, institutions/universities and countries)?*

The findings obtained from bibliometric analysis based on the descriptive characteristics of the scientific studies included in the research (such as years, publication languages, authors, institutions, journals, and countries) are presented under the following headings:

*Distribution of publications by years:* The distribution of scientific studies by years is shown in Figure 2.



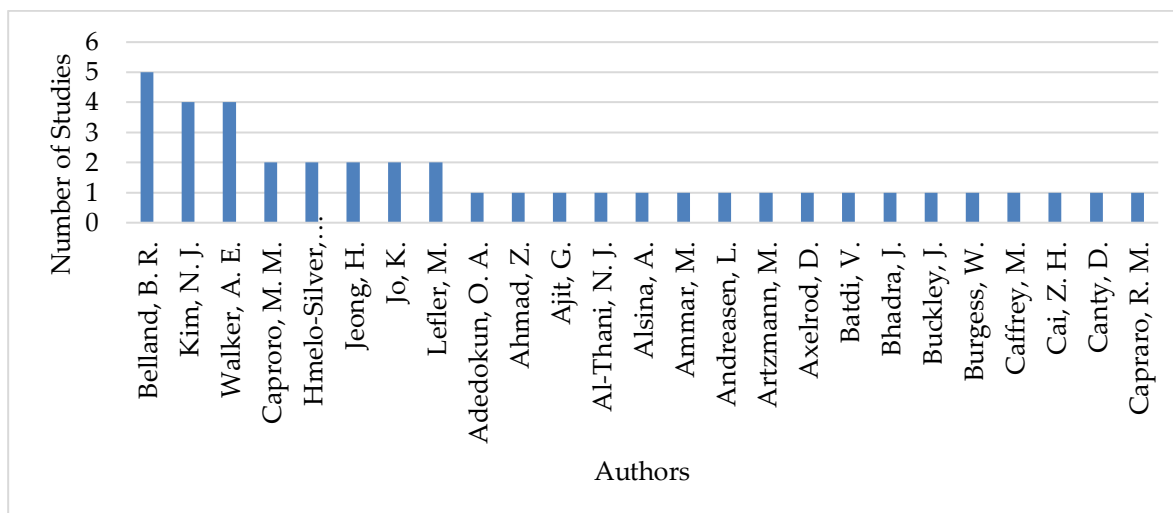
**Figure 2.** Distribution of Scientific Studies by Year

When Figure 2 is examined, it is seen that the first scientific studies started to be published in 2015 (2 studies) with the method determined in the relevant field, it continued by doubling in the following year, and although there was a decrease in the following year, it generally continued to increase in the following years. In general, the number of studies does not increase at the same rate every year and shows a fluctuating trend. However, when the slope is considered in general, it is seen that the studies start slowly at the beginning and increase in the following years. Considering that as of the date of this analysis, the year in which the study was conducted is still ongoing, it is anticipated that the number of studies in the relevant field will likely increase this year.

*Distribution of publications by publication languages:* It was determined in the analysis that 37 of the 38 studies conducted using the meta-analysis method in the field of STEM education were published in English and only 1 study was published in Spanish. This finding is important for addressing the language preference of research in STEM education and international science communication. This indicates that researchers prefer a more

common language to communicate their studies to a wider audience and to evaluate opportunities for scientific collaboration at the global level.

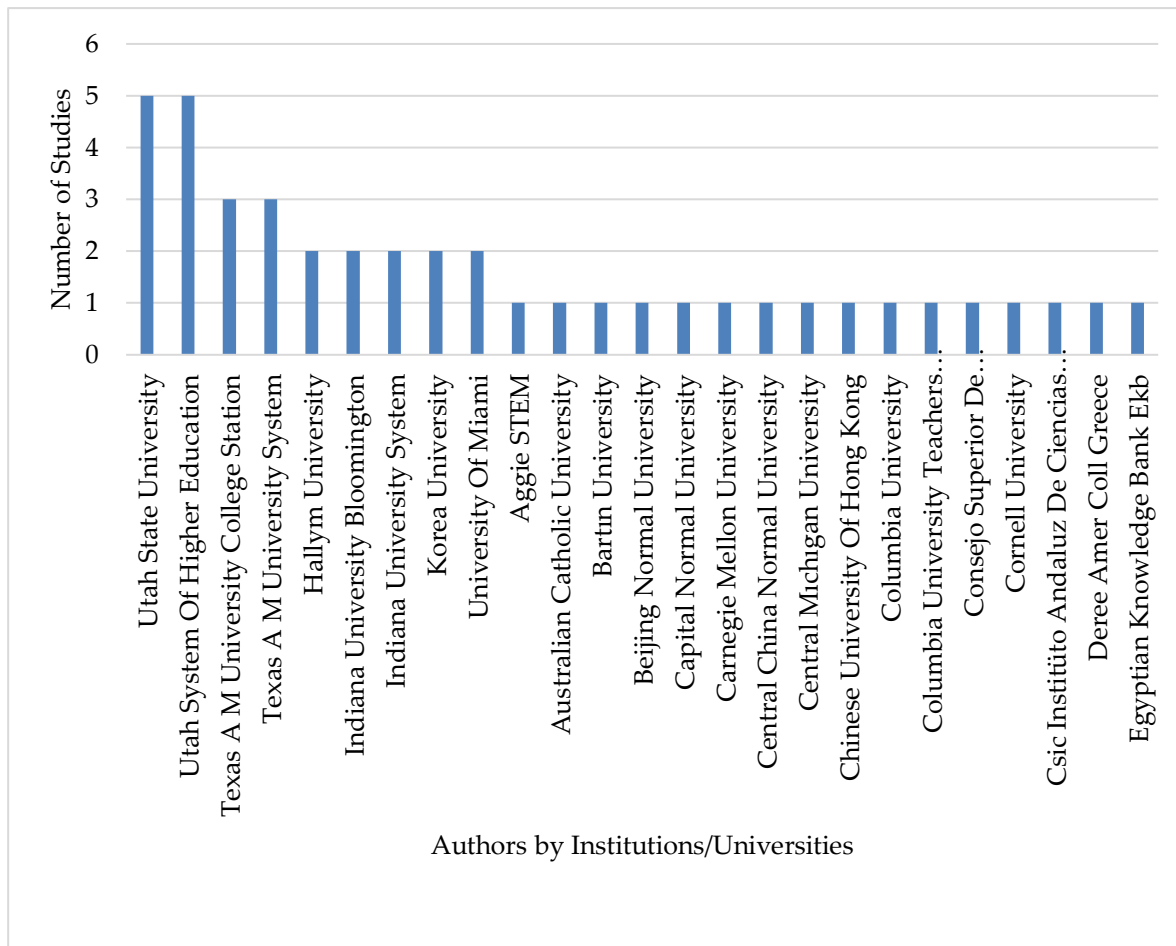
*Distribution according to the number of articles per author:* The distribution according to the number of scientific studies per author is shown in Figure 3.



**Figure 3.** Distribution by Number of Scientific Studies Per Author

Figure 3 shows that 140 authors contributed to the creation of 38 scientific studies on the related subject in the WoS database. This chart shows 25 authors out of the total number. In this context, Belland has conducted the most scientific studies in the relevant field with a total of (5) studies. Afterwards, Kim and Walker enter (4). It is seen that Capraro, Hmelo-Silver, Jeong, Jo, and Lefler (2) each contributed to the field with scientific studies. However, it was observed that all other authors contributed to the field with a scientific study. These findings show that Belland has contributed the most to studies in this field, indicating that this researcher has played a pioneering role in this field and that his work has received wide attention. Other researchers such as Kim, Walker, Capraro, Hmelo-Silver, Jeong, Jo, and Lefler have also made significant contributions. This shows that various subtopics in the field of STEM education are addressed by different experts, and their work adds significant value to the field. The findings also reflect the diversity of research in STEM education and the wide interest in this field. The contributions of different authors with different perspectives contribute to the diversification and deepening of knowledge in this field. This is a positive sign for the development of STEM education.

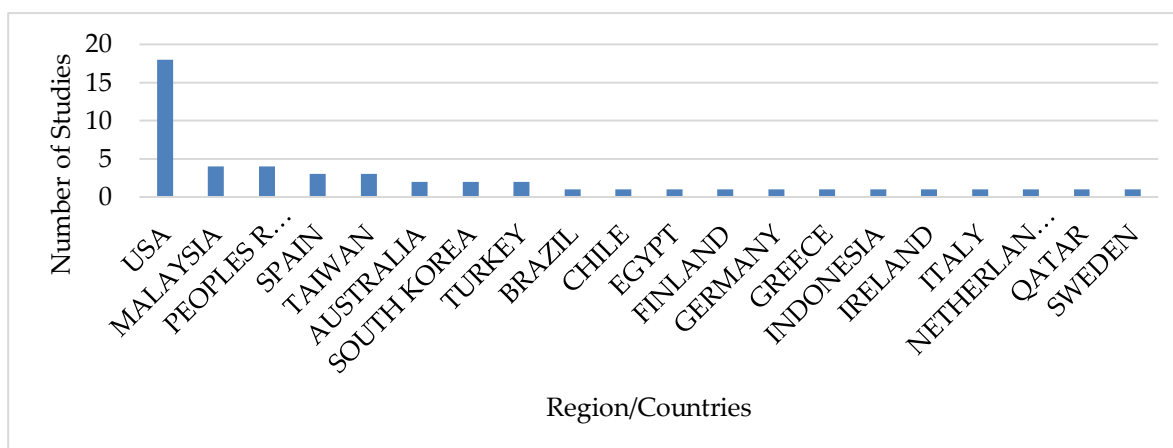
*Distribution of publications by institutions/universities:* The distribution of scientific study authors by institution/university is shown in Figure 4.



**Figure 4.** Distribution of Scientific Study Authors by Institutions and Universities

Figure 4 shows the distribution of the authors who contributed to the creation of 38 scientific studies on the related subject in the WoS database, according to the institutions and universities with which they are affiliated. Figure 4 shows that Utah State University and the Utah System of Higher Education have the highest number of scientific studies in this field. In addition, three scientific studies were conducted from Texas A&M University College Station and Texas A&M University System; and 2 scientific studies were conducted, each from Hallym University, Indiana University Bloomington, Indiana University System, Korea University, and University of Miami. These findings can be interpretable that Utah State University and the Utah System of Higher Education are the institutions that have contributed the most to scholarly work in this area, although other institutions have also made significant contributions. It has been determined that all other authors have conducted a scientific study at their institutions.

*Distribution of publications by country:* The distribution of scientific studies by region/country where they are published is shown in Figure 5.



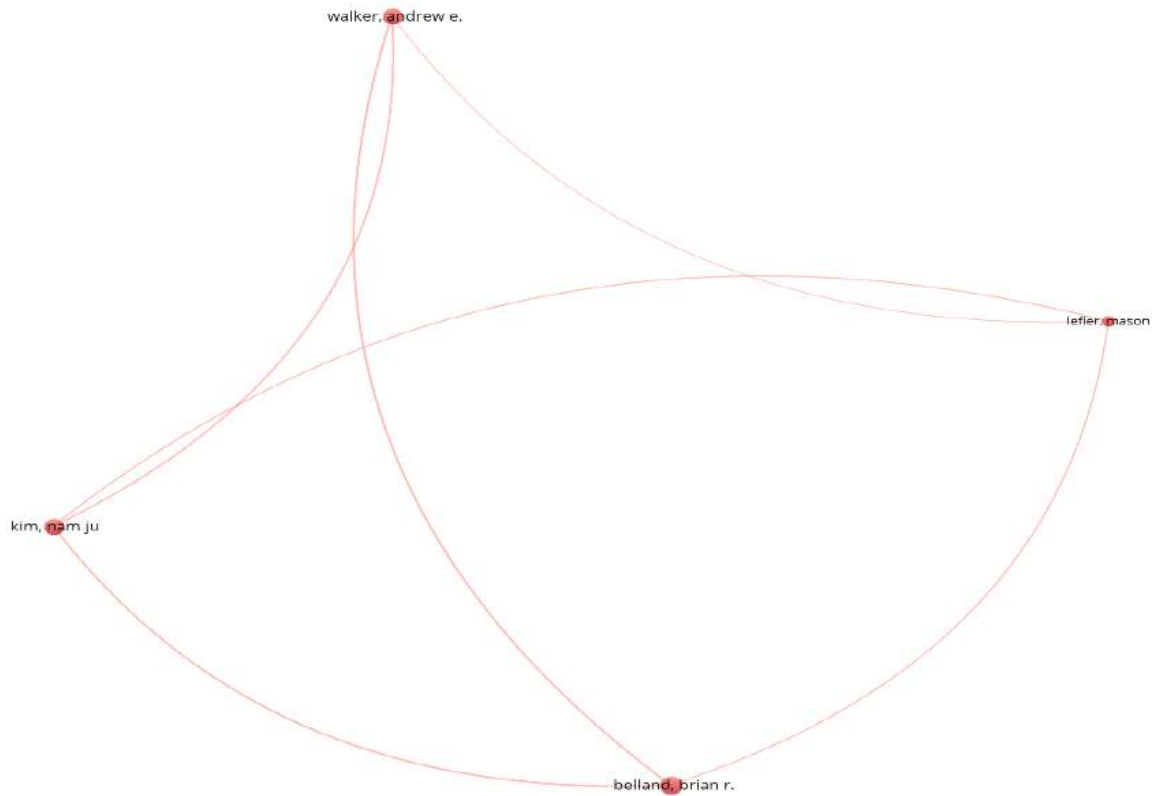
**Figure 5.** Distribution of Scientific Studies by Region/Countries Where They Are Published

Figure 5 shows the 20 countries in which the publications containing the relevant key concept in the WoS database were generated. Because of the examination of Figure 5, the highest number of scientific studies in this field were published in the USA (18). Malaysia (4) and China (4), respectively; Spain (3) and Taiwan (3); Turkey (2), Australia (2), and South Korea (2) have been observed to contribute to this field with scientific studies, while all other countries have taken part in a field related to scientific study. In addition, the figure shows that there is a sharp decrease in the number of publications from other countries after the United States. According to these data, most of the scientific studies on the key concepts analyzed in the WoS database are conducted in the USA, which is an important leader in this field. Among other countries, Malaysia and China make significant contributions to studies in this field, but there is a significant decrease in the number of publications after the USA. Other countries make a limited contribution in this field.

*The Second Subproblem: How is the distribution of scientific studies conducted using the meta-analysis method in the field of STEM education according to bibliometric features (co-citation network, co-authorship network and common key concepts)?*

According to the descriptive features of the scientific studies included in the research (co-citation network, co-authorship network and common key words), the findings obtained because of the bibliometric analysis are presented under the following headings. In this context, in the network visualization maps created with the VOSviewer program, the thickness of the lines represents the power of cooperation, the size of the circle indicates the number of articles, and the colours indicate the cluster of collaborations.

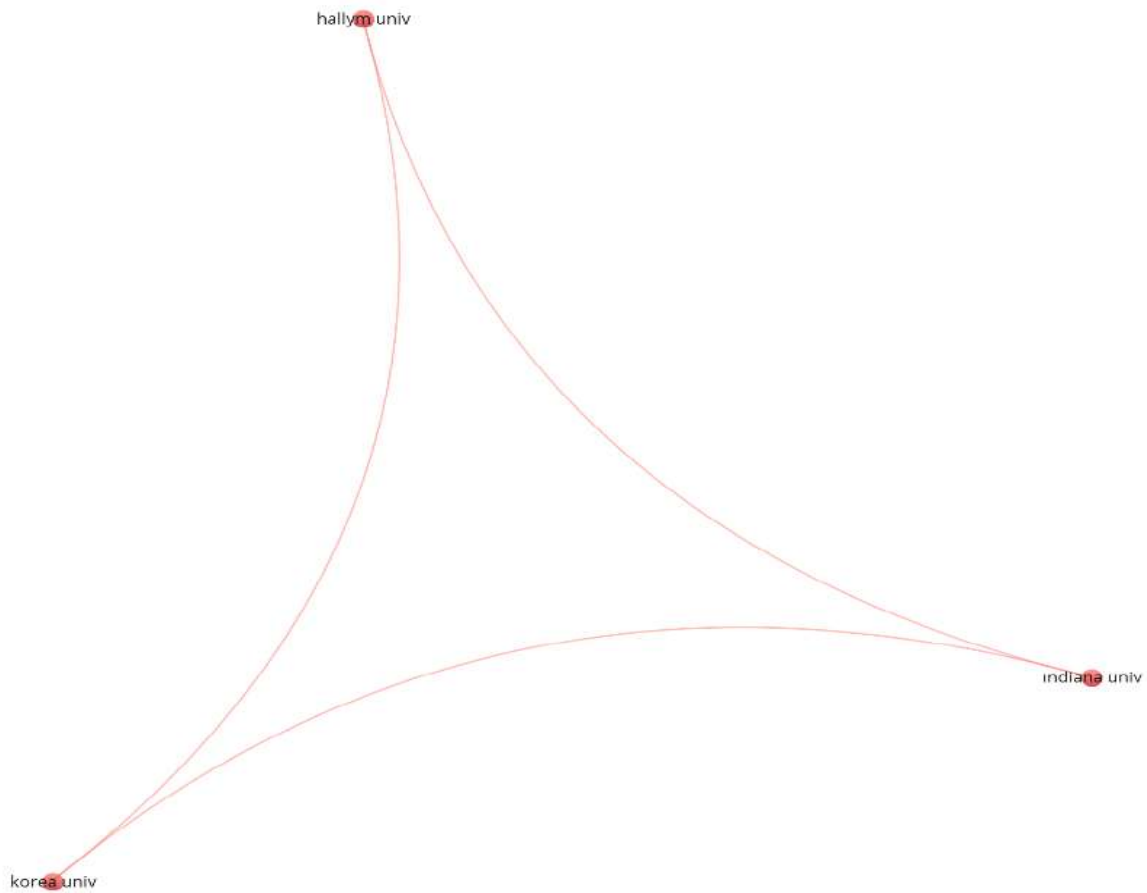
*Author co-citation network of publications:* Figure 6 shows the network visualization map showing the collaborative power of authors who conduct scientific studies.



**Figure 6.** Co-authorship Network Visualization Map for Authors

While creating the network visualization map in Figure 6, a condition was set in the VOSviewer program that required at least two articles per author. This condition was met by 8 of 140 authors. In the network visualization map made later, clusters were created based on author collaborations and are thus seen in red as a single cluster. Because there are only 8 authors in the network visualization map that meet the condition of at least two articles per author, clusters based on author collaborations are shown in a single red colour on the map.

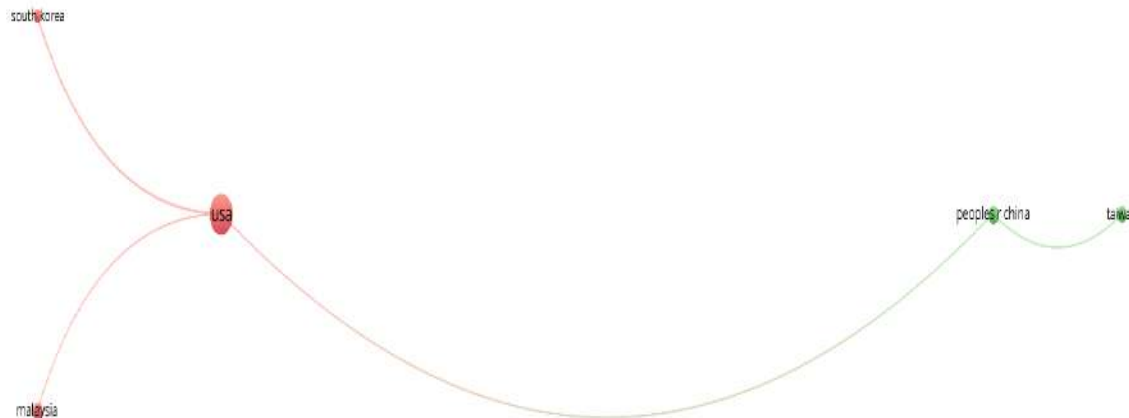
*Common citation network of publications according to the institutions/universities with which the authors are affiliated:* Figure 7 shows the network visualization map showing the collaboration power of the institutions/universities with which the authors are affiliated.



**Figure 7.** Co-authorship Network Visualization Map by Author Institutions/Universities

When generating the network visualization map in Figure 7, a condition was set in the VOSviewer program that required a minimum of two articles per institution/university. Because of this condition, 6 of 63 institutions or universities fulfilled this condition. Then, in the network visualization map created, 3 different institutions or universities “ Hallym” University, Indiana University, and Korea University ” seem to be in cooperation. This was expressed under a single cluster according to the cooperative connection status.

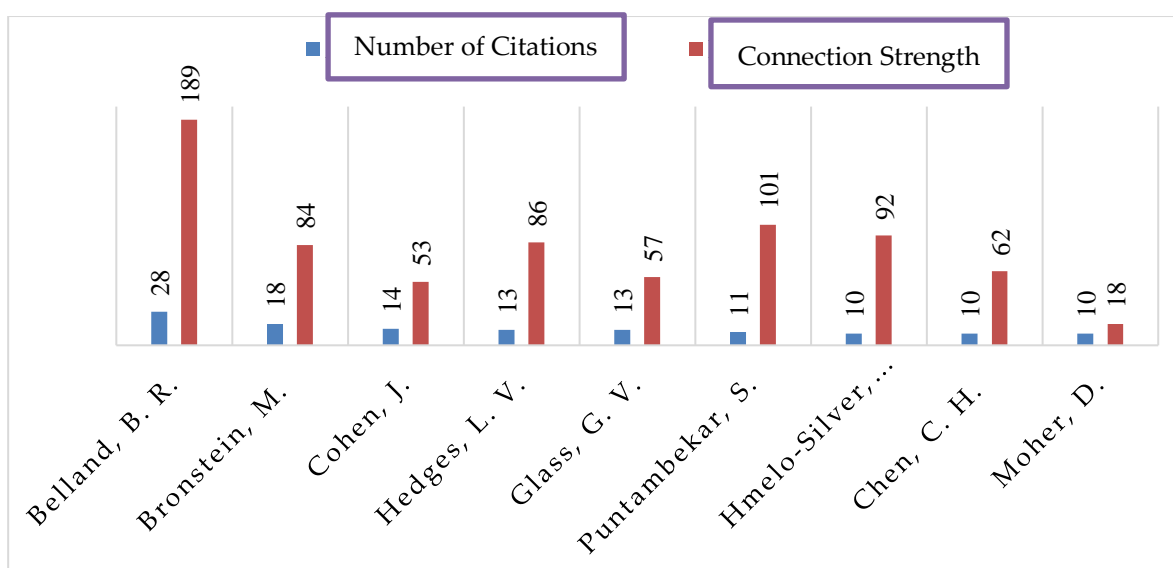
*Network of co-authorship of publications by region/country:* Figure 8 shows the collaboration strength of the region/country where the authors are located.



**Figure 8.** Co-authorship Network Visualization Map of Publications by Region/Country of Authors

While creating the network visualization map in Figure 8, a condition was set in the VOSviewer program that required at least two articles per region or country. Because of this condition, it has been observed that 8 of 20 regions or countries meet this condition. In the network visualization map created, it is seen that 5 different regions or countries are in cooperation and are divided into two different clusters according to their connection status. The red cluster consists of 3 regions or countries, "Malaysia, South Korea, and the United States", and the green cluster consists of 2 regions or countries, "China and Taiwan". These results show that scientific cooperation between specific regions or countries is prominent and that this cooperation network is divided into two distinct clusters.

*Distribution of publications by co-cited authors:* Co-citations of cited authors are shown in Figure 9.

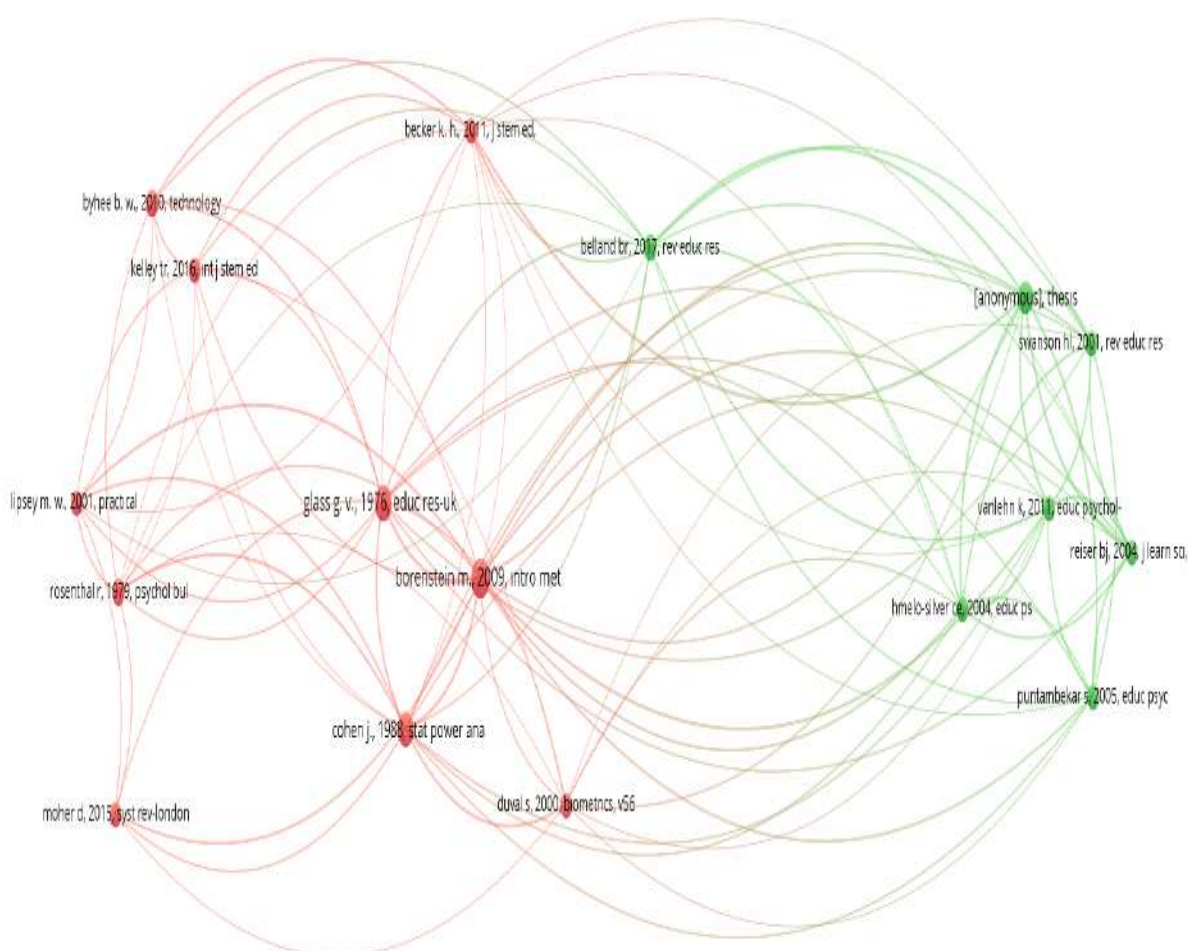


**Figure 9.** Co-Citation of the Cited Authors

In Figure 9, the minimum number of citations for the co-authors of the publications was determined as 10, and it was observed that 9 out of 2084 authors fulfilled this condition.

Figure 9 shows the total number of citations and link strengths of these authors. Co-citation refers to the frequency of simultaneous citation of two articles by other articles in the case of a bibliographic match (Cunill et al ., 2019). In this context, the visual in the figure shows that the closeness and relationships between the authors are strong. In addition, when the total link strength is taken into account, it is observed that the author named Belland, BR stands out as the most cited author. This image shows that this group of authors collaborate extensively with each other, reflecting the strong closeness and relationships between the authors. Furthermore, based on the total link strength, Belland, BR is the most cited author. These results indicate that this group of authors is effectively engaged in scholarly collaboration and that Belland, BR's work has had a significant impact in various fields.

*Distribution of publications by commonly cited sources:* The network visualization map of the distribution of publications by commonly cited sources is shown in Figure 10.



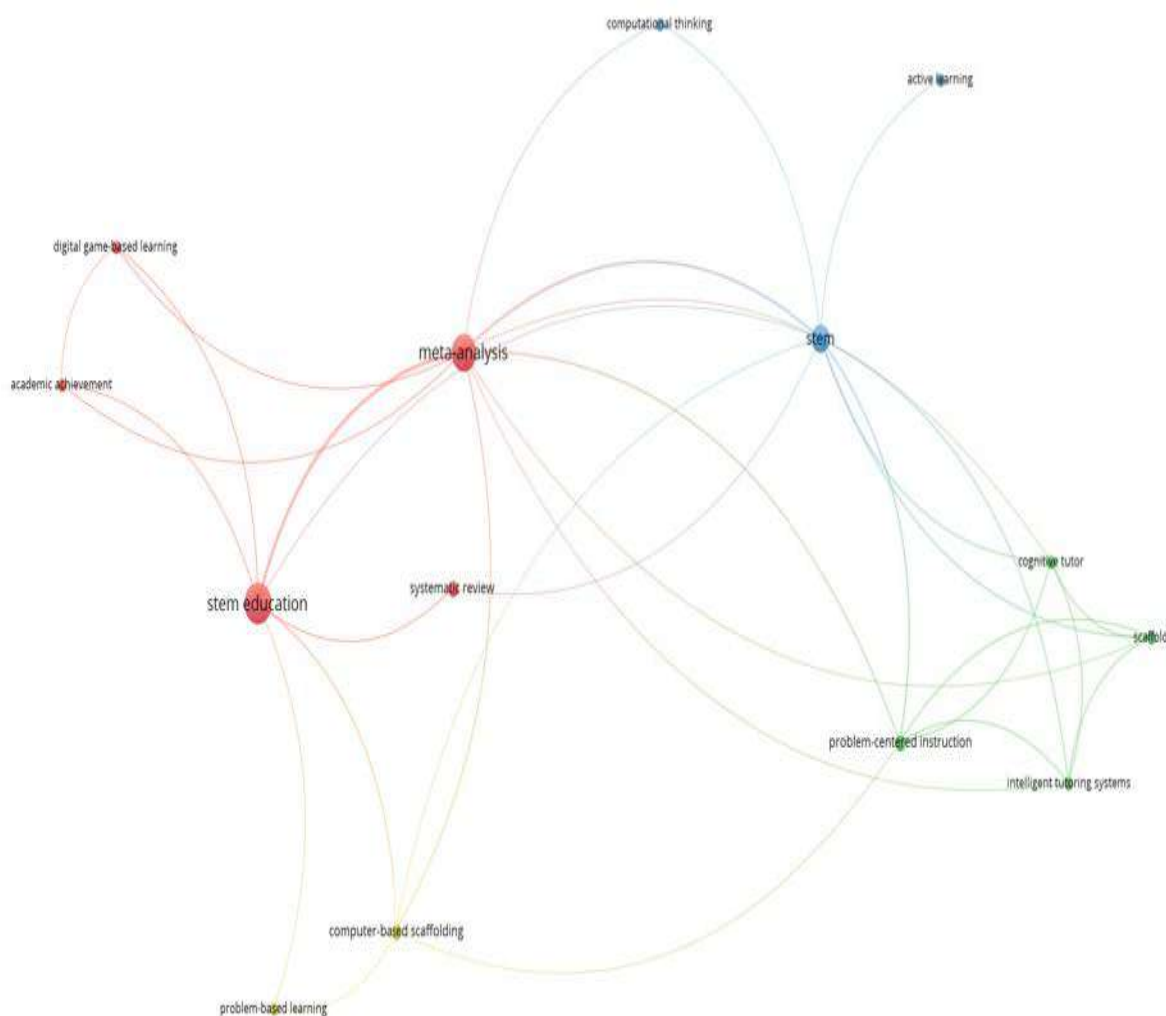
**Figure 10.** Network Visualization Map of the Distribution of Publications from Commonly Cited Sources

In the network visualization map presented in Figure 10, the 17 commonly cited sources that meet the specified conditions are divided into 2 different clusters, red and green. The network visualization map presented in Figure 10 depicts the distribution of



publications based on their shared references. This map divides 17 sources meeting the specified criteria into two different clusters: red and green. When evaluated in terms of the common references among the cited sources, a minimum citation count of 5 was set for each cited source, and 2691 sources meeting this criterion were identified among the cited references. This finding shows that many sources are frequently cited in scientific studies and that these sources play an important role. Accordingly, the source receiving the highest number of citations from the cited references is a book chapter authored by Borenstein in 2009. This chapter holds the top position in terms of citations (12) and link strength (51) in meta-analysis studies in the field of STEM education. These results show the importance of this book chapter in the field of STEM education and that it is a frequently consulted resource in a wide range of research literature.

*Common keywords most used in publications:* Figure 11 shows the most used keywords in scientific studies and the links to their use in the network visualization map.



**Figure 11.** Network Visualization Map of Combined Use of Keywords in Publications

The network visualization map in Figure 11 shows the combination of keywords. While the network visualization map was created with the VOSviewer program, the

minimum number of keywords was determined to be 2, and it was seen that 14 of 118 keywords met this condition. Accordingly, the 14 keywords included in the network visualization map are divided into 4 different clusters which are red, blue, yellow, and green according to the frequency of use together. Accordingly, apart from “STEM”, “STEM education”, “meta-analysis”, “computer-based” learning”, “digital game-based learning”, “academic achievement”, “active learning” and “problem-centred It is seen that there are key concepts that evoke technology such as “instruction”. This situation can be interpretable that STEM education and technology-enhanced learning are important focal points in the studies and that these terms are frequently discussed together.

*The Third Subproblem: What is the status of the content analysis of scientific article studies conducted using the meta-analysis method in the field of STEM education?*

In this section, content analysis of 18 articles published in the WoS database, which was carried out using the method determined in the relevant field, was carried out (APPENDIX). The findings obtained from the content analysis are presented in Table 3.

Table 3 shows that the studies are generally aimed at determining the effect of a method in STEM education on the performance of students in that field. While 4 of the conducted studies focus on a particular field, it is seen that the studies generally approach STEM education holistically and try to reveal the variables that are considered, considering that they may directly or indirectly affect the performance in this field.

**Table 3**

*Content Analysis Findings of Scientific Article Studies Conducted with Meta-Analysis in STEM Education*

Row	Author(s) / Years	Purpose	Results
1	Santhosh and collages (2023)	To investigate the impact of an informal project-based learning model on students' learning outcomes compared with a traditional classroom environment.	The informal project-based learning method had moderately significant effects on students' learning outcomes compared with the traditional learning method. The overall effectiveness of the informal project-based learning method was influenced by the teaching model, the assessment method, student group size, and course duration.
2	Arztmann, Hornstra, Jeuring, and Kester (2023)	To examine the effects of game interventions on different student groups in STEM subjects.	Using a game-based learning approach in STEM education has a moderately positive effect on cognition, motivation, and behaviour. It was concluded that primary school students achieved higher learning outcomes and experienced game interventions as more motivating than secondary school students and that gender did not have any moderating effect.

3	Zhang, Zhou and Zhang (2023)	To examine the magnitude of the relationships between STEM interventions/ programs and teachers' perceptions of STEM.	All intervention types were found to be effective in improving teachers' STEM knowledge, STEM teaching skills, and students' perceptions of STEM learning. The strongest impact of curriculum-based interventions and interventions focusing on professional development was observed in the development of teachers' STEM knowledge. In-service teachers tended to benefit more from the interventions in terms of both STEM knowledge and STEM teaching skill perceptions.
4	Yucelyigit and Toker (2021)	To examine the effect of STEM studies on learning and development in early childhood education.	The STEM approach was found to have positive effects on preschool children's learning and development. It was concluded that the implementation of STEM activities in the preschool period improves children's skills in STEM fields. In addition, it was concluded that the implementation of STEM activities in the preschool period improves children's skills in mathematics, science, and technology. This study provides an encouraging recommendation for preschool teachers to include STEM practices in their classrooms.
5	Williams and Young (2021)	To characterize the application of reliability generalization meta-analytic studies in empirical research on mathematics education.	Because of the analyses carried out in the article, it was seen that the reliability generalization meta-analytic studies on mathematics education did not mention the reliability of the articles examined among the studies or cited previously reported reliability.
6	Siregar, Rosli, Maat, and Capraro (2020)	To analyze the results of STEM program studies that affect students' mathematics achievements.	It was concluded that STEM impacts students' mathematics achievements. The effect of the STEM program on students' mathematics achievements did not depend on the variables of education level, source of publication, or length of intervention.
7	Parker, Van Zanden, Marsh, Owen, Duineveld and Noetel (2020)	To assess the intersection of gender, social class, and cultural context by exploring gender differences in STEM-related expectations of success.	Gender differences were generally found to have small effect sizes. Using the concept of intersectionality, we find that heterogeneity in gender effect sizes is large and that gender differences are primarily moderated by socioeconomic status, ethnic diversity, and, to some extent, national gender equality.
8	Fidai, Capraro, and Capraro (2020)	Examining the effect of computer-assisted instruction on students' computational thinking skills.	The use of computer-assisted instruction was found to have a positive effect on students' computational thinking skills.

9	Kim and collages (2020)	To determine the effect of group size, the type of computer-aided scaffolding intervention used in groups or individually, and the effect of computer-aided scaffolding.	It shows that computer-aided scaffolding leads to statistically significant cognitive learning effects when students solve problems individually and when working in pairs, triads, and small groups. The moderator analyses also revealed that the effect sizes for groups were higher when students worked in pairs when metacognitive scaffolding was present in group activities, and when there was scaffolding but no collaboration support.
10	Jeong, Hmelo Silver, and Jo (2019)	Examining the effect of computer-supported collaborative learning in STEM education.	Computer-supported collaborative learning in STEM education has a medium-sized effect. This shows that the effects of technology and pedagogy vary depending on the forms of collaboration, students' educational levels, and learning domains.
11	Chase et al., (2019)	Examining how teachers shape students' cognitive engagement and transfer.	Teachers should provide clear and precise instructions, encourage students to share their ideas, and respect students' different perspectives. These results provide insight into how teachers can more effectively guide students to increase their cognitive engagement and transfer.
12	Batdi, Talan, and Semerci (2019)	To examine STEM education from a meta-analytic and meta-thematic perspective and to determine its impact on academic achievement and different variables.	STEM had a moderately significant and positive effect on academic achievement. STEM also had a positive effect on the development of different skills.
13	Lee and collages (2018)	To investigate the success of a course in general chemistry at Cornell University.	This shows that the course for general chemistry at Cornell University led to significant improvements in the final course grades for priority and non-priority students. It has also been observed to lead to progressive improvement and retention in subsequent chemistry courses. These results may help in discussing strategies for developing similar courses in STEM education. However, it is also noted in the research that the results of this study may require a more detailed analysis of the demographic characteristics of the priority students.
14	Belland and collages (2017)	To synthesize the results of 144 experimental studies on the effects of computer-based scaffolding designed to assist STEM students.	Computer-based scaffolding has consistently shown a positive effect on cognitive outcomes across a range of use contexts, scaffolding characteristics, and evaluation levels.

15	Belland, Walker, and Kim (2017)	Examining the effect of using computer-aided scaffolding in STEM education on students' cognitive outcomes.	This shows that the use of computer-aided scaffolding increases students' cognitive outcomes in STEM education. The study found that the use of computer-aided scaffolding was effective in improving students' problem-solving, argumentation, and evaluation skills. Moreover, the effect of scaffolding on students' cognitive outcomes differed across the student population and STEM disciplines.
16	Kim, Belland, and Walker (2017)	Investigating the effectiveness of computer-based scaffolding in the context of problem-based learning for STEM education through a Bayesian meta-analysis.	Computer-based scaffolding significantly affected cognitive outcomes in the context of problem-based learning in STEM education. It was also found that the effects of computer-based scaffolding ranged from small to medium depending on the characteristics and context of the use of computer-aided scaffolding.
17	Belland, Walker, Olsen, and Leary (2015)	To determine the effect of computer-based scaffolding features and study and test score quality on cognitive outcomes in STEM education at the secondary school, university, graduate, and adult levels.	The computer-aided scaffolding model positively affected learning; studies with zero threats for internal validity had lower effect sizes than studies with two threats; studies with one threat for external validity had larger effect sizes than studies with zero threats; and studies with no fading had higher effect sizes than studies with constant fading.
18	Adedokun and collages (2015)	To conduct a meta-analytic evaluation of the impact of a virtual field trip on students' perceptions of scientists.	In addition to the statistically significant effect of each publication, zipTrips had a statistically significant summary (combined) effect on participants' perceptions of scientists.

## DISCUSSION AND CONCLUSION

The aim of this research is to examine scientific studies conducted using the meta-analysis method in the field of STEM education according to the specified analysis characteristics. In this context, when we analyze the distribution of scientific studies conducted using the meta-analysis method in the field of STEM education in terms of their descriptive characteristics, we observe a general increasing trend in the number of publications starting in 2015. As of the date of our analysis, this study reveals 7 publications in the literature for the years 2022 and 2023. However, considering that 2023 is not yet complete, it is important to emphasize the possibility of an increase in the number of publications within this year. Similarly, in the studies conducted in the literature, we also observe a rapid increase in the number of studies related to STEM education, highlighting the growing importance of research in this field (Cavas et al., 2020; Sungur Gul et al., 2022).

Furthermore, when analyzing the distribution of scientific studies' authors based on their affiliated institutions or universities, it is observed that both Utah State University and

the Utah System of Higher Education stand out with 5 scientific studies each. However, it is noteworthy that the publications affiliated with the relevant university in the WoS database are often produced by different authors. For example, it is evident that Brian R. Belland's affiliation with Utah State University positions him as one of the most prolific authors in this field. On the other hand, it's noticed that universities like Yonsei University and the University of Miami, where Nam Ju Kim is affiliated, do not rank at the top in terms of productivity. This situation highlights that while authors may stand out individually in terms of productivity, the representation capability of institutions can present a different picture. Thus, it can be assessed that not only prolific authors like Brian R. Belland and Nam Ju Kim as well as other authors play a significant role in representing institutions.

Similarly, when analyzing the distribution of studies based on countries/regions, the United States stands out with 18 scientific studies in this field. This analysis can be considered as an extension of author and university analyses and reflects the natural outcome of previous analyzes. The most productive authors and institutions, when viewed cumulatively, distinctly highlight their respective countries/regions.

In summary, all these analyses shed light on various aspects of studies conducted in the field of STEM education. The prominence of the English language aligns with its status as the universally accepted language of science and fits well with the structure of databases. Likewise, productive authors such as Brian R. Belland and Nam Ju Kim enhance their impact on the field's literature, along with the representation capabilities of their institutions. The distribution of publications across databases and country/region analyses demonstrate the geographic spread of studies and the influence of major publishers, underscoring the comprehensiveness and expanded perspective these analyses offer. Collectively, these results provide a foundation to comprehend different dimensions of scientific research and meta-analysis studies in the STEM education field, contributing to predicting future trends.

When examining the scientific publications in terms of bibliometric characteristics in the study, it is observed that the most productive authors are interconnected and their affiliated institutions/universities collaborate as well. This situation reflects the establishment of a collaboration network at the country/region level. The network visualization map created on a country/region basis particularly shows the United States at the centre of the map, forming strong connections with other countries. This highlights the fact that these leading countries actively collaborate with authors from various countries in terms of publication count and collaboration.

Regarding the total citations and link strength of scientific publications, it is evident that a methodological book chapter stands out in connection with meta-analysis. These publications noticeably elaborate on the meta-analysis method, which is as novel as STEM education itself. Hence, the obtained results are not abnormal. Therefore, the reason for only one of Belland's works receiving the most citations is likely due to the relatively recent

emergence of these works. With the recent citation counts and link strengths of these authors, they are predicted to stand out prominently in this field.

In the analysis, another significant finding is that apart from "STEM", "STEM education" and "meta-analysis," keywords that are prominently highlighted in scientific studies include technology-associated terms such as "computer-based learning," "digital game-based learning," "academic achievement," "active learning," and "problem-centred instruction." This situation allows us to evaluate the trends and focal points of research in the field of STEM education from a broader perspective. The prominence of these keywords aligns with the increasing emphasis on technology integration and the role of digital tools in education within STEM education research. Approaches such as computer-based learning and digital game-based learning aim to provide students with interactive and participatory learning experiences, thereby making learning processes more effective and engaging (Donmez Usta & Ultay, 2022; Hacıoglu & Donmez Usta, 2020; Saricam, 2019). These technology-enhanced approaches serve as essential tools to capture students' attention, motivate them, and make learning more meaningful (Donmez Usta & Turan Guntepe, 2019).

Academic achievement-focused studies, on the other hand, examine how STEM education impacts students' knowledge and skill acquisition (Acar et al., 2018; Akdag, 2017; Aydin Gunbatar & Tabar, 2019; Judson, 2014; Olivarez, 2012; Tasci & Sahin, 2020; Wade Shepherd, 2016; Wosu, 2013). In particular, the development of competencies related to STEM fields holds significant importance for students to better respond to future career goals and the needs of the job market (McPherson & Anid, 2014). Active learning and problem-centred instruction represent approaches where students can direct their own learning processes and generate solutions to real-world problems (Fortus et al., 2005; Meyrick, 2011; Saleh, 2016; Sahin et al., 2014; Tasci & Sahin, 2020; Wosu, 2013). These learning methods help students enhance 21st-century skills such as analytical thinking, collaboration, creativity, and critical thinking while offering the potential to make learning more meaningful and enduring (Corlu et al., 2014; Dogan & Kahraman, 2021; NRC, 2011; Sahin et al., 2014; Sanders, 2009; Wang et al., 2011). The prominence of these keywords signifies that STEM education is a holistic approach that not only focuses on subject knowledge but also aims to equip students with the ability to effectively use technology and integrate various skills. These concepts reflect the prominent themes in STEM education research, guiding the shaping of future educational practices and contributing to student development.

Because of the content analysis of the scientific article studies on the meta-analysis method in the field of STEM education, it was seen that these studies generally focused on determining the effect of a method in STEM education on student performance. Wahono and collages (2020) emphasized that studies related to meta-analysis methods in the field of STEM education generally focus on determining the effect of a method on student performance in STEM education. In their meta-analysis study on effective strategies for

integrated STEM education, Mustafa and collages (2016) emphasized that integrated STEM education supports instructional strategies that encourage students to invent and innovate through hands-on activities and project-based learning. The findings of this meta-analysis can be interpretable that integrative approaches in STEM education have positive effects on students' learning. Cakici and collages (2021) specifically focused on the impact of STEM education on students' academic achievement in science courses. Furthermore, Tenti (2021) conducted a meta-analysis to examine the impact of integrating STEM education into various learning models on students' physics learning outcomes. This provides evidence that studies using meta-analysis in the field of STEM education generally focus on determining the impact of STEM education on student performance.

The majority of these studies have approached STEM education from a holistic perspective and discussed the variables that may directly or indirectly affect student performance. It has been noticed that Belland and collages have come to the fore in studies on scaffolding in particular. The results that computer-assisted instruction, project-based instruction, and educational games have positive effects on STEM education are supported by the findings that the STEM education approach contributes positively to development and learning in early childhood. These results also coincide with the key concepts of the study that emerged from the bibliometric analysis. A meta-analysis by Mustafa and collages (2016) on effective strategies for integrated STEM education highlighted that project-based learning, often integrated with STEM, promotes teaching strategies that encourage students to invent and innovate. This hands-on approach enables students to engage in real-world problem-solving and creative design, enhancing learning activities and leading to meaningful learning (Lou et al., 2014). Furthermore, STEM enactments, particularly those that integrate project-based learning, have been found to be effective student learning outcomes (Wahono et al., 2020). The study recommends a combination of learning approaches, orientations, and instruction duration to maximize the effectiveness of STEM education. Moreover, integrating STEM education with creative education and project-based learning has shown positive effects on students' integrated STEM thinking and imaginative ability (Tsai et al., 2017). This student-centred learning model enhances the learning and integration of STEM knowledge. Overall, these findings support the claim that computer-assisted instruction, project-based instruction, and educational games have positive effects on STEM education. These approaches provide students with hands-on, real-world learning experiences that promote problem-solving, innovation, and the integration of STEM knowledge. By engaging students in active learning, these teaching methods positively contribute to their development and learning in early childhood and beyond.

In addition, the results of the moderator analysis of the meta-analysis studies show that the effectiveness of the project-based learning method is affected by factors such as the teaching model, assessment method, student group size, and course duration, that the educational game approach is more effective in younger age groups, and that gender has a



significant effect among different age groups. points to important results that do not make a difference. Various factors influenced the results of the moderator analysis of the meta-analysis studies support the claim that the effectiveness of the project-based learning method. Kokotsaki and collages (2016) explained that project-based learning involves students constructing knowledge by solving real problems, asking questions, conducting investigations, and reporting findings. This study also highlights the importance of collaboration and the need for a shared goal in project-based learning. Mustafa and collages (2016) further emphasized that project-based learning is a dominant strategy in STEM education implementation and improves students' skills and competitiveness in a knowledge-based society. This study can be interpretable that educators should explore how project-based learning can be effectively implemented in their teaching. Regarding the educational game approach, Malik and collages (2017) compared game-based oral health education with conventional oral health education. The results showed that the implementation of a crossword game-based oral health education program significantly increased children's oral health-related knowledge and improved their oral hygiene status. This can be interpretable that educational games can be an effective aid in teaching and preventing oral diseases in children. Furthermore, the literature can be interpretable that the effectiveness of these approaches may vary depending on factors such as age and gender. Wirahayu and collages (2022) found that the application of video-assisted project-based learning was effective in improving students' mathematical creative thinking skills. The study also highlighted the effectiveness of the hybrid learning model in providing knowledge and developing life skills. Additionally, Vega and collages (2022) conducted a rapid review of the use of video games to improve the sexual health of young people. The findings indicated that while there were some promising outcomes, the results across studies were mixed, can be interpretable that the effectiveness of game-based interventions may vary. In summary, the literature supports the claim that the effectiveness of project-based learning and educational games in STEM education is influenced by various factors. These factors include the teaching model, assessment method, student group size, course duration, age group, and gender. Educators should consider these factors when implementing these approaches to maximize their effectiveness.

### LIMITATIONS AND RECOMMENDATIONS

While this research provides significant contributions to the literature, there are certain limitations that need to be considered in future studies. This study focused on 38 scientific publications in bibliometric analysis and 18 in content analysis. Furthermore, the study only considered scientific works written in English and available in the WoS database, limited to the concepts of "STEM education and meta-analysis." Therefore, it might not fully encompass the spectrum of STEM education practices. Therefore, there is a need for studies that provide a broader perspective and encompass various concepts. Taking these limitations into account will help future research approach the topic more comprehensively and with a broader perspective.

Considering the limitations of this study, suggestions for future research can be offered. First, increasing the number of studies used in bibliometric analysis and considering different databases can help cover a wider range of literature. Examining more studies while conducting content analysis can help us better understand the diversity and depth of STEM education practices. In addition, examining studies published in different languages beyond the English language, where this study is limited, may strengthen the generalizations of the study as it will include different cultural and geographical perspectives. In this context, it may be advisable to perform similar analyses using a wider range of languages, including publications in other languages. However, conducting studies that examine STEM education practices in more detail and analyze the effects of different learning methods on student achievement in more detail may help future research reach more specific results. Finally, conducting research that goes beyond the studies in this field and examines the impact of STEM education on skills such as general learning experience and critical thinking, as well as student performance, can provide a more holistic understanding.

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## APPENDIX

1. Santhosh, M., Farooqi, H., Ammar, M., Siby, N., Bhadra, J., Al-Thani, N. J., Sellami, A., Fatima, N., & Ahmad, Z. (2023). A meta-analysis to gauge the effectiveness of STEM informal project-based learning: Investigating the potential moderator variables. *Journal of Science Education and Technology*, 1-15.
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## *Author(s)' statements on ethics and conflict of interest*

*Ethics statement:* We hereby declare that research/publication ethics and citing principles have been considered in all the stages of the study. We take full responsibility for the content of the paper in case of dispute.

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# Educational Challenges that Syrian Refugee Students with Disabilities Experience

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## Abstract:

Since the beginning of the civil war in Syria, Türkiye has been receiving millions of Syrian refugees. Based on the reports of the Ministry of National Education (MONE) of Türkiye, more than one million refugees in Türkiye are of school age. Children are one of the most affected groups from the refugee flow. The literature indicated that lack of communication and language skills, limited support by parents, and economic and cultural differences were educational challenges that typically developing Syrian refugee children in Türkiye have been experiencing. However, very few studies have explored the educational issues that Syrian refugee children with disabilities have been experiencing. This study was conducted to contribute to the literature by exploring the educational challenges that Syrian refugee children with disabilities have been experiencing. Structured and semi-structured interviews were conducted with eight parents of refugee children with disabilities and eight teachers of the students. Findings of the present study indicated that most of the educational issues that children with disabilities have been experiencing were the same as those experienced by typically developing Syrian refugee children. These common issues included language and communication barriers, cultural differences, and economic issues. The present study added that limited cooperation between parents and teachers, lack of educational materials designed for bilingual children with disabilities, and lack of expectations of parents from their children with disabilities were the issues that Syrian refugee children with disabilities have been experiencing. This study provides implications for practice and suggestions for future research.

## Keywords:


Educational Challenge, Syrian, Refugee, Disability, Parent, Teacher

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## INTRODUCTION

Since the beginning of the civil war in Syria, Türkiye has been receiving millions of Syrian refugees. Based on their status given by the Turkish government, some Syrian people are called refugees, some of them are called those with temporary protection status, and some of them are called immigrants. The United Nations High Commissioner of Refugees (UNHCR) (2023) uses the term refugee to explain those “people who have been forced to leave from their country and have crossed international borders to find safety in another country.” The definition of refugee by the UNHCR fits the scope of this study. Furthermore, because the term refugee is more inclusive and often used by research to identify Syrians in Türkiye (Cavkaytar et al., 2021; Çetin & Koç, 2021; Tanrıku, 2017), the term refugee is used throughout this study.

Türkiye is one of the countries that has been hosting more refugees than any other country in the world (Karataş & Ayyıldız, 2021), and the majority of these refugees come from Syria. Refugee flows affect both the hosting country and mostly refugees themselves because refugee people leave their houses and country without any preparation, and they usually have difficulties finding basic needs such as shelter and food in the hosting country. Children are one of the most affected groups from the refugee flow (Serin & Paslı, 2021). Based on the reports of the Ministry of National Education (MONE) in Türkiye, more than one million refugees are at school age and only %63,29 are able to go to school. (MONE, 2020a; Ministry of Immigration, 2020).

### Refugee Education

To coordinate the education of Syrian refugee children in Türkiye, the Turkish government implemented regulations and cooperated with European organizations such as the United Nations International Children’s Emergency Fund (UNICEF) (UNICEF, 2023). However, despite all the efforts that the Turkish government has been putting in to coordinate and facilitate the education of refugee children, research indicates that there have been some challenges regarding schools, students, and parents (Cavkaytar et al., 2021; Serin & Paslı, 2021; Tanrıku, 2017). Research that explored the education of Syrian refugees focused on different topics, including educational regulations, challenges, and the role of teachers and parents in the educational process (Çetin & Koç, 2021). The results of the research indicated that lack of access to school, language barrier (Başar et al, 2018; Serin & Paslı, 2021; Emin, 2018), lack of support by parents (Cülha & Demirtaş, 2020), and socio-cultural differences were challenges relevant to the education of refugee children in Türkiye (Cavkaytar et al., 2021; Ergün & Özsöz, 2022).

Access to education was challenging for some Syrian refugees because of different factors. A study conducted in the eastern part of Türkiye indicated that Syrian refugee children wanted to go to school, but they were not able to because they frequently moved

around and could not afford going to school (Başar et al, 2018). Furthermore, most Turkish teachers were not used to having students who were not fluent in Turkish in their classroom. Thus, including refugee children in the same classroom as their Turkish-speaking peers resulted in some challenges for teachers (Erdem, 2017). In a study, teachers were interviewed to explore the challenges refugee children have been experiencing in education. The results of the study indicated that students' lack of ability to speak Turkish was one of the main problems (Cavkaytar et al., 2021). Furthermore, Cülha and Demirtaş (2020) reported that some Syrian parents were not supportive for educating their children. Due to economic constraints, numerous parents found themselves compelled to have their children work instead of enrolling them in school (Gencer (2017). Some research also indicated that Syrian children had adaption, discrimination, and friendship problems because of differences in their culture and education system (Kiremit et al., 2018; Reçber, 2014).

### Refugee Students with Disabilities

Most of the research conducted regarding the education of Syrian refugees focused on typically developing children. Few studies have explored the education of refugee children with disabilities. The educational challenges that refugee children with disabilities have been experiencing had already begun before they moved to Türkiye (UNICEF TMK, 2018). Refugee children were deprived of services that they needed because of the circumstances of warfare in Syria (Karnas, 2020). In addition, many typically developing children had physical or mental disabilities due to war. For example, some children lost their body parts, such as the hand, arm, or leg, which caused physical disability (Karnas, 2020). There is no official information regarding the current numbers of Syrian refugee children with disabilities in Türkiye, but according to the International Organization for Migration's (IOM) reports, there is one person with disability in every ten houses of Syrian refugees (IOM, 2017). Therefore, a research report regarding the education of Syrian children with disabilities indicated that 6.1% of Syrian children either had a disability or had to stay at home because of their disability and health issues (Blue Pencil Relief Association, 2019).

A study that explored the identification of refugee children with disabilities indicated that a transparent evaluation and identification is employed in Türkiye for Syrian children with disabilities (Çetin & Koç, 2021). Another study reported various challenges that special education teachers who worked at Guidance and Research Centers [RAM]) have been experiencing in evaluation and identification. Cultural differences, language barriers, and children's psychological standing were reported as personal challenges. Differences in evaluation procedures were reported as process-related challenges. Couple teachers reported that they could not use some evaluation tools because they were neither convenient to translate nor culturally sensitive. The study also reported that students were too reluctant to talk, which was interpreted as a result of trauma they were potentially exposed to when they were in Syria. Accordingly, the teachers reported that they could use any evaluation tool with the help of a translator. Four teachers reported that evaluation tools could be

generated based on Syrian refugees' language and culture (Ünay et al., 2021). For an in-depth understanding of challenges that Syrian refugee children have been experiencing, more research is needed.

### Theoretical Framework

Based on the challenges indicated in the literature, the present study was structured through the lens of "resumption of an ordinary life" theory, which addresses the idea that refugee children seek an ordinary life despite changes in their placement and culturally different environments (Kohli, 2014). This theory conceptualized students' experiences through safety, belonging, and success. Although refugee students have been seeking an ordinary life based on the given theory, issues that they faced at schools regarding adaptation, discrimination, and friendship (Kiremit et al., 2018; Reçber, 2014) may raise safety and belonging concerns at schools. Limited Turkish literature on refugee children with disabilities addressed concerns regarding evaluation, diagnosis, and placement of children (Ünay et al., 2021). These concerns may raise questions regarding safety and belonging because a misdiagnosed child might be placed in an educational setting that is not safe for his or her educational needs. Furthermore, once a child with a disability is placed in an educational setting that is not convenient for his or her educational needs, it is likely that the student will not be successful. Given that a student's success depends on education provided in a convenient educational setting where the student belongs, further information is needed for a comprehensive understanding of the issues that potentially prevent refugee students with disabilities from convenient education. Therefore, this study was conducted to explore the educational challenges that Syrian refugee children with disabilities have been experiencing.

### Purpose of the Study

The purpose of this study was to explore the educational challenges that Syrian refugee children with disabilities have been experiencing. Specifically, the following research questions guided this study:

1. From the teachers' perspective, what are the challenges that refugee students with disabilities have been experiencing?
2. From the parents' perspective, what are the challenges that refugee students with disabilities have been experiencing?

## METHOD

### *Research Model*

This study employed qualitative research to address the challenges that Syrian refugee children with disabilities have been experiencing at special education classrooms in Türkiye. Qualitative research is used for an in-depth understanding of the experiences that participants reported (Merriam, 2013). Data were collected from parents and teachers of Syrian children with disabilities.

### *Participants*

The sample of the study comprised eight parents of Syrian children with disabilities and their respective teachers. Each student had either moderate to severe intellectual disability or autism spectrum disorder. The students have been placed in special education classrooms with their peers with disabilities. Each classroom was placed in different general education schools in Kilis provision of Türkiye, located at the Syrian border. The number of students in each classroom ranged from three to eight. Snowball sampling which is a purposeful sampling method, was used to recruit the participants. The data were collected in the fall semester of 2022–2023 academic year. Demographic information about the participants is presented in Table 1. For confidentiality purposes, any information reflecting the identity of participants was not presented in the study. Instead, participants were given codes. Teachers were coded as T1, T2, T3...T8 and parents were coded as P1, P2, P3...P8. Each teacher in this study had at least one student from Syria in her/his classroom. Demographic data of participants shown at table 1.

**Table 1.** *Demographic Characteristics of Participants*

<b>Teachers</b>	<b>Gender</b>	<b>Year of Exp.</b>	<b>Age</b>	<b>Education Status</b>
T1	Male	1-5 year	26-30 years old	Licence
T2	Male	1-5 year	26-30 years old	Licence
T3	Male	1-5 year	26-30 years old	Licence
T4	Male	1-5 year	21-25 years old	Licence
T5	Male	6-10 year	26-30 years old	Licence
T6	Female	1-5 year	26-30 years old	Licence
T7	Female	1-5 year	26-30 years old	Master's Degree
T8	Female	6-10 year	31-36 years old	Licence
<b>Parents</b>	<b>Gender</b>	<b>Age</b>	<b>Education Status</b>	
P1	Male	39 years old	High School	
P2	Female	28 years old	Primary School	
P3	Female	29 years old	Primary School	
P4	Female	30 years old	Primary School	
P5	Female	32 years old	Secondary School	
P6	Female	32 years old	Secondary School	



P7	Female	34 years old	Secondary School
P8	Female	36 years old	High School

### *Data Collection*

Data were obtained through semi-structured interviews with teachers and fully structured interviews with parents. Based on the literature, interview forms were developed by the researchers and reviewed by three experts and one teacher from the field. In light of the feedback and evaluations of three field experts and a special education teacher, the forms were revised, and the revised versions were used to collect the data. The interview questions for parents were translated into Arabic and collected by three college students who were fluent in both Arabic and Turkish. The transcribed interview text was then translated into Turkish. One phone interview was conducted with each interviewee. The interviews with teachers and parents varied in duration, ranging from 17 to 28 min for teachers and 7 to 12 min for parents.

### *Data Analysis*

The collected data were analyzed using content analysis. In the content analysis, similar data are brought together within the framework of certain codes and themes (Cresswell, 2007). The dataset was checked by all authors individually and discussed to cooperate on themes. Findings of the study were presented through each theme and some direct quotations by participants.

### *Ethical Considerations*

The authors hereby declare that research/publication ethics and citing principles have been considered in all stages of the study. The authors take full responsibility for the content of the paper in case of dispute. Ethical and security concerns were also considered during the study. The consent of the participants was considered in the study for both teachers and parents. In this context, consent forms were signed by the participants. It was declared to the participants that no information regarding their identities would be disclosed. The ethical approval document was taken from a "Higher Education Institutions Scientific Research and Publication Ethics Directive."

Ethical review board name: Kilis 7 Aralık University Ethical Review Board

Date of ethics review decision: 12.10.2022

Ethics assessment document issue number: E-76062934-044-11719

## RESULTS

The findings of this study are presented through four themes derived from the data. The themes were communication and language skills, instructional challenges, socio-cultural issues, and lack of cooperation and coordination. These themes and codes were presented in Table 2.

**Table 2.**

*Challenges that Syrian refugee students with disabilities experienced*

Themes	Codes	Participants
<b>Communication and Language Skills</b>	Communication with the teacher	T1,T2,T3,T4,T5,T6,T7,T8,P2
	Communication with peers	T1,T2,T4,T7,T8,P2,P5,P7,P8
	Teacher-Family Dialogue	T2,T3,T5,T6
	Language learning challenges	T1,T3,T6,T7,T8
	Prejudice against language	T1,T4,T8
<b>Instructional Challenges</b>	Misidentification	T1,T2,T3,T4,T5,T6,T7,T8
	Alphabet difference	T1,T3,T4,T5,T6,T7,T8
	Language barrier	T1,T2,T3,T5,T6,T7,T8,P2,P7,P8
	Limited family involvement	T1,T2,T4,T7,T8
	Educational material deficiencies	T1,T2,T4
<b>Socio-cultural issues</b>	Cultural differences	T1,T2,T3,T4,T5,T6,T7,T8
	Cultural biases	T2,T3,T5,T6,T8
	Economic difficulties	T1,T3,T6,T7,P2,P3,P5,P6,P7,P8
	Social Adjustment Difficulties	T1,T6,T9,P1,P3,P6
	Hygiene Culture	T2,T4,T5
<b>Lack of cooperation and coordination</b>	Parent-Teacher relationship	T1,T2,T3,T4,T5,T6,T7,T8
	Low parental expectations	T1,T2,T3,T4,T5,T8
	Cooperation with management	T1,T6,T8
	Cooperation with specialists	T5,T8

### *Challenges in Communication and Language Skills*

All teachers reported that the biggest challenge in the education of Syrian refugee students with disabilities was related to language and communication skills. Teachers usually did not have difficulties establishing emotional connections with students, but they had difficulties communicating. The majority of the teachers reported that refugee students with disabilities did not communicate with their Turkish peers at all due to the language barrier. Some teachers also stated that the quality of education and training decreased due to communication difficulties. All the teachers emphasized the benefits of interpreter support for communication. One teacher stated the following:

*"Syrian students usually interact with their Syrian peers. They do not talk to Turkish students unless they must. They cannot communicate because they cannot speak the language. Their*

*communication with each other is better. Even if they already know Turkish, they speak Arabic. In this case, the Turkish students move away from them. Even if we try to unite them in the school, they leave from each other after a while."* T3

Teachers reported that there were three main difficulties that prevented the development of Turkish language skills in refugee students with disabilities. The first challenge was lack of exposure to the Turkish language because most of the peers in the classroom and the neighborhood were Syrian. The second challenge was the lack of course contents supporting language development of children. The third challenge reported by teachers was lack of parent involvement in education. A teacher stated

*"Everyone speaks Arabic in my Syrian students' homes, streets, and even at school. There is almost no environment for Turkish interaction. Their population is very dense in the Kilis province. Eighty percent of the students in our school are Syrian. If the family does not care about learning Turkish, our job becomes very difficult. Families have resistance against learning Turkish. They see Turkish education as an assimilation. There is a nationalist approach. In fact, they send their children to unofficial Arabic and language courses on the weekends."* T1

Teachers in this study recommended (a) intensive language education at pre-school; (b) placement of only one refugee student in each classroom; (c) more conversation activities between Turkish students and Syrian refugee children; (d) more special education materials designed for bilingual children; and (e) encouraging parents to learn Turkish.

Parents in this study reported similar challenges as teachers reported. According to the parents, the most common challenges that students have been experiencing at schools were related to language, communication, and social interaction. While two parents reported that their children did not have problems communicating in Turkish and making Turkish friends, five parents reported that their children had difficulties communicating with their teachers and friends. However, some parents reported that communication difficulties have decreased over time. All parents reported that interpreters at schools helped them when they needed to communicate with teachers. The most prominent challenge reported by parents was communication difficulties between their children and their Turkish classmates. A parent stated

*"When my daughter started school, no one came close to her. Every day when she came from school, she used to cry asking herself why am I like that. Recently, this problem has gradually started to disappear, and other children have started to get used to her."* P2

### *Challenges in Instructional Difficulties*

Teachers reported that some instructional challenges in teaching Syrian refugee children with disabilities had negative impacts on the quality of education. Language barriers and lack of communication were reported as the main challenges in teaching. In addition, many teachers reported that the special education teaching materials provided in the classrooms were inadequate. Furthermore, most teachers reported serious difficulties in

teaching, reading, and writing due to differences in the Turkish and Arabic alphabets. Teachers also believed that many of their students were not diagnosed correctly and that some of them would better be included in inclusive classrooms with their typically developing peers. Almost all teachers stated that Syrian refugee children are deprived of some out-of-school services, such as rehabilitation services, which were provided free for Turkish students. This is an important deficiency for Syrian refugee children. Some teachers also reported that lack of family support slowed down their learning at home. Two teachers stated

*"They learn things specific to their own culture from their families. For example, their parents teach them to write from right to left, as in Arabic. Thus, we have difficulties in teaching writing because no matter how many times I show them, they always start writing from the right. Same issue is seen in reading activities"* T1

*"We also have problems with materials. We cannot get any support from the school administration regarding the shortage of materials in special education. We need to use different types of materials based on the children's needs, but we do not have enough materials for that"* T3

Most parents reported that they were mostly satisfied with the school environment and the education services provided. Parents were aware that they could not support the education of their children because they could not speak the language, and they regretted it. Contrary to the teachers, most parents reported that the educational materials provided to their children were sufficient. Two statements of parents are listed below:

*"My daughter loves her school and her teachers very much; she even says that she wants to go to school on holidays. she only has problems communicating with her peers. I am very satisfied with the interest of the teachers."* P2

*"My son do nothing at home. I do not speak Turkish either, so I do not even know if he has done his homework. I want to help and support him, but I cannot".* P8

### *Challenges in the Sociocultural Context*

Teachers reported that refugee students with disabilities have experienced many difficulties in education in terms of social, economic, and cultural aspects. The reported common difficulties were (a) problems arising from cultural differences; (b) lack of cultural adaptation in teaching; (c) problem behaviors learned in family culture; (d) economic difficulties and child labor; (e) differences in hygiene culture; and (f) socio-cultural prejudices.

Teachers had difficulties in social skills and behavior training due to cultural differences. For example, some behaviors that were considered inappropriate in Turkish culture were normal in Syrian children's own culture or vice versa. Furthermore, because of cultural differences, students have had difficulties in understanding some concepts related to family and society in the curriculum. Some teachers reported some behaviors of refugee students, such as sharing the same spoon with someone else and eating with hands were

inappropriate behaviors that they witnessed in schools. Therefore, some teachers prioritized goals related to social and cultural adaptation and took this circumstance into consideration when preparing IEPs. In addition, male teachers reported that the mothers of their Syrian students had never communicated with them and usually refused to come to school. The teacher stated:

*"When I invite the mother to school to talk about the child's progress, she doesn't come because I am a man... She doesn't want to communicate with me, the interpreter, who is a man, doesn't want to communicate with her much, I sometimes feel hopeless." T2*

The parents did not mention cultural differences but addressed some prejudices and economic difficulties. One parent reported that they thought having a child with a disability was a punishment given to them by God. Many refugee children frequently missed school because they worked in various part-time jobs after school. A parent stated:

*"The teacher used to ask the children to buy some materials, and when I told my daughter that I couldn't buy the materials, she used to get upset and say that everyone else was bringing the materials and she was the only one not bringing them to school. Therefore, I had to borrow money to buy the materials. I walk with her two kilometers to school every day. Sometimes I cannot. There is no shuttle service. She is incapable of going to school on her own." P2*

#### *Challenges in Co-operation and Coordination*

Teachers experienced many challenges with regard to co-operation and coordination with parents. The common challenges were insufficient parent support, low parental expectations, differences in school management, and insufficient expert support. Most of the teachers stated that lack of family support and care weakens the quality of education. Some teachers emphasized that small numbers of parents were more caring, sensitive, and open to cooperation. A teacher stated

*"Family is essential in special education. Education of children with disabilities is a process that cannot be carried out by the school alone or that the family can overcome alone. I only do homework on the weekends for repetition of what I taught at school, but the students are not assisted or tracked at home. Usually, the family has no expectations from the student. They only send them to school to keep them busy." T3*

Parents were usually satisfied with the services provided at schools and did not feel a deficiency in cooperation and coordination. Parents reported that they were satisfied with the communication and interest of teachers and school administration. A parent stated

*"Our teacher is very caring. We talk from time to time and get information about our child. We try supporting them in everything we do, and I really hope we will continue to support them. I don't know how to read and write because I only studied until the fourth grade, and I don't speak Turkish, but his older sisters speak Turkish, and they help my child." P3"*

## DISCUSSION AND CONCLUSION

This study explored the challenges that special education teachers have been experiencing with their Syrian refugee children with disabilities in their classrooms. Most of the research on refugee children in Türkiye was conducted regarding the education of typically developing Syrian children. Few studies have addressed the education of refugee children with disabilities. These studies focused on the challenges of evaluation and identification (Çetin & Koç, 2021; Ünay et al., 2021). This study mostly focused on challenges in classrooms and found similar challenges that were reported for typically developing children in the literature. This study indicated some unique findings that were not mentioned in research conducted on typically developing children.

Access to education has been reported as a challenge for typically developing children (Kultaş, 2017). Because of economic issues, some parents forced their children to work instead of sending them to school (Çülha & Demirtaş, 2020). The findings of this study indicated the same issue for refugee children with disabilities. Shortage of economic situation of parents was a factor that prevented refugee children from accessing education. One parent reported that her child often missed school and collected paper to contribute to her parents' economics. Child labor is a serious issue in many countries, and it was very common among refugee children in Türkiye. The United Nations or UNICEF can handle this issue by providing financial support for parents as long as they let their children enroll in school regularly.

This study found that the biggest challenge regarding the education of refugee children with disabilities was related to language and communication. Language and communication issues were also reported in the literature as one of the main challenges regarding the education of typically developing Syrian children. The Turkish government is aware of this issue, so projects such as PIKTES have been employed to increase the Turkish language skills of refugee children. However, as of 2023, almost all teachers and numerous parents still address the language and communication barriers in the classroom. Therefore, the efforts that the Turkish government has put in to increase the Turkish language skills of refugee children have not been very effective. As one of the teachers in the present study recommended, the number of refugee children in the classrooms should be decreased to prevent them from speaking Arabic among each other at school. In addition, the curriculum should be modified by adding activities aiming to increase language and communication skills.

Similar to the findings in the Turkish literature, some teachers in this study reported that the evaluation and diagnosis of some Syrian children were problematic and biased. This study added that Syrian children were deprived of rehabilitation services, which is an important deficiency for Syrian refugee children with disabilities. Furthermore, some teachers reported that lack of family support slowed down students' learning at home. To overcome these issues, policies are needed to simplify the easy access of refugee children

with disabilities to rehabilitation services. Furthermore, a parent in this study reported that having a child with a disability was a punishment given to them by God. This finding is interesting, and this belief might be common among many Syrians about children with disabilities. Given this perspective, it is not surprising that teachers reported insufficient parental support and low parental expectations. To overcome this issue, parents should be trained regarding the importance of parental support for the education of their children with disabilities.

The literature indicates that discrimination against refugee children and lack of friendship between Turkish and refugee children are some of the challenges in classrooms (Kiremit et al., 2018). This challenge was also reported for children with disabilities in this study. Some parents reported that the language barrier has been decreasing as Syrian students learn Turkish over time. This study found that parents played an important role in this issue. Some parents were worried about being assimilated into Turkish culture so they have not had a positive approach to Turkish education and culture. Probably, the children of these parents could not improve their language skills and missed most of the classes, which potentially caused prejudice against the Turkish language and culture.

Furthermore, this study indicated that some cultural behaviors could result in discrimination against refugee children by Turkish students. For example, eating with one's hand is unacceptable in Türkiye, but is very typical in Syrian culture. Using each other's kitchen utensils is not appropriate in Turkish culture, but it is often seen among Syrian children. Once refugee children demonstrate these behaviors when they are with their Turkish peers, they might want to stay away from them. To overcome this issue, Turkish students should be taught to be respectful toward cultural differences and refugee children should be taught to be sensitive toward the culture in which they live.

Although most parents in the present study were satisfied with the education that their children with disabilities have been receiving, teachers in the present study reported some challenges that affected the quality of education. Some of the findings, which were not reported for typically developing children in the literature but were reported for children with disabilities in the present study, were low parental expectations and lack of special education materials needed for bilingual students with disabilities in the special education classrooms. In particular, refugee children with disabilities were limited in language, which made them more dependent on visual materials. Therefore, school districts in Türkiye should prioritize the material needs of special education classes. Districts might ask for material support from universities close to them.

Language and communication barriers prevented parents from cooperating with teachers. However, most parents in this study indicated that translators were very helpful when they needed to communicate with teachers. It seemed that parents were willing to cooperate, but language barriers resulted in a lack of cooperation. The schools might organize some events where refugee parents and translators are invited to increase

cooperation between teachers and parents. Furthermore, some teachers in this study reported lack of care by parents. One possible explanation for teachers' perception that refugee parents are not sufficiently involved could be cultural differences. Some male teachers in this study reported that mothers of their Syrian children never talked to them, which caused a lack of cooperation between parents and teachers. To overcome this issue, Turkish male teachers should better cooperate with the fathers of their Syrian students.

This study explored the educational challenges that Syrian refugee children with disabilities have experienced. Sixteen participants, including eight teachers and eight parents, participated in the study. The findings of this study indicated that the educational challenges that refugee children with disabilities have been experiencing were similar to the educational challenges that typically developing children have been experiencing. The need for more visual materials for refugee children with disabilities and cultural beliefs toward children with disabilities were some of the findings that were not reported in the literature for typically developing children. Policy makers, teachers, and parents should consider the implications of this study for practice.

### LIMITATIONS AND RECOMMENDATIONS

This study has some implications for practice. The financial situation of Syrian parents is an important issue that prevented some students from going to school. Therefore, some regulations should be enacted to keep school-age Syrian children at school. Furthermore, the number of projects such as PIKTES should be increased because a shortage of language and communication has negative effects on teaching, learning, and cooperation. Both Turkish and Syrian children should be taught to be aware of cultural differences. Teachers should put more effort into finding or developing materials based on students' needs.

The findings of this study should be interpreted with respect to its strengths and limitations. The interviews with parents were conducted using a structured interview form by college students. Thus, the interview durations were shorter, resulting in limited data from parents. Semi-structured interviews conducted by professionals would provide more data from parents. In addition, only one father participated in the study. Fathers may express different challenges than mothers. Therefore, it would be better to have more fathers as participants in the study. The data of this study were obtained in Kilis province of Türkiye, where Syrian children have the highest density compared to other provinces. Different findings can be found in cities where refugee children have a lower density. The literature lacks quantitative studies regarding the content of this study. Future researchers may conduct quantitative studies with more participants.



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### Data Availability Declaration

While the primary datasets utilized in this study are not publicly accessible due to certain constraints, they are available to researchers upon a formal request. The authors have emphasized maintaining the integrity of the data and its analytical rigor. To access the datasets or seek further clarifications, kindly reach out to the corresponding author. Our aim is to foster collaborative academic efforts while upholding the highest standards of research integrity

### Author Contributions

Abdullah EKER, Mustafa KARNAS, and Beyza ALPAYDIN, contributed equally to this work. They collaboratively handled the conceptualization, methodology design, data acquisition, and analysis. Each author played a significant role in drafting and revising the manuscript, ensuring its intellectual depth and coherence. All authors have thoroughly reviewed, provided critical feedback, and approved the final version of the manuscript. They jointly take responsibility for the accuracy and integrity of the research.

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## Attitudes and Beliefs of 4th Grade Primary School Students toward the Social Studies Course

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### Abstract:


The social studies course can be described as an ongoing process that attempts to prepare individuals for life through the transfer of culture and ensures their socialization. It is thought that students' beliefs and attitudes toward this course are essential for achieving the course objectives. The objective of this research is to determine the attitudes and belief levels of fourth- grade students toward the social studies course with respect to various variables and to review the relationship between attitudes and belief levels toward the social studies course. During the research, descriptive survey and relational survey models, both quantitative research methods, were used in combination. The study population consists of primary school students throughout Turkey in their fourth grade during the 2022–2023 academic year. 1326 primary school students in the fourth grade constituted the sample group of the study. The research data were collected using the "Social Studies Course Attitude Scale" and the "Social Studies Course Belief Scale". Because of the study, it was determined that there was a positive and moderate relationship between the students' attitudes and beliefs toward the social studies course, and it was noted that students' attitudes and beliefs toward social studies course were significantly high. Teachers and educators, while conducting efforts to enhance students' attitudes toward the social studies course, can also contribute to students' success by focusing on their positive beliefs about this course.

**Keywords:** Primary school students, social studies course, attitude, belief


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## INTRODUCTION

Education can be described as a process that facilitates behavioral change in individuals in an attempt to prepare them for life according to certain goals of the society and to support the socialization of individuals through the transfer of cultural values. The general objectives of education include, among others, raising good citizens who demonstrate appropriate behavioral characteristics as expected by society, embracing the core values of society, and developing attitudes and beliefs in line with these values. Everyone accept that the continuity and level of development of a society are highly correlated with education. Therefore, each society has its own education system built to serve its needs. The basic building block of an education system is schools, and their function is to provide students with education. Learning activities are conducted at schools according to predefined programs to achieve the desired behavioral changes in students (Fidan, 1996; Şimşek and Demir, 2012).

Education and training periods are divided into various types and stages based on the age and developmental characteristics of the students. Primary schools in our education system are the foundation on which the entire education process is built and they are also where future generations are first shaped. The main purpose of education in primary schools is to prepare students for life and equip them with the knowledge, skills, and attitudes that they will need in their daily lives (Ergin, 2006). At the primary school level, social studies which is designed to prepare students for their social life, is essential in providing them with the basic knowledge and skills necessary to become good citizens. The social studies subject, which equips students with the necessary tools to become first a good person, then an effective citizen, and finally a world citizen in this global world (Tay, 2022), draws upon the content of social sciences and offers a subset of this content as required to raise effective citizens. In this context, the mission of raising active citizens for a democratic society both in Turkey and throughout the world has been largely delegated to the social studies curriculum. Thus, social studies education has become a key factor that determines whether a society is made of productive and participatory individuals with national and democratic attitudes and values, problem-solving and decision-making skills (Öztürk and Otluoğlu, 2002; Safran, 2008; Aktepe, Tahiroğlu and Sargin, 2014). In Turkey, social studies education at the primary school level is delivered in a course of 3 h per week in the fourth grade as per the 2023 Social Studies Course Teaching Program (MEB, 2023).

A review of the Social Studies Course Teaching Program shows that it is designed to ensure that students acquire the desired behaviors in the cognitive, affective, and psychomotor domains. During the acquisition of behaviors, it is essential that affective learning and cognitive learning are prioritized. Affective characteristics have a significant impact on cognitive achievement in the relevant field, and this effect is approximately as important as one-fourth of cognitive achievement (Bloom, 1995; National Research Council, 1996). In other words, as is the case with any other course, for students to achieve the

intended learning outcomes and succeed in the social studies course, they must show a keen interest in, develop a positive attitude, and have a positive belief in that subject. Therefore, one of the main factors that determine a student's success in a course is affective entry behaviors, which comprise a student's habits, values, beliefs, and attitudes. (Aktepe, Tahiroğlu and Sargin, 2014; Erden, 1997; Ergin, 2006; Kayalı, 2003; Özçelik, 1992).

Attitude, considered as one of the affective entry characteristics, refers to the positive or negative behaviors an individual develops toward any object, concept, or situation (Kağıtçıbaşı, 2004). According to Aydın (2010), attitudes influence and shape students' emotions, thoughts, and behaviors. Attitudes, which are believed to influence students' decision-making and behaviors, play a significant role in learning (Altınok and Açıkgöz, 2006). Students' attitudes can shape their levels of knowledge on the subject, their performance, their willingness to acquire knowledge, and their interests.

Research on attitudes indicates a significant relationship between students' school performance and their attitudes, demonstrating that as students' positive attitudes toward the subject increase, their achievements also improve (Tay and Akyürek Tay, 2006). Therefore, it can be said that a positive attitude adopted by students toward the subject will positively impact their academic success. Therefore, if students have a positive attitude toward a specific subject or course, this can enhance their cognitive achievements. Therefore, educators can positively influence students' learning experiences by understanding and supporting their emotional needs, thus helping them become more successful. Hence, knowing the extent of student attitudes can enable educators to determine their teaching methods, enhance students' learning experiences, and provide more effective education. This information can be considered a crucial factor in offering better instruction and guidance to students, increasing student motivation, and consequently improving learning outcomes.

Another affective characteristic that needs to be developed in students is belief. The beliefs that students have represent an important aspect of the education and training process (Çiftçi and Yıldız, 2020). According to the definition in the Turkish Language Association [TDK] dictionary, belief is "being bound to an idea, something which is believed in, opinion, doctrine". In addition, a review of the relevant literature shows that the term "belief" is defined in different ways. According to Goldin (2002), beliefs are mental structures that are accepted as true by an individual and acquired by that individual through coding and belong to that individual. However, Schoenfeld (1989) describes belief as a personal conceptualization, understanding, or feeling. Belief is also said to be a part of an individual's knowledge (Furinghetti and Pehkonen, 2002; Pajares and Miller, 1995). Beliefs affect an individual's motivation, feelings, thoughts, and behaviors (Uysal and Kösemen, 2013).

On the other hand, a review of the literature reveals that the concepts of belief and attitude are intertwined and that belief is even expressed as an attitude (Pehkonen and

Pietila, 2003). Attitudes and beliefs are closely interlinked in terms of the cause– effect relationship. Attitudes are hidden in certain value judgments and beliefs, and they continue to exist as long as the beliefs and value judgments on which they are based remain (Çöllü and Öztürk, 2006). If an individual has a negative attitude toward any object, they will also have negative beliefs about that object (Morgan, 2000). However, the beliefs that students hold affect how they behave and process information (Garner and Alexander, 1994). Considering the power of belief, understanding a student’s beliefs provides insight into their knowledge, learning, and motivation (Buehl and Alenxander, 2001). Students’ beliefs also affect their learning (Richardson, 1996). Based on the information mentioned above the students’ attitudes and beliefs about the social studies course both play an important role in achieving the desired level of characteristics that are expected to be imparted to students through the social studies course. In this context, knowing the level of students’ attitudes and beliefs regarding the social studies course is an important factor in improving the quality of social studies teaching (Öztürk, Akyürek Tay, Ergül, & Tay, 2023).

The literature in this field includes studies examining the attitudes of primary and secondary school (4th, 5th, 6th and 7th grade) students toward the social studies course (Akın, 2014; Aktepe, Tahiroğlu, & Sargın, 2014; Coşkun, 2011; Ergin, 2006; Kayalı, 2003; Meral, 2013, Oğur, 2009; Özkal, Güngör and Çetingöz, 2004; Öztürk and Baysal, 1999; Şahin, 2001; Şimşek and Demir, 2012; Tay and Akyürek Tay, 2006, Tosun and Nalçacı, 2023; Yılmaz and Şeker, 2011). Other studies have examined the effects of the methods used in delivering social studies lessons on students’ attitudes toward the social studies course (Ada, Baysal and Kadioğlu, 2009; Aladağ, 2007; Balkan, 2007; Deveci, 2002; Fidan, 2004; Karakuş, 2004; Karakuş, 2009; Yılmaz, 2006). Based on the results of these studies, it has been concluded that the use of methods and techniques aligned with the constructivist approach (project-based learning in social studies, problem-based learning, cooperative learning, maps and geographical information systems, etc.) has a positive influence on students’ attitudes toward social studies. However, it has been noted that there is a smaller number of studies on fourth- grade primary school students and the current social studies program. Additionally, the literature review did not return any research examining the students’ attitudes and beliefs about the social studies course together. This was the starting point of this research which is hoped to eliminate this deficiency in the field. In this context, the objective of this research is to examine the attitudes and beliefs of fourth- grade primary school students toward the social studies course in terms of some variables and to identify the relationship between the attitudes and beliefs of fourth- grade primary school students toward the social studies course. This research has been designed to identify the deficiencies in affective input behaviors by measuring the attitudes and beliefs of fourth- grade students toward the social studies course for making social studies teaching more effective, determining the actions that must be taken to make the attitudes and beliefs of the students more positive, and providing a reference resource for future studies in this field. It is thought that insight into whether students’ attitudes and beliefs change in terms of different



variables and whether there is a relationship between students' attitudes and beliefs will be useful in determining the methods to be followed in teaching social studies. For this purpose, answers have been sought to the following two main problems and their sub-problems:

#### Research Problem

1. Is there a significant relationship between the attitudes and belief levels of fourth-grade primary school students toward the social studies course?

2. Do the attitudes and belief levels of fourth- grade primary school students toward the social studies course change significantly in terms of different variables?

#### Sub-problems

1) At what level are the attitudes of the 4th grade primary school students toward the social studies course?

2) Is there any significant difference between 4th grade primary school students' gender, how much time they spend reading a book on a day, the educational background of families, parents' professions, geographical region in which the students live, and their attitudes toward the social studies course?

3) At what level are the beliefs of the 4th grade primary school students about the social studies course?

4) Is there any significant difference between 4th grade primary school students' gender, how much time they spend reading a book on a day, the educational background of families, parents' professions, geographical region in which the students live, and their beliefs about the social studies course?

5) Is there any relationship between fourth- grade primary school students' attitudes and beliefs about the social studies course?

## METHOD

### *Research Model*

In this study, the survey model, i.e., a quantitative research method, was used to identify the attitudes and beliefs of 4th grade primary school students about the social studies course. Survey research, in the most general sense, describes and defines the characteristics of a sample selected from the population, reveals its nature, and generalizes it to the population. This type of research typically uses a large population and is conducted with a large group, and attempts to describe the tendencies, attitudes, concerns, opinions, and characteristics of the individuals in the sample. Descriptive survey research is conducted by describing existing variables, situations, or events as they are, without any intervention by the researcher (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz and

Demirel, 2021; Creswell, 2017; Hoccoğlu and Baysal, 2019; Karakaya, 2014; Tuncer, 2020). For this purpose, considering the size of the population consisting of fourth- grade primary school students in Turkey, a descriptive survey method was used to describe the attitudes and beliefs of fourth- grade primary school students about the social studies course and generalize them to the population. At the same time, the relational survey model was used to investigate the attitudes and beliefs of the 4th grade primary school students about the social studies course in terms of different variables, to determine whether attitudes and beliefs change together or not, and to determine the degree of change, if any.

### *Population and sample*

The population of the research consists of primary school students throughout Turkey in their fourth grade in the 2022–2023 academic year 2022–2023. A sample group representing the characteristics of the population was formed to generalize conclusions obtained from this sample group to the overall population with the "multistage sampling" method, i.e., a method that is typically used when it is not possible to reach or create a list of all individuals in a given population. First, using the "stratified sampling" method, seven geographical regions in Turkey were divided into strata, and geographical parts of each stratum were examined to determine the provinces in which the study would be conducted independently from each other. In the second stage, a list of schools in those provinces was created, and the schools were selected using the "simple random" sampling method. During the third stage, the "criterion sampling" method -a purposeful sampling strategy- was used by taking "being a 4th grade primary school student" as a criterion. Thus, a sample group of 1326 primary school students in the fourth grade in the 2022–2023 academic year across the schools selected according to the simple random method was created as the research sample. The demographic information of the sample group participating in the research is given in Table 1.

Table 1.

*Demographics of the Study Group*

Variable	Group	f	%
<b>Gender</b>	Female	694	52
	Male	632	48
<b>Time spent reading per day</b>	0 min	75	5.7
	1-30 minutes	572	43.1
	31-60 minutes	383	28.9
	61-90 minutes	183	13.8
	More than 90 min	113	8.5
<b>Mother's Educational Level</b>	Primary school	326	24.6
	Illiterate	150	11.3
	Secondary school	259	19.5
	High school	332	25.0
	University	259	19.5
<b>Father's Educational Level</b>	Primary school	67	5.1
	Illiterate	241	18.2
	Secondary school	276	20.8
	High school	365	27.5
	University	377	28.4
<b>Mother's Profession</b>	Tradesperson/craftsperson	62	4.7
	Housewife	1004	75.7
	Public Officer	131	9.9
	Private Sector	75	5.7
	Self-employment	54	4.1
<b>Father's Profession</b>	Unemployed	31	2.3
	Tradesperson/craftsperson	391	29.5
	Public Officer	217	16.4
	Private Sector	377	28.4
	Self-employment	310	23.4
<b>Geographic Region</b>	Marmara Region	181	13.7
	Aegean Region	129	9.7
	Central Anatolia Region	341	25.7
	The Mediterranean Region	316	23.8
	The Black Sea Region	85	6.4
	Eastern Anatolia Region	111	8.4
	Southeastern Anatolia Region	163	12.3
<b>Total</b>		1326	100

*Data Collection Tools*

The "Social Studies Course Attitude Scale", "Social Studies Course Belief Scale" and a demographic information form were used during this research, which was conducted to describe the attitudes and beliefs of 4th grade primary school students about the social studies course and to determine whether there was a significant relationship between them.

To determine the construct validity of the "Social Studies Course Attitude Scale" developed by Ulu Kaln and Topkaya (2017), which consists of 12 three-point Likert items

designed to determine the attitudes of the fourth grade primary school students toward the social studies course, a factor analysis was conducted by the researchers who developed this scale. Because of the factor analysis, the Kaiser–Meyer– Olkin (KMO) value of the scale was found to be .87, and the value in the Bartlett Sphericity test was found to be significant ( $p = .000$ ). The reliability coefficient (Cronbach’s alpha) value of the scale was  $\alpha = .84$ . These values indicate that it is a valid and reliable scale (Ulu Kalın and Topkaya, 2017). The Cronbach’s alpha value obtained at the end of this research was  $\alpha = .84$ .

The "Social Studies Course Belief Scale", which was developed by Öztürk, Akyürek Tay, Ergül, and Tay (2023) and is used to determine the beliefs of fourth- grade primary school students about the social studies course, consists of 19 three-point Likert items. Because of the factor analysis conducted by the developers of the scale, the Kaiser–Meyer–Olkin (KMO) value of the scale was found to be .91, and the value in the Bartlett Sphericity test was found to be significant ( $p < 0.000$ ). The reliability coefficient (Cronbach’s alpha) value of the scale was  $\alpha = .89$ . These values show that the scale is valid and reliable scale (Öztürk, Akyürek Tay, Ergül and Tay, 2023). The Cronbach’s alpha value obtained at the end of this research was  $\alpha = .87$ .

The response options for the items in both scales are as follows: "Agree (2.34-3.00)", "Partly Agree (1.67-2.33)", "Disagree (1.00-1.66)". Since the scores on the scale range between 1.00 and 3.00, the closer the scores are to 3, the higher the students’ level of agreement with the proposition, and the closer the scores are to 1.00, the lower the students’ level of agreement with the proposition.

After parental consent forms were obtained from the sample group of the research, i.e., 1326 primary school students in their fourth grade in the 2022–2023 academic year, the Social Studies Course Attitude Scale and the Social Studies Course Belief Scale were completed by the students.

### *Data Analysis*

Descriptive statistics of the data obtained from the study were analyzed using the SPSS 25.00 package program. First, the data were tested to see whether they showed normal distribution. For this purpose, the histogram, variance coefficient, skewness/kurtosis, detrended plot, Kolmogorov–Smirnova, and Shapiro– Wilk tests were used to perform normality testing of each independent variable. The data obtained from the Social Studies Course Attitude Scale and the Social Studies Course Belief Scale did not show a normal distribution.

The Mann– Whitney U" test, a nonparametric statistical test, was used to determine whether the students’ attitudes and beliefs about the social studies course showed a significant difference according to gender. Since the data did not show a normal distribution, the Kruskal– Wallis H" test was used to determine whether there was a significant difference in terms of the students’ attitudes and belief levels, amount of time

spent reading per day, parents' educational level, parents' professions, and the geographical region in which they lived. Additionally, the Spearman –Brown test was performed to determine the relationship between the students' attitudes and beliefs about the social studies course. The analysis results are provided as frequency distribution graphs and tables.

### *Ethical considerations*

During the research process, data were collected meticulously and participants' privacy and anonymity were protected. Each student participating in the research and their parents were formally informed about the research objectives, methodologies, and potential outcomes. More importantly, they were assured of their right to withdraw from the study without being subject to any adverse consequences. All collected data, including interview tools and participants' consent documentation, were stored securely on the researcher's personal computer, which was protected with strict password protection measures.

In alignment with the overarching commitment to ethics, this study stringently adhered to all provisions delineated in the "Higher Educational Institutions Scientific Research and Publication Ethics Directive." It is imperative to note that there were zero instances of activities that might infringe upon the clauses stated under the "Actions Against Scientific Research and Publication Ethics."

Ethical Review Board: [Kırşehir Ahi Evran University, Social and Human Sciences Scientific Research and Publication Ethics Committee]

Date of Ethics Review Decision: [10.05.2023]

Ethics Assessment Document Issue Number: [2023/04/22]

## FINDINGS

It was determined that the answers given to the Social Studies Course Attitude Scale by the 4th grade primary school students participating in the research did not show a normal distribution, and the data were tested using the non-parametric Chi-square ( $\chi^2$ ) test to determine the attitude level of the students. Related data are provided in Table 2.

**Table 2.**

*Chi-square ( $\chi^2$ ) Test Results for 4th Grade Primary School Students' Attitude Levels toward the Social Studies courses*

	n	sd	$\chi^2$	p
<b>Social Studies Course Attitude Scale</b>	1326	20	1697.968	.000

When Table 2 is examined, it is seen that the attitudes of the 4th grade primary school students toward the social studies course are significantly high ( $\chi^2=1697.968$ ;  $p<.05$ ).

The Mann–Whitney U test results for the social studies course attitude scale scores of male and female fourth- grade primary school students are given in Table 3.

**Table 3.**

*Mann–Whitney U Test Results Show a Significant Difference Between the 4th Grade Primary School Students' Gender and Attitudes toward the Social Studies Course*

Gender	n	Mean Rank	Sum of the Ranks	U	p
Female	694	692.22	480401.50	199371.50	.004
Male	632	631.96	399399.50		

It was found that there was a significant difference between the attitudes of female and male students toward the social studies course ( $U=199371.50$ ,  $p<.05$ ). Considering the mean ranks, it was noted that the female students' attitudes toward the social studies courses were higher than those of the male students.

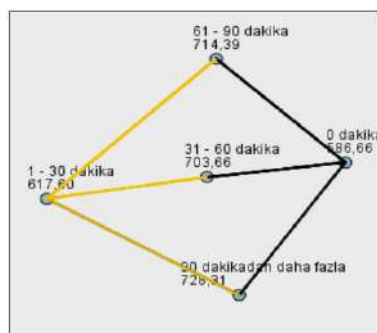
The Kruskal–Wallis Test results for the scores of 4th grade primary school students on the social studies course attitude scale with respect to how much time they spent reading per day are given in Table 4.

**Table 4.**

*Kruskal–Wallis Test Results for 4th Grade Primary School Students with Respect to the Amount of Time Spent Reading Books Per Day*

	Time spent reading per day	n	Mean Rank	$\chi^2$	sd	p	Significant Difference
1	0 min	75	586.66	22.308	4	.000	3 > 2
2	1-30 minutes	572	617.60				4 > 2
3	31-60 minutes	383	703.66				5 > 2
4	61–90 minutes	183	714.39				
5	More than 90 min	113	728.31				
	Total	1326					

Table 4 shows that there was a significant difference between the attitudes of the 4th grade primary school students toward the social studies course and the amount of time they spent reading books per day ( $\chi^2=22.308$ ;  $p<.05$ ). A significant difference was found between the attitudes of students who read books for 31–60 minutes, 61–90 minutes, and more than 90 min per day, and the attitudes of students who read books for 1-30 minutes. It is seen that the significant difference is in favor of those students who read books for 31–60 minutes, 61–90 minutes, and more than 90 min per day.



**Figure 1. Relationship Between 4th Grade Primary School Students' amounts of Time spents Reading Books Per Day and Their Attitudes toward the Social Studies courses**

The data were tested using the Kruskal– Wallis test to determine the relationship between the attitudes of the 4th grade primary school students toward the social studies course and their mother's educational level. The results are presented in Table 5.

It was determined that the answers given to the Social Studies Course Attitude Scale by the 4th grade primary school students participating in the research did not show a normal distribution, and the data were tested using the non-parametric Chi-square ( $\chi^2$ ) test to determine the attitude level of the students. Related data are provided in Table 2.

**Table 2.**

*Chi-square ( $\chi^2$ ) Test Results for 4th Grade Primary School Students' Attitude Levels toward the Social Studies courses*

	n	sd	$\chi^2$	p
<b>Social Studies Course Attitude Scale</b>	1326	20	1697.968	.000

When Table 2 is examined, it is seen that the attitudes of the 4th grade primary school students toward the social studies course are significantly high ( $\chi^2=1697.968$ ;  $p<.05$ ).

The Mann– Whitney U test results for the social studies course attitude scale scores of male and female fourth- grade primary school students are given in Table 3.

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<b>Female</b>	694	692.22	480401.50	199371.50	.004
<b>Male</b>	632	631.96	399399.50		

It was found that there was a significant difference between the attitudes of female and male students toward the social studies course ( $U=199371.50$ ,  $p<.05$ ). Considering the mean ranks, it was noted that the female students' attitudes toward the social studies courses were higher than those of the male students.

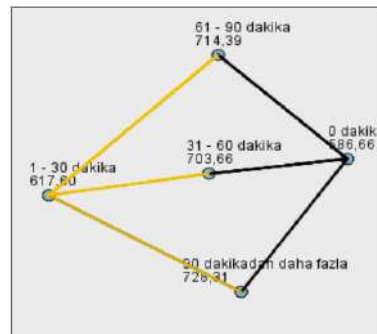
The Kruskal– Wallis Test results for the scores of 4th grade primary school students on the social studies course attitude scale with respect to how much time they spent reading per day are given in Table 4.

**Table 4.**

*Kruskal– Wallis Test Results for 4th Grade Primary School Students with Respect to the Amount of Time Spent Reading Books Per Day*

	Time spent reading per day	n	Mean Rank	$\chi^2$	sd	p	Significant Difference
1	0 min	75	586.66	22.308	4	.000	3 > 2
2	1-30 minutes	572	617.60				4 > 2
3	31-60 minutes	383	703.66				5 > 2
4	61–90 minutes	183	714.39				
5	More than 90 min	113	728.31				
	Total	1326					

Table 4 shows that there was a significant difference between the attitudes of the 4th grade primary school students toward the social studies course and the amount of time they spent reading books per day ( $\chi^2=22.308$ ;  $p<.05$ ). A significant difference was found between the attitudes of students who read books for 31–60 minutes, 61–90 minutes, and more than 90 min per day, and the attitudes of students who read books for 1-30 minutes. It is seen that the significant difference is in favor of those students who read books for 31–60 minutes, 61–90 minutes, and more than 90 min per day.



**Figure 1. Relationship Between 4th Grade Primary School Students' amounts of Time spents Reading Books Per Day and Their Attitudes toward the Social Studies courses**

The data were tested using the Kruskal– Wallis test to determine the relationship between the attitudes of the 4th grade primary school students toward the social studies course and their mother's educational level. The results are presented in Table 5.

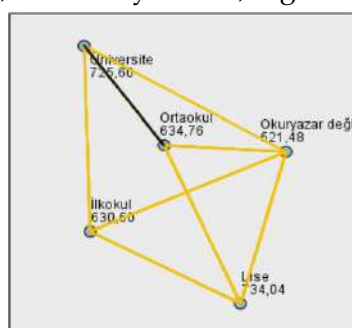


**Table 5.**

*Kruskal– Wallis Test Results for Fourth- Grade Primary School Students with Respect to Their Mother's Educational Level*

	<b>Mother's Educational Level</b>	<b>n</b>	<b>Mean Rank</b>	<b><math>\chi^2</math></b>	<b>sd</b>	<b>p</b>	<b>Significant Difference</b>
1	Illiterate	150	521.48	43.346	4	.000	2 > 1
2	Primary school	326	630.50				3 > 1
3	Secondary school	259	634.76				4 > 1
4	High school	332	734.04				5 > 1
5	University	259	725.60				4 > 2
	Total	1326					5 > 2
							4 > 3

According to Table 5, there was a significant difference between the attitudes of the 4th grade primary school students toward the social studies course and the educational level of their mothers ( $\chi^2=43.346$ ;  $p<.05$ ). A significant difference was found between the attitudes of those students whose mother's educational level was primary school, secondary school, high school, or university, and the attitudes of those students whose mother's educational level was illiterate. Regarding the students' attitudes toward the social studies course, a significant difference was also found between the students whose mothers' educational level was university or high school and the students whose mother's educational level was primary school. In this case, it is seen that the difference is in favor of those whose mother's educational level is primary school, secondary school, high school, or university.



**Figure 2. Relationship between the Attitudes of 4th- Grade Primary School Students toward the Social Studies Course and Their Mother's Educational Level**

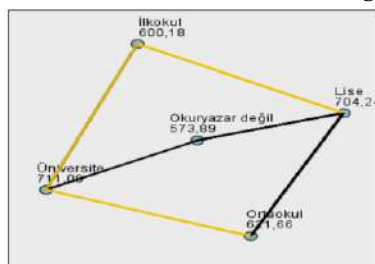
The data were tested using the Kruskal– Wallis test to determine the relationship between the attitudes of the 4th grade primary school students toward the social studies course and their father's educational level. The results are presented in Table 6.

**Table 6.**

*Kruskal– Wallis Test Results for Fourth- Grade Primary School Students with Respect to Their Father's Educational Level*

	<b>Father's Educational Level</b>	<b>n</b>	<b>Mean Rank</b>	$\chi^2$	<b>sd</b>	<b>p</b>	<b>Significant Difference</b>
1	Illiterate	67	573.89	23.925	4	.000	4 > 2
2	Primary school	241	600.18				5 > 2
3	Secondary school	276	621.66				5 > 3
4	High school	365	704.24				
5	University	377	711.09				
	Total	1326					

According to Table 6, there was a significant difference between the attitudes of the fourth- grade primary school students toward the social studies course and the educational level of their fathers ( $\chi^2=23.925$ ;  $p<.05$ ). Regarding the students' attitudes toward the social studies course, a significant difference was found between the students whose father's educational level was high school or university and those whose father's educational level was primary school, and between the students whose father's educational level was university and those whose father's educational level was secondary school. In this case, the difference is in favor of the fathers' educational levels being high school or university.



**Figure 3. Relationship between the Attitudes of 4th Grade Primary School Students toward the Social Studies Course and Their Father's Educational Level**

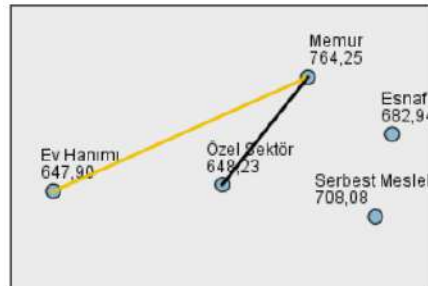
The data were analyzed using the Kruskal– Wallis test to determine the relationship between the attitudes of the 4th grade primary school students toward the social studies course and their mother's profession. The results are presented in Table 7.

**Table 7.**

*Kruskal– Wallis Test Results for Fourth- Grade Primary School Students with Respect to Their Mother's Profession*

	<b>Mother's Profession</b>	<b>n</b>	<b>Mean Rank</b>	$\chi^2$	<b>sd</b>	<b>p</b>	<b>Significant Difference</b>
1	Tradesperson/craftsperson	62	682.94	11.955	4	.018	3 > 2
2	Housewife	1004	647.90				
3	Public Officer	131	764.25				
4	Private Sector	75	648.23				
5	Self-employment	54	708.08				
	Total	1326					

Because of the data analysis, it was determined that there was a significant difference between the attitudes of the fourth- grade primary school students toward the social studies course and their mother's profession, as shown in Table 7 ( $\chi^2=11,955$ ;  $p<.05$ ). Regarding attitudes toward the social studies course, a significant difference was found between students whose mothers were public officers and those students whose mothers were housewives. This difference favored the students whose mothers were public officers.



**Figure 4. Relationship between the Attitudes of 4th Grade Primary School Students toward the Social Studies Course and Their Mother's Profession**

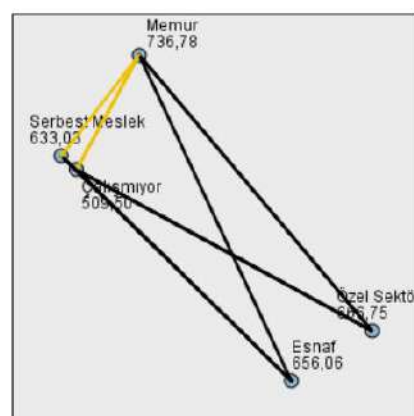
The data were analyzed using the Kruskal– Wallis test to determine the relationship between the attitudes of the 4th grade primary school students toward the social studies course and their father's profession. The results are presented in Table 8.

**Table 8.**

*Kruskal– Wallis Test Results for Fourth- Grade Primary School Students with Respect to Their Father's Profession*

	Father's Profession	n	Mean Rank	$\chi^2$	sd	p	Significant Difference
1	Unemployed	31	509.50	15.366	4	.004	3 > 1
2	Tradesperson/craftsperson	391	656.06				
3	Public Officer	217	736.78				
4	Private Sector	377	666.75				
5	Self-employment	310	633.03				
	Total	1326					

According to Table 8, there was a significant difference between the attitudes of the fourth- grade primary school students toward the social studies course and the profession of their fathers ( $\chi^2=15.366$ ;  $p<.05$ ). Regarding attitudes toward the social studies course, a significant difference was detected between students whose fathers worked as public officers and those whose fathers were unemployed or self-employed. This difference was in favor of students whose fathers worked as public officers.



**Figure 5. Relationship between the Attitudes of 4th Grade Primary School Students toward the Social Studies Course and Their Father's Profession**

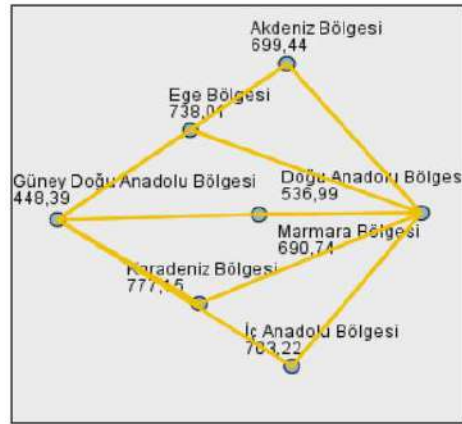
The Kruskal– Wallis test was used to determine the relationship between the data collected from 7 geographical regions of Turkey and the students' attitudes toward the social studies course. The results obtained are presented in Table 9.

**Table 9.**

*Kruskal– Wallis Test Results for Fourth- Grade Primary School Students with Respect to Their Geographic Region*

Geographic Region	n	Mean Rank	$\chi^2$	sd	p	Significant Difference
1 Marmara Region	181	690.74	84.772	6	.000	1 > 7, 2 > 7
2 Aegean Region	129	738.01				3 > 7, 4 > 7
3 Central Anatolia Region	341	703.22				5 > 7
4 The Mediterranean Region	316	699.44				1 > 6, 2 > 6
5 The Black Sea Region	85	777.15				3 > 6, 4 > 6
6 Eastern Anatolia Region	111	536.99				5 > 6
7 Southeastern Anatolia Region	163	448.39				
Total	1326					

There was a significant difference between the attitudes of the 4th grade primary school students toward the social studies course and their geographic region ( $\chi^2=84.772$ ;  $p<.05$ ). Regarding attitudes toward the social studies course, there was a significant difference between students living in the Marmara Aegean Central Anatolia Mediterranean, and Black Sea regions and those living in the Southeastern Anatolia region. At the same time, there was a significant difference, regarding attitudes toward social studies, between students living in the Marmara Aegean Central Anatolia Mediterranean, and Black Sea regions and those living in the Eastern Anatolia region. This difference favored the students living in the Marmara Aegean Central Anatolia Mediterranean, and Black Sea regions.



**Figure 6. Relationship between the Attitudes of 4th Grade Primary School Students toward the Social Studies Course and Their Geographic Region**

It was determined that the answers given to the Social Studies Course Attitude Scale by the 4th grade primary school students participating in the research did not show a normal distribution, and the data were tested using the non-parametric Chi-square ( $\chi^2$ ) test to determine the attitude level of the students. The related data are provided in Table 10.

**Table 10.**

*Chi-square ( $\chi^2$ ) Test Results for 4th Grade Primary School Students' Belief Levels in the Social Studies courses*

	n	sd	$\chi^2$	p
<b>Social Studies Course Belief Scale</b>	1326	29	1089.520	.000

When Table 10 is examined, it is seen that the belief levels of the 4th grade primary school students toward the social studies course are, based on the Social Studies Course Belief Scale, significantly high ( $\chi^2=1089.520$ ;  $p<.05$ ).

The Mann–Whitney U test results for the social studies course belief scale scores of male and female fourth grade primary school students are given in Table 11.

**Table 11.**

*Mann–Whitney U Test Results Show a Significant Difference Between the 4th Grade Primary School Students' Gender and Beliefs About the Social Studies Course*

Gender	n	Mean Rank	Sum of the Ranks	U	p
<b>Female</b>	694	694.85	482222.50	197550.500	.002
<b>Male</b>	632	629.08	397578.50		

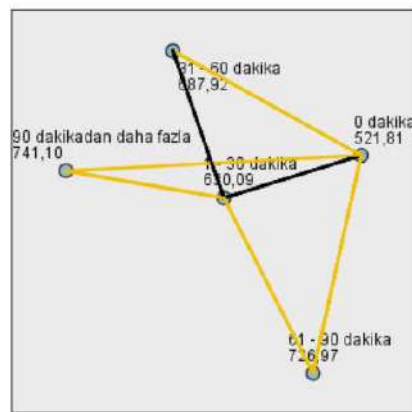
It was found that there was a significant difference between the beliefs of female and male students toward the social studies course ( $U=197550.500$ ,  $p<.05$ ). Considering the mean ranks, the female students' beliefs toward the social studies course are higher than those of the male students.

**Table 12.**

*Kruskal– Wallis Test Results for 4th Grade Primary School Students with Respect to the Amount of Time Spent Reading Books Per Day*

	Time spent reading per day	n	Mean Rank	$\chi^2$	sd	p	Significant Difference
1	0 min	75	521.81	25.980	4	.000	3 > 1
2	1-30 minutes	572	630.09				4 > 1
3	31-60 minutes	383	687.92				5 > 1
4	61–90 minutes	183	726.97				4 > 2
5	More than 90 min	113	741.10				5 > 2
	Total	1326					

Table 12 shows that there was a significant difference between the beliefs of the 4th grade primary school students toward the social studies course and the amount of time they spent reading books per day ( $\chi^2=25.980$ ;  $p<.05$ ). Regarding the beliefs about the social sciences course, a significant difference was found between those students who read books for 31–60 minutes, 61–90 minutes, and more than 90 min per day and those students who read books for 0 min per day, and between those students who read books for 61–90 minutes and more than 90 min per day and those students who read books for 1-30 minutes per day. The significant difference was in favor of students who read books for 31-60 minutes, 61–90 minutes, and more than 90 min per day.



**Figure 7. Relationship Between 4th Grade Primary School Students' amounts of Time Spent Reading Books Per Day and Their Beliefs About the Social Studies courses**

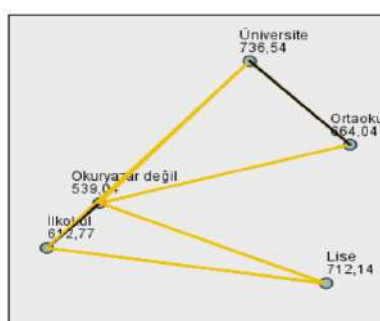
The educational level of the students' parents was determined using the Social Studies courses Belief Scale and the demographic information form. The researcher tested data obtained by using the Kruskal – Wallis test. The relationship between students' beliefs about the social studies course and their mother's or father's educational level is presented in Table 13 and Table 14.

Table 13.

*Kruskal– Wallis Test Results for Fourth- Grade Primary School Students with Respect to Their Mother's Educational Level*

	Mother's Educational Level	n	Mean Rank	$\chi^2$	sd	p	Significant Difference
1	Illiterate	150	539.04	36.533	4	.000	3 > 1
2	Primary school	326	612.77				4 > 1
3	Secondary school	259	664.04				5 > 1
4	High school	332	712.14				4 > 2
5	University	259	736.54				5 > 2
	Total	1326					

Table 13 shows that there was a significant difference between the students' beliefs about the social studies course and their mother's educational level ( $\chi^2=36.533$ ;  $p<.05$ ). A significant difference was found between the beliefs of those students whose mother's educational level was secondary school, high school, or university, and the beliefs of those students whose mother's educational level was illiterate. Simultaneously, a significant difference was found between the beliefs of those students whose mother's educational level was university or high school, regarding social studies, and the beliefs of those students whose mother's educational level was primary school. In this case, the difference is in favor of those students whose mothers' educational level is secondary school, high school, or university.



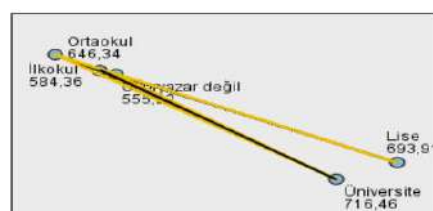
**Figure 8. Relationship Between the Beliefs of 4th Grade Primary School Students About the Social Studies Course and Their Mother's Educational Level**

Table 14.

*Kruskal– Wallis Test Results for Fourth- Grade Primary School Students with Respect to Their Father's Educational Level*

	Father's Educational Level	n	Mean Rank	$\chi^2$	sd	p	Significant Difference
1	Illiterate	67	555.22	25.849	4	.000	5 > 1
2	Primary school	241	584.36				4 > 2
3	Secondary school	276	646.34				5 > 2
4	High school	365	693.91				
5	University	377	716.46				
	Total	1326					

Table 14 shows that there was a significant difference between the students' beliefs about the social studies course and their father's educational level ( $\chi^2=25.849$ ;  $p<.05$ ). A significant difference was found between the beliefs of those students whose father's education level was high school or university, and the beliefs of those students whose father's educational level was illiterate or primary school. In this case, the difference is in favor of the fathers' educational levels being high school or university.



**Figure 9. Relationship Between the Beliefs of 4th Grade Primary School Students About the Social Studies Course and Their Father's Educational Level**

The Kruskal – Wallis test was applied to the profession of the students' parents as obtained through the Social Studies courses Belief Scale and the demographic information form. The relationship between students' beliefs about the social study course and their mother's or father's profession is presented in Table 15 and Table 16.

**Table 15.**

*Kruskal– Wallis Test Results for Fourth- Grade Primary School Students with Respect to Their Mother's Profession*

	<b>Mother's Profession</b>	<b>n</b>	<b>Mean Rank</b>	<b><math>\chi^2</math></b>	<b>sd</b>	<b>p</b>	<b>Significant Difference</b>
1	Tradesperson/craftsperson	62	740.91	7.155	4	.128	
2	Housewife	1004	651.97				
3	Public Officer	131	715.31				
4	Private Sector	75	631.07				
5	Self-employment	54	708.31				
	Total	1326					

According to Table 15, there was no significant difference between the beliefs of the 4th grade primary school students participating in the research toward the social studies course and their mother's profession ( $\chi^2=7.155$ ;  $p>.05$ ).

**Table 16.**

*Kruskal– Wallis Test Results for Fourth- Grade Primary School Students with Respect to Their Father's Profession*

	<b>Father's Profession</b>	<b>n</b>	<b>Mean Rank</b>	<b><math>\chi^2</math></b>	<b>sd</b>	<b>p</b>	<b>Significant Difference</b>
1	Unemployed	31	609.16	9.468	4	.050	
2	Tradesperson/craftsperson	391	654.90				
3	Public Officer	217	719.84				
4	Private Sector	377	677.45				
5	Self-employment	310	623.38				
	Total	1326					



According to Table 16, there was no significant difference between the beliefs of the 4th grade primary school students participating in the research toward the social studies course and their father's profession ( $\chi^2=9.468$ ;  $p=.05$ ).

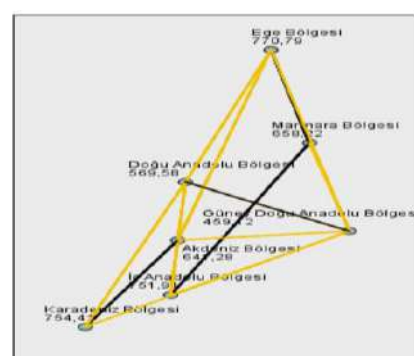
The Kruskal– Wallis test was used to determine the relationship between the data collected from 7 geographical regions of Turkey and the students' attitudes toward the social studies course. The results obtained are presented in Table 17.

**Table 17.**

*Kruskal– Wallis Test Results for Fourth- Grade Primary School Students with Respect to Their Geographic Region*

	Geographic Region	n	Mean Rank	$\chi^2$	sd	p	Significant Difference
1	Marmara Region	181	658.22	87.746	6	.000	1 > 7, 2 > 7
2	Aegean Region	129	770.79				3 > 7, 4 > 7
3	Central Anatolia Region	341	751.91				5 > 7
4	The Mediterranean Region	316	641.28				1 > 6
5	The Black Sea Region	85	754.41				3 > 6
6	Eastern Anatolia Region	111	569.58				5 > 6
7	Southeastern Anatolia Region	163	459.12				3 > 4
	Total	1326				2 > 4	

According to Table 17, there was a significant difference between the 4th grade primary school students' beliefs about the social studies course and the geographical region in which they lived in ( $\chi^2=87.746$ ;  $p<.05$ ). Regarding attitudes toward the social studies course, there was a significant difference between students living in the Marmara Aegean Central Anatolia Mediterranean, and Black Sea regions and those living in the Southeastern Anatolia region. At the same time, it was determined that there was a significant difference between the attitudes of the students living in the Marmara Central Anatolia, and Black Sea regions toward the social studies course and the attitudes of the students living in the Eastern Anatolia region, and between the beliefs of students living in the Aegean and Central Anatolia regions and the students living in the Mediterranean region toward the social studies course. This difference favored the students living in the Marmara , Aegean, Central Anatolia, and Black Sea regions.



**Figure 10.** Relationship between the Beliefs of 4th Grade Primary School Students Toward the Social Studies Course and Their Geographic Region

The relationship between the attitudes and beliefs of fourth- grade primary school students was determined by performing the Spearman– Brown test with the data obtained from the social studies course attitude scale and social studies course belief scale.

**Table 18.**

*Spearman Brown Test Results for the Relationship Between Attitudes and Beliefs of 4th Grade Primary School Students About the Social Studies Course*

		<b>Attitude</b>	<b>Belief</b>
<b>Attitude</b>	Correlation Coefficient	1.000	.443**
	Sig. (2-tailed)	.	.000
	N	1326	1326
<b>Belief</b>	Correlation Coefficient	.443**	1.000
	Sig. (2-tailed)	.000	.
	N	1326	1326

According to Table 18, there was a moderately positive and significant relationship between the attitudes and beliefs of the 4th grade primary school students toward the social studies course ( $r=.443$ ;  $p<.01$ ). This means that as the attitude level of the fourth- grade primary school students increases, their belief levels also increase.

## RESULTS and DISCUSSION

The social studies course plays a critical role in preparing students for social life. It is of great importance to provide students with basic knowledge and skills so that they can become good citizens. However, many factors need to be considered to ensure that this course can be delivered effectively and that the students can be raised as individuals who possess the intended characteristics. These factors also include students' attitudes and belief levels toward the social studies course. Students' attitudes and beliefs toward the social studies course may affect the content and teaching style of this course. A different teaching method may need to be considered for this course depending on whether the level of students' attitudes and beliefs about the course are high, medium, or low. Students' attitudes and belief levels toward social studies may also affect their learning process. Therefore, determining students' attitudes and belief levels toward social studies is essential in planning and conducting teaching activities. Understanding how students perceive and view the course can give teachers the opportunity to develop a better teaching strategy. This information can positively impact course content, preparatory work, teaching methods, material selection, and measurement-evaluation processes. As a result, students' attitudes and belief levels toward social studies are important factors that need to be considered to ensure effective delivery of the social studies course. For this purpose, the attitudes and beliefs of fourth- grade primary school students toward the social studies course in terms of

some variables were examined, and the relationship between the attitudes and beliefs of fourth- grade primary school students toward the social studies course was identified.

According to the results obtained from the Social Studies Course Attitude scales, the 4th grade primary school students' attitudes toward the social studies course were significantly high. A review of the literature shows that the results of this research are parallel to the results of previously published research in that the attitudes of 4th and 5th grade primary school students towards the social studies course are positively high (Tay and Akyürek Tay, 2006), students exhibit positive attitudes towards the social studies course (Ergin, 2006; Akın, 2014; Aktepe, Tahiroğlu, and Sargın, 2014; Özkal, Güngör and Çetingöz, 2004), and in secondary school, 6th and 7th grade students' attitudes toward the social studies course are at a medium level (Oğur, 2009; Şimşek and Demir, 2012), and overall they have a positive attitude toward the social studies course (Kayalı, 2003; Oğur, 2009; Şimşek and Demir, 2012).

Upon review of the relationship between the attitudes of fourth- grade primary school students toward the social studies course and their gender, it was found that there was a significant difference between them and that the attitudes of female students toward the social studies course were higher than those of male students. While the results of the studies carried out by Altıntaş (2005), zkan, Güngör and Çetingöz (2004), and Tay and Akyürek Tay (2006) showing that there was a significant relationship between student attitudes towards the social studies course and their gender and that this relationship favored female students support the results of this research, other authors, including Akın (2014), Coşkun (2011), Demir (2010), Ergin (2006), Oğur (2009), Öztürk (1999), Sidekli (2010), Meral (2013), (Yılmaz and Demir, 2014), concluded that there were no significant differences between the genders of students regarding the student attitudes. In a study conducted on gifted or specially talented students, Uzun (2006) determined that male students had more positive attitudes than female students.

It was noted that there was a significant difference between the attitudes of fourth- grade primary school students toward the social studies course and the amount of time they spent reading books per day. It was determined that the students who read books for 31–60 minutes, 61–90 minutes, and more than 90 min per day had higher attitudes compared with those students who read books for 1-30 minutes per day. No study could be found in the literature that examined students' attitudes toward the social studies course compared to how much time they spent reading books per day.

To determine the relationship between the educational levels of the students' families and their attitudes toward the social studies course, the mothers' and fathers' educational levels were evaluated on an individual basis. Upon review of the educational level of students' mothers, it was noted that there was a significant difference between the students' attitudes toward the social studies course and their mother's educational level. This difference was in favor of those students whose mother's educational level was primary

school, secondary school, high school, or university, and it was determined that as the mother's education level increased, the attitudes of the students also increased. A significant difference was also detected upon review of the relationship between the attitudes of fourth-grade primary school students toward the social studies course and their father's educational level. It was highly value that the attitudes of students whose fathers are high school or university graduates are higher than those of students whose fathers are primary or secondary school graduates.

While Demir (2010) found a significant relationship between the mother's educational level and the student's attitude toward the social studies course, the other study could not find a significant relationship between the father's educational level and attitude. Oğur (2009) stated that both mother and father's educational levels had a significant effect on students' attitudes toward the social studies course. Accordingly, the parents of the students who demonstrated the highest attitude on average toward the social studies course were university graduates. Similarly, according to Coşkun (2011), students whose mothers and fathers had higher education also had higher cognitive attitudes and social skills regarding the social studies course compared with those students whose mothers and fathers had lower education. Meral (2013), on the other hand, concluded that the increase in the educational level of the students' fathers had an impact on the students' opinions and that it positively affected the opinions of students, especially those students whose fathers were university graduates, about the social studies course. However, there was no relationship between the educational level of the mother and the student's attitudes. Although there are certain studies (Ergin, 2006; Yılmaz and Demir, 2014) that did not find, unlike the results of this research, a significant relationship between students' attitudes toward the social studies course and the educational level of their parents, those studies also. concluded that a relative increase was observed in the students' attitudes as the education level of the students' parents increased.

To determine the relationship between the parents' professions and the students' attitudes toward the social studies course, the mothers' and fathers' professions were evaluated on an individual basis. Regarding attitudes toward the social studies course, a significant difference was found between students whose mothers were public officers and those students whose mothers were housewives. This difference favored the students whose mothers were public officers. When the relationship between the attitudes of the fourth-grade primary school students toward the social studies course and their father's profession was examined, a significant difference was detected, regarding attitudes toward the social studies course, between those students whose fathers worked as public officers and those students whose fathers were unemployed or self-employed. This difference favored the students whose fathers worked as public officers. Contrary to this research, Meral (2013) found that there was no significant difference between the attitudes of the students and the professions of their mothers and fathers. Similarly, Coşkun (2011) determined that the students' attitudes toward the social studies course did not differ depending on their

mother's profession, whereas the students' attitudes toward the social studies course differed depending on their father's profession. The conclusion that the attitudes of students whose fathers were public officers were higher than those of students whose fathers were in other professions is parallel to the results of this research in terms of the effect of father's profession on attitudes.

With the data collected across the 7 geographical regions of Turkey, it was examined whether the attitudes of the students changed depending on the geographical region in which they lived. A significant difference was found between geographic regions in terms of students' attitudes toward the social studies course. It was concluded that this difference was in favor of those students living in the Marmara, Aegean, Central Anatolia, Mediterranean, and Black Sea regions, and that the attitudes of students living in the Southeastern Anatolia and Eastern Anatolia regions were lower than those living in other regions. No research could be found in the literature that attempted to determine the relationship between geographic regions and students' attitudes toward the social studies course. However, Tay and Akyürek Tay (2006) found that, regarding the relationship between the place of residence of students and their attitudes, the attitudes of those students residing in city centers were higher than those residing in rural areas. When the results of the region or area of settlement where the students live are examined, it can be concluded that the students living in more developed regions/areas of settlement demonstrate a higher level of attitudes.

According to the results obtained from the Social Studies Lesson Belief Scale, the fourth- grade primary school students' belief levels toward the social studies course were significantly high. In the literature, no study could be found that measured students' belief levels about the social studies courses with respect to different variables.

It was found that there was a significant difference between the beliefs of fourth- grade female students and male students toward the social studies course. It was noted that the female students' beliefs toward the social studies courses were higher than those of the male students. Similar results were also noted with respect to the students' attitude levels toward the social studies course.

It was concluded that there was a significant difference between the 4th grade primary school students' beliefs about the social studies course and the amount of time they spent reading books per day, and that this difference favored the students who read books for 31-60 minutes, 61-90 minutes, and more than 90 min per day. Similar results were obtained in terms of the attitude levels of the students and the amount of time they spent reading books per day. Based on these results, it can be said that as the amount of time spent by students reading books per day increases, the students' attitudes and beliefs toward the social studies course also increase.

Upon review of the relationship between the education level of families and students' beliefs about the social studies course, it was concluded that there was a significant

difference between both the mother's educational level and the father's educational level and the students' beliefs about the social studies course, based on the data obtained from the students participating in the research. It was determined that this significant difference was in favor of those students whose mothers were secondary school, high school, and university graduates, and that the belief levels of these students were higher than those of the others.

When the relationship between parents' professions and students' beliefs about the social studies course was examined with respect to mother's and father's professions individually, no significant difference was found.

It has been determined that there is a significant difference between the geographical region in which the fourth- grade primary school students lived and their beliefs about the social studies course. This difference was in favor of those students living in the Marmara, Aegean, Central Anatolia, and Black Sea regions, and the attitudes of the students living in these regions were higher than those in other regions.

In this study, when the data obtained from the Social Studies Lesson Attitude Scale and the Social Studies Lesson Belief Scale applied to 4th grade primary school students were compared, a moderately positive and significant relationship was found between the attitudes and beliefs of 4th grade primary school students toward the social studies course. Therefore, it can be thought that as the level of attitude of fourth- grade primary school students toward the social studies course increases, their belief levels also increase. This situation indicates a notable relationship between the attitudes and beliefs of fourth- grade primary school students toward the social studies course. In particular, this moderately positive relationship shows that students perceive the course, how much they value it, and how much they believe in it influence each other. As students evaluate the course more positively, this indicates that their beliefs about the course also increase. This situation can positively affect students' motivation and achievements. Therefore, teachers and educators, while working on improving students' attitudes toward the social studies course, can also contribute to students' success by focusing on their positive beliefs about this course. Although there is no study to determine the relationship between attitudes and beliefs of primary school students toward the social studies course when examining the literature, studies that reveal a positive and significant relationship between students' attitudes and beliefs/epistemological beliefs/self-efficacy beliefs toward different courses (mathematics, English, science lesson, etc.) (Ocak & Erbasan, 2017; Sevimbay, 2016; Yilmaz, 2011) also support this result.

## RECOMONDATIONS

Based on the conclusion that male students' attitudes and belief levels toward the social studies course are lower than those of female students, students' attitudes and belief levels about the course can be determined at the beginning of each year. Afterwards,

activities can be scheduled that will especially appeal to students who demonstrate low attitudes and beliefs and can increase their interest in the course.

Since those students who spend more time reading books per day have higher attitudes and beliefs about the social studies course, more time can be allocated to reading activities in the social studies courses. Books with social content can be read during classes.

The parents of students with a lower educational level can be given awareness training and engaged in the education process, depending on their professional status. This may help improve the attitudes and beliefs of the students' parents, which will in turn be reflected on the students' levels.

Based on the result that the students living in the South-Eastern Anatolia and Eastern Anatolia regions have lower attitudes and beliefs compared with the students in other regions, the curriculum can be revised according to the characteristics of the regions, students' environmental conditions, and interests. In particular, learning outcomes can be modified to better suit the characteristics of the regions.

The moderately significant and positive relationship found between the attitudes and beliefs of 4th grade primary school students toward the social studies course indicates that as students develop a positive attitude toward the course, their beliefs about the course also increase. This situation can positively impact students' motivation and achievements. Therefore, teachers and educators, while conducting efforts to enhance students' attitudes toward the social studies course, can also contribute to students' success by focusing on their positive beliefs about this course.

The Social Studies course content should be associated with current events to help students understand the current events occurring in society. This can increase students' interest in social studies and make them more informed citizens.

Organizing field trips for the social studies course can enable students to experience and see the subjects related to the course in a more tangible manner. Trips can be made to historical and cultural places or may also involve visits to local governments.

Relating lessons to daily life can help students understand the course content more easily. Students are presented with examples of how they can apply the new information in real life, and they are encouraged to make connections.

This study examined the relationship between attitudes and beliefs. In subsequent studies, the reasons and effects of this result can be investigated in more detail. It is important to understand how students' beliefs and attitudes are shaped to contemplate the reasons behind this result. In addition, it may be recommended to explore how this relationship contributes to students' improved performance or increased interest in their social study courses. Such research can assist educators in understanding students' attitudes and beliefs and teaching their classes more effectively. Furthermore, delving deeper into such relationships can be valuable in the development of educational policies and the design

of educational programs to make the educational process more effective and encourage students to approach their courses more positively. Metin girmek için burayı tıktatın.

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## Data Availability Declaration

### Data Availability Upon Formal Request:

While the primary datasets utilized in this study are not publicly accessible due to certain constraints, they are available to researchers upon a formal request. The authors have emphasized maintaining the integrity of the data and its analytical rigor. To access the datasets or seek further clarifications, kindly reach out to the corresponding author. Our aim is to foster collaborative academic efforts while upholding the highest standards of research integrity.

## Author Contributions

Betül Akyürek Tay and Nazire Çiçek contributed equally to this work. They collaboratively handled the conceptualization, methodology design, data acquisition, and analysis. Each author played a significant role in drafting and revising the manuscript, ensuring its intellectual depth and coherence. All authors have thoroughly reviewed, provided critical feedback, and approved the final version of the manuscript. They jointly take responsibility for the accuracy and integrity of the research.

### *Author(s)' statements on ethics and conflict of interest*

**Ethics statement:** We hereby declare that research/publication ethics and citing principles have been considered in all the stages of the study. We take full responsibility for the content of the paper in case of dispute.

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## Facing Forward: Obstacles and Related Implications for Kindergarten Teachers' Professional Development

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### Abstract:

*In line with the new trend toward reforming the education system in the 21st century, teachers are more willing to accept changes to improve performance and achieve success in the educational process. Early Childhood Education (ECE) in Saudi Arabia has recently witnessed a huge revolution. Teacher Professional Development (PD) is one of the most influential elements in achieving quality education. The present study focuses on revealing the professional development program (PDP) obstacles faced by kindergarten teachers from their perspectives, as well as their implications for overcoming these obstacles. Based on the model of PDPs developed in this research, it is divided into three main elements: administrative, personal, and digital. The current investigation adopted an exploratory approach, where a total of (n=102) kindergarten teachers in the city of Mecca, Saudi Arabia, participated in this study by filling out a self-administered questionnaire. The results showed that all kindergarten teachers admitted that they faced several obstacles in their professional practices, which hindered the quality of their practices. Most kindergarten teachers reported a lack of motivation and inadequate training opportunities, which influenced their reluctance to participate in PDPs. However, they revealed their positive attitudes and willingness to implement various strategies and practices that contribute to their own PD. It recommends that decision makers and government agencies consider the needs and capabilities of kindergarten teachers during training and involve them in the professional planning and development process to ensure that the training outputs are more effective in their professional practice.*

### Keywords:

Administrative, digital obstacles, children, implications, kindergarten teachers, training program.

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## INTRODUCTION

The Ministry of Education in Saudi Arabia has been interested in diversifying education programs not only in public and private educational sectors but also in universities, including practical and applied education. The Ministry has also paid attention to ongoing practical training to increase the efficiency of teachers and develop their expertise and skills in the field of ECE (Allehyani & Alfayez, 2022). However, implementing many educational activities requires early childhood (EC) teachers to acquire many skills that may be considered complex in the area of the use of technology and digital resources (Al Shanawani, 2023). Indeed, EC teachers are considered the basis for the success of the educational process; thus, attention must be paid to their development and professional training. This can be achieved by identifying the main aspects of teachers' professional needs by a group of specialists in the field of teacher development and training.

Professionalism requires teachers to follow through with professional development in accordance with changes in science and technology and community needs to achieve quality in human resources and work requirements locally and internationally (Utami & Latiana, 2018). Castle (2009) defined professionalism as a lifelong process that includes the promotion of knowledge and skills, moral responsibilities toward children, and social relationships with children's parents and caregivers, colleagues, and the community. Hervie and Winful (2018) define professional development as a set of processes designed for improving the professional knowledge, skill development, and positive behavior of teachers so that they can consequently lead to improved student learning. These definitions are limited to a few aspects of PD. Accordingly, this study introduces a broader understanding of PD in education. The model of PDPs developed in this research is not only related to teachers' personal and digital skills but also includes the administrative skills associated with PD in general, interwoven with ongoing successful teaching performance. Teachers may encounter several obstacles related to these skills, which this investigation explores further.

Professional Development Programs (PDPs) are part of the ongoing process toward achieving institutional excellence that aims to raise teacher competency and student achievement. PDP activities are critically associated with improving children's learning outcomes (Switbert, 2013; Sywelem & Witte, 2013; Guskey & Sparks, 2002). PDPs take many forms, including workshops, seminars, conferences, summits, and courses (Kuranchie, 2019). Kizilbash (2016) asserts that PDPs seek to change teachers' teaching practices, attitudes, and beliefs, which is reflected positively in improving students' learning outcomes. Clarke et al. (2021) confirmed that EC teachers' learning and PD are important factors in the development of education that provides quality EC Education (ECE). This requires well-organized continuous training and preparation teaching programs. Sustainable Professional Development (SPD) is a set of processes describing learning and practices that support teachers' professional development. Meade et al. (2012) highlighted



the need for ECE centers' ongoing investment in teachers by providing more professional development opportunities to support their unqualified employees in understanding and applying appropriate. Accordingly, the roles and responsibilities of teachers have undergone a massive transformation with social, scientific, economic, and technological changes (Griffin et al., 2012), which have an enormous influence on the system of education (Dolton et al., 2018; Metzler & Woessmann, 2012). Teachers' in-service training programs may not adequately sustain their professional development. Tuncel and Çobanoğlu (2018) asserted that professional development environments must consider the needs of each trainee before planning development programs. They also noted that government-organized in-service training programs should not focus on improving teachers' existing knowledge but should be more generally concerned with how teachers are trained in what they need to know. Furthermore, giving more attention to teachers' training needs affects their positive attitudes toward improvement.

To the best of our knowledge, this research is the first to respond directly to professional development concerns by investigating the unique obstacles associated with PDPs in kindergarten teachers' practices in Saudi Arabia. This research also intends to reveal teachers' perspectives on better strategies and practices to overcome these obstacles. The research questions guiding this investigation were:

1. What are the administrative obstacles that teachers face in PD?
2. What are the digital obstacles that teachers face in PD?
3. What are the personal obstacles faced by teachers?
4. What are the PD strategies and practices to overcome the obstacles from the kindergarten teachers' perspectives?

#### Kindergarten Teachers in the Saudi Context

Kindergarten education is a part of ECE in Saudi Arabia. The kindergarten stage serves children aged 3–6 years. According to Allehayni (2016), attendance is compulsory for children in all three stages of learning, which are divided into KG1, KG2, and KG3 as follows:

KG 1: accepts children who are at the age of three years

KG2: accepts children who have reached the age of four years.

KG3: accepts older children between five and six years of age. The KG3 stage is designed to prepare kindergarteners with the required skills for elementary school by the following academic year. These skills include emergent literacy and numeracy. In all KG stages, a teacher's qualification must be no less than a bachelor's degree in Early Childhood Education (Allehyani, 2016). The average child– teacher ratio in each kindergarten classroom varies from 20 to 25 (Allehyani & Alfayez, 2022).

Recently, the ECE witnessed a historic transformation in educational policy, which includes the assigning stage where female kindergarten teachers are allowed to teach boys

in the first three grades in the Saudi educational system (Allehyani & Alfayez, 2022). One of the main Sustainable Development Goals (SDG) of the Ministry of Education in Saudi Arabia is to encourage continuing education and provide opportunities for all people, including educators' professional development (Ministry of Education, 2021). Saudi Vision 2030 intended to achieve a separate strategic objective in goal 5, "Gender equity" to increase women's participation in the areas of health, education, protection, and employment in line with the goals and objectives of the SDGs (General Authority for Statistics, 2018). One of the significant strategic goals is to empower women in education, and this involves preparing female teachers for their new duties. Furthermore, this influential step toward female teachers' empowerment in the educational sector has created new demands and challenges, which require enabling those teachers to fulfill further expectations (Allehyani & Alfayez, 2022).

Saudi Arabia's Vision 2030 encourages Saudi higher education institutions to provide development opportunities for learners and trainers to enrich their skills and knowledge in local and international platforms with the intention of raising the quality of education (Alshuwaikhat & Mohammed, 2017). To achieve Saudi Vision 2030 of sustainable development in education, the Ministry of Education began to make a sustained effort to develop educational policies that are more open toward achieving cultural diversity and equity in education (Allehyani, 2022a, Allehyani, 2022b). This included the development of curricula at all educational levels and the infrastructure of institutions, including modern learning resources and teachers' preparation programs (Allehyani, 2022a; Allehyani & Alfayez, 2022; Singh et al., 2022). In addition, the EC curriculum framework in Saudi Arabia ensures that all teachers have adequate training and in-depth knowledge to deliver high-quality education to support young children in achieving their appropriate development (Ministry of Education, 2018). The process of transforming the ECE system in Saudi Arabia focused on providing high-quality services, building more school buildings, providing adequate school furniture for students and teachers, strengthening partnerships with relevant private sectors, and engaging all stakeholders in teacher education and training to lead to better learning outcomes (Ministry of Education, 2022, Allehyani, 2023). Despite these efforts, some kindergarten teachers still have not received adequate training and have limited knowledge and skills in teaching young children (Allehyani & Alfayez, 2022). This significant result can be used as an impetus for further investigation in the field of professional development of kindergarten teachers.

### EC Teachers' Professional Development

With the technological revolution in education, professional demands and responsibilities have increased on the shoulders of female teachers to increase their competencies and skills in education. With radical shifts in social and cultural dynamics, teachers' professional development has become crucial for them to perform better and meet

new requirements (Krecic & Grmek, 2008). A qualified teacher must identify, organize, and adapt resources in different contexts and take advantage of technological advances in providing appropriate learning opportunities for learners (Abuhmaid, 2020; Ramírez-Montoya et al., 2021; Vivas Urías, 2016). Professional development is a major factor affecting teachers' careers by improving their skills and motivating them to develop their practice and orientation (Sharma, 2018). The study by Ackah-Jnr (2020) revealed that female teachers considered lack of motivation as one of the main challenges in moving forward to active participation in professional development. PDPs require teachers to employ several active learning strategies in classrooms (Ramírez-Montoya et al., 2021). Prior studies have noted that novice teachers did not get enough opportunity to reflect on their efforts during teaching practice due to the short duration of the training program, which ranges from 12 weeks only (Noor, 2019). These significant findings reflect the fact that teachers' curriculum training is more theoretical and places little emphasis on teaching practice. The results of a previous study by Ntumi (2016) revealed that most of the preschool teachers surveyed are responsible in their school, but they do not organize frequent in-service training for teachers in new directions in the EC curriculum. In addition, those teachers indicated that additional barriers they encounter influence the successful implementation of the curriculum, including lack of teaching materials, lack of parental involvement, and insufficient knowledge of the EC curriculum (Ntumi, 2016).

### Model of PDPs

Based on the developed model of PDPs in this study, teachers must explicitly achieve multiple requirements related to enhancing administrative, personal, and digital skills. According to the model of PDPs, the administrative aspect in educational institutions requires adopting positive organizational behavior to enhance and embrace teachers by creating an appropriate environment that aims to sustain and improve the organization (Cartwright & Cooper, 2014; Demir, 2015). For educational institutions, Tindowen (2019) identified teachers' organizational behavior, which consists of five main dimensions: organizational commitment, professional commitment, job engagement, organizational citizenship behavior, and supervisory support. Teachers who have a high ability to perform effectively and efficiently in schools demonstrate more significant organizational commitment and an ability to perform discretionary activities beyond formal activities, in addition to a sense of commitment and passion toward the teaching profession and a desire to participate in their work with a high tendency to establish a harmonious relationship with supervisors and department heads (Tindowen, 2019). These general administrative elements are complemented by other elements such as offering adequate opportunities for teachers to select the proper PDPs that meet their training needs, kindergarten administrators' awareness of requirements to update PDPs, and the quality of PDPs regarding content, qualified trainers, and the ratio of trainers to trainees.

Obstacles in meeting administrative requirements may cause teachers to be left behind in following up on PDPs, which this study explores further. Eroglu and Kaya (2021) revealed that teachers' negative attitudes toward professional development are due to several reasons, including inappropriate course content, ineffective instructors, course location or planning, the selection of inappropriate participants, and an insufficient number of suitable courses. Singha and Sikdar (2018) assert that the content of teacher training and PDPs should entail their knowledge of the subjects they teach, their understanding of implementing appropriate pedagogies, and their application of teaching techniques. Other significant barriers to teachers' professional development are financial problems, unsatisfactory evaluation of performance, and lack of PD opportunities (David & Bwisa, 2013; Eroğlu & Kaya, 2021; İzci & Eroğlu, 2016; Kaçan, 2004).

Additionally, inconvenient training course time for in-service teachers is the most significant barrier hindering their professional development activities (Ekşi, 2010; Eroglu & Kaya, 2021). Several scholars have identified further barriers, including the inefficacy of trainers, lack of time, selection of inappropriate participants, insufficient number of courses, and high workload (David & Bwisa, 2013; İzci & Eroğlu, 2016; Kaçan, 2004; Özen, 2004; Özoğlu, 2010; Topçuoğlu, 2015). A previous study by Can (2019) reported that teachers and administrators stated that there are several difficulties associated with PDPs, which include inadequate recruitment of teachers, uncertainty in understanding educational policies, permanent change in the education system, and teachers' lack of purpose and motivation. These administrative barriers may negatively affect teachers' performance and desire for PDPs.

The second element for achieving the model of PDPs for teachers is the personal aspect. Khandaker (2021) identified that teachers' personal development consists of factors such as self-knowledge, developing professional ideas, and gaining confidence, which are reflected in their professional positivity and thoughts, beliefs, and attitudes. However, the difference in knowledge among teachers is evident in the digital divide, which is associated with the generational gap. Accordingly, teachers from older generations often need more training to meet the challenges of the digital divide (Cabrera, 2020; Köttl et al., 2021). Despite this gap in digital needs, Prensky (2010) stated that the three generations studied (the silent generation, the baby boomers, and the millennials) demonstrated the need for digital training courses, such as online safety, and the need to structure this training content to suit the circumstances of each generation. This may cause a particular barrier for the older generation of teachers to get involved in PDPs if they have low self-esteem and are less motivated to participate.

Moreover, teachers should be motivated to acquire modern competences to keep pace with continuous change in the learning environment (Omotayo & Haliru, 2020). Musonda et al. (2020) argue that when teachers are well-trained through continued participation in PDPs, they are better able to apply active teaching and appropriate learning approaches with students, enabling them to contribute effectively to higher-order thinking tasks such

as analysis, synthesis, and evaluation (Mwila et al., 2022). Such programs deepen teachers' knowledge, fostering their skills and productivity (Barreto, 2020). In addition, it supports them to perform more efficiently and effectively than they would have had they not acquired new competencies (Anane & Kuranchie, 2022). Teachers should also take PDPs seriously and participate in all available programs, even if at their own expense, as it is a sure way to enhance their professional development (Anane & Kuranchie, 2022).

The third element of the PDP model is the digital aspect. With the boom and advancement in technology in education, teachers must introduce modern learning methods that require the acquisition of digital skills. In this vein, PDPs should target the development of teachers' digital competencies, whether implemented in early education or in other forms of primary schools, which positively impact raising appropriate levels of digital literacy for teachers (Rambousek et al., 2015). Educational administrators should encourage teachers to join online training platforms that provide an integrated system of teaching and learning courses to develop multiple digital skills (Ala-Mutka et al., 2008). Contemporary empirical research by Citriadin and Hakim (2021) revealed that teachers actively seek to solve difficult situations by going beyond their current professional level in terms of improving their digital competencies through participation in digital transformation. Most importantly, schools should be equipped with a variety of technological devices in addition to establishing training teams to design and implement digital learning tools so that teachers can use these devices to develop digital learning strategies and methods (Citrthiadin & Hakim, 2021). Furthermore, adequate training programs should be organized to develop teachers regularly, considering the content that would provide them with basic competencies (Allehyani, 2022a, & Anane & Kuranchie, 2022). Hence, continuing in-service professional development for teachers is often neglected in some education systems. This affects some teachers as they still do not have attitudes and beliefs about the importance of applying technology (Vennemann, 2017). Surprisingly, there appears to be no obvious reason for the distribution of teachers with different attitudes and beliefs about the usefulness of applying technology in educational contexts (Eickelmann & Vennemann, 2017). Hence, PDPs should be arranged with consideration of the teachers' needs and expectations to ensure it will be appropriate and beneficial for them to participate in the training programs.

## METHOD

### *Research Design*

This study adopts a descriptive analytical approach to examine a specific scientific phenomenon. To reach a logical explanation, this approach was used to investigate PDP obstacles, including administrative, digital, and personal, among kindergarten teachers in the city of Mecca in Saudi Arabia. Likewise, teachers' perspectives toward better strategies and practices to overcome obstacles to PDPs were investigated. The researcher developed

the instrument to answer the research questions and is related to the study design. A self-administered questionnaire was used as the main research tool for the current study. The selection of this instrument can be justified because it effectively measures teachers' behavior, attitudes, preferences, expectations, and intentions on relatively large topics at a lower cost and time consumption than other methods. Furthermore, it allows respondents to complete the survey themselves. According to Dalati and Marx Gómez (2018), the self-administered questionnaire is highly structured and contains closed-ended questions, and its very simple design allows respondents to provide their answers easily.

### *Participants*

The researchers received ethical approval from the Ethics Department before entering the research sites. After obtaining ethical approval, the researchers contacted the Early Childhood Department in Mecca to disseminate the questionnaire to teachers. The study sample was randomly selected and consisted of (n=102) female teachers from public kindergarten centers. These teachers were selected from different kindergarten classes, including KG1, KG2, and KG3, where children ranged between 4 and 6 years. The researchers obtained the participants' approval to participate in the recent research after ensuring that they understood the purpose of the investigation.

### *Research instrument and Data Collection*

The self-administered questionnaire was constructed using Microsoft Forms and distributed by the Department of Early Childhood official email and social networking sites such as WhatsApp. The self-administered questionnaire is divided into three main sections, including demographic information, obstacles, and ways to overcome them. The first section consists of two questions that highlight the demographic information of the participants, including their qualifications and teaching experience. The second section consists of three questions, including administrative, personal, and digital obstacles faced by kindergarten teachers in PD. Each element in each obstacle element consists of eight statements. The last section includes the teachers' strategies and practices to overcome these obstacles, which consists of 22 statements. The items contained questions and answer options, which involved a 5-point Likert scale (1 = strongly agree, 2 = agree, 3 = partially agree, 4 = disagree, 5 = strongly disagree). The set of statements asking teachers about agreements regarding the obstacles they face during their practice life includes five responses.

### *Statistical Analysis*

Data were analyzed using SPSS (v. 26). A descriptive analysis technique was applied to analyze the generated data. It uses frequencies and percentages to summarize the attributes of the data set in the questionnaire.

### *Ethical considerations*

Prior to conducting data collection, in the first stage, the questionnaire was subject to content and context examination by the experts of Ethics Committee to ensure that all elements were scientifically correct and relevant to the subject of the research. In the next stage, the final evaluation was conducted by two experts in the Higher Committee for Scientific Research Ethics. Their assessment and recommendation were taken into account in the final version of the questionnaire. After obtaining the final approval from the head of University Ethics Committee, the questionnaire was validated before the study, using an experimental group.

Ethical Review Board: [Umm Al-Qura University]

Date of Ethics Review Decision: [9.11.2022]

Ethics Assessment Document Issue Number: [17.11.2022]

## RESULTS

### *Demographic Information*

The demographic section of the questionnaire was divided into two questions: (i) qualification and (ii) teaching experience. These questions were analyzed using SPSS to study sample characteristics. The frequencies and percentages from the participants' demographic information were analyzed and are shown in Table 1. As shown in Table 1, more than half of kindergarten teachers (66, 64.7%) had a bachelor's degree. Almost half of those teachers (42, 41.2%) indicated that they had long teaching experiences, between 10 years and more, in teaching kindergarten.

**Table 1**

*Frequencies and percentages of the Demographic sample characteristic*

Variable	Categories	Frequency	Percent%
Qualification	Bachelor	66	64.7
	Higher diploma	15	14.7
	Master	21	20.6
	Total	102	100.0
Years of Experience	Less than 5 years	29	28.4
	6 to less than 10 years	31	30.4
	10 years and more	42	41.2
	Total	102	100.0

### *Internal Consistency Validity*

A correlation coefficient test was used to determine the degree of each item and the degree of the questionnaire. Note that all correlation coefficients had acceptable scores and were statistically significant (see Table 2 below).

**Table 2***Correlation coefficients between the degree of each item and the survey*

Administrative obstacles to PD		Digital obstacles		Personal constraints		Solutions to overcome obstacles			
N	Correlations	N	Correlations	N	Correlations	N	Correlations	N	Correlations
1	.700**	1	.816**	1	.763**	1	.730**	9	.777**
2	.728**	2	.796**	2	.788**	2	.771**	10	.710**
3	.734**	3	.748**	3	.730**	3	.768**	11	.800**
4	.757**	4	.802**	4	.689**	4	.769**	12	.746**
5	.774**	5	.815**	5	.853**	5	.755**	13	.730**
6	.801**	6	.729**	6	.753**	6	.833**	14	.750**
7	.672**	7	.799**	7	.798**	7	.735**	15	.769**
8	.642**	8	.813**	8	.807**	8	.801**		

Note. \*\* Statistically significant at the level of significance (0.01)

### Reliability Test

Reliability refers to the degree to which measures are free from error, thus yielding consistent results (i.e., consistency of procedure). If the scale consistently shows the same score for individuals or statements of equal values, the procedure is considered reliable. The reliability analysis applied the level of Cronbach's ( $\alpha$ ) as the criterion of internal consistency in the self-administered questionnaire, that is, how closely a set of items are related as a group. Cronbach's alpha is a reliability coefficient that measures inter-item reliability or the degrees of internal consistency/homogeneity between variables measuring one construct/concept (i.e., the degree) to which different items measuring the same variable attain consistent results. This analysis is necessary to study the scale features and internal consistency between the questionnaire items and their correlation. The analysis was performed by calculating Cronbach's alpha for independent variables. The Cronbach alpha equation ranged between ( $\alpha = 0.871 - 0.948$ ), and the reliability coefficient for the tool as a whole was ( $\alpha = 0.920$ ), which are statistically significant high values.

**Table 3***Person correlation coefficients of the sample's estimates of the dimension of administrative obstacles to PD*

Axis	No	Cronbach Alpha	Test-Retest
Administrative obstacles to PD	8	0.871	0.864
Digital obstacles	8	0.914	0.892
Personal constraints	8	0.903	0.889
Strategies and practices for addressing PD obstacles	15	0.948	0.901
Total	39	0.920	0.917

Table 3 shows that the internal consistency coefficients according to the Cronbach alpha equation ranged between ( $\alpha = 0.871 - 0.948$ ), and the reliability coefficient for the tool



as a whole was ( $\alpha = 0.920$ ), which are statistically significant high values. The data in Table (3) indicate that the internal consistency coefficients according to the Test– Retest equation ranged between ( $\geq 0.864 < 0.901$ ), and the reliability coefficient for the tool as a whole was ( $< 0.917$ ), which are statistically significant high values.

### *Instrument Validity*

Means (M) and standard deviations (SD) were assessed for each construct and related items, and items were then ranked in descending order according to the following scale: (Low 0 – 2.33, Moderate 2.34 – 3.67, and High 2.52 – 4).

**Table 4**

*Means and standard deviations of teachers' administrative obstacles*

NO	Statement	M	SD	Rank	Importance level
1	The limited opportunities available for teachers to choose PDPs based on their training needs.	4.43	0.72	1	High
7	Kindergarten administration's lack of interest in curricular activities and events.	4.31	0.74	2	High
8	Lack of response of the kindergarten administration to the teacher's suggestions.	4.29	0.82	3	High
5	Lack of awareness of those in charge of PDPs in kindergartens regarding monitoring the actual training needs of trainees.	4.24	0.91	4	High
4	There is a gap between the content of the PDPs provided to the trainees and the educational reality.	4.20	0.89	5	High
2	PDPs contents are repetitive and a lack of novelty.	4.13	0.71	6	High
3	A high trainee– trainer ratio, where each trainer is responsible for many trainees.	4.02	0.93	7	High
6	The majority of trainers in PDPs are not qualified.	4.02	0.95	8	High
Overall		4.20	0.61	-	High

Table 4 presents the means and standard deviations for administrative obstacles to PD items. The analyzes showed that kindergarten teachers had limited opportunities available for them to choose in PDPs based on their training needs with a high level of the mean value of ( $M=4.43$ ,  $SD=0.72$ ). Meanwhile, those teachers also stated that the training courses usually have a high trainee– trainer ratio, where each trainer is responsible for many trainees with a mean value of ( $M=4.02$ ,  $SD=0.93$ ). These results provide more insight into the inadequate administrative planning of PDPs, which should be considered to improve the future of education. Further analysis revealed that teachers reported a lack of awareness of those in charge of PDPs in kindergartens in monitoring the actual training needs of trainees, which had the mean value of ( $M=4.02$ ,  $SD=0.95$ ).

The mean value of the overall assessment of this variable was ( $M=4.20$ ,  $SD=0.61$ ), which had a high level of agreement in the study sample.

**Table 5***Means and standard deviations of teachers' digital obstacles*

NO	Statement	M	SD	Rank	Importance level
1	Lack of training intensity in digital courses.	4.32	0.96	1	High
6	Kindergarten administration's lack of interest in monitoring the training needs of teachers in the field of technology.	4.27	0.80	2	High
8	The kindergarten environment is not prepared to activate educational technologies.	4.27	0.94	2	High
4	Teachers prefer to use sensory teaching methods instead of modern technology.	4.23	0.85	4	High
5	Most teachers are not proficient in English, which is the primary language used in computer programs and applications.	4.23	0.90	4	High
3	Lack of knowledge of how to fix technical defects in devices when using them.	4.22	0.86	6	High
2	Lack of digital programs to train teachers in the use of educational techniques.	4.21	0.90	7	High
7	Kindergarten teachers' lack of attitudes and beliefs about the importance of the implementation of digital technologies in the classroom.	4.15	0.95	8	High
Overall		4.24	0.71	-	High

Based on Table 5, which presents the values of M and SD for digital obstacles items, it can be noticed that statement number 1: "A lack of the training intensity in digital courses provided for teachers" recorded the high-level mean value among the statements being rated by the study sample, thus was ranked first with a mean of ( $M=4.32$ ,  $SD=0.96$ ). Statement number 7: "The kindergarten teacher's lack of attitudes and beliefs toward the importance of the implementation of digital technologies in the classroom" was ranked last with a mean of ( $M=4.15$ ,  $SD=0.95$ ). The mean value of the overall assessment of this variable was ( $M=4.24$ ,  $SD=0.71$ ), which recorded a high level of agreement in the study sample.

**Table 6***Means and standard deviations of teachers' personal obstacles*

NO	Statement	M	SD	Rank	Importance level
6	The teachers focus more on obtaining a development program certificate than on raising their professional level in the field.	4.47	0.741	1	High
4	Effect of heavy workload on the health and work quality of teachers.	4.35	0.792	2	High
5	Low motivation toward innovation and creativity in developing performance.	4.30	0.842	3	High

8	Teachers believe that the more years of experience, the fewer PDPs are needed.	4.30	0.854	4	High
1	The teacher's job satisfaction level is low, which weakens his interest in personal development.	4.28	0.750	5	High
7	The teacher's lack of interest in exchanging professional experiences with her colleagues in kindergarten.	4.27	0.858	6	High
2	Impact of poor time management on teachers' job performances.	4.22	0.863	7	High
3	The teacher's unwillingness to attend PDPs.	4.09	0.935	8	High
Overall		4.29	0.64	-	High

As shown in Table 6, kindergarten teachers indicated several personal obstacles they encountered in their practical life. Most of those teachers stated that they focused only on obtaining a certificate of development programs without caring about raising their professional level, with a high-level mean of ( $M=4.47$ ,  $SD=0.741$ ). In contrast, few teachers declared that they were unwilling to attend PDPs, which ranked last with a mean of ( $M=4.09$ ,  $SD=0.935$ ). The mean value of the overall assessment of this variable was ( $M=4.29$ ,  $SD=0.64$ ), which showed a high level of agreement in the study sample. Table 7 presents the values of means and standard deviations for kindergarten teachers' strategies and practices to address obstacles they face during their professional careers.

**Table 7**

*Means and standard deviations of strategies and practices to overcome PD obstacles*

NO	Statement	M	SD	Rank	Importance level
7	Teachers should be highly motivated to continuously participate in field research and identify weaknesses to overcome	4.51	0.70	1	High
13	Activating partnerships with colleges of education and local and international training institutions.	4.49	0.74	2	High
15	Kindergarten principals should ensure that all teachers are able to master the required skills and share their training performance feedback with colleagues.	4.48	0.70	3	High
1	Reducing the teaching burden on teachers to give them opportunities to benefit from PDPs.	4.46	0.73	4	High
12	Attract qualified trainers to participate in the planning and implementation of PDPs.	4.46	0.74	4	High
3	Involve teachers in the process of designing, planning, and implementing PDPs.	4.45	0.80	6	High
8	Pay sufficient attention to improving the digital skills of teachers by enrolling them in various specialized courses.	4.44	0.78	7	High
11	Improving the physical environment in the kindergarten center to meet the PDPs' requirements.	4.44	0.75	7	High
10	Activating peer visits, discussion groups, and self-evaluation among teachers to enhance their practices.	4.41	0.71	9	High

14	Establish an online training platform for kindergarten teachers and provide them with various training courses, workshops, and seminars.	4.39	0.73	10	High
4	Establishing PD committees within each kindergarten center to activate PDPs.	4.38	0.84	11	High
2	Benefit from exchanging teaching experiences with leading global education institutions in developing PDPs.	4.37	0.82	12	High
6	Encouraging teachers to learn the English language by joining appropriate training courses.	4.35	0.80	13	High
9	Stimulating self-learning for teachers to achieve professional growth by taking advantage of learning resources in digital libraries.	4.35	0.73	13	High
5	Kindergarten principals should spread the culture of PD, increase teachers' motivation, and monitor their professional level.	4.31	0.86	15	High
Overall		4.42	0.58	-	High

The results in Table 7 show that most kindergarten teachers agreed that they should be highly motivated to continuously participate in field research to identify weaknesses and overcome them with a mean value of ( $M=4.51$ ,  $SD=0.70$ ). Moreover, the teachers agreed that more attention should be paid to the principle of activating partnerships with colleges of education and local and international training institutions with a mean value of ( $M=4.49$ ,  $SD=0.74$ ). While few kindergarten teachers stated that principals should spread the culture of PD, raise teachers' motivation, and monitor their professional level with a mean of ( $M=4.31$ ,  $SD=0.86$ ). The mean value of the overall assessment of this variable was ( $M=4.42$ ,  $SD=0.58$ ), which recorded a high level of agreement in the study sample.

## DISCUSSION

The present study was designed to determine the reality of integrating the developed model of PDPs for kindergarten teachers and the most relevant obstacles that they face during this stage. These obstacles incorporate personal, administrative, and digital training needs. This study also proposes several strategies and practices that contribute to the advancement of kindergarten teachers' PD. The importance of the current study reflects the fact that these results are unique and contribute significantly to enriching existing knowledge in the field of professional development for kindergartenteachers, not only in the Saudi context but also worldwide. Primarily, the current study showed that, according to kindergarten teachers, the obstacles to their professional performance could be attributed to the lack of appropriate training opportunities available to them. Several administrative obstacles occurred and faced those teachers during their PDPs in kindergarten. Most kindergarten teachers indicated that they have limited opportunities to choose appropriate courses in PDPs based on their training needs. This result reflects those of Tuncel and Çobanoğlu (2018), who found that professional development planning should pay attention

to and take into account teachers' needs to enhance their professionally active performance. Therefore, in-service training designed to meet the needs of trainees contributes to increasing the quality of the individual and the productivity of the institution.

Second, in the domain of digital obstacles, more than half of kindergarten teachers who participated in this research declared that they experienced a lack of training intensity in digital learning courses provided for teachers who are interested in employing computers in education. This finding broadly supports the work of other studies in this area linking teachers' digital training with their active and effective participation in digital transformation (Citriadin & Hakim, 2021; Omotayo & Haliru, 2020; Rambousek et al., 2015). Moreover, our literature review could identify research gaps that still need to be addressed in the field of professional development of kindergarten teachers. Among the most important of these gaps was with regard to patterns in the attitudes of teachers and beliefs about educational technology and its applications. The most important clinically relevant finding was that some kindergarten teachers in this study lacked attitudes and beliefs about the importance of the implementation of digital technologies in the classroom. This result is consistent with those of Eickelmann and Vennemann (2017), who found that some teachers still do not have positive attitudes and beliefs regarding the importance of applying technology and technology in their practices. A possible explanation for this may be that some teachers have expressed that they prefer to apply sensory teaching methods with kindergarten children more than digital methods, which may require effort and specific skills.

Lastly, regarding teachers' personal obstacles, most kindergarten teachers stated that they focus more on obtaining a development program certificate than on raising their professional level in the field. This is due to the heavy burden on teachers in obtaining training certificates to develop their teaching skills in various professional aspects, whether personal, digital, or administrative. Many teachers reported that heavy workload impacts their health and work quality. Fewer teachers indicated they were unwilling to attend PDPs. In accordance with the present results, previous studies have demonstrated that teachers found the high workload and lack of professional development opportunities to be unsatisfactory (Eroglu & Kaya, 2021). Teachers expressed dissatisfaction with the heavy workload and lack of quality professional development opportunities that fit into their schedules. The absence of compatibility between the number of teaching hours prescribed for teachers and the vocational training schedule may lead to their reluctance to join training programs, which negatively affects their performance. More importantly, many kindergarten teachers indicated that they should be highly motivated to continuously participate in field research and identify weaknesses to overcome. Moreover, many kindergarten teachers argued that it is important to activate partnerships with colleges of education and local and international training institutions. This finding is consistent with that of Ackah-Jnr (2020) and Sharma (2018), who found that female teachers faced a lack of motivation, which is considered one of the main challenges affecting them toward active

participation in professional development. Although motivation is internal and is represented in teachers' unwillingness to learn, it must be considered when planning PDPs to inspire teachers' minds and move their desire toward ongoing development.

Not surprisingly, the greatest obstacle to teachers' professional development is the large teaching burden, which hinders them from benefiting from PDP content. Interestingly, almost half of the teachers asserted that kindergarten principals should ensure that all teachers are able to master the required skills and share their training performance feedback with colleagues after attending PDPs. Moreover, the results of the current study drew attention to the need to improve the physical environment of kindergartens. Many kindergarten teachers expressed the need for sufficient attention to improve the digital skills of teachers by enrolling them in various specialized courses. The yields in this investigation were higher than those of other studies, such as Mwila et al. (2022), Omotayo & Haliru (2020), and Tuncel & Çobanoğlu (2018), who argued that it is crucial to equip an environment with a variety of training programs and learning resources that serve all teachers, regardless of their teaching experience, to build and enhance their teaching competencies and skills. Despite these challenges, most kindergarten teachers are aware of the new trend of implementing modern and innovative teaching strategies and accept the new demands associated with the contemporary transformation in ECE. This modern trend begins, as confirmed by the teachers in the results of the current study, by improving training from higher education institutions, encouraging scientific research in the field of childhood, and strengthening cooperation from EC centers so that preservice teachers are able to further develop their professional competencies.

## LIMITATIONS AND RECOMMENDATIONS

The results of the existing study contributed to clarifying the gap in the professional development of teachers in Saudi Arabia, which can be used in planning for the upgrading of preschool education. The fruitful results of this study contributed to discovering, analyzing, and addressing the challenges facing teachers by policymakers and educational leaders regarding the implementation of curricula in preschool education to overcome these challenges. This combination of findings provides some support for the conceptual premise of identifying the difficulty in determining teachers' needs, in addition to highlighting the deep gap in the lack of a collaborative culture between training agencies and teachers to know and meet their training needs. The researchers recommend that there should be a collaborative network between kindergarten centers and training agencies to develop policies within schools and determine appropriate training standards based on teachers' needs. In the same vein, there should be continuous monitoring of the professional development process in the organizations by the training agencies to identify deficiencies in meeting teachers' needs and address them by policymakers. In addition, the study recommends the necessity of evaluating the professional development opportunities

offered to teachers, which is critical in ensuring the continued achievement of teachers' goals toward growth in educational practices in EC learning. Undoubtedly, engaging teachers in high-quality PDPs is essential to maintaining and improving the quality of the profession and achieving and improving the SDGs in early education worldwide. The findings of our research have important implications for developing educational institutions, designing programs in training centers, and public and private institutions to follow up with the government and organize political initiatives with the aim of improving and developing the current reality of education. Government bodies, stakeholders, and policymakers in Saudi Arabia must work together with educators to improve the professional development sector.

Although the results of this study are conclusive, they are not without limitations. A limitation of the current study is related to the small sample size, which makes it difficult to generalize. Future research can apply increasing the sample size and collecting data from more respondents in contexts different from the Saudi context. In addition, although the analyses presented reveal some interesting results, methodological limitations and future research should be addressed and discussed. Using a mixed methodology that relies on the use of tools such as questionnaires and class observations can enhance future results.

## CONCLUSION

The current study developed and embraced a model of PDPs for kindergarten teachers at the national and international levels. It also reflects the strategic educational plans outlined in Saudi Arabia's Vision 2030, which supports the SDG in achieving quality education through empowering female teachers in ECE. As discussed earlier, empowering female teachers who are dominant in the ECE field in the Saudi context requires ongoing PD training. The results yielded from this investigation encourage decision-makers in educational policies to motivate and empower teachers toward developing their higher knowledge and skills, which enriches educational practices. The results of the current study can be used to draw attention to the need to encourage teachers to develop career paths and acquire appropriate qualifications to be well prepared for competition on the road toward achieving Vision 2030, which requires deep understanding and high skills to bridge the gaps between the reality of teachers in PD and their needs. From the results of the current research, it can be concluded that there are shortcomings in providing opportunities and activities for the professional development of teachers, especially those who have spoken in the current situation, and this has an impact on teachers' self-esteem and their motivation toward improving their work performance. Ultimately, successful PDPs require mutual collaboration and a shared vision between teachers and administrators toward career enhancement and achievement of goals.

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# Qualitative Analysis of the Relationship between Online Homework and Prior Success, Self-efficacy, Perceived Responsibility, Motivation and Academic Success

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## Abstract

This study aims to analyze the relationships between online homework and students' prior success, self-efficacy beliefs, perceived responsibility, motivation and academic success. In School of Foreign Languages at the University of Gaziantep, which is a Turkish public university, an online homework application has been used as a part of the program, in this study online homework has been studied in terms of its relationship with students' prior success, self-efficacy beliefs, perceived responsibility, motivation and academic success. In this study it was concluded that students' prior success is effective on their online homework performances, self-efficacy beliefs and perceived responsibility, in general students' online homework performances are effective on their self-efficacy beliefs, perceived responsibility, motivation and academic success in a positive way. Moreover, it was concluded that highly motivated students and the students with higher sense of responsibility are academically successful. As a result, it was suggested that analyzing online homework in different levels of education can enable researchers to learn more about the effects of online learning systems.


## Keywords:

Online homework, self-efficacy, perceived responsibility, motivation, academic success


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## INTRODUCTION

Homework is a learning practice applied in different ways at different levels of education. Cooper (1989) defined homework as tasks given to students outside school hours. The purpose of homework is to consolidate and support acquired new knowledge and skills (Saffkova,2015). As homework is widely used all over the world, homework practices have become a subject whose effects are frequently researched in learning-teaching processes. Homework has a positive effect on increasing academic success (Cooper, 1989; Hoeke, 2017). In addition, homework plays an important role in students' development of effective study habits. As a learning tool, homework can enable students to take responsibility and teach which behaviors lead to being a more productive learner (Bembenutty, 2011). With an increasing number of online education systems, traditional homework has begun to replace to online homework. Using online platforms for homework provides some benefits for students' academic success and cognitive development.

Technology creates tools that can be used to solve problems that arise in the field of education (Kirschner and Selinger, 2003). During the COVID-19 pandemic, students with different levels had to use online platforms in line with their educational goals. The issue of technology use in education, which sometimes appears as a necessity and sometimes as an obligation, is examined from various aspects and brings new applications to the agenda. According to Pascarella (2004), online homework offers instant feedback and multiple trial opportunities, and it is also easy to use because it can be easily accessed in different environments. In these aspects, online homework is more advantageous than traditional homework.

Students who use online homework in line with their educational goals should take responsibility for the learning process (Saffkova,2015). It is important to employ some cognitive processes so that the time students spend on homework contributes to their success. In this context, the concepts of self-efficacy, responsibility, and motivation appear to come to be at the forefront. Self-efficacy is one of the basic concepts of social cognitive theory. The concept of self-efficacy represents a person's personal judgments about their own abilities (Bandura,1997; Zimmerman and Kitsantas, 2005,2008). Students with high self-efficacy beliefs are more effective in using cognitive strategies, which is reflected in academic success (Schunk, 1991). Zimmerman and Kitsantas (2005) examined the effects of self-efficacy beliefs and perceived responsibility on academic success, and revealed that students' self-efficacy beliefs affected their perceived responsibility. According to Bandura (1997), students who act with high self-efficacy beliefs in their learning experiences see themselves as responsible for academic outcomes. Motivational processes (success expectations) and volitional processes (taking responsibility) significantly contribute to student performance (Corno, 1992). Thus, students' cognitive processes appear to be an important factor affecting their academic success and performance.



Zimmerman and Kitsantas (2005) examined the effects of students' homework on self-efficacy, perceived responsibility, and academic success. According to the results of the study, homework practices directly affect self-efficacy beliefs and perceived responsibility. Many studies have shown that online homework positively affects student success (Cooper et al., 2006; Shuman, 2015; Zimmerman and Kitsantas, 2005, 2008). In addition to academic success, analyzing the relationship of online homework with cognitive processes and prior success is important in terms of using these applications in the most efficient way. Integrative self-regulation and awareness can help people become competent in life, which is related to self-fulfillment (Ryan et al., 2006). In SDT (self-determination theory) happiness relates to good quality motivation, which results in successful functioning. According to Ryan and Deci (2015), self-determination theory (SDT) is a motivational theory of personality, development, and social processes related to motivation types that can predict learning and performance outcomes (Deci&Ryan,2015). According to SDT, motivated behaviour can help learners become autonomous because it emanates from integrated sense of self. In this study, learners' projection of their intended behaviours in learning has been highlighted concerning their self-efficacy beliefs, motivation levels, perceived responsibility, and academic success. Overall, students' self-efficacy beliefs, motivation levels, perceived responsibility are interrelated in line with self-regulation and self-determination which are effective on students' academic success.

During the COVID-19 pandemic that took effect in 2020-2021 and the earthquake disaster that affected the Southeastern Anatolia region of Turkey in 2023, students in higher education institutions continued their classes through online applications. During this period, online homework applications have become even more important, and the grading of students' projects and assignments has emerged as a necessity. While these situations once again reveal the importance of effective use of online applications, it is thought that analyzing online homework applications by considering different variables will also make valuable contributions to the development of students and shaping educational programs. Some studies reveal the effects of existing online homework programs in different levels of education. According to Dursun (2021), online homework has a positive effect on academic success in line with self-regulated learning in higher education. Similarly, Zelyüt (2017), Yıldırım et al. (2017) and İleri (2013) stated that online homework applications in higher education positively affect academic success. Overall, existing literature about the effects of online homework in higher education reveals the importance of becoming a self-regulated learner and using online applications effectively for academic success.

The scope of the research was to determine students' thoughts on the relationship between their first exam grades (prior success), online homework performances, self-efficacy beliefs, perceived responsibility, motivation levels, and final grades (academic success). For this purpose, the research problem statements created in line with the relevant literature are as follows:

### *Research Problems*

- Q1:** What are students' opinions about the effects of first grades on their self-efficacy beliefs, perceived responsibility, and online homework?
- Q2:** What are students' opinions about the effects of self-efficacy beliefs on perceived responsibility, motivation, and academic success?
- Q3:** What are students' opinions about the effects of online homework on their self-efficacy beliefs, perceived responsibility, motivation, and academic success?
- Q4:** What are students' opinions about the effects of perceived responsibility on academic success?
- Q5:** What are students' opinions about the effects of motivation on academic success?

## METHOD

### *Research Model*

This study is qualitative research to analyze the effects of online homework and the relationships among online homework and prior success, self-efficacy beliefs, perceived responsibility, motivation, and academic success variables according to student opinions.

### *Participants*

Within the scope of the study, 20 students, 9 females and 11 males, were selected from the students studying in the School of Foreign Languages by using the incidental sampling technique, one of the purposeful sampling methods, and interviews were planned with these students. Information about the students who voluntarily participated in the research is given in the table below.

Table 1. Participant Information

<b>Participant</b>	<b>Faculty</b>	<b>Department</b>	<b>Module</b>	<b>Gender</b>
<b>S1</b>	College of Liberal Arts and Sciences	Sociology	B1+	Female
<b>S2</b>	Engineering Faculty	Textile Engineering	B2	Female
<b>S3</b>	Engineering Faculty	Electrical and Electronic Engineering	B1	Male
<b>S4</b>	Faculty of Medicine	Medicine	B1+	Male
<b>S5</b>	Engineering Faculty	Mechanical Engineering	B2	Male
<b>S6</b>	Engineering Faculty	Industrial Engineering	B2	Female
<b>S7</b>	Education Faculty	English Language Teaching	B2	Male
<b>S8</b>	Business and Administration	Business	A2	Male
<b>S9</b>	Architecture Faculty	Urban and Regional Planning	A2	Female
<b>S10</b>	Engineering Faculty	Mechanical Engineering	A2	Male
<b>S11</b>	Engineering Faculty	Electrical and Electronic Engineering	A2	Male
<b>S12</b>	Engineering Faculty	Civil Engineering	A2	Female
<b>S13</b>	Engineering Faculty	Industrial Engineering	B2	Female
<b>S14</b>	Engineering Faculty	Mechanical Engineering	A2	Male
<b>S15</b>	College of Liberal Arts and Sciences	Sociology	B1+	Male
<b>S16</b>	Faculty of Medicine	Medicine	B1+	Female
<b>S17</b>	Engineering Faculty	Mechanical Engineering	B1+	Male
<b>S18</b>	Engineering Faculty	Food Engineering	B1+	Female
<b>S19</b>	Engineering Faculty	Textile Engineering	B1	Female
<b>S20</b>	Engineering Faculty	Mechanical Engineering	B1	Male

As seen in the table above, the interviews planned to obtain the data were conducted with 20 students, 13 from the faculty of engineering, 2 from the faculty of medicine, 2 from the faculty of liberal arts and sciences, 1 from the faculty of architecture, 1 from the faculty of business and administration, and 1 from the faculty of education. In this table the participant names given as S1,S2 etc. stand for student 1, student 2 etc., which means that each student is given a number in the analysis. At the School of Foreign Languages the education program is planned with a modular system, and participants of this study were selected for the third module. During the data collection process, six participants were studying in the A2 module, three in the B1 module, six in the B1+ module and five in the B2 module. The Common European Framework (CEFR) organizes language proficiency into six levels from

A1 to C2, and these levels are grouped into three broad levels as: basic user, independent user, and proficient user. According to this grouping A1 and A2 are beginner levels, B1 and B2 are intermediate levels, C1 and C2 are advanced levels.

### *Data collection tools*

In this research, interview, a qualitative data collection method, was used. According to Karasar (2012), the interview technique is a research method frequently used to investigate knowledge, thoughts, behavior, attitudes, and their reasons on different subjects. Within the scope of the study, 'semi-structured interview' type was selected from the interview types, and an interview form was prepared accordingly. During the process of preparing interview questions three main criteria were considered, which are based on the study of Büyüköztürk et al. (2014): preparing questions directly related to the purpose of the research, selecting participants who can answer accurately, and selecting questions that are easy to answer. While preparing the interview form, the researcher relied on the following principles set forth by Merriam (2009):

- Preparing focused questions
- Asking open-ended questions
- Avoiding manipulation
- Preparing alternative questions
- Writing different types of questions
- Arranging questions logically
- Developing questions

At the beginning of the data collection process, the researcher prepared a draft of possible interview questions, which were written according to the research questions of the study. As a second step, two professors who are specialized in educational studies checked these questions and gave feedback. With these corrections and feedback, the researcher made necessary changes and prepared the final draft for the interviews, which had 20 questions. The data collection process was conducted during the COVID-19 pandemic, and the students were taking their courses online, so the researcher reached out to the students with the help of their class teachers and scheduled online meetings with them. The interviews were planned and conducted via the Zoom application. The researcher recorded every single interview, and then she transcribed them with the help of the Microsoft 365 program. To avoid mistakes, the researcher checked the transcribed material by listening to each interview again. Each interview lasted for approximately 15 min.

### *Data Analysis*

In this study, the data were analyzed using the content analysis method. During the data analysis process, the researcher followed the same steps as a lecturer who is an expert in the field and carried out the analysis. Within the framework of the stages laid out by Yıldırım and Şimşek (2016), the data were coded, themes were found, and the findings were defined

and interpreted. The research questions posed at the beginning created a framework for the analysis. In this regard, the themes and codes were evaluated under the determined categories, and the relationships were revealed. To ensure validity and reliability during the analysis process, the researcher received critical feedback from two faculty members who are experts in the field through the expert review method to ensure internal validity (credibility), and followed the detailed description approach to ensure external validity (transferability). Lincoln and Guba (1985) expressed the concept of reliability as consistency in qualitative research. In this study, the researcher recorded each interview and transcribed them one by one. In addition, the researcher checked whether the comments were confirmed with the raw data with the help of an expert through the concept of confirmability (objectivity).

### *Ethical considerations*

In the course of this research, we paid attention to ethical guidelines meticulously, ensuring that the integrity and reliability of the study were never compromised. In order to ensure the validity and reliability of the study, it was aimed at achieving the credibility (internal validity), transferability (external validity), dependability (reliability) and confirmability (objectivity) criteria by Guba (1981). For credibility, the demographic information of the students was given. Moreover, expert opinions were obtained during the development of the interview questions and in forming categories, themes and codes. To ensure transferability the data were transferred through detailed descriptions and direct quotations were obtained from the participants. For dependability expert opinions were obtained as mentioned. For the content analysis two researchers created the codes separately, discussed the points on which they did not agree and they reached a consensus. This stands as an indication to show that dependability was achieved. For confirmability each interview was transcribed via Office 365 program and the documents were confirmed by participants. Also, video recordings and written interview documents were kept by the researcher during and after the data collection process.

In this study, all the required rules to be followed within the scope of “Higher Education Institutions Scientific Research and Publication Ethics Directive” were followed. No action listed under the title “Actions Against Scientific Research and Publication Ethics” was taken.

Ethical review board name: Gaziantep University Social and Human Sciences Scientific Research and Publication Ethics Committee

Date of ethics review decision: 15.02.2022

Ethics assessment document issue number: 150667

## **RESULTS**

According to the results obtained from the content analysis, the effects of first exam on learning English, online homework performance, self-efficacy beliefs, and perceived

responsibility are shown, and the results of the study about prior success are categorized under the themes given in the table below:

Table 2. Effects of prior success (first grade)

Category	Theme	Codes	F
First Grade Learning English	Positive Effect	Specifying the level	7
		Contribution to improvement	3
		Awareness	2
		Being motivated	2
		Awareness in studying	1
	Negative Effect	Starting at the wrong level	1
	No Effect	Had no effect	1
First Grade Online Homework	Positive Effect	Being attentive to homework	2
		Studying more for homework	2
		Studying more productively	2
		Focusing more on homework	1
	No Effect	Had no effect	3
First Grade Self-efficacy beliefs	Positive Effect	Awareness	5
		Increasing beliefs	2
		Starting with confidence	1
		Focusing more	1
		Positive expectations	1
		Sense of ability	1
	Negative Effect	Disappointment	3
		Losing Confidence	2
		Fear	1
		Bad effect	1
No Effect	Had no effect	3	
First Grade Perceived Responsibility	Positive Effect	Taking more responsibility	11
		Studying more	3
		Being more determined	2
		Seeing deficiencies	1
		Giving importance	1
	No Effect	Had no effect	3

Participants stated that first grades (prior success) generally have positive effects on English education, online homework performance, self-efficacy beliefs, and perceived responsibility. The statements of some participants about prior success are as follows:

**S1:** “Thanks to this exam, I realized that I needed to study English more.”

**S14:** “I see where I am. This is how I measure my own level and I see where to start and where to go because of this level placement exam, so determining my own level helps me a lot in learning my own situation.”

**S6:** “It affected my efficacy beliefs. I realized that I needed to study better and more efficiently, so I realized that knowing only basic things is not enough.”

When the findings regarding self-efficacy beliefs were examined, it was revealed that students with high self-efficacy beliefs generally had high motivation, tended to take more

responsibility, and were more successful academically. According to the results obtained from the content analysis, the effects of self-efficacy beliefs on learning English, motivation, perceived responsibility and academic success are shown, and the results of the study about self-efficacy are categorized under the themes given in Table 3.

Table 3. *Effects of self-efficacy beliefs*

	Category	Theme	Codes	F
Self-efficacy Beliefs	Self-efficacy beliefs Learning English	High self-efficacy beliefs	Learning better	6
			Succeeding	3
			Improvement	2
			Less Disappointment	1
			Will to succeed	1
		Low self-efficacy beliefs	Feeling disqualified	1
			Distant education	1
		High self-efficacy beliefs	High Motivation	13
	Self-efficacy beliefs Motivation			
	Self-efficacy beliefs Perceived Responsibility	High self-efficacy beliefs	Taking more responsibility	15
		Low self-efficacy beliefs	Taking more responsibility	2
		No effect	Had no effect	1
	Self-efficacy beliefs Academic Success	High self-efficacy beliefs	Becoming successful	16
No effect		Had no effect	1	

According to these results, students think that they learn better and their academic success increases accordingly when they have high self-efficacy beliefs. Some students believe that their self-efficacy beliefs have no effect on their perceived responsibility and academic success. The statements of some participants about self-efficacy are as follows:

**S9:** “When the feeling of “Yes I can” come to me, I felt better and I think I learned faster. Of course, my previous knowledge of English or my aptitude also has a lot to do with it, but I think it goes better once I feel it.”

**S13:** “Perhaps it is one of the most important effects because people can do what they believe. If I try to achieve this or if I fully believe in something, I can learn something about this subject.”

**S12:** “I think it's very important, because when you don't really have a belief in your proficiency, especially in English, nothing progresses. You continue at the same level. That's why I think it's so important.”

**S5:** “The effects of self-efficacy on motivation.. I think efficacy is something that directly affects motivation. If you trust and believe in yourself, motivation is generally higher.”

According to the results obtained by analyzing student opinions about online homework, most of the participants generally stated that the practices they performed on the Oxford Online Learning platform had a positive effect on their English education. These students expressed positive elements such as the opportunity to practice, reinforcement, and revision provided by the online homework platform, as well as the online support offered, the opportunity to prepare for the exam, feedback, and revealing the deficiencies in this way. According to the results obtained from the content analysis, the effects of online homework on learning English, self-efficacy beliefs, perceived responsibility, motivation, and academic success are shown, and the results of the study about online homework are categorized under the themes given in Table 4.

Table 4. *Effects of online homework*

	Category	Theme	Codes	F	
Online Homework	Online Homework Learning English	Positive effect	Opportunity to practice	5	
			Instructiveness	5	
			Opportunity to reinforce	4	
			Opportunity to revise	4	
			Online support	4	
			Studying for the exam	2	
			Getting feedback	1	
			Revealing deficiencies	1	
	Online Homework Self-efficacy beliefs	Positive effect	Increasing belief	5	
			Evaluating yourself	2	
			Feeling qualified	1	
			Making effort	1	
			Negative effect	Feeling bad	1
				Losing the will	1
Losing dedication	1				
Online Homework Perceived Responsibility	No effect	Grading	Gaining responsibility	8	
		Doing regularly	Increasing responsibility	7	
		Doing the homework	Gaining responsibility	4	
		Improvement	2		
		Had no effect	1		



Online Homework Academic Success	Positive effect	Opportunity to practice	5
		Revision	4
		Contribution to listening	4
		Opportunity to reinforce	3
		Getting feedback	3
		Seeing mistakes	1
		Increase in grades	2
Online Homework Motivation	No effect	Had no effect	1
	Motivational effects	High motivation	5
		Making fewer mistakes	3
		Being more willing	2
		Seeing the right and wrong answers	2
		Learning from mistakes	1
		Becoming ambitious	1
	Demotivating effects	Systemic Problems	3
		Low motivation	3
		Losing self-confidence	1

Participants stated that online homework increased their self-efficacy beliefs, which is a positive effect, and also made them feel competent. They stated that the evaluation of these homeworks within a scoring system and the necessity to complete them regularly due to timing is an element that increases responsibility. In addition, participants stated that online homework is an element that increases academic success with the opportunity to practice, the opportunity to revise and reinforce, the contribution it provides to listening, and the feedback it provides. In addition, most of the students who stated that online homework has motivating effects stated that their motivation increased in this way. The statements of some participants about online homework are as follows:

**S16:** “In general, it had a good effect in terms of practice. When we put the subject we see in the book into practice online, it becomes more memorable.

**S18:** “So actually it is a good thing, it reinforces education and reinforces the things we do. For example, we can see the things we saw in class again. If we do them quickly, it gives us the chance to practice immediately . When we do it later, it is a preparation for the exam.

**S19:** “We are studying in the English preparatory class, and Online Practice works very well. There are some excellent exercises. Whether it is writing, speaking, or grammar. Also, the vocabulary section is excellent. The system stands as a whole. I liked that system very much.

**S17:** “For example, studying from a book is one thing, but now that the internet has become so widespread, online seems more practical. It sounds like it's easier to reach things online. Anyway, we have our phone and computer at our fingertips, that's why we connect more, so we can do it more often. That is why it increases success.

**S11:** “It was effective, I think it increased self-efficacy beliefs because these Oxford Online Practice improves us. Of course, it also improves our self-efficacy beliefs.”

**S1:** “I tried to do these homeworks regularly, in a planned way, and this increased my responsibility.”

According to the results obtained from the content analysis, the effects of perceived responsibility on learning English and academic success are shown, and the results of the study about perceived responsibility are categorized under the themes given Table 5.

Table 5. *Effects of perceived responsibility*

	Category	Theme	Codes	F	
Perceived Responsibility	Perceived Responsibility Learning English	Taking responsibility	Studying more	5	
			Improvement	2	
			Studying regularly	1	
			Passing the module	1	
			Maintaining self-control	1	
			Learning faster	1	
			Long-term benefit	1	
			Effect of the pandemic	1	
	Perceived Responsibility Academic Success	Positive effects	Increasing success	13	
			Contribution/professional life	2	
			Studying more	2	
			Contribution to social life	1	
			Becoming self-regulated	1	
			No effect	No change in success	1
				Had no effect	1

Because of the analysis, the theme of taking responsibility regarding the effect of perceived responsibility on English education emerged. A significant portion of the participants stated that they studied harder and made progress when they felt more responsible in the learning process. When the answers to the question on perceived responsibility and academic success were analyzed, two themes emerged: positive effects and ineffectiveness. Most participants stated that feeling more responsible in the learning process increased their academic success. In addition, its contribution to professional life and ensuring more study are among the positive effects of perceived responsibility. The statements of some participants about perceived responsibility are as follows:

**S9:** “I think the more responsible you feel and the more you act accordingly, the more learning will help, at least to some extent, because I think repeating the things you have learned and doing things like concentrating on it affect you a lot because you don't want to

do it when you don't feel that responsibility. When I was there, for example, I didn't do much after class and I was learning less about them. Afterwards, I needed a lot of repetition, so I think that feeling of responsibility and concentrating on that language helps more in the learning process.

**S14:** “I think it had a positive effect on my English education because I don't think I would have learned English if I didn't have a sense of responsibility. Whatever I learned, I learned thanks to my sense of responsibility. If I didn't have a sense of responsibility, I probably wouldn't be able to learn anything, because I think we should be aware of what we're doing when learning a language.”

**S16:** The sense of responsibility actually accelerates learning. Since I have that sense of responsibility, my learning process was shortened and it had a positive effect on me.

**S1:** Taking responsibility also affects academic success. As you take responsibility, your academic success increases, you study and study harder to fulfill that responsibility, and you set more goals for yourself; thus, your academic success increases.

According to the results obtained from the content analysis, the effects of motivation on learning English and academic success are shown, and the results of the study about motivation are categorized under the themes given in Table 6.

Table 6. *Effects of motivation level*

	Category	Theme	Codes	F		
Motivation	Motivation Learning English	High motivation	Learning more	5		
			Increasing success	2		
			Enjoying	2		
			Conserving free time	1		
			Studying more	1		
			Learning more	1		
			Keeping trying	1		
		Low Motivation	Feeling inadequate	1		
			Failing in continuity	1		
			Motivators	Teacher comments	1	
		Motivation Academic Success	High motivation	Inner motivation	1	
				Future plans	1	
				Increasing success	Increasing success	12
					Studying more	3
Making an effort	2					
Learning better	2					
Giving importance	1					
Low motivation	Being unable to reach the goal	1				

Themes of high motivation, low motivation, and motivators emerged regarding the effects of motivation level on English education. Most of the students stated that having a high level of motivation enabled them to learn better. In addition, students talked about increasing their success, learning quickly and enjoying themselves. The statements of some participants about motivation are as follows:

**S6:** “I think the more motivated we are, the faster we learn, so the higher my motivation, the more I want it and the more I get the reward.

**S9:** “When I am motivated, I focus on studying better, especially on those days. When I listen better, I understand things better. That is why I think I'm more productive when my motivation is high. I think it is an important factor, especially in lessons.”

Student opinions regarding the effects of motivation on academic success revealed the themes of high and low motivation. Most of the students mentioned high motivation and associated it positively with increased success, striving, learning, and studying.

**S1:** “My motivation to learn affects my level of success. It affects me like this: The more motivated I am, the more I study, I study better, and I study more efficiently. This affects my performance for the better.”

**S13:** “I think it affects you because, for example, you have motivated yourself, I will succeed in this job. If you motivate yourself by saying, "I will learn this, I will be successful in this language, etc.," you will study harder. The more you study, the more you succeed.”

**S6:** Yes, of course, it affects, so being motivated means wanting. In my opinion, it means striving for it, making effort, and as we do this, it affects our level. Therefore, it definitely affects the level of learning.

## DISCUSSION

In this study, the effects of online homework on students' academic success were analyzed in line with self-efficacy beliefs, perceived responsibility, motivation, and prior success of students in a higher school of foreign languages. The study reveals the opinions of students about this online homework system, and students' cognitive processes have been highlighted within the related online homework application.

When the literature on students' prior success is examined, it is seen that high-achieving students also have high homework success, and that their homework performance is also high because these students spend more time on homework (Zimmerman, 2008; Zimmerman & Kitsantas, 2005). Prior success is an important predictor of evaluating homework

performance (Weinert & Helmke, 1995). The findings obtained in this study support the information presented in the literature. Bandura (1977) stated that self-efficacy can be affected by other variables, and success plays a role in increasing self-efficacy beliefs. In his studies, Zimmerman (1992, 2005, 2008) stated that students who were successful in their previous learning experiences had high efficacy beliefs. The findings confirm the information revealed by previous studies, according to which students' prior achievements positively affect their self-efficacy beliefs. Zimmerman (1992, 2005, 2008) also stated that successful students take greater responsibility in their learning processes. The findings obtained in this study also revealed that students' prior success had a positive effect on taking responsibility.

According to the findings obtained within the framework of questions aimed at revealing the effects of self-efficacy beliefs, high self-efficacy beliefs lead to a high level of motivation. Bandura (1994, 1999) states that self-efficacy affects motivation through outcome expectations. Similarly, Bandura (1997) stated that students with high self-efficacy beliefs act as active agents in learning processes and take more responsibility in this direction. The qualitative findings revealed in this study showed that students' self-efficacy beliefs positively affected their perceived responsibility. In the relevant literature, there are studies showing that self-efficacy beliefs positively affect academic success (Yurt, 2014; Li, 2016; Vogt et al., 2007). Zimmerman stated (1992, 2005, 2008) that self-efficacy beliefs affect academic success. The findings obtained in this study are parallel to the information in the literature.

In this study, the effects of online homework were analyzed, and it was revealed that students' homework performances had a positive effect on their self-efficacy beliefs, perceived responsibility, motivation and academic success. Giving homework at the university level and encouraging students accordingly are factors that increase their self-efficacy beliefs (Ramdass and Zimmerman, 2011; Zelyüt, 2017). Homework is a teaching tool that predicts students' perceived responsibility and positively affects students' perceived responsibility (Kitsantas & Zimmerman, 2008; Goodnow & Warton, 1992; Warton, 1997). In this study, most participants stated that online homework positively affected their perceived responsibility. When the literature is examined, there are studies showing that online homework directly and positively affects academic success, whereas other studies show that they do not affect academic success at all. In their studies at the university level Dursun (2021), İleri (2013) and Shuman (2015) revealed that any type of homework affects the academic success of students positively. Most of the participants in this study stated that the Oxford Online Learning homework platform positively affected their academic success. In this study, the effects of online homework application on motivation levels were also analyzed. According to the results, most of the participants shared the opinion that online homework positively affected their motivation levels. Online homework has a positive effect on students' motivation (Erdoğan and Çiğdem, 2017), and these applications have features that motivate students, such as providing feedback and multiple attempts (Babaali and Gonzalez, 2015).

When the answers given to the questions about the effects of perceived responsibility on academic success are analyzed, we see that the participants state that perceived responsibility

affects academic success positively. These qualitative findings are in parallel with some studies in the literature. Perceived responsibility is essential both in completing homework and reaching academic success (Zimmerman, 2020; Bempechat, 2004). Yalçın (2021) stated that gaining awareness of responsibility increases academic success. Likewise, Zimmerman and Kitsantas (2005) state that perceived responsibility directly affects academic success.

When the findings of the study on motivation and academic success are analyzed, it is seen that most of the participants stated that they study harder, learn better, and are more successful when they have high motivation. Motivation contributes positively to academic success (Kempler and Krajcik, 2006; Karakış, 2020; Yenice, Saydam and Telli, 2012). The findings obtained in this study are similar to those of many studies in the literature in this sense. As a result, the online homework application implemented as a part of the education program at the School of Foreign Languages is considered an element that positively affects cognitive processes and contributes to students' academic success.

In social cognitive theory outcome expectations provide an insight into potential future success and the self-efficacy beliefs of learners shape their performance outcomes. In this study the analysis of students' opinions about the online homework application in a higher school of foreign languages provides an insight into the interrelated effects of different variables on online homework performance. The theoretical background related to cognitive perspective, online homework, and academic success is parallel to the results of this study. Thus, it can be concluded that in general students' online homework performances are affected by their prior success, higher self-efficacy beliefs, higher sense of responsibility, and higher motivation. Students can perform better and gain academic success when they implement cognitive processes effectively in online homework applications. It can also be concluded that students' perceptions of responsibility, higher levels of motivation, and higher self-efficacy beliefs have an effect on online homework performances and academic success.

## RESULT

Students at every module level studying at Gaziantep University School of Foreign Languages used the Oxford Online Learning platform both during the COVID-19 pandemic period and during the periods when education was conducted face-to-face. The grades they receive on this platform are added to the students' end-of-module success scores. The data presented in this research allowed the online homework platform to be examined in the context of academic success and cognitive processes. In line with the information obtained from the study, it was concluded that students generally expressed positive opinions about online homework, both in terms of their relationship with academic success and their relationship with cognitive processes. It is parallel to most of them. As a result of the study, it was concluded that in higher education, online homework applications play an important role not only for academic success but also for the improvement of self-regulated learning. The results obtained in this study reveal the necessity of focusing on students' cognitive processes in online learning as a key factor in academic success. In addition, these processes

should be analyzed within different contexts and at different levels of education for their relationship with learning environments.

### LIMITATIONS

Within the scope of this study, the data collection process was carried out during the COVID-19 pandemic, which necessitated online interviews with students. Technical problems occurred from time to time during the interviews, and these were resolved by the researcher by renewing the records. In order to avoid bias, the interview questions were formed meticulously by the researcher, and the participants were given some background information beforehand. However, students' previous experiences in the language learning process may have created some bias about the use of online applications. Drawing a general picture about online homework was among the goals being fulfilled, so the researcher tried to draw conclusions that can be generalized. However, collected data from a higher school of foreign languages enabled us to draw conclusions from a Turkish higher education context, which makes it hard to draw general conclusions in some parts of the study.

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