Kastamonu Eğitim Kastamonu Education Dergisi Journal

|Research Article|

Teachers' Professional Development Needs and Barriers: The case of Turkey

Öğretmenlerin Mesleki Gelişim İhtiyaçları ve Engelleri: Türkiye Örneği

Berna Yüner[1]

Abstract

Purpose: This study, drawing on the Turkey data from TALIS 2018, examines the teachers' need for professional development and their perceived barriers to professional development. It provides insights into the differences in teachers' perceptions according to gender, seniority, and school level variables.

Methodology: This study is a quantitative descriptive research. t-test and ANOVA were used to determine whether the variables made a significant difference.

Findings: Concerning professional development, female teachers reported higher needs for student behaviors and classroom management while male teachers noted significantly higher needs for pedagogical competencies in teaching the subject field and knowledge of the curriculum. The results show that all teachers have higher level need for teaching in multicultural and multilingual setting. However, new teachers have indicated significantly higher needs than veteran teachers. Lack of employer support and irrelevant professional development activities are noted as two higher level barriers preventing teachers attain professional development. The barriers to professional development, except one, are denoted significantly higher by novice teachers. The lack of time due to family responsibilities is indicated significantly higher by veteran teachers.

Highlights: It is observed that school level causes significant differences in teachers' professional development needs for subject matter and pedagogy and their perceived barriers. Relying on the results, the research provides implications for professional development providers to maximize the effectiveness of professional development of teachers.

Öz

TALIS 2018 Türkiye verisine dayanarak yapılan bu çalışma, öğretmenlerin mesleki gelişime duydukları ihtiyacı ve mesleki gelişime karşı algıladıkları engelleri incelemektedir. Çalışmada cinsiyet, kıdem ve okul düzeyi değişkenlerinin neden olduğu farklılıklar incelenmiştir. Bu çalışma nicel betimsel bir araştırmadır. Değişkenlerin anlamlı fark oluşturup oluşturmadığının belirlenmesinde t-testi ve ANOVA'dan yararlanılmıştır. Mesleki gelişim ile ilgili olarak, kadın öğretmenlerin öğrenci davranışlarına ve sınıf yönetimine; erkek öğretmenlerin müfredat bilgisi ve pedagojik yeterliliklere ilişkin daha yüksek mesleki gelişim ihtiyacı belirttikleri saptanmıştır. Araştırma sonucunda, tüm öğretmenlerin çok kültürlü ve çok dilli ortamda öğretime ilişkin mesleki gelişime daha fazla ihtiyaç duyduklarını belirlenmiştir. Bununla birlikte, yeni öğretmenler, deneyimli öğretmenlerden daha yüksek düzeyde ihtiyaç belirtmiştir. Yönetici desteğinin eksikliği ve ilgisiz mesleki gelişim faaliyetleri, öğretmenlerin mesleki gelişime ulaşmasını önleyen iki yüksek puanlı engel olarak belirtilmiştir. Aile sorumluluklarından dolayı zaman sıkıntısı, kıdemli öğretmenler tarafından anlamlı düzeyde yüksek olarak belirtilmiştir. Bunun dışında mesleki gelişimin önündeki engeller, yeni öğretmenler tarafından anlamlı ölçüde daha yüksek olarak belirtilmiştir. Okul düzeyinin, öğretmenlerin konu ve pedagoji için mesleki gelişim ihtiyaçlarında ve algılanan engellerde anlamlı farklılıklar oluşturduğu saptanmıştır. Araştırma sonuçlarına dayanarak, mesleki gelişim etkinliklerinin en üst düzeye çıkarılması için mesleki gelişim sağlayıcılarına öneriler sunulmuştur.

INTRODUCTION

Education system has been in the process of reforms due to continuous development, increasing diversity and emphasis on effectiveness, accountability and transparency. Teachers' professional development is viewed as one of the keys for success in these reforms (Bautista and Ortega-Ruiz 2015). Consequently, teachers are expected to validate and upgrade their knowledge and skills to meet new challenges (Saha and Dworkin 2009, OECD 2010). The United Nations points out the importance of continuous professional development for teachers within sustainable development goal 4 which is "to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all", includes increase of qualified teachers through teacher training (UNESCO 2015).

Professional development is accepted as the driving force for improving teachers' teaching quality (Hattie 2009). It is seen as a key to improve student learning and to reach the goal of educational enterprise (Johnson and Golombek 2011). There is a widespread agreement on the relationship between teaching quality and students' learning outcomes (Darling-Hammond 2000, Hattie 2009, Jensen et al. 2016, Knapp 2003, Polly et al. 2015, Rowe 2003, Wenglinsky 2002). Therefore, teachers' professional

development is thought to be crucial for creating an effective learning environment and improving student learning (Cohen and Hill, 2001, Darling-Hammond et al. 2009, Evers et al. 2016).

Effective schools require teachers to be active learners (Girvan et al. 2016). To ensure a qualified learning environment that increases students' motivation and improves their learning skills, teachers should improve their teaching and pedagogical skills via personal development programs. Teachers need long-term, content-focused, collaborative and coherent professional development programs. However, there are individual factors including age, gender, teaching experience and school variables such as type of school, its location and level of school (ISCED) that vary the needs of teachers for professional development (Zhang et al. 2019). Therefore, policymakers should give more attention to identify the factors that lead differences between the needs of teachers and their barriers to participate in professional development activities.

Organization for Economic Cooperation and Development (OECD) conducts Teaching and Learning International Survey (TALIS) which is a comprehensive survey of teachers, school leaders and their learning environments. The survey includes a theme depicting teachers' needs for professional development on subject matter and pedagogy and teaching for diversity and the barriers which prevent them from participating in professional development programs. The current study is a descriptive study based on the examination of teachers' professional development needs and barriers to professional development in Turkey.

Review of Literature

Professional development comprises the activities which aim to shift teachers' knowledge, attitude and behaviors in a positive way for the purpose of improving their teaching practice (OECD 2014). The target of professional development activities is to provide useful tactics for increasing teacher quality and improving student achievement (Desimone 2009, Girven et al. 2016, Witte and Jansen 2016). TALIS provides details about teachers' professional development needs and the barriers they encounter. This section reviews the literature about these domains.

Need for Professional Development

Teachers need to be life-long learners (Eleonara 2003, Hiebert et al. 2002). They are role models of students and they shouldn't lose their motivation to learn and improve themselves. Therefore, they should be supported in their ongoing professional development according to their needs. Professional development becomes more meaningful and effective when it addresses the needs of teachers (Dorling- Hammond et al. 2009, Meissel et al. 2016). Consequently, it is appropriate to plan professional development activity contents with regard to the development of technology and its incorporation in education, change of social structure, increase of diversity and changing social and educational expectations.

Today, cultural diversity has gradually become a feature of the global world. Especially, the wave of migration has affected all parts of life. Therefore, diversity has become one of the most important issues in education in recent years. For this reason, TALIS governing board highlighted cultural diversity as a topic in the questionnaire and conceptual framework. Ely and Thomas (2001) has pioneered two dominant perspectives –equality and multiculturalism- in the field of cultural diversity. Equality perspective regards all students in one class and approaches them equally (Schachner 2014). Multiculturalism acknowledges diversity and regards it as enrichment in school. With this perspective, schools are more open to other cultures. Although equity and multiculturalism seem like different approaches, schools often combine them (Schachner 2014).

Professional development can concern various subjects like classroom management and creating disciplinary climate (Daresh 2003), students with special needs (Cooc 2019, OECD 2018), curriculum design and planning (Garet et al. 2001), incorporation of technology in education (Daling-Hammond et al. 2001, Korkko et al. 2016). TALIS technical report combines the professional needs of teachers under two factors, need for professional development for subject matter and pedagogy, and need for professional development for teaching for diversity (OECD 2019). The former addresses teachers' needs for organizing the teaching environment, increasing the quality of teaching and improving the content. The latter includes the needs for alternative approaches for individual learning, multicultural and multilingual setting and teaching students with special needs.

Barriers to Professional Development

Studies reveal that there are personal and contextual challenges affecting teachers' participation in professional development (Kwakman 2003). Time, accessibility, motivation, financial issues, unsupportive managers, work pressure, staff shortage are some of these barriers (Drage 2010, Geldenhnys and Oosthuizen 2015). Lind (2007) listed major barriers as financial issues, family related responsibilities and time and distance conflicts. The barriers TALIS (2018) listed for teachers' assessment are the lack of pre-requisites, high-cost expenditure, lack of support from the employer, lack of time due to family responsibilities and irrelevant subjects for professional development. Time is an important obstacle as school schedule is not always conducive for professional development (Lind 2007, Lucilio 2009). TALIS 2013 results showed that schedule conflict and lack of opportunities are the major barrier to pursue professional development (OECD 2014).

Variations in Professional Development Perceptions

Teacher and school characteristics can lead to significant differences in professional development. TALIS provides information about teachers' age, gender, seniority, school type (public/private), level (primary, lower secondary, upper secondary), location of school (rural/city) which enables comparisons for differences. Studies revealed various results. Sağır (2014) reported significant difference in the professional development needs of teachers according to gender variable while Desimone et al. (2006) revealed age as a significant independent variable for attending professional development. Amanulla and Aruna (2014) found out a significant difference between female and male teachers, public and private schools, new and veteran teachers. TALIS 2013 results showed seniority as a significant variable on teachers' perception of professional development and that new teachers participate in more professional development (OECD 2014). On the other hand, Alade and Odebode (2014) observed that age, gender, education qualifications, seniority did not make a significant difference in teachers' perceived benefits of professional development.

In Turkey, in-service training department of the ministry of national education is responsible for the professional development of teachers (Ministry of National Education 1973). In 2018, Turkey's education vision 2023 has announced. The main objective of the 2023 vision is to educate talented and ethical individuals who love science, are interested in culture and will use their knowledge and skills for the welfare of humanity. The vision stresses that the quality of national education can only be achieved with the qualification of teachers. Therefore, within the restructure of professional development of teachers and school administrators, various professional development programs including face-to-face, formal, distance training, are planned to improve general and subject-specific instruction and to support vocational development.

it is accepted that in service education has a crucial role to meet the growing needs of education in global world. In service education is necessary to enhance work performance and motivation of teachers. Therefore, it is important to determine the current situation of teachers' professional development needs. The identified needs will guide the future studies and increase the quality of education. Therefore, in this study, it is aimed to determine the professional needs of teachers in Turkey. Turkey participated TALIS with all compulsory education levels; primary education (International Standard Classification of Education [ISCED 1]), lower secondary education (ISCED 2) and upper secondary education (ISCED 3). This study, drawing on the Turkish teacher data from TALIS 2018, aims to identify the teachers' need for professional development and their perceived barriers to professional development, and to find out whether gender, seniority, and school level make significant differences. This study seeks to answer the following questions;

1. What are the teachers' professional development needs for subject matter and pedagogy?

2. What are the teachers' professional development needs for teaching for diversity?

3. What are teachers' barriers to professional development?

4. Do teachers' professional development needs and barriers show significant differences according to teachers' gender, seniority, education level and school grade variables?

METHOD

This study, which aims to determine the professional development needs of teachers, is a quantitative descriptive research. Descriptive study is conducted to describe a phenomenon and its characteristics. It is concerned with what rather than why or how something is happened. It is analyzed quantitatively using descriptive statistics like frequencies, percentages and averages (Nassaji, 2015). T-test and ANOVA were used to determine whether the variables made a significant difference.

Data Source and Sampling

In this study, to examine the professional development needs of teachers and the barriers to professional development, TALIS 2018 Turkey data were used. In TALIS, teachers are asked to indicate their professional development needs in terms of subject matter and pedagogy and teaching for diversity and the barriers preventing them to participate professional development activities (OECD, 2019).

TALIS followed two-staged random sampling. At first 200 schools were chosen randomly as samples than 20 teachers were selected from these schools. 48 countries and economies took part in TALIS. The survey was conducted in three phases; the pilot phase, the field trial phase, and the main survey phase, respectively.

Participants

15498 Turkish teachers participated in the study. 8194 teachers were female (%52.9) and 7304 teachers were male (%47.1). Among the participants, 3204 (%20.7) teachers were working in primary school, 3952 (%25.5) teachers were in lower secondary school and 8342 (%53.8) teachers were in upper secondary school. The highest education level that teachers graduated was short-cycle tertiary education for 424 teachers (%2.7), bachelor's degree for 12892 teachers (%83.2), master's degree for 2058 teachers (%13.3) and doctoral degree for 67 teachers (%04). In this study, being coherent with literature, teachers were divided into two categories for seniority teachers (Martin, Yin, and Mayall, 2006; Tsui, 2005). Teachers who have teaching experience less than five years were addressed new teachers while teachers who have teaching experience approximately six years and more were addressed as veterans. Among the participant, 2788 (%18) teachers were new teachers and 12096 (%78) teachers were veterans. 616 (%4) teachers did not indicate their experience.

Measure and Data Collection

TALIS 2018 teacher questionnaire was used as the data collection tool for this study. *Needs for professional development in subject matter and pedagogy scale, needs for professional development for teaching for diversity scale* and *professional development barriers scale* were used from TALIS technical report (OECD, 2019). Each country's national study center was responsible for the adaptation of the international survey to their national context. The adaptation process included national adaptation verification, translation verification, and layout verification steps.

Needs for professional development in subject matter and pedagogy scale is a four-Likert scale. It asks teachers to indicate to what extent they need professional development. Teachers score the items from 1 to 4. 1 indicates "no need at present" while 4 indicates "high level of need". The scale includes items related to knowledge of the subject field, pedagogical competence, knowledge of curriculum, student assessment and management of classroom and student behaviors. The higher score indicates a higher level of need.

Needs for professional development for teaching for diversity scale is used to evaluate teachers' needs for professional development for teaching for diversity. It asks teachers to indicate to what extent they need professional development regarding the needs for alternative approaches for individual learning, multicultural and multilingual setting and teaching students with special needs. Each item is scored from items from 1 to 4. One indicates "no need at present" while 4 indicates "high level of need". The higher score is interpreted as the higher level of need.

Professional development barriers scale is a four Likert scale which is used to depict teachers' perceived barriers to their professional development participation. Teachers are asked how strongly they agree or disagree with the listed barriers. Not having pre-requites, lack of employer support, not having time due to family responsibilities, high expense of professional development, time conflicts with working schedule and irrelevant subject items are the listed barriers. Each item is scored from items from 1 to 4. One indicates "strongly disagree" while 4 indicates "strongly agree". For the interpretation of the results, scores close to 4 were interpreted as higher-level barriers. The higher score is interpreted as the higher level of barriers for professional development.

Data Analysis

In this study quantitative method were used to address the research questions. Mean, standard error and standard deviation were utilized to find out the level of teachers' need for professional development and level of barriers to professional development. To analyze the significant difference with regard to the gender and seniority variables t-test was used and for school level variable ANOVA was utilized.

RESULTS

Results of the current study revealed that teachers indicate a higher-level of need for teaching for diversity than for subject matter and pedagogy. In terms of subject matter and pedagogy, the higher-level need of teachers was 'student assessment practices' (M=1.71) [Table 1] while it as 'teaching in a multicultural or multilingual setting' (M=2.43) regarding needs for teaching for diversity [Table 2]. It was revealed that the highest level of barrier was 'lack of employer support' (M=2.56) while the lowest-level need was 'not having pre-requisites' (M=1.49) [Table 3].

Table 1. Professional development needs for subject matter and pedagogy

Needs for subject matter and pedagogy	Overall			Gender		Seniority		School level		
	M	SD	SE	Female	Male	Novice	Veteran	ISCED 1	ISCED 2	ISCED 3
Knowledge and understanding of my subject field(s)	1.58	.819	.007	1.57	1.59	**1.75**	1.55	1.55	1.56	**1.60**
Pedagogical competencies in teaching my subject field(s)	1.70	.846	.007	1.69	**1.72**	**1.86**	1.67	1.68	1.71	1.71
Knowledge of the curriculum	1.63	.858	.007	1.61	1.66	**1.77**	1.60	1.61	1.61	**1.65**
Student assessment practices	1.72	.876	.007	1.71	1.73	**1.84**	1.69	1.67	1.70	**1.74**
Student behaviors and classroom management	1.69	.894	.007	**1.71**	1.66	**1.89**	1.64	**1.71**	**1.72**	1.66

Bold means indicate a significant difference (*p*<.05)

Table 2. Professional development needs for teaching for diversity

Needs for teaching for diversity	Overall			Gender		Seniority		School level		
	M	SD	SE	Female	Male	Novice	Veteran	ISCED 1	ISCED 2	ISCED 3
Approaches to individualized learning	2.06	.971	.008	2.07	2.05	**2.20**	2.03	1.97	2.09	2.08
Teaching students with special needs	2.37	1.041	.008	2.38	2.35	**2.52**	2.33	2.29	2.40	2.38
Teaching in a multicultural or multilingual setting	2.43	1.123	.009	2.43	2.42	**2.56**	2.40	2.36	2.46	2.44

Bold means indicate a significant difference (*p*<.05)

Table 3. Barriers to professional development

Barriers	Overall			Gender		Seniority		School level		
	M	SD	SE	Female	Male	Novice	Veteran	ISCED 1	ISCED 2	ISCED 3
I do not have the pre-requisites	1.49	.697	.006	1.46	**1.51**	**1.62**	1.46	1.51	1.48	1.48
Professional development is too expensive	2.30	.848	.007	2.29	2.31	**2.38**	2.28	2.27	**2.32**	2.30
There is a lack of employer support	2.56	.892	.007	2.53	**2.59**	**2.63**	2.54	**2.50**	2.56	2.57
I do not have time because of family responsibilities	2.25	.921	.007	**2.29**	2.21	2.12	**2.28**	2.28	**2.28**	2.23
There is no relevant professional development offered	2.52	.87	.007	**2.54**	2.49	**2.56**	2.51	**2.44**	2.53	2.54

Bold means indicate a significant difference (*p*<.05)

Teacher Gender Difference

In this research, to see whether there is a significant difference between female and male teachers' professional development needs and their perceived barriers to professional development t-test was performed. Results presented in Table 1 show that 'student behaviors and classroom management' need was reported significantly higher by female teachers (t=3.244, p<.05). Male teachers noted significantly higher levels of needs for 'pedagogical competencies in teaching my subject field(s)', 'knowledge of the curriculum' than female teachers (t=-2.629; -3.462; p<.05, respectively).

Results in Table 2 show that the gender variable did not lead a significant difference in terms of their professional development needs for teaching for diversity. Results in Table 3 present that male teachers reported "lack of employer support" and 'not having pre-requisites" barriers significantly higher than female teachers (t=-4.542; -1.142; p<.05, respectively). Female teachers reported 'there is no relevant professional development offered' and 'not having time due to family responsibilities' significantly higher than male teachers (t=3.479; 5.556; p<.05, respectively). Table 3 also presents the highest-ranked barrier of female teachers as 'there is no relevant professional development offered' (M=2.54) and the highest barrier of male teachers as 'there is a lack of employer support' (M=2.59).

Difference Between New and Veteran Teachers

With regard to teachers' needs for professional development for subject matter and pedagogy, Table 1 depicts that novice Turkish teachers indicated higher needs for knowledge and understanding of my subject field(s)' (M=1.75), 'pedagogical competencies in teaching my subject field(s)' (M=1.86), 'knowledge of the curriculum'(M=1.77), 'student assessment practices'(M=1.84) and 'student behaviors and classroom management' (M=1.89). Results of the t-test showed that the difference is significant in favor of novice teachers (t=11.017; 10.373; 8.943; 7.738; 12.735; p<.5, respectively).

Results in Table 2 present that the rank of the professional development needs of novice teachers is 'teaching in a multicultural or multilingual setting' (M=2.56), 'teaching students with special needs' (M=2.52) and 'approaches to individualized teaching'

(M=2.20). The rank was the same for the veteran teachers (M=2.40; 2.33; 2.03, respectively). The results of the t-test showed that novice teachers reported significantly higher need than veteran teachers for these items (t=6.851; 8.892; 7.977; p<.05, respectively).

Table 3 reveals that perceptions of novice and veteran teachers regarding the barriers to professional development show significant differences. New teachers feel higher barriers preventing them from professional development. They reported significantly higher scores for 'I do not have the pre-requisites', 'professional development is too expensive', 'there is a lack of employer support', 'there is no relevant professional development offered' (t=11.216, 5.754; 4.512; 2.363, p<.05, respectively). The only barrier veteran teachers have significantly higher score is 'I do not have time because of family responsibilities' (t=8.467, p<.05). It can be observed that the three highest-ranked barrier of new teachers are 'there is a lack of employer support' (M=2.63), 'there is no relevant professional development offered' (M=2.56) and 'professional development is too expensive' (M=2.38).

Difference Between School Levels

Results in Table 1 reveals that significant differences exist among between school levels. Upper secondary school teachers noted significantly higher-level of needs for 'knowledge and understanding of my subject field(s)' (M=1.60) 'knowledge of the curriculum' (M=1.65) and 'student assessment practices' (1.74) [F=6.354; 4.673; 9.505; p<.05, respectively]. On the other hand, they reported the lowest-level need for 'student behaviors and classroom management (M=1.66). Primary school teachers (M=1.71) and lower secondary school teachers (M=1.72) indicated a significantly higher need for management of classroom ad student behaviors [F=7.646, p<.05].

Table 2 shows that teachers in all compulsory levels of school reported higher needs for professional development for teaching for diversity. Professional development needs of teachers ranked as 'teaching in a multicultural or multilingual setting', 'teaching students with special needs' and 'approaches to individualized teaching' in this factor. ANOVA results shows that among teachers, primary school teachers were the ones who reported significantly lower-level of need for 'approaches to individualized learning' (M=1.97), 'teaching students with special needs' (M=2.29) and 'teaching in a multicultural or multilingual setting' (M=2.36) [F=15.595; 11.982; 6.606; p<.05].

For the perceived barriers of the teachers to professional development, Table 3 shows that the highest two barriers of teachers working in different levels of schools are 'there is a lack of employer support', 'there is no relevant professional development offered', it was observed that primary school teachers consider 'there's a lack of employer support' and 'there is no relevant professional development offered' as significantly higher barriers [F=7.997; 15.815, p<.05, respectively].

DISCUSSION

Based on the TALIS 2018 data of Turkish teachers, this study investigated teachers' professional development needs and their perceived barriers. Professional development activities become more meaningful when they address the needs of the teachers. Karabenick and Conley (2011) points out that effectiveness of professional development activities depends on how much teacher value them and how much activities address teachers' needs. The current study investigated the teachers' development needs in two categories; need for teaching diversity and need for subject matter and pedagogy.

Professional Development Needs for Subject Matter and Pedagogy

The findings of the study revealed that in terms of their professional development needs for subject matter, male and female teachers identified student assessment practices as the highest-level needed item. It was also the highest-level needed professional development item of primary and upper secondary school teachers. This finding is consistent with the study of Melouk (2001) which revealed that the majority of teachers have received very limited training in assessment and they indicate their interest in assessment practices.

Student assessment is a systematic process of collecting and analyzing information in order to evaluate students' learning and improve their learning levels. Assessment practices are critical for determining the effectiveness of teaching. Consequently, teachers may have indicated the highest-level need for this item. Moreover, Turkey has adopted a constructive approach and renewed education curriculum regarding this approach. Within the scope of the constructive approach, it is advocated that students acquire skills by living. On the other hand, Turkey has a challenging exam process. The success of the students is evaluated based on the exam scores. Moreover, parents who want their children get high scores in national exams and study in more qualified schools, push teachers to follow exam-focused instructions and assessments. This dilemma may also be a reason for the high professional development needs of teachers in student assessment.

When teachers' professional development needs were compared regarding their seniority, it was observed that there is a significant difference between veteran and novice teachers. New teachers reported higher-level need for each item. New teachers who have idealistic expectations (Rust 1994), face challenges in real classroom setting such as higher student-teacher ratio, lack of induction, lack of materials, lack of curriculum guidance (Kauffman, et. al. 2002). Walls et al. (2002) stated that new teachers rely more on their theoretical knowledge while veterans rely more on their previous experiences. As new teachers do not have teaching experience as much as veterans, they feel higher need for professional development.

The highest-level need of novice teachers was student behavior and classroom management. This finding was coherent with the literature (Goodwin 2011, Rodríguez and McKay 2010, Zhang et al. 2019). Classroom management is accepted as more challenging for novice teachers (Evertson and Weinstein 2006, Friedman 2000, Jones 2006). The experience gained in working life provides teachers with alternative solutions for teaching practices as well as classroom discipline. For this reason, experienced teachers manage their classrooms more effectively than less experienced teachers (Martin et al. 2006). Veteran teachers establish classroom routines and spend less time for controlling individual student behavior. For this reason, seniority makes a significant difference in teachers' professional development need for classroom management.

Professional Development Needs for Teaching for Diversity

Knowledge of the subject matter, pedagogical competence and classroom management strategies are the key factors for teaching. However, teachers scored their need for subject matter and pedagogy lower than their need for teaching for diversity. The findings are consistent with Wong and Snow (2000) who stated that to teach successfully teachers have to understand students' culture, background, language diversity and prior experiences. Migration is one of the features of the global world, especially for Turkey. Turkey hosts about 4 million refugees, mostly Syrian, and approximately 1.74 million of whom are children. In 2019, there are 645,000 immigrant children enrolled in the compulsory education system of Turkey. Consequently, diversity has become non-negligible fact for Turkey. These students having different cultural backgrounds require teachers to update their teaching and communication competence.

The results depicted that the rank of the professional development needs for teaching for diversity as 'teaching in a multicultural or multilingual setting', 'teaching students with special needs' and 'approaches to individualized teaching', respectively. This rank was the same for all categories of teachers in this study. In Turkey, teacher education programs at universities include classes which emphasize that each student is a different individual and the course should be planned and processed considering these differences (Council of Higher Education, 2018). In addition, how to prepare a plan for students with special needs and the processes to be followed for these students are within the scope of the teaching process of prospective teachers. However, multiculturalism and multicultural education is a relatively new concept. This may explain the teachers' rank of needs.

Professional Development Barriers

The barriers to professional development, except one, are denoted significantly higher by novice teachers. The lack of time due to family responsibilities is indicated significantly higher by veteran teachers. Having less teaching experience, novice teachers indicated higher level of professional development needs than veteran teachers. New teachers pointed out 'lack of employer support and 'irrelevant professional development activities' as two higher level barriers preventing them attain professional development. These two items were found to be the two highest-level barriers for female and male teachers, and for all school level teachers, too. There is not a consistent finding in the literature in terms of barriers, but a majority of the studies reported time conflict as the most significant barrier (Badri et al. 2016, Geldenhuys and Oosthuizen 2015, Drage 2010, Fernandez-Manzanal et al. 2015).

Not having the pre-requisites was the least scored barrier by both groups. This finding is consistent with another finding of the study. The results showed that 'knowledge and understanding of the subject field(s)' is the lowest level needed item for all teachers. It can be inferred that regardless of their gender, seniority and school level they work in, teachers are confident about knowledge about their field and they don't see lack of pre-requisites as a high barrier.

CONCLUSION AND IMPLICATIONS

Using Turkish data, this study provides empirical evidence for understanding the professional development needs of teachers and their perceived barriers. It seems like recent changes in population influenced teachers' professional needs. Therefore, activities related to multicultural and multilingual settings should be given priority. With a better understanding of cultural differences, teachers would be more supportive and effective (Badri et al. 2016). The responses of Turkish teachers in TALIS also reveals that they identify teaching students with special needs as required competence.

Student assessment issue is seen important for teachers. In order to improve the quality of education, innovative approaches and methods have been used in education. Teachers should also be supported on how to evaluate these new methods. Also, as mirrored in the literature (Rodríguez and McKay 2010, Zhang et al. 2019, Evertson and Weinstein 2006, Friedman 2000, Jones 2006) classroom management is challenging for new teachers. Practice-based professional development activities should be organized relying on these needs of new teachers.

The absence of relevant activities is a barrier expressed by teachers. In this respect, it would be beneficial to cooperate with institutions such as universities and non-governmental organizations which can offer different content to teachers. The other higher-level perceived barrier is lack of employer support. Consequently, necessary regulations should be updated in order to provide support to teachers. To increase teachers' participation in professional development activities, financial or symbolic incentives which give the participants advantages for promotion, assignment to another school can be provided.

In 2019 a 4-semester education system was introduced in Turkey. During the periods between semesters, professional development programs are planned for teachers. These programs not only include instruction practices but also activities that create positive organizational climate such as trips to historical and cultural places in the region, picnics, and collaborative workshops. The new system may lead to a change in the teachers' professional development. Therefore, a longitudinal study on the professional development needs and barriers of Turkish teachers would provide remarkable findings.

In this study questions related to Turkish teachers' professional development needs and barriers are sought to answer. This study is limited to the teachers participating in TALIS. It can be renewed with school principals to expand the issue of professional development. Moreover, future studies can further investigate the relationship between professional development needs and teachers' self-efficacy, instructional practices, classroom management, disciplinary climate. The current study used teacher's gender, seniority and school level as independent variables. Further studies might consider teachers' education level, school type, school location.

Based on the results of the study, the ministry of education in Turkey should consider the teachers' needs before planning professional development programs to maximize effectiveness. The difference between teacher groups should be considered, especially for new teachers who indicated higher needs for all professional development contents. New teachers should receive more support for their professional development. Induction activities that are used to adapt new teachers to the teaching process and to enable senior teachers to orient themselves to the new school environment may be useful for both teacher groups. Monetary and nonmonetary incentives might be used to motivate teachers and encourage them to participate in professional development. Master's and doctorate degrees, which will enable the development of teachers, can be encouraged. In the in-service training of teachers, cooperation with universities can be made and academicians and teachers can be brought together. Meetings can be organized where successful teachers can share their experiences. Qualitative studies can be conducted to identify the deficiencies in the process carried out to determine teachers' professional development needs, and arrangements can be made according to the results of this study.

Declaration of Conflicting Interests
The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The author received no financial support for the research, author-ship, and/or publication of this article.

Statements of publication ethics
I hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Ethics Committee Approval Information

Since this study was carried out with open access data from the international data base (TALIS) , the approval of the ethics commission was not applied.

REFERENCES

Alade, O., and Odebode, O., 2014. An assessment of the impact of the teachers' professional development program under Lagos "eko" secondary education project in Lagos State. *Journal of Education and Practice, 5,* 1-8.

Amanulla, A., and Aruna, P., 2014. Effect of teacher efficacy on professional development of higher secondary school teachers of Kerala. *Journal of Humanities and Social Science (IOSRJHSS)*, *19*, 37-41.

Badri, M., et al., 2016. Perception of Teachers' Professional Development Needs, Impacts, and Barriers: The Abu Dhabi Case. *SAGE Open, 6*. 10.1177/2158244016662901.

Bautista, A., and Ortega-Ruíz, R., 2015. Teacher professional development: International perspectives and approaches. *Psychology, Society and Education, 7*(3), 240-251.

Cohen, D. K., & Hill, H. C., 2001. Learning and policy: When state education reform works.

Cohen, D. K., and Hill, H. C., 2001. *Learning and policy: When state education reform works*. New Haven, CT: Yale University Press.

Cooc, N., 2019. Teaching students with special needs: International trends in school capacity and the need for teacher professional development. *Teaching and Teacher Education, 83*, 27-41.

Council of Higher Education, 2018. https://www.yok.gov.tr/kurumsal/idari-birimler/egitim-ogretim-dairesi/yeni-ogretmen-yetistirme-lisans-programlari.

Daresh, J. C., 2003. *Teachers mentoring teachers*. Thousand Oaks, CA: Corwin Press.

Darling-Hammond, L., 2000. Teacher quality and student achievement: A review of state policy evidence. *Education Policy Analysis Archives*, 8(1), 1-44. http://dx.doi.org/10.14507/epaa.v8n1.2000.

Darling-Hammond, L., et al., 2009. Professional learning in the learning profession. Washington, DC: National Staff Development Council;

Desimone, L., 2009. Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher*, 38(3), 181-199.

Desimone, L. M., Smith, T., and Ueno, K., 2006. Are teachers who need sustained, content-focused professional development getting it? An administrator's dilemma. *Educational Administration Quarterly*, *42*, 179-215.

Drage, K., 2010. Professional development: Implications for Illinois career and technical education teachers. *Journal of career and technical education, 25*, 24-37.

Ely, R. J. and Thomas, D. A., 2001. Cultural diversity at work: the effects of diversity perspectives on work group processes and outcomes. *Administrative Science Quarterly, 46*(2.), 229-273.

Evers, A. T., et al., 2016. Job demands, job resources, and flexible competence: the mediating role of teachers' professional development at work. *Journal of career development, 43*(3), 227–243. https://doi.org/10.1177/0894845315597473

Evertson, C. M., and Weinstein, C. S., 2006. Classroom management as a field of inquiry. *In*: C. M. Evertson and C. S. Weinstein, eds. *Handbook of classroom management: Research, practice, and contemporary issues.* Mahwah, NJ: Lawrence Erlbaum Associates, 3-16.

Fernandez-Manzanal, R., et al., 2015. Environmental behaviors in initial professional development and their relationship with university education. *Journal of Cleaner Production, 108*, 830-840.

Friedman, I., 2000. Burnout: Shattered dreams of impeccable professional performance. *Journal of Clinical Psychology, 56,* 595–606.

Garet, M. S., et al., 2001. What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal*, *84*(4), 915- 945.

Geldenhuys, J., and Oosthuizen, L., 2015. Challenges influencing teachers' involvement in continuous professional development: A South African perspective. Challenges influencing teachers' involvement in continuous professional development: A South African perspective. *Teaching and Teacher Education, 51,* 203-212.

Girvan, C., Conneely, C., and Tangney, B., 2016. Extending experiential learning in teacher professional development. *Teaching and Teacher xEducation, 58*, 129-139.

Goodwin, A. L., 2011. Professional Development Schools and the professionalization of teaching. *In*: J. E. Neapolitan, ed. *Taking Stock of Professional Development Schools: What's Needed Now, National Society for the Study of Education*. NY: Teachers College, 432-443.

Hattie, J., 2009. *Visible Learning: A Synthesis of over 800 meta-analyses relating to achievement*, Routledge: London.

Hiebert, J., Gallimore, R., and Stigler, J. W., 2002. A knowledge base for the teaching profession: What would it look like and how can we get one? *Educational Researcher*, *31*(5), 3-15. http://dx.doi.org/10.3102/0013189X08331140.

Jensen, B. et al., 2016. *Beyond PD: Teacher professional learning in high-performing systems*. National Center on Education and the Economy, Washington, DC. http://www.ncee.org/wp-content/uploads/2015/08/BeyondPDWeb.pdf

Johnson, K. E., and Golombek, P. R., 2011. *Research on second language teacher education: A sociocultural perspective on professional development*. Taylor and Francis. https://doi.org/10.4324/9780203844991.

Jones, V., 2006. How do teachers learn to be effective classroom managers? *In*: C. M. Evertson and C. S. Weinstein, eds. *Handbook of classroom management: Research, practice, and contemporary issues.* Mahwah, NJ: Erlbaum, 887–907.

Karabenick, S. A. and Conley, A., 2011. *Teacher motivation for professional development: Math and science partnership-Motivation assessment program*. Ann Arbor, MI: University of Michigan.

Knapp, M. S., 2003. PD as a policy pathway. *Review of Research in Education, 27*, 109–157.

Korkko, M., Kyro-Ammala, O., and Turunen, T., 2016. Professional development through reflection in teacher education. *Teaching and Teacher Education, 55*, 198-206.

Kwakman, C. H. E., 2003. Factors affecting teachers' participation in professional learning activities. *Teaching and teacher education*, *19*(2), 149-170. https://doi.org/10.1016/S0742-051X(02)00101-4

Lind, V., 2007. High quality professional development: an investigation of the supports for and barriers to professional development in arts education. *International Journal of Education and the Arts, 8*(2).

Lucilio, L., 2009. What secondary teachers need in professional development? *Journal of Catholic Education, 13.* 10.15365/joce.1301042013.

Martin, N. K., Yin, Z., and Mayall, H., 2006. *Classroom management training, teaching experience and gender: Do these variables impact teachers' attitudes and beliefs toward classroom management style?* Paper presented at the Annual Conference of the Southwest Educational Research Association, Austin, TX. Retrieved from ERIC database. (ED494050)

Ministry of National Education., 1973. National education principal law.

Meissel, K., Parr, J. M., and Timperley, H.S., 2016. Can professional development of teachers reduce disparity in student achievement? *Teaching and Teacher Education, 58*, 163–173.

Melouk, M., 2001. The state of EFL evaluation in Morocco: The testers and teachers' opinions. *In*: A. Zaki and M. Naji, eds. *The teaching and assessment of English for global purposes*. Paper presented at MATE proceedings, Essaouira. Rabat: MATE, 41-51.

Nassaji H. Qualitative and descriptive research: Data type versus data analysis. Language Teaching Research. 2015;19(2):129-132. doi:10.1177/1362168815572747

OECD, 2010. *PISA 2009 Results: What Makes a School Successful? Resources, Policies and Practices*. OECD, Paris.

OECD, 2013. *TALIS 2013 conceptual framework.* OECD, Paris.

OECD, 2014. *TALIS 2013 Results: An International Perspective on Teaching and Learning.* OECD Publishing.http://dx.doi.org/10.1787/9789264196261-en

OECD, 2018. T*eaching in Focus #23 Teaching students with special needs: Are teachers well-prepared?*. https://www.educacionyfp.gob.es/inee/dam/jcr:93ad627e-af50-481a-a20d-2658be6a138c/tif%2023%20bueno.pdf

OECD, 2019. *TALIS 2018 Technical Report*. OECD, Paris.

Polly, D., et al., 2015. Linking professional development, teacher outcomes, and student achievement: The case of a learner-centered mathematics program for elementary school teachers. *International Journal of Educational Research*, *72*, 26-37.

Rodríguez, A. G., and McKay, S., 2010. Professional development for experienced teachers working with adult english language learners. *CAELA NetworkBrief*. https://files.eric.ed.gov/fulltext/ED540598.pdf

Rowe, K., 2003. The importance of teacher quality as a key determinant of students' experiences and outcomes of schooling. *In:* Meiers, M., ed. *Building Teacher Quality: ACER Research Conference, 2003: Proceedings,* 19-21 October 2003 Melbourne. Australian Council for Educational Research, https://research.acer.edu.au/cgi/viewcontent.cgi?article=1001&context=research_conference_2003.

Sağır, M., 2014. Teachers' professional development needs and the systems that meet them. *Creative Education*, *5*, 1497-1511. doi:10.4236/ce.2014.516167

Saha, L. J. and Dworkin, G. A., 2009. Introduction: New perspectives on teachers and teaching. *In*: L. J. Saha and A. G. Dworkin, eds. *International handbook of research on teachers and teaching.* New York: Springer, 3-11.

Schachner, M., 2014. *Contextual conditions for acculturation and school-related outcomes of early adolescent immigrants in Germany.* Thesis (PhD). Tilburg University.

Tsui, M., 2005. *Sage Sourcebooks for SSHS the Human Services: Social work supervision: Contexts and concepts* Thousand Oaks, CA: SAGE Publications, Inc. doi: 10.4135/9781452232553

UNESCO, 2015. *Education 2030, Incheon declaration (ıd) and framework for action.* http://uis.unesco.org/sites/default/files/documents/education-2030-incheon-framework-for-action-implementation-of-sdg4-2016-en_2.pdf

Walls, R. T., et al., 2002. The characteristics of effective and ineffective teachers. *Teacher Education Quarterly, 29*(1), 39-48. Retrieved from http://www.teqjournal.org/backvols/2002/29_1/w02__walls_nardi.pdf

Wenglinsky, H., 2002. How schools matter: The link between teacher classroom practices and student academic achievement. *Education Policy Analysis Archives,10*(12), 1-30. http://dx.doi.org/10.14507/epaa.v10n12.2002.

Witte, T., and Jansen, E., 2016. Students' voice on literature teacher excellence. Towards a teacher organized model of continuing professional development. *Teaching and Teacher Education*, *56*, 162-172.

Wong, L., and Snow, C., 2000. *What teachers need to know about language?* (Contract No. ED-99-CO-0008). Washington, DC: U.S. Department of Education's Office of Educational Research and Improvement, Center for Applied Linguistics.

Zhang, S., Shi, Q., and Lin, E., 2019. Professional development needs, support, and barriers: TALIS US new and veteran teachers' perspectives. *Professional Development in Education*, DOI: 10.1080/19415257.2019.1614967.
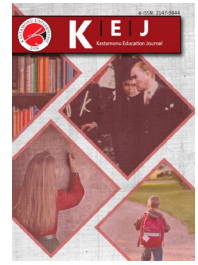
Fourth Grade Primary School Students' Solutions to the Questions on Fractions and the Models They Use in Solving

İlkokul 4. Sınıf Öğrencilerinin Kesirler Konusundaki Sorulara Yönelik Çözümleri ve Çözümde Kullandıkları Modeller

Ergün YURTBAKAN[1], **Tuba AYDOĞDU-İSKENDEROĞLU**[2]

Abstract

Purpose: This study aims to define the solutions towards fractions and solving models case of fourth grade primary school students.

Design/Methodology/Approach: Case study of qualitative research was used in this study. Selected by means of convenient case sampling, 113 fourth grade primary school students were included in this research. Fractions test developed by the researchers was applied to the students and the data obtained from the students were analyzed with descriptive analysis.

Findings: Primary school 4th grade students were able to rank equal fractions of units and denominators, and add and subtract operation in fractions and solve problems that require these operations. It was seen that students who could model fraction types (simple, improper, whole number of fraction) could not determine the fraction of a multiplicity, but they could show the fraction of the multiplicity on at model. Students modelling types of fractions (proper, improper, mixed) are not able to define a fraction of multiplicity whereas they seem to determine the fraction on a model.

Highlights: It has been determined that students who can model ordering fractions with equal denominators cannot model ordering unit fractions, addition and subtraction, and problems that require these operations.

Öz

Çalışmanın amacı: Araştırmada ilkokul 4. sınıf öğrencilerinin kesirler konusuna yönelik çözümleri ve çözümleri modelleme durumlarını belirlemek amaçlanmıştır.

Materyal ve Yöntem: Nitel araştırma yaklaşımlarından özel durum yöntemi ile yürütülen araştırmaya 113 ilkokul 4. sınıf öğrencisi dahil edilmiştir. Öğrencilere araştırmacılar tarafından geliştirilen kesirler testi uygulanmış, öğrencilerden elde edilen veriler betimsel analiz ile analiz edilmiştir.

Bulgular: ilkokul 4. sınıf öğrencilerinin birim ve paydaları eşit kesirleri sıralayabildikleri, kesirlerde toplama ve çıkarma işlemleri ile bu işlemleri gerektiren problemleri çözebildikleri tespit edilmiştir. Kesir türlerini (basit, bileşik, türemiş) modelleyebilen öğrencilerin, bir çokluğun kesir kadarını belirleyemedikleri görülse de çokluğun kesir kadarını model üzerinde gösterebildikleri görülmüştür.

Önemli Vurgular: Paydası eşit kesirleri sıralamayı modelleyebilen öğrencilerin; birim kesirleri sıralamayı, toplama ile çıkarma işlemini ve bu işlemleri gerektiren problemleri modelleyemedikleri tespit edilmiştir.

---

[1] **Corresponding Author,** Trabzon University, Faculty of Education, Department of Primary Education, Trabzon, TURKEY; gamsiz6436@gmail.com, https://orcid.org/0000-0001-8811-6320

[2] Affiliation, Trabzon University, Faculty of Education, Department of Primary Education, Trabzon, TURKEY; tubaiskenderoglu@gmail.com, https://orcid.org/0000-0002-6282-9100

INTRODUCTION

Mathematics is a concept for general ideas and abstract expressions that include commonality of objects or events in the field (Ubuz, 1999). Primary and secondary school periods are especially important in the awareness of concepts by students or teaching by teachers (Duran, 2013; Zaslavsky and Shir, 2005). The abstractness of the concepts or the inability to be fully understood by the students causes the misconceptions of the concepts in the students (Batdal-Karaduman ve Elgün-Ceviz, 2018). In our country, there are misconceptions about mathematics such as geometry (Yenilmez and Yaşa, 2008), probability (Dawn, 2016), problem solving (Invincible and Yilmaz, 2008), environment, space, volume (Daghli, 2010), algebra (Kocakaya-Baysal, 2010) fractions (Gürel and Okur, 2016).

Fractions are among the most difficult mathematics concepts faced by primary school students (Hansen, 2014). Although fractions tell a quantity like integers, they differ from whole numbers in terms of how much the parts are ratherthan the whole and the reason why students make mistakes is that they do not understand the part-whole relationship well (Altun, 2014; Kocaoğlu and Yenilmez, 2010). Therefore, teachers need to be more careful when teaching the subject of fractions (Önal and Yormaz, 2017). Firstly, teachers should be interested in the subject and develop a positive attitude towards the course when teaching fractions (Altun and Çelik, 2018). Then they should conduct their courses with student-centered activities, enabling students to gain experience (Biber, Tuna and Aktaş, 2013; Ersoy and Ardahan, 2003; Kocaoğlu and Yenilmez, 2010). For this reason, they should use concrete and digital materials that have an important place in fraction teaching in their courses (Ergöl and Sezgin Memnun, 2020), and to structure the subject of fractions using different models for students with learning difficulties (Biber, Tuna and Aktaş, 2013; Kocaoğlu and Yenilmez, 2010).

The model, emerges at the end of the modelling process, which acts as a bridge between mathematics and real life (Ortiz and Dos Santos, 2011; Sriraman, 2006). Modelling; it provides the opportunity to produce more flexible and analytical solutions to events by concretizing mathematical knowledge and looking at real-life problems from a mathematical perspective (Berry and Houston, 1995; Mousoulides, Christou and Sriraman, 2006). Therefore, in the modelling process, it is important for students to interpret problem situations, organize information, predict solutions and try possible solutions, and create models for an in-depth understanding of events (Biembengut and Hein, 2010; Lesh and Doerr, 2003). For this purpose, it is necessary to understand the complex systems of the modelling process, to develop shareable tools using different disciplines and to work as a team (Chan, 2013). In this way, students will be able to easily make mathematical definitions, read data from tables and charts, justify their explanations, improve their discussions, learn meaningfully and improve their mathematical attitudes (Işık and Es, 2019; Lesh and Doerr, 2003; Tural Sönmez, 2019; Watters, English and Mahoney, 2004).

In mathematics education, mathematical modelling is important because traditional methods are inadequate in gaining the ability to use mathematics in daily life (Lingefjard, 2012; Peter, 2018). For this reason, it is necessary to use appropriate and different models to expand and deepen the fraction understanding of both students and teachers. Because models are used to help the student develop new concepts and relationships, establish the relationship between concepts and symbols, and to measure the student's level of understanding (Olkun and Toluk Uçar, 2012). These models are region/area, number line, and set models (van de Walle, 2012). In the region/area model from these models, the fraction number is embodied as a specific part of a region, while number line models compare lengths and measurements instead of fields. The number line model used in the length models, on the other hand, qualifies the fraction number as a real number. In the set model some of the objects in a set are represented. In other words, a set of objects creates a fraction of a group of objects that are a subset of the whole and the whole (Olkun and Toluk Uçar, 2012; van de Walle, 2012). In order for students to discover these concepts and models in fractions, teachers need to know pedagogical practices, be able to use appropriate models and give opportunities to students in a classroom environment (Aydoğdu-İskenderoğlu, 2017; Utley and Reeder, 2012).

When looking at the literature; studies aimed at identifying conceptual misconceptions regarding fractions (Adıgüzel, et al., 2018; Altıparmak, et al., 2017; Ayyıldız and Altun, 2013; Flores, Hinton and Taylor, 2018; Pesen, 2007; Pesen, 2008; Trivena, Ningsih and Jupri, 2017; Türkdoğan, et al., 2015), teacher opinions on the teaching of fractions (Doğan and Temur, 2011; Gökkurt, Soylu and Demir, 2015; Kar and Işık, 2015; Toptaş, Han and Akın, 2017), the situations of elemantary school students are examined, opinions and metaphors about fractions are taken (Altun and Çalik, 2018; Ergöl and Sezgin Memnun, 2020; Stafylidou and Vosniadou, 2004). It is seen that studies are carried out to determine the mistakes that primary school students make in sorting fractions, in adding and subtracting fractions, and to examine the effect of realistic mathematics education in making sense of decimal fractions (Önal and Yorulmaz, 2017; Phu Loc, Huu Tong and Thai Chau, 2017; Uça and Saracaloğlu, 2017). However, it is seen that there are no studies that reveal the status of primary school students in all achievements of the subject of fractions in the Primary Mathematics Teaching Program such as modelling fractions, sorting fractions, collecting and removing and solving problems requiring these operations. Therefore, it is necessary to determine the status of the 4th grade students in the final semester of primary school in all achievements of the fractions in the Primary Mathematics Curriculum.

It is seen that various studies have been carried out with primary, elemantary school students, preservice teachers and teachers related to modelling skills (Çiltaş and Işık, 2013; Delice and Kertil, 2015; Deniz and Akgün, 2018; Eraslan and Kant, 2015; Erdoğan, 2019; Hıdıroğlu and Bukova Güzel, 2015; Kal, 2013; Kertil, 2008; Olkun, Şahin, Akkurt, Dikkartın and Gülbağcı, 2009;

Şahin and Eraslan, 2016; Tekin Dede and Bukova Güzel, 2013; Tural Sönmez, 2019; Ulu, 2017). Primary and elementary school teachers' opinions on teaching fractions by model (Gökkurt, Soylu and Demir, 2015; Toptaş, Han and Akın, 2017), a study examining the relationship between fractions modelling and mathematics attitudes of secondary school students (Işık and Es, 2019). In this sense, no previous studies have found any studies for all gains. In addition, you can use the Primary Mathematics Curriculum in all achievements regarding 4th grade of primary school, examining the modelling skills of students (modelling fractions, types of fractions, problems requiring addition and subtraction in fractions, problems requiring addition and subtraction in fractions) will fill the lack of literature. Therefore, the difficulties in modelling fractions and fractions, which are not used much in daily life according to whole numbers, are at the beginning of abstract and difficult subjects of mathematics and are one of the subjects that primary school students are most mistaken for, are worth investigating especially at the primaryy school level (Albayrak, 2000; Kocaoğlu and Yenilmez, 2010; Okur and Çakmak-Güzel, 2016). Identifying the misconceptions about fractions in the 4th grade and the modelling status of the students will help teachers plan their next lessons and consider course processing with different methods and techniques and materials in order to prevent the misconceptions that students will experience in the coming years.

Accordingly, in this research, primary school 4th grade students' solutions to the subject of fractions and their modelling situations will be determined. Depending on this purpose, the following sub-problems will be searched for answers.

1. What is the modelling status of fraction types of primary school 4th grade students?

2. What is the status of primary school 4th grade students ordering fractions with equal units and denominators correctly and modeling the order?

3. What are the situations of primary school 4th grade students to determine the fraction of a multiplicity and show it on the model?

4. What is the situation of primary school 4th grade students in addition and subtraction in fractions, solving problems that require these operations, and modelling their solutions?

METHOD

Research Model

In order to define the solvings towards fractions and solving models case of fourth grade primary school students, qualitative research deigns and case studies were used. The case study focuses on an up-to-date event, case, situation, group, and individuals, allowing for in-depth research (Bassey, 1999; Stake, 1995; Yin, 1994: Akt. Ekiz, 2009). Based on this study, case study was referred because of deep research on all achievements of fractions and modelling of the 4th grade primary school students.

Study Group

Selected via convenient case sampling, 113 (58 female, 55 male) 4th grade primary school student who study in a district, Trabzon, Turkey have participated in research. Convenient case sampling is associated with making it easier or easier for people or groups to participate in the research process (Ekiz, 2009). Convenient case sampling has been applied in order to speed up the research and make it easy for students to reach.

Data Collection Tools

In this study, open-ended fraction test have been applied which are developed by researchers. Before the fractions test was developed, the primary school 4th grade mathematics curriculum was examined. In the program, it is seen that there are these gains related to fractions: "1- *Recognizes simple, improper and mixed fractions and shows them with models, 2- Compares and sorts unit fractions, 3- Specifies a specified simple fraction of a multiplicity, 4- Compares up to three fractions with equal denominators, 5- Collects and subtract denominators with equal fractions, 6- Solves problems that require fractional addition and subtraction.*" (MEB, 2018). Questions have been prepared about the gains. The questions prepared are presented to the opinion of 6 classroom teachers who are teachers of the students in the working group ranging from 10-20 years of service. Teachers evaluated the prepared questions in terms of students' level of conformity and language. Afterwards, the questions were presented to two experts in mathematics education. Finally, the test was applied as a pilot study to 10 students in the 4th grade of primary school. Some of the questions of the test are symbolic and some are prepared as verbal problems. In the first question of the test, composed of 6 items in total, students are expected to model fractions types; in the second, order unit fractions by modelling them; right in the third, recognize a fraction of multiplicity and show it with model; in the fourth, order equivalent fractions by modelling them; in the fifth, solve addition and subtraction problems of fractions by modelling them; and in the sixth question, which consists of two different problems that require addition and subtraction, students are expected to solve the problems by modelling.

Gain 1: Show the fractions given below with the model.

$$\frac{2}{5} \qquad\qquad \frac{6}{5} \qquad\qquad 3\frac{1}{5}$$

Gain 2: Model the following unit fractions and sort them from large to small.

$$\frac{1}{8} \qquad\qquad \frac{1}{3} \qquad\qquad \frac{1}{6}$$

Gain 3: 3/7 of the 56 kilograms of apples in a case are rottenAccording to this, how many kilograms of apples are left? (Solve by drawing a model.)

Gain 4: Line the following fractions from small to large by modelling them.

$$\frac{9}{12} \qquad\qquad \frac{5}{12} \qquad\qquad \frac{7}{12}$$

Gain 5: Model the following operations.

a) $\quad 3\frac{1}{9} + \frac{4}{9} =$

b) $\quad \frac{7}{11} - \frac{5}{11} =$

Gain 6:

a) Ahmet's gone 3/10 and then 5/10 of a road. What time did Ahmed go on the road? (make the solution by modelling it.)

b) 11/12 of a tank is filled with water. Since 5/12 of the water in this tank and the fruit trees are iringged, how many of the tanks are left with water? (make the solution by modelling it.)

Figure 1. Fractions open-ended success test

Data was collected in 2nd term of 2018-2019 educational year after the achievements related to fractions subject were completed. Suggesting the fact that 40 minutes was sufficient for students to complete the tests, 6 classroom teachers adjusted one course hour in a day on which all the students were available in order that they did not affect one another; and then all teachers executed tests at the same time.

Data Analysis

In the descriptive analysis, the data is interpreted and summarized according to the previously determined themes (Yıldırım ve Şimşek, 2013: s. 256). Questions that students are to model fractions requisite answers classified as True (T) and False (F). Unit and equivalent fractions have been divided into categories: both ordering and modelling are true (OTMT), ordering is true but modelling is false (OTMF), ordering is false but modelling is true (OFMT), all answers are false (AAF) and questions are unanswered (U). Defining a fraction of multiplicity, operating addition and subtraction, solving related problems and modelling have also been separated into categories: both operation and modelling are true (OTMT), operation is true but modelling is false (OTMF), operation is false but modelling is true (OFMT), all answers are false (AAF) and questions are unanswered (U). The answers of the students were evaluated separately by 2 researchers. Similarity between the two assessments; calculated according to Miles and Huberman's (2004) formula. According to this formula; common results are divided by the sum of common results and non-common results and multiplied by face. The similarity from the researchers' codes was found to be 95%. The inconsistent results were discussed by two researchers and concluded in common. Related questions are quoted from the students' answer sheets, mistake subjects and shown in the tables. The answers of the students are evaluated individually, while the mistakes in the modelling encountered in each question; MM1, MM2,... codes are given. A total of 15 modelling mistakes were found in the students' answers. The mistakes made by the students regarding the concepts were evaluated by the researchers according to the following criteria. (see Table 1).

Table 1. Categorization of the mistakes made by students

Abbreviations	Mistakes
MM1	Not all are drawn the same size
MM2	Re-scanning of the scanned part in the first fraction in the second fraction
MM3	The part removed in the whole is ultimately shown as existing
MM4	Show subtraction with the addition model
MM5	Split the whole into more than denominators
MM6	Inability to divide the whole into equal parts
MM7	Unable to show the removed model on the model even though it has drawn
MM8	Inability to draw the result of the model
MM9	Divide the model by the share and paint the denominator
MM10	Draw only the result of a process
MM11	Show only subtrahend of the model
MM12	Irrelevant modelling
MM13	Showing each fraction in the ranking with different wholes
MM14	Showing the numenator and denominator by relocating
MM15	Fractional parts as much as fractions in showing the multi-multi-length

FINDINGS

In this part of the study, students' ability to model fractions, model and sort equal fractions of unit fractions and denominators, determine by modelling the fraction of a multiplicity, model and solve the process of collecting and removing fractions and solving fraction problems using model will be examined.

Findings for Research Question 1

In this part of the study, students' modelling status of fraction types was examined and the data obtained were presented in Table 2.

Table 2. Students' Ability to Model Fraction Types

Answers	Simple fraction	İmproper fraction	Whole number of fraction
True	112	93	82
False	1	20	30
Unanswered	0	0	1

Almost all of the students are able to model simple fractions, the vast majority can model improper fractions, and nearly three-quarters can model whole number of fractions. When it comes to modelling fraction types; it is seen that there is a decrease in the number of students from the simple fraction to the whole number of fractions.

The correct answers that students give when it comes to modelling fraction types and the answers to the most mistakes of all types are shown in Figure 2.

    a.   Accurate modelling of fraction types of students with code Ö1
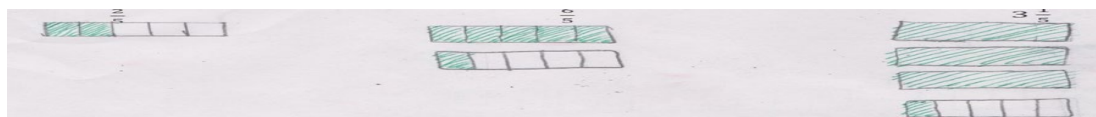
b. Wrong modelling of student MM12 in simple fraction
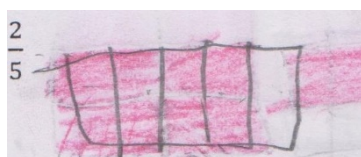
c. MM12 coded incorrect modelling of student Ö66 in improper fraction
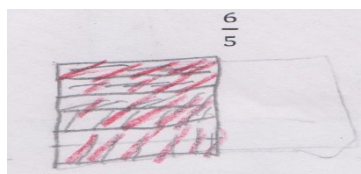
d. MM1 coded incorrect modelling of student Ö28 in whole number of fraction

Figure 2. Modelling fraction types

It is seen that only 1 of the students models the simple fraction in a way that is irrelevant to the share and denominator (MM12). For example, the student appears to have scanned more than as much as desired despite dividing the fraction into 5 equal parts. In the improper fraction; 16 of the students made the mistake code MM12, 2 MM9, 1 student MM1 and MM6. The sample answer shows that the student can show the whole fraction (5/5) and not 5/6 (see Figure 1.c).

In the whole numbered fraction, 21 students made the mistake code MM1, 9 students MM12, 1 student MM13 and MM14. In the sample answer (see figure 1.d.), it is seen that the fractions are not the same size, although the whole numbered fraction shows correctly what is desired. In this context, it is understood that the students do not understand that the fractions in the whole numbered fractions should be the same size.

Findings for Research Question 2

In this part of the study, students' ability to sort and model units and denominators equal fractions was examined and the data obtained were shown in Table 3.

Table 3. Students' are sorted and modeled unit fractions, denominator equal fractions

Students' ability to sort and model unit fractions and denominators equal fractions					
Fractions	OTMT	OTMF	OFMT	AAF	U
Unit fractions	39	41	4	29	0
Denominator equal fractions	57	4	38	12	2

80 of the students did the unit fraction ranking correctly (OTMT, OTMF), 33 students got it wrong (OFMT, AAF); 43 students (OTMT, OFMT) do modelling correctly, while 70 students (SDMH, TH) appear to have mismodeled modelling. In this sense, it can be stated that students can sort unit fractions but cannot model them.

More than half of students were found to be correct in sorting equal fractions of denominators (61 students; OTMT, OTMF), the vast majority (95 students; OTMT, OFMT) also appears to be doing the modelling correctly. In this context, it can be concluded that students have no problems with both sorting and modelling of equal fractions of denominators.

The following illustrations of students' modelling status for sorting fractions equal to units and denominators are shown below (see Figure 3).

a- Correct modelling of unit fractions of student with code Ö8;
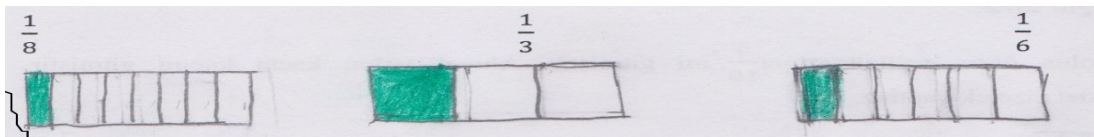
b- MM1 coded incorrect modelling of the student with the code Ö56 for sorting unit fractions
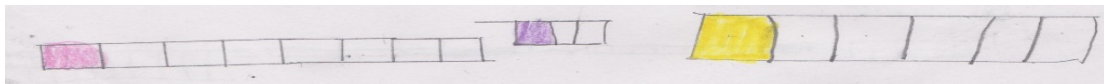
c- Accurate modelling of the student with the code Ö19 on sorting the denominators equal fractions
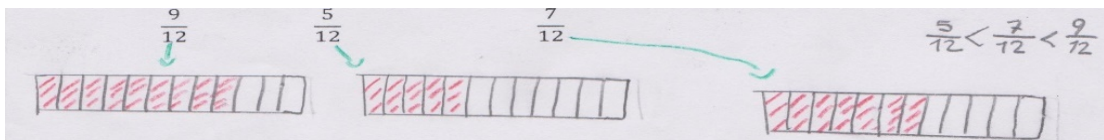
d- MM12 coded erroneous modelling of the student with code Ö70 on sorting equal fractions of denominators
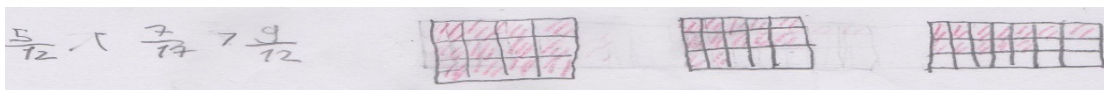
Figure 3. Errors in modelling fractions sorting

It was observed that 43 of the students correctly showed the unit fractions ranking on the model, 53 students made the mistake coded MM1, 9 students made the error coded MM12 and 8 students made the mistake coded MM13. Students were expected to draw models of the same size on all three simple fractions, while they were expected to cut as many of them into equal parts (see Figure 3.a.), but nearly half of the students drew the desired model for each fraction, but the three fraction models were not the same size (MM1) (see Figure 3.b.).

Students were expected to cut all boots of the same size and each whole into equal parts for three fractions with equal denominators (see Figure 3.c). It appears that most students modeled the correct question irrelevantly by 14 students (HM12) (see Figure 3.d.).

Findings for Research Question 3

At this stage of the research, the students' ability to model the fraction of a multiplicity was examined and the data obtained were shown in Table 4.

Table 4. Students' determination status by modelling the fraction of a multiplicity

Students' ability to identify and model the fraction of a multiplicity				
OTMT	OTMF	OFMT	AAF	U
36	13	34	28	2

Nearly half of the students appear to have correctly answered the fraction of the multiplicity (49 students; IDMD, IDMH). When looking at the ability of a multiplicity to show fractions on the model; it is seen that 70 of the students (IDMD, IHMD) can show in the correct model.

The answers of the students to show the fraction of a multiplicity on the model are shown in Figure 4 below.

a- Accurate modelling of the student with the code Ö75
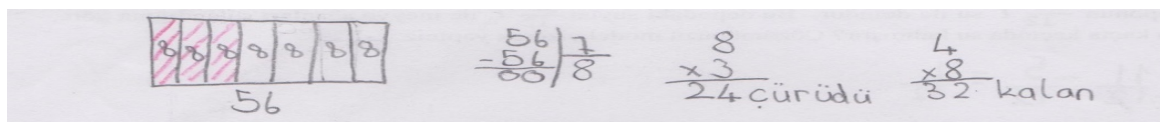
b- Incorrect modelling of student with code 31 code HM12 on the subject
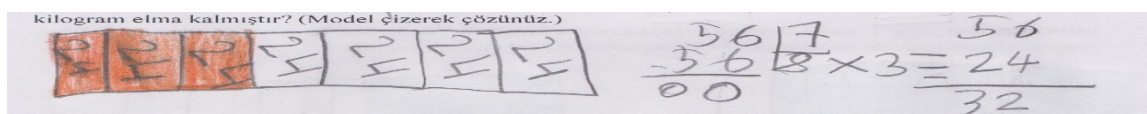
Figure 4. Modelling the fraction of a multiplicity

It was found that 70 of the students were able to accurately model the fraction of a multiplicity, while 34 students made the error coded MM12, 6 students MM11, 1 student MM6 and MM7 when modelling.

In the modelling of the fraction of a multiplicity, the students were first expected to divide the entire fraction into 7 equal parts, show the decaying apple and the remaining apple part, then write down the amount per piece and determine the desired amount (see Figure 4.a.).

In the question answered correctly by almost three-quarters of students (70), it is seen that the wrong modelers are not able to determine (irrelevant modelling) in each unit in the model (see Figure 4.b.).

Findings for Research Question 4

In this part of the research, students' ability to solve and model problems requiring the process of addition and subtraction fractions was examined.

Table 5. Students' situations of solving and modelling problems that require the addition, subtraction process and these operations in fractions

Operation-problem	Students' addition and subtraction and modelling skills in fractions				
	OTMT	OTMF	OFMT	AAF	U
Addition	5	85	0	20	3
Subtrction	12	81	0	19	1
Addition problem	42	49	3	10	9
Subtraction problem	18	63	1	15	16

Although the vast majority of students (90 students; OTMT, OTMF) did the addition correctly, almost all of them (108 students; OTMF, AAF, U) were unable to model the collection process. Although the vast majority of students (93 students; OTMT, OTMF) also did the subtraction correctly, it appears that they did the modelling incorrectly (101 students; OTMF, AAF, U). In this sense, it can be concluded that the students did the addition and subtraction process correctly in the fractions but could not show the procedures on the model.

It is seen that 91 of the students (OTMT, OTMF) solved the fraction problem that required the addition process, while 68 students (OTMF, AAF, U) could not show it on the model. Although 71 students (OTMT, OTMF) solved problems requiring subtraction, 94 students (OTMF, AAF, U) could not show on the model. In this context, it can be concluded that students solve problems that require addition and subtraction in fractions but cannot show them on the model.

The status of students to show the addition, subtraction and problems that require these operations on the model is presented in figure 5.

a- Accurate modelling of the addition process of the student with the code Ö101
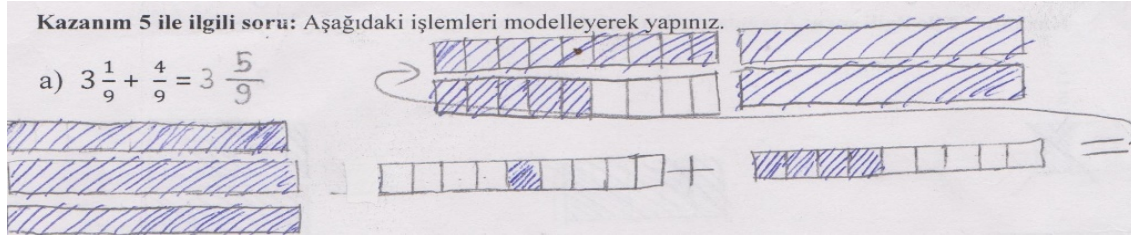
b- MM2 coded incorrect modelling of student with code Ö58 on addition

c- Accurate modelling of the subtraction process of the student coded Ö47
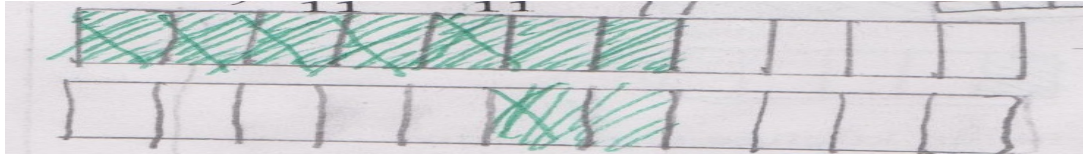
d- Incorrect modelling of the subtraction process of the student coded Ö33
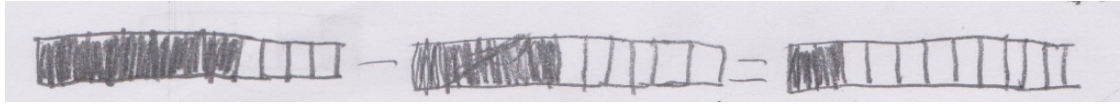
e- Accurate modelling of the problem that requires the addition process of the student coded Ö29
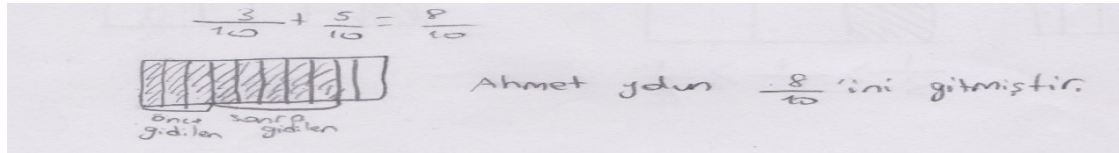
f- MM2 coded incorrect modelling of student Ö3 on the subject
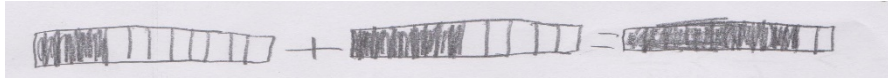
g- Accurate modelling of the problem requiring subtraction of student with the code Ö112
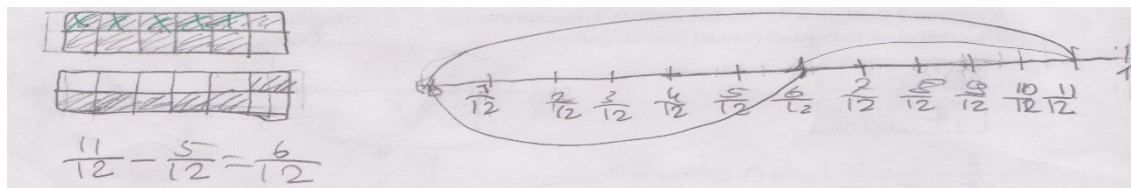
h- Incorrect MM3 coded modelling of student with code Ö56 on the subject

Figure 5. Modelling problems that require these operations with addition, subtraction

While 5 of the students were seen to correctly model the addition process in the fractions; 38 students were found to have made the error coded MM2, 28 students MM12, 21 MM10, 15 MM1, 2 students MM8 and 1 student MM6. When modelling the addition process in fractions, students are expected to first mark the first fraction on the same whole, then show the second fraction in parts that were not previously marked in the fraction, and ultimately all the marked parts are expected to be marked (see Figure 5.a.). It has been observed that most of the students made the mistake of marking the part they marked in the first fraction again in the second fraction (HM2) (see Figure 5.b.).

It turned out that 12 of the students correctly modelled the subtraction process in fractions, 37 students made MM3, 30 students made MM12, 21 students made MM10, 6 students made MM8 and 4 students made the MM7 error. In the subtraction process, it is expected to determine the desired number of the marked parts in the second fraction after the desired part is shown in the first fraction, and to show the unmarked parts of the first fraction in the resulting section (see Figure 5.c.). It is seen

that most of the students determined the desired number of the parts marked in the first fraction in the second fraction, but showed the part they removed again in the resulting section (HM3) (see Figure 5.d.).

While it is seen that 45 of the students can correctly model solving the problem that requires addition; Thirty-three were found to have made the mistake, MM2, 12 students MM10, 8 students MM12, 4 students MM8 and 2 students MM4. When modelling the problem that requires addition in fractions, students were expected to first mark the first fraction on the same whole, then to show the second fraction in parts that had not been previously marked in the fraction, and as a result, all the marked parts were expected to be marked (see Figure 5.e.), but it was observed that most of the students had the mistake of marking the part they marked in the first fraction again in the second fraction (see Figure 5.f.f).

While 19 of the students were found to have correctly modeled the solution of the problem that required subtraction; It was determined that 29 of the students made the mistake coded MM3, 18 students MM12, 12 students MM8, 10 students MM10, 3 students MM4 and MM7, 2 students MM11 and 1 student MM5.

In the problem requiring subtraction, it is expected to determine the desired number of the marked parts in the second fraction after the desired part is shown in the first fraction, and to show the unmarked parts of the first fraction in the resulting section (see Figure 5.g.). Most of the students also determine the desired amount of the parts marked in the first fraction, as in the question that requires removal in the fractions, but show the part they extracted again in the resulting section (see Figure 5.h.).

CONCLUSION, DISCUSSION AND RECOMMENDATIONS

At the and of study; primary school 4th grade students were able to rank equal fractions of units and denominators, and add and subtract operation in fractions and solve problems that require these operations. It was seen that students who could model fraction types (simple, improper, mixed) could not determine the fraction of a multiplicity, but they could show the fraction of the multiplicity on at model. Students modelling types of fractions (proper, improper, mixed) are not able to define a fraction of multiplicity whereas they seem to determine the fraction on a model.

The study found that students were able to sort both denominator equal fractions and unit fractions. Önal and Yorulmaz, (2017) found that the students sorted the fractions like natural numbers. In fact, many studies have shown that students are mistaken about this (Biber, Tuna and Aktaş, 2013; Soylu and Soylu, 2005; Stafylidou and Vosniadou, 2004; Tuna and Aktaş, 2013). hese misconceptions; it is seen by the students that only the denominator of the fraction is observed in the form of making the large incision look larger or thinking that the value of the fraction increases in cases where the value of the denominator or share is decreased (Bingölbali and Özmantar, 2012; Demiri, 2013; Okur and Çakmak-Güzel, 2016; Stafylidou and Vosniadou, 2004). The reason why the students in the study were successful in sorting the fractions may be because teachers theoretically know the subject of fractions well (Chick, Pham and Baker, 2006). In addition, there are some rules that can be used to sort both denominator equal and unit fractions, which may have been taught to students by teachers. However, it may be that the students in the study did not have a good understanding of the part-whole relationship required to learn the fractions underneath their difficulty in modelling when sorting the unit fractions (Charalambous and Pitta-Pantazi, 2005). The fact that students do not understand the whole-part relationship may be because teachers have not spent enough time modelling in lessons. The reason these students make no mistake in modelling the ordering of equal fractions of denominators is that they can easily model the same fractions, all of which consist of simple fractions, and after determining the desired parts (share), they can concretely realize which is more and which is less.

The study found that students made no mistake in solving the process of addition and subtraction fractions. However, in some studies, it has been revealed that students write the same fractional denominator and share in the fractions as the natural number, and in the extraction they think of the denominator and the share separately and subtract the small number from the large number, and they act just like in natural numbers (Kar and Işık, 2015; Önal and Yorulmaz, 2017). Some studies have also found that students are wrong to addition and subtraction fractions (Biber, Tuna and Aktaş, 2013; Trivena, Ningsih and Jupri, 2017). It is generally seen that the errors made in the addition process are in the form of separate considerations of the shares and denominators and the collection among themselves (Biber, Tuna and Aktaş, 2013; Soylu and Soylu, 2005). The reason the subtraction cannot be performed may be because students think it is difficult to remove in fractions (Trivena, Ningsih and Jupri, 2017). The fact that the students in the study also had a good understanding of the relationship between the share and denominator in the fractions may have led them to make mistakes in addition and subtraction fractions. However, students made mistakes in showing the solution of the addition and subtraction process on the model, and the reason for this is that; It may be because teachers point out that only shares should be collected when performing the procedures in the solution of the addition and subtraction of only equal fractions in the primary school mathematics curriculum. Because it is seen that teachers in primary schools do not have enough knowledge about modelling fractions (Aydoğdu-İskenderoğlu, 2017). Teachers who do not have this competence can focus only on theoretical knowledge when teaching fractions to students, but they may not dwell on modelling the processes as much or at all as they do on modelling the types of fractions to embody them. For these reasons, students are likely to make mistakes, as in this research, both in modelling the collection and extraction processes and in modelling the solution of the problems that require these processes.

The study found that students did not make mistakes in solving problems that require the process of additing and subtracting fractions, but they made mistakes in determining the fraction of a multiplicity asked as a problem. The study of Biber, Tuna and Aktaş (2013) is similar to the results of the research, but the results of this research are at odds with the research of Başgün and Ersoy (2000). Although the reason why students were wrong in solving fraction problems depends on the correct modelling (Biber, Tuna and Aktaş, 2013), the students in the study had problems with modelling even though they solved the problems correctly. The reason why students have trouble solving the problems of finding the fraction of a multiplicity; Fractional problems at the primary school level, which only involve the addition and subtraction process, may be due to the fact that more than four students who have previously acquired four processing skills have learned what words such as increase, addition, addition, deficiency, separation, subtraction mean in the problem. Because students who learn these words correctly can decide which action to take to solve the problem correctly. Students who decide which action to take may have concluded the correct way to solve the problems by warnings of teachers that only the shares should be processed when additing and subtracing the denominator in equal fractions.

Although the students in the study were able to model the types of fractions and the fraction of a multiplicity; it was determined that they made mistakes such as drawing all of them in equal fractions of different sizes, addition in fractions and showing the scanned part in the first fraction as scanning, subtraction and the problem requiring removal as the result. Other studies have found that students were wrong to understand the whole of the piece, that is, to co-cut fractions, which are the nature of fractions, or to write fractions that are broken into equal parts (Haser and Ubuz, 2002; Lamon, 2011; Okur and Çakmak-Güzel, 2016; Önal and Yorulmaz, 2017; Pesen, 2007, Phu Loc, Huu Tong and Thai Chau, 2017). However, in the study of Uça and Saracaloglu, (2017) it was seen that the students were able to form a whole relationship in parts. This may be because of classroom teachers do not know enough about modelling and cannot use it adequately (Toptaş, Han and Akın, 2017). In one study, teachers were asked to evaluate the answers of their students and teachers were found to be inadequate in explaining the misconceptions of their students (Karaağaç and Köse, 2015). It has been observed that most secondary school teachers start with activities suitable for fraction teaching, but have incomplete information about the models and subjects they use in fraction teaching (Gökkurt, Soylu and Demir, 2015), In this context, it can be considered that teachers have the misconceptions about fractions. Failure of teachers with misconceptions to teach modelling of different achievements may be the reason why students cannot model what is desired.

Recommendations

1. Problem solving, addition, subtraction, determining the specified amount of a multiplicity, modelling fractions equal to the unit and denominator, students who have problems with the problem can be processed with concrete materials (orange, cake, fraction sets, fraction cards...) to eliminate their problems.

2. Teachers, who are the priority in solving the problem that students often experience in modelling fractions, can be asked to plan enriched course activities focused on errors by explaining the mistakes that students make about fractions.

3. Qualitative studies can be carried out to determine why students have difficulty modelling fractions.

4. Longitude studies can be carried out to see if students continue to make mistakes after being taught their mistakes in modelling.

5. The achievements of students at each class level in modelling the subjects that contain all the gains in fractions can be examined and compared.

Declaration of conflicting interests

Funding

Statements of publication ethics

We hereby declare that the study has no unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers

REFERENCES

Adıgüzel, T., Şimşir, F., Çubukluöz, Ö. ve Gökkurt-Özdemir, B. (2018). Türkiye'de matematik ve fen eğitiminde kavram yanılgılarıyla ilgili yapılan yüksek lisans ve doktora tezleri: Tematik bir inceleme. *Bayburt Eğitim Fakültesi Dergisi, 13*(25), 57-92.

Altıparmak, K. ve Palabıyık, E. (2017). 4. ve 5. sınıf öğrencilerinin ondalık gösterim konusundaki kavram yanılgılarının ve hatalarının tespiti ve analizi. *Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi, 5*(2), 448-470.

Altun, M. (2014). *Matematik öğretimi.* Bursa: Aktüel Yayınları

Altun, H. ve Çelik, A. (2018). Kesir ve rasyonel sayılar konusu ile ilgili öğrencilerin ilgi ve düşünceleri. *International Journal of New Trends in Arts, Sports &Science Education, 7*(1), 1-14.

Aydoğdu-İskenderoğlu, T. (2017). The problems posed and models employed by primary school teachers in subtraction with fractions. *Educational Research and Reviews, 12*(5), 239-250. doi. 10.5897/ERR2016.3089.

Ayyıldız, N. ve Altun, S. (2013). Matematik dersine ilişkin kavram yanılgılarının giderilmesinde öğrenme günlüklerinin etkisinin incelenmesi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi (H. U. Journal of Education) 28*(2), 71-86.

Başgün, M. ve Ersoy, Y. (2000). *Sayılar ve aritmetik 1: Kesir ve ondalık sayıların öğretilmesinde bazı güçlükler ve yanılgılar*. IV. Fen Bilimleri Eğitimi Kongresi Bildiri Kitabı: 604-608, MEB Yay., Ankara.

Batdal-Karaduman ve Elgün-Ceviz, (2018). Matematik öğretiminde kavram karikatürlerinin öğrenci başarısına etkisi. *Elektronik Sosyal Bilimler Dergisi, Cilt:17,* Sayı:67, 1268-1277.

Berry, J. & Houston, K. (1995). *Mathematical modelling*. Bristol: J. W. Arrowsmith Ltd.

Biber, A. Ç., Tuna, A. ve Aktaş, O. (2013). Öğrencilerin kesirler konusundaki kavram yanılgıları ve bu yanılgıların kesir problemleri çözümlerine etkisi. *Trakya Üniversitesi Eğitim Fakültesi Dergisi, Cilt 3,* Sayı 2, 152-162.

Biembengut, M. S. & Hein, N. (2010). Mathematical modelling: Implications for teaching. R. Lesh, P. L. Galbraith, C. R. Haines ve A. Hurford (Yay. haz.). *Modelling Students' Mathematical Modelling Competencies* içinde (ss. 481-490). New York: Springer.

Bingölbali, E. ve Özmantar M. F. (2012). Matematiksel kavram yanılgıları: Sebepleri ve çözüm arayışları. E. Bingölbali ve M.F. Özmantar (Ed.), Matematiksel *zorluklar ve çözüm önerileri içinde (s. 63-95).* Ankara: Pegem A Yayıncılık.

Chan, C. M. E. (2013). Students' Designing an Ideal Tourism Route as Mathematical Modelling. In G. A. Stillman, G. Kaiser, W. Blum and J P. Brown (Eds.) *Teaching mathematical modelling: Connecting to research and practice* (pp. 153-163). Springer Science & Business Media

Charalambous, C. Y. & Pitta-Pintazi,D., (2005). Revisiting a theoretical model on fractions: implications for teaching and research. In Chick, H. L. ve Vincent, J. L. (Eds.). *Proceedings of the 29th Conference of the International Group for the Psychology of Mathematics Education*, 2, 233-240.

Chick, H. L., Pham, T. H. & Baker, M., (2006). *Probing teachers' pedagogical content knowledge: Lessons from the case of the subtraction algorithm*. In 29th Conference of the Mathematics Education Research Group of Australasia, 1, 139-146.

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

Dağlı, H. (2010). *İlköğretim beşinci sınıf öğrencilerinin çevre, alan ve hacim konularına ilişkin kavram yanılgıları*. (Yayımlanmamış yüksek lisans tezi). Afyon Kocatepe Üniversitesi Sosyal Bilimler Enstitüsü, Afyon.

Delice, A. ve Kertil, M. (2015). Investigating the representational fluency of pre-service mathematics teachers in a modelling process. *International Journal of Science and Mathematics Education*, *13*(3), 631-656. doi:10.1007/s10763-013-9466-0

Demiri, L. (2013). Öğrencilerin kesirler konusundaki kavram yanılgılarıyla ilgili öğretmen ve öğretmen adaylarının bilgilerinin incelenmesi. Yayınlanmamış yüksek lisans tezi. Marmara Üniversitesi, İstanbul.

Deniz, D. ve Akgun, L. (2018). İlköğretim Matematik Ogretmeni Adaylarinin Matematiksel Modelleme Becerilerinin Incelenmesi. *Akdeniz Egitim Arastirmalari Dergisi, 12*(24), 294-312. doi: 10.29329/mjer.2018.147.16

Doğan-Temur, Ö. (2011). Dördüncü ve beşinci sınıf öğretmenlerinin kesir öğretimine ilişkin görüşleri: fenomenografik araştırma. *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi, 29*, 203-212.

Duran, M. (2013). İlköğretim 7.sınıf öğrencilerinin görsel matematik okuryazarlığı hakkındaki görüşleri. *Mehmet Akif Ersoy Üniversitesi Eğitim Bilimleri Enstitü Dergisi, 2* (2), 38-51.

Ekiz, D. (2009). *Bilimsel araştırma yöntemleri*. Ankara: Anı Yayıncılık.

Eraslan, A. ve Kant, S. (2015). Modelling processes of 4th-year middle-school students and the difficulties encountered. *Educational Sciences: Theory ve Practice*, *15*(3), 809-824. doi:10.12738/estp.2015.3.2556

Erdoğan, F. (2019). İlköğretim matematik öğretmeni adaylarının matematiksel modelleme özyeterliklerinin belirlenmesi. *Mersin Üniversitesi Eğitim Fakültesi Dergisi, 15*(1), 118-130.

Ergöl, H. ve Sezgin Memnun, D. (2020). Ortaokul öğrencilerinin kesir kavramına ilişkin ürettikleri metaforlar. *Uluslararası Toplum Araştırmaları Dergisi, 10*(15), 1920-1939.

Ersoy, Y. ve Ardahan, H. (2003). "İlköğretim okullarında kesirlerin öğretimi II: Tanıya yönelik etkinlikler düzenleme. Erişim: http://www.matder.org.tr/bilim/ioko2tyed.asp?ID=49, 27.04.2005.

Flores, M. M., Hinton, V. M. & Taylor, J. J. (2018). CRA fraction intervention for fifth-grade students receiving tier two interventions. preventing school failure. *Alternative Education for Children and Youth, 62*(3), 198-213, DOI: 10.1080/1045988X.2017.1414027

Gökkurt Özdemir, B., Bayraktar, R. ve Yılmaz, M. (2017). Sınıf ve ortaokul matematik öğretmenlerinin kavram yanılgılarına ilişkin açıklamaları. *Trakya Üniversitesi Eğitim Fakültesi Dergisi, 7*(2),284-305.

Gökkurt, B. Soylu, Y. ve Demir, Ö. (2015). Ortaokul matematik öğretmenlerinin kesirlerin öğretimine yönelik görüşlerinin incelenmesi. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi (EFMED), 9*(2), 230-251.

Gürel, Z. Ç. ve Okur, M. (2016). Ortaokul 6. ve 7. sınıf öğrencilerinin kesirler konusundaki kavram yanılgıları. *Erzincan Üniversitesi Eğitim Fakültesi Dergisi, 18*(2), 922-952.

Hansen, A. (2014). *Children's errors in mathematics*. London: Sage Publications

Haser, Ç. ve Ubuz, B. (2002). Kesirlerde kavramsal ve işlemsel performans. *Eğitim ve Bilim, 27*(126), 53-61.

Hıdıroğlu, Ç. ve Bukova Güzel, E . (2015). Teknoloji destekli ortamda matematiksel modellemede ortaya çıkan üst bilişsel yapılar. *Turkish Journal of Computer and Mathematics Education (TURCOMAT), 6*(2), 179-208.

Işık, K. ve Es, H. (2019). Ortaokul öğrencilerinin kesirlerle işlemleri modelleme becerilerinin, matematik tutumlarının ve arasındaki ilişkinin bazı bağımsız değişkenlere göre incelenmesi. *Gazi Üniversitesi Eğitim Fakültesi Dergisi, 39*(3), 1347-1380.

Kal, F. M. (2013). *Matematiksel modelleme etkinliklerinin ilköğretim 6.sınıf öğrencilerinin matematik problemi çözme tutumlarına etkisi* (Yayımlanmamış yüksek lisans tezi). Kocaeli Üniversitesi, Fen Bilimleri Enstitüsü, Kocaeli

Kar ve Işık, (2015). İlköğretim matematik öğretmenlerinin öğrencilerin kurdukları problemlere yönelik görüşlerinin incelenmesi: Kesirlerle toplama işlemi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 30*(1), 122-136

Karaağaç, M. K. ve Köse, L. (2015). Öğretmen ve öğretmen adaylarının öğrencilerin kesirler konusundaki kavram yanılgıları ile ilgili bilgilerinin incelenmesi. *Sakarya Üniversitesi Eğitim Fakültesi Dergisi, 30*, 72-92.

Kertil, M. (2008). *Matematik öğretmen adaylarının problem çözme becerilerinin modelleme sürecinde incelenmesi*. Yayınlanmamış yüksek lisans tezi. Marmara Üniversitesi Eğitim Bilimleri Enstitüsü, İstanbul.

Kocakaya-Baysal, R. (2010). *İlköğretim öğrencilerinin (4-8. sınıf) cebir öğrenme alanında oluşturdukları kavram yanılgıları.* (Yayımlanmamış yüksek lisans tezi), Abant İzzet Baysal Üniversitesi Sosyal Bilimler Enstitüsü, Bolu.

Kocaoğlu, T. ve Yenilmez, K. (2010). Beşinci sınıf öğrencilerinin kesir problemlerinde yaptıkları hatalar ve kavram yanılgıları. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi, 14*, 71-85.

Lamon, S. J. (2011). *Teaching fractions and ratios for understanding: Essential content knowledge and instructional strategies for teachers* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Lesh, R. A. ve Doerr, H. (2003). Foundations of a models and modelling perspective on mathematics teaching and learning. R. A. Lesh ve H. Doerr (Ed.). *Beyond constructivism: A models and modelling perspective on mathematics teaching, learning, and problem solving* içinde (s. 3-34). Mahwah, NJ: Lawrence Erlbaum.

Lingefjard, T. (2007). Mathematical modelling in teacher education- necessity or unnecessarily, W. Blum, P. L. Galbraith, H-W. Henn, and M. Niss (Yay. haz.). *Modelling and Applications in Mathematics Education* içinde (ss. 330-340). New York, NY: Springer.

MEB, (2018). *İlköğretim matematik öğretim programı (1-8. Sınıflar).* Ankara.

Miles, M. B. & Huberman, A. M. (1994). *Qualitative data analysis*. London: Sage Publications.

Mousoulides, N. (2007). A modelling perspective in the teaching and learning of mathematical problem solving. Unpublished Doctoral Dissertation. University of Cyprus.

Okur, M. ve Çakmak-Gürel, Z. (2016). Ortaokul 6. ve 7. sınıf öğrencilerinin kesirler konusundaki kavram yanılgıları. *Erzincan Üniversitesi Eğitim Fakültesi Dergisi Cilt - Sayı: 18* – 2. DOI=10.17556/jef.30116.

Olkun, S., Şahin, Ö., Akkurt, Z., Dikkartın, F. ve Gülbağcı, H. (2009). Modelleme yoluyla problem çözme ve genelleme: İlköğretim öğrencileriyle bir çalışma. *Eğitim ve Bilim, 34*(151), 65-73.

Olkun S. ve Toluk Uçar, Z. (2012). *İlköğretimde etkinlik temelli matematik öğretimi*. Ankara, Anı yayıncılık.

Ortiz, J. ve Dos Santos, A. (2011). Mathematical modelling in secondary education: A case study. G. Kaiser, W. Blum, R. B. Ferri ve G. Stillman (Yay. haz.). *Trends in Teaching and Learning of Mathematical Modelling: ICTMA 1*4 içinde (ss. 127-135). Netherlands: Springer.

Önal, H. ve Yorulmaz, A. (2017). İlkokul dördüncü sınıf öğrencilerinin kesirler konusunda yaptıkları hatalar. *Eğitim ve Toplum Araştırmaları Dergisi/JRES, 4*(1), 98-113.

Özkan, Ö., Tekkaya, C. ve Geban, Ö. (2001). *Ekoloji konularındaki kavram yanılgılarının kavramsal değişim metinleriyle giderilmesi.* Yeni Binyılın Basında Fen Bilimleri Egitimi Sempozyumu Bildirileri 7-8 Eylül 2001 içinde (s.191-194). İstanbul: Maltepe Üniversitesi.

Pesen, C. (2007). Öğrencilerin kesirlerle ilgili kavram yanılgıları. *Eğitim ve Bilim, 32*(143), 79-88

Pesen, C. (2008). Kesirlerin sayı doğrusu üzerindeki gösteriminde öğrencilerin öğrenme güçlükleri ve kavram yanılgıları. *İnönü Üniversitesi Eğitim Fakültesi Dergisi, 9*(15).

Peter, S. (2018). The use of heuristic strategies in modelling activities. ZDM: *The International Journal on Mathematics Education, 50*(1-2), 315-326.

Phu Loc, N., Huu Tong, D. & Thai Chau, P. (2017). Identifying the concept "fraction" of primary school students: The investigation in Vietnam. *Educational Research and Reviews, Vol. 12*(8), pp. 531-539.doi.10.5897/ERR2017.3220.

Soylu, Y. ve Soylu, C. (2005). İlköğretim beşinci sınıf öğrencilerinin kesirler konusundaki öğrenme güçlükleri: kesirlerde sıralama, toplama, çıkarma, çarpma ve kesirlerle ilgili problemler. *Erzincan Eğitim Fakültesi Dergisi, 7*(2), 101-117.

Sriraman, B. (2006). Conceptualizing the model-eliciting perspective of mathematical problem solving. M. Bosch (Yay. haz.). *Proceedings of theFourth Congress of the European Society for Research in Mathematics Education (CERME* 4) içinde (ss. 1686-1695). SantFeliu de Guíxols, Spain: FUNDEMI IQS, Universitat RamonLlull.

Stafylidou, S. & Vosniadou, S. (2004).The development of students' understanding of the numerical value of fractions. *Learning and Instruction, 14,* 503–518.

Şafak, C. (2016). *8. sınıf öğrencilerinin olasılık konusundaki kavram yanılgıları.* (Yayımlanmamış yüksek lisans tezi), Abant İzzet Baysal Üniversitesi Eğitim Bilimleri Enstitüsü, Bolu.

Şahin, N. ve Eraslan, A. (2016). İlkokul öğrencilerinin modelleme süreçleri: Suç problemi. *Eğitim ve Bilim, 41*(183), 47-67.

Tekin Dede, A. ve Bukova Güzel, E. (2013). Examining the mathematics teachers' design process of the model eliciting activity: Obesity problem. *Elemantary Education Online*, *12*(4), 1100-1119.

Toptaş, V., Han, B. ve Akın, Y . (2017). Sınıf öğretmenlerinin kesirlerin farklı anlam ve modelleri konusunda görüşlerinin incelenmesi. *Sakarya Üniversitesi Eğitim Fakültesi Dergisi, (33*), 49-67

Trivena, V., Ningsih, A. R. & Jupri, A. (2017). *Misconception on addition and subtraction of fraction at primary school students in fifth-grade*. International Conference on Mathematics and Science Education (ICMScE), 895.

Tural Sönmez, M. (2019). Yedinci sınıf öğrencilerin matematiksel modelleme sürecinde orantısal akıl yürütmelerini etkileyen faktörler. *İlköğretim Online, 18*(2), 734-759.

Türkdoğan, A., Güler, M., Bülbül, B. Ö. ve Danişman, Ş. (2015). Türkiye'de matematik eğitiminde kavram yanılgılarıyla ilgili çalışmalar: Tematik bir inceleme. *Mersin Üniversitesi Eğitim Fakültesi Dergisi, Cilt 11*, Sayı 2.doi. 10.17860/efd.26545

Ubuz, B. (1999). 10. ve 11. sınıf öğrencilerinin temel geometri konularındaki hataları ve kavram yanılgıları (10th and 11th grade students errors and misconceptions on basic geometry). *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 16*-17, 95-104.

Ulu, M. (2017). Examining the Mathematical Modelling Processes of Primary School 4th-Grade Students: Shopping Problem. *Universal Journal of Educational Research, 5*(4), 561-580.

Uça, S. ve Saracaloğlu, A. S. (2017). Öğrencilerin ondalık kesirleri anlamlandırmasında gerçekçi matematik eğitiminin kullanımı: bir tasarı araştırması. *İlköğretim Online, 16*(2), 469-496

Utley, J. & Reeder, S. (2012). Prospective elementary teachers' development of fraction number sense. *Investigations in Mathematics Learning, 5*:2, 1-13, DOI: 10.1080/24727466.2012.11790320.

Van de Walle, J. A. (2004). *Elementary and middle school mathematics: teaching developmentally (5th ed.)*. Boston, MA: Pearson.

Watters, J. J., English, L. D., & Mahoney, S. (2004). Mathematical Modelling in The Elementary School. *In American Educational Research Association Annual meeting*, San Diego. Retrieved August 2017, https://eprints.qut.edu.au/1667/1/AERA_Modelling_Z.pdf.

Yenilmez, K. ve Yaşa, E. (2008). İlköğretim öğrencilerinin geometrideki kavram yanılgıları. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi, 21*(2), 461-483.

Yenilmez, K. ve Yılmaz, S. (2008). İlköğretim ikinci kademe öğrencilerinin problem çözmedeki kavram hataları. *Sakarya Üniversitesi Eğitim Fakültesi Dergisi, 15*, 75-97.

Yıldırım, A. ve Şimşek, H. (2013). *Sosyal bilimlerde nitel araştırma yöntemleri*. Ankara, Seçkin Yayıncılık

Zaslavsky, O. & Shir, K. (2005), Students' conceptions of a mathematical definition. *Journal for Research in Mathematics Education, 36*(4), 317-346.
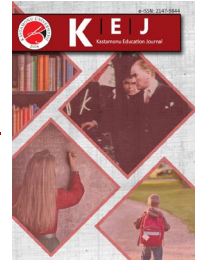
| Research Article / Araştırma Makalesi|

Can Dialogic Discourse Enhance Student Active Participation?

Diyalojik Söylem Öğrencinin Derse Aktif Katımını Arttırabilir mi?[1]

Yılmaz SAĞLAM[2], Sedat KANADLI[3], Pınar GÖKSU[4], Emine Aynur GİZLENCİ[5], Vildan KARATEPE[6]

Abstract

Purpose: This study aimed to investigate contribution of a professional development program committed to providing quality training to support dialogic talk to student active participation. Indicators of active participation, in the context of this study, were the speaking duration of the teacher compared to student, the number of different ideas of the students emerging in the classroom milieu, the number of students answering per question asked by the teacher, and the rate of students' personal answers for the questions asked by the teacher.

Design/Methodology/Approach: In recruiting teachers, gathering, and analyzing data, the educational design-based research (DBR) method was adopted. A total of seventeen teachers volunteered and participated in a four-week course program. The program involved theoretical and practical information about authoritative and dialogic talk. After the program had been completed, the teachers worked in pairs, designed lesson plans, and implemented the plans in their classrooms. Teachers' pre- and post-intervention practices were videotaped and then transcribed.

Findings: A total of four teachers being able to successfully implement the dialogical discourse in their classrooms were selected for analysis and the findings are reported in the present study. The descriptive analysis showed that dialogical discourse generally contributed a significant increase in student talk ratio, number of student responses, new ideas, and students' personal responses.

Highlights: Dialogical discourse-based education has reduced the speaking time of teachers. It contributed to the emergence of different ideas in the classroom. It increased students' active participation in the lesson and their individual response rates.

Öz

Çalışmanın amacı: Bu çalışmanın amacı diyalojik söylemi geliştirmeye yönelik olarak tasarlanan bir hizmet içi eğitim programının sınıf içi öğrenci aktif katılımına olan katkısını araştırmaktır. Bu çalışma bağlamında sınıf-içi aktif katılım; öğretmenin öğrenciye göre konuşma süresi, sınıfta ortaya çıkan öğrenci farklı fikir sayısı, öğretmen tarafından sorulan bir soru başına cevap veren öğrenci sayısı ve öğretmen tarafından sorulan soruların öğrenci tarafından bireysel olarak yanıtlanma oranı olarak belirlenmiştir.

Materyal ve Yöntem: Araştırmada öğretmen seçimi, verilerin toplanması ve analiz edilmesinde, tasarım tabanlı araştırma (DBR) metodu benimsenmiştir. Çalışmada toplamda on yedi öğretmen gönüllü olarak dört haftalık bir eğitim programına katılmıştır. Program, diyalojik ve otoriter söylemler ile ilgili teorik bilgiler ve bu söylemlerin uygulama örneklerinden oluşmuştur. Programın sonunda öğretmenler partnerleri ile birlikte çalışarak ders planları tasarlamışlar ve kendi sınıflarında bu planları uygulamışlardır. Tüm uygulamaların (eğitim öncesi ve sonrası sınıf içi uygulamaların) video kayıtları yapılmış ve bu kayıtlar akabinde yazılı hale getirilmiştir.

Bulgular: Bu çalışmada diyalojik söylemi sınıflarında en iyi kullanan dört öğretmenin sınıf uygulamaları analiz edilmiştir. Araştırma verilerinin betimsel analizleri diyalojik söylemin, öğrencilerin konuşma süresinde, derse katılma oranlarında, yeni fikirler ortaya koymalarında ve öğrencilerin bireysel yanıtlama oranında genel olarak anlamlı bir artışa katkı sağladığı belirlenmiştir.

Önemli Vurgular: Diyalojik söylem temelli eğitim öğretmenlerin konuşma sürelerini düşürmüştür. Sınıfta farklı fikirlerin ortaya çıkmasına katkı sağlamıştır. Öğrencilerin derse aktif katılımını ve bireysel cevap verme oranlarını arttırmıştır.

Citation/Alıntı: Sağlam, Y., Kanadlı, S., Göksu, P., Gizlenci, E. A., & Karatepe, V. (2022). Can dialogic discourse enhance student active participation?, *Kastamonu Education Journal, 30*(1), 24-35. doi: 10.24106/kefdergi.749894

INTRODUCTION

Meaning first emerges from the child-adult interaction on a social plane and then finds a psychological ground for itself (Vygotsky, 1978). In other words, external speech, which grows on a social basis, then turns into internal speech in the individual and becomes a thinking (cognitive) tool that the individual could use in the face of a problem (Vygotsky, 1930). Therefore, the origins of the cognitive development should be sought in one's social interactions. Similarly, student-teacher interactions in the classroom can shape the way students think. The discourse used by the teacher has the feature of influencing students' critical thinking skills (Hajhosseiny, 2012), problem-solving skills, and reasoning (Gillies & Khan, 2009). In addition, teacher discourse can also affect students' internalization of concepts, in other words, their appropriation of concepts (Billett, 1998).

If the meaning is socially created as a result of teacher-student and student-student interaction in the classroom environment, this type of interaction is called dialogic discourse. An instruction based on dialogic discourse improves students' scientific reasoning and understanding in science classrooms (Mercer et.al., 1999; Mercer et.al., 2004) and has the potential to increase their motivation towards the subject matter (Mercer et.al., 2009; Scott, 2008), may contribute to the development of arguments (Demirbağ, 2017), and may improve critical thinking skills (Hajhosseiny, 2012); however, the research on the impact of dialogic discourse on student participation seems inadequate. Therefore, in this study, a professional development program was developed to train several teachers. The aim of this study is to find out the impact of this professional development program on the students' active participation in the classroom.

Active participation can be defined as a process in which the student himself/herself constructs his/her own knowledge by interacting with the learning environment designed by the teacher. This process occurs as a result of teacher's deliberate and conscious attempt to encouraging active participation in the classroom milieu (Pratton & Hales, 1986). Therefore, the discourse that the teacher uses in the classroom consciously or unintentionally has the power to affect the active participation of the students in the class. In the context of this study, the signals of active participation in the classroom were the speaking duration of the teacher compared to students, the number of different ideas of the students emerging in the classroom milieu, the number of students' answers per question, and the rate of students' personal answers for the questions.

Teachers generally use two types of discourse language in the classroom, authoritative and dialogic (Mortimer & Scott, 2003). Authoritarian discourse is more teacher-centered and is a form of discourse in which students are seen as objects. In this discourse, only the voice of authority is heard and what is said is not open to discussion (Bakhtin, 1981). In this type of communication, student ideas are unimportant and not allowed to be discussed in class; rather, it is desired by the teacher that students focus on the scientific point of view (Mortimer, 2005). In this discourse, if the ideas suggested by the student contribute to the scientific point of view, the teacher considers these ideas, while if they do not, he ignores these ideas (Scott et.al., 2006). In authoritarian discourse, the teacher is expected to control student ideas, rearrange them and present the scientific point of view, while the student is expected to follow the directions from the teacher and accept the scientific point of view (Scott et.al., 2006).

Unlike authoritarian discourse, dialogic discourse is more student-centered and in this discourse, the student is seen as a subject. For this reason, in dialogic discourse, the unique voices of individuals are heard and what is said is open to discussion (Bakhtin, 1981). The main feature of dialogic discourse is that it allows the discovery of student ideas and the development of new ideas by discussing these discovered ideas (Mortimer, 2005). Thus, in this discourse, the teacher considers more than one point of view, reveals different ideas, and interprets these ideas and relates them to the scientific point of view (Mortimer & Scott, 2003, p.33). While the teacher is expected to explore students' ideas and compare different perspectives in dialogic discourse, students are asked to share their ideas, listen to others, try to understand the ideas put forward, and gain new ideas by discussing with others (Scott et.al., 2006).

Another difference between authoritarian and dialogic discourses is that authoritarian discourse does not have a specific time and place, whereas dialogic discourse emerges in a specific time and place (McCormick & Donato, 1998). Let us now examine the dialogic and authoritative types of discourses through two examples. The following dialogues are taken from a science class. In this class, a dialogue about plant roots takes place between the teacher and the students. In this and the following dialogue, the letter *T* stands for the teacher and pseudonyms were used for the students.

> 01 T: Guys, we have seen many plants around us and you may have noticed that the roots of these plants are different from each other *[Teacher projects a picture of 3 different types of roots on the board].* How many types of plant roots do you think there are? and what are the properties of these roots? Who can tell me? Ahmet!
> 02 Ahmet: Teacher, there are 3 types of roots. These are tap, fibrous and storage roots.
> 03 T: Good! Right, well done. So who's going to say what they're about? Semih!
> 04 Semih: Teacher, fibrous roots connect the plant to the deep.
> 05 T: Is that so? Did your friend tell the truth? What was the feature of the fibrous root? Ahmet!
> 06 Ahmet: Teacher, in fibrous roots, the main root and the lateral roots are the same in terms of thickness. Teacher, these roots occupy a large area near the surface of the soil.
> 08 T: Good, Fatima!
> 09 Fatma: In the tap root, the main root is thick, while the lateral roots are thin and attached to the main root.
> 10 T: Well done! Beautiful. You are telling the truth. So who's to say storage root?

11 Fatih: The plant stores nutrients in the root.

In this dialogue, the teacher used an authoritarian discourse. In this type of discourse, only one voice is heard, and this voice is the voice of the superiors. In the above dialogue, it can be thought that there are four students' (*Ahmet, Semih, Fatma, and Fatih*) voices and the teacher's voice. But in reality, only one voice is heard in the above dialogue, and that voice is the scientific voice. Notice that there are *3 types of roots (2nd statement), tap, fibrous and storage roots (2nd statement), the main root and lateral roots are the same in terms of their thickness (6th statement), while the main root is thick in tap root, the lateral roots are thin (9th statement)* are scientific and they voice scientific facts. While the teacher accepts the correct (scientifically accepted) ideas (2, 6, 9, 11) he rejects the inappropriate idea (4). Therefore, only one voice is heard in this dialogue, and this voice is the voice of science. This voice is an alien one for other students in the class who are unfamiliar with this discourse (for students who do not know the subject). This type of speech belonging to the superiors (scientists), is incomprehensible, indisputable, and inaccessible. Secondly, there is no time and space in this discourse. The above-mentioned terms such as tap root, hairy root, storage root, main root, and lateral root can be used today, have been used in the past and have the potential to be used in the future. Time and space cannot limit this type of discourse. Now let's examine a dialogue in which dialogic discourse exists on the same subject.

01 T: *[The teacher brings corn, beans, and potatoes to the class with soil in it. At the same time, he projects a picture on the board where these three plants are shown in the soil. He forms groups of three or four of the students].* "Guys, these are the roots of corn, beans, and potatoes. Look, they're still on their land. I want you to work as a group and draw these roots in your notebooks." *[Students try to draw pictures of roots in their notebooks. The teacher walks between the groups].* "I think everyone drew it. Is there any group that didn't draw? *[No response from the class].* "Okay, then who will tell me the differences between these roots? Yes",
02 Group 3: Corn root is more scattered than the others. More. Hard.
03 T: Good! Another! *[Teacher notes student's statements on the board]*
04 Group 5: Teacher, we can eat the potato, but the corn and bean root are inedible. Others are tough.
05 T: Good! What else? *[Teacher notes student's statements on the board]*
06 Group 2: Bean root long and branched. More delicate. Potatoes are fat. Corn root is scattered and numerous.
08 T: Good! Yes, you are. *[Teacher notes student's statements on the board]*
09 Group 1: One long vein in the bean root and the small veins connected to this vein, in corn all the veins are elongated from the main stem, in potatoes there is no veining.
…
17 T: Well, done! Beautiful. *[Teacher notes student's statements on the board]* Now, friends, you all found the differences very nice. This is how *(showing the bean root)* there is a long root in the middle and short roots attached to this root in biology, tap root in biology, if it is messy like you said *(pointing to the corn root)* fibrous root and this way *(pointing to the potato)* you call it. If it can be eaten like a nutrient, that is, if it stores nutrients, such roots are also called storage roots. *[Teacher notes Tap Root, Fibrous Root, and Storage Root on the board]*

In this dialogue, the teacher used a dialogic discourse. In this sort of discourse, multiple voices are heard, the voices are unique (belonging to individuals) and are intelligible. In the dialogue above, the group's first drew the plant roots and then expressed the differences between them. However, in this way of expression, unlike the previous dialogue, we hear more than one voice and witness the students' own thoughts. *"We can eat the potato, but the corn and the bean root are inedible" (4th statement), "The bean root is long and branched. More delicate. The potato is fat" (6th statement), "One long vein in the bean root and small veins attached to this vein"(9th statement).* When the statements are examined, it is seen that these discourses are original ideas belonging to the students. These statements are not scientific and can be easily recognized by other students. Secondly, there is time and space in this discourse. All the conversations above between teacher and students are about the three roots that are brought into the classroom. So all conversations that occur have a time and a space. The corn root spoken about is the corn plant that is currently in class, or the bean root spoken about is related to the bean plant that is in the current class.

Purpose of the study

The aim of this study is to determine the contribution of a professional development program designed to develop dialogic discourse to the active participation of students in the classroom. For this purpose, answers to the following research questions were sought:
1. How does dialogic discourse-based instruction contribute to teachers' in-class speaking time?
2. How does dialogic discourse-based instruction contribute to the number of new ideas?
3. How does dialogic discourse-based instruction contribute to the number of students attending the course?
4. How does dialogic discourse-based instruction contribute to students' individual response rates?

METHOD

This study is a design-based research. Design-based research is a research method that provides validity to the research by being carried out in realistic educational environments and the results obtained contribute to the evaluation, regulation and development of applications in these contexts (Anderson & Shattuck, 2012). Design-based research, like experimental studies, has an intrusive feature; however, unlike experimental studies, the intervention can be changed and improved as the process continues (Bakker & van Eeerde, 2015). In the context of this study, the videos of the classroom teachers were taken before the intervention started, feedbacks and corrections were made on the work they did in the classroom while the intervention continued, and at the end of the intervention, the videos were shot again and compared with the preliminary videos. The type of discourse used by teachers in their classroom practices was published in another qualitative study (Saglam, et al. 2015). In this study, the contribution of the professional development program to the active participation of students in the classroom is reported.

Teacher Selection and Pre-Training Video Shooting

Criterion sampling method, one of the purposive sampling methods, was used to determine the study group. In this method, individuals who meet a set of predetermined criteria are included in the sample (Yıldırım & Şimşek, 2006, p.112). In the context of this study, the criteria were determined as *(i)* teachers being classroom teachers, *(ii)* teaching second or third grades, *(iii)* being able to attend at least two people from the same school, and *(iv)* volunteering. A total of 21 classroom teachers voluntarily participated in the professional development program prepared accordingly. These teachers work in public schools and were chosen from among the teachers who actually took the course and wanted to take part in the project voluntarily. Since data will be collected for at least two semesters during the research and teachers must stay in their current classrooms during this period, 2nd and 3rd grade teachers were preferred in the selection of the candidates. In addition, teachers were planned to work together during and after the training, and during the application, teachers were asked to apply from the same school in pairs or groups of three. Therefore, individual applications were not accepted. The research consists of two stages. In the first stage of the study, a total of 17 teachers (7 groups in pairs and 1 group in three) participated in the trainings, and their in-class dialogues were followed throughout the program. The video-recordings of these teachers were analyzed in terms of dialogic and authoritative discourse (Appendix-1), and as a result of these analyzes, four teachers who were able to successfully apply dialogic discourse in their classrooms and had the highest level of development (T3, T4, T11 and T15) were selected to participate in the second phase of the study. In this study, the practices of these four teachers are reported.

Data Collection Method

Data were collected through in-class video footage. Before the trainings, permissions were obtained from the students and parents for video shooting, and the teachers' in-class practices were recorded with a video recorder. A total of 90 videos (5 videos for each teacher on average) of mathematics, science and social studies lessons were shot. The trainings started in April 2014 and were completed at the end of 4 sessions (5, 13, 18 and 25 April 2014). Each training took approximately 3 hours. During the trainings, information was given about dialogic and authoritative discourse. In this process, besides the theoretical information, examples from classroom practices were also presented. In the selection of the examples, the 2nd and 3rd grade curriculum was taken into account. At this stage, teachers had the opportunity to watch sample applications of mathematics, science and social studies lessons from these grade levels. In the last week of the training and in the weeks following the training, the teachers were asked to make lesson plans to implement in their own classrooms. In consultation with researchers and working with their partners, teachers planned lessons and implemented them in their classrooms. The classroom practices of the teachers after the training were recorded again with the help of video recorders. A total of 63 videos (4 videos for each teacher on average) of mathematics, science and social studies lessons were shot. This number was more than the planned number (average of 3 videos), which again allowed for a more comprehensive data analysis. In this way, teachers have the opportunity to follow good classroom practices, participate in a training program that spans time and allow mutual discussions, learn a concept directly related to their classroom practices (dialogical discourse), have the opportunity to work with a colleague from the same school and grade level, and actively participate in this process. Discussing, planning and designing courses are among the important features of professional development programs (Wilson & Berne, 1999; Garet et al., 2001; Desimone, 2009). All the videos captured were then transcribed by the researchers. Among the limitations of this research are the participation of a small number of teachers in the trainings, the completion of the trainings in a period of one month, and the inevitably affecting the classroom practices of the teachers.

Data analysis

In this study, the video collected data of 4 teachers who participated in the second stage of the professional development program were written down and analyzed on the basis of the table (Appendix-2) given in the appendix. Teachers' pre- and post-training practices were compared in terms of student speaking time, student participation, number of different ideas and the rate of expressing these ideas individually. For this purpose, a pre-training video and a post-training video were selected for analysis.

In this selection stage, attention was paid to the selection of videos from the same course type. For example, if a Turkish lesson belonging to the pre-training was selected for analysis, another Turkish lesson was chosen for analysis after the training. Descriptive statistics (frequency and percentages) were used in the analysis of these data.

Chi-square test can be used to determine whether there is a significant difference between observational data in experimental and survey studies (Büyüköztürk, 2005. p.146). In this study, in-class videos of teachers before and after the application; A single sample chi-square test was used to determine whether there was a significant difference between speaking times, the number of different ideas, the number of students attending the course and the individual response rates of the students.

Data Analysis Reliability

The classroom practices of the teachers were first analyzed by the researchers according to the table given in Appendix 2. In order to determine the reliability of these analyzes, a randomly selected video and code definition tables were given to three different researchers. Researchers were asked to analyze these videos and transcripts independently of each other based on the criteria given in the table. Researchers analyzed each other's videos in terms of question type, number of respondents (teacher, class, or student), number of ideas and speaking times (teacher and student), and proportions of all these numbers. In these analyzes, it was seen that there was a consensus of over 90% in terms of the number of codes (types and number of questions) and speaking times. Therefore, this result showed that the coding made had a high level of reliability (Miles & Huberman, 1994, p.69).

FINDINGS

The teacher-student dialogues that emerged in the classrooms of successful teachers (T3, T4, T11, T15) before and after the training were analyzed according to the definition table given in Appendix 1, and question types were determined. Afterwards, each transcript and video was analyzed by the scholars according to the table given in Appendix 2. One pre-training video and one post-training video of each teacher were selected for analysis. In this selection stage, attention was paid to the selection of videos from the same course type. For example, if a Turkish lesson belonging to the pre-training was selected for analysis, another Turkish lesson was selected for analysis after the training. In the analysis phase, first of all, the number of question types used by teachers and the number of answers to these questions by the teacher, students or class were determined. Afterwards, these numbers were divided by the total number of questions and their ratios were calculated. For example, 20 of T3's 56 questions in total were answered by the students and 36 by the class before the training. The percentage of answers to the questions by the students was found by dividing 20 by 56 and multiplying the result by 100 (36%). This information can be seen in the first seven columns of the table. After this stage, *the number of students who responded* was determined. In this determination process, how many students answered each question type was made by looking at the transcripts (counting how many different students answered). *The number of students who answered per question* was determined by dividing the number of students who answered by the number of questions. For example, in T3's class, 33 students answered 19 questions of the definition type. Therefore, in this example, the number of students per question was calculated by dividing 33 by 19 (1.7). *While determining the number of students' claims of different solutions/ideas*, the number of answers different from the first answer given to each question was found. For example, in T3's class, a total of 11 different answers (solution, idea or assertion) were received to the definition type questions. While determining the teacher and student speaking times, the videos were watched and the durations of the teacher and student speaking sections were found in these videos. Activities such as extracurricular conversations, moments of silence or reading a book are not included in these speaking times. After the obtained times were divided by the total time, the ratios of teacher-student speaking times were calculated.

Contribution of Dialogical Discourse-Based Instruction to Teacher Speaking Times

The percentage of participating teachers' speaking time was calculated over the ratio of teacher speaking time to total student and teacher speaking time. Therefore, a decrease in teacher speaking time indicates an increase in student speaking time. The speaking time percentages of the participating teachers before and after the training are given in Figure 1.
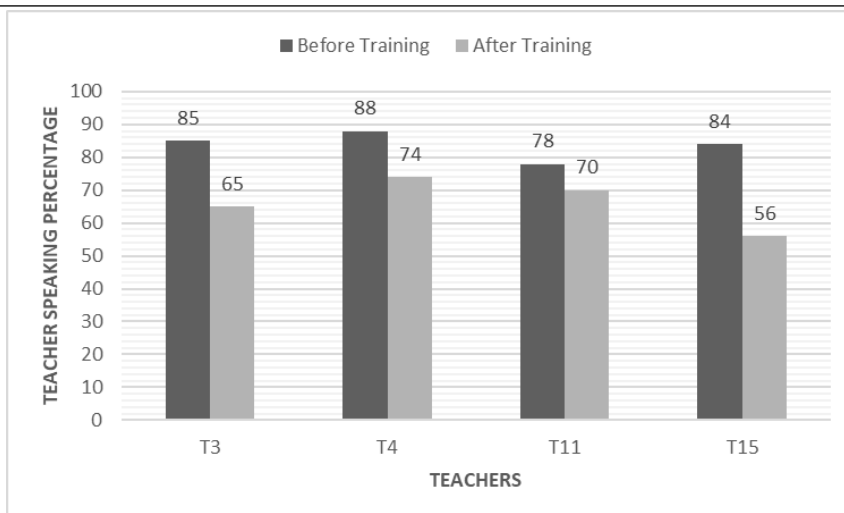
Figure 1. Percentage of teachers speaking time before/after training

As seen in Figure 1, it was seen that all teachers talked less after the training when compared to the pre-training. According to this, while teachers with the codes Ö3, Ö4, Ö11 and Ö15 spoke at the rate of 85%, 88%, 78% and 84% before the training, this rate decreased to 65%, 74%, 70% and 56%, respectively, after the training. The results of the chi-square test performed to determine whether this observed decrease is significant is given in Table 1.

Table 1. Chi-square test result for observation results

Teacher	Before Training	After Training	$\chi^2_{(1)}$	p
T3	85	65	2.667	.102
T4	88	74	1.210	.271
T11	78	70	0.432	.511
T15	84	56	5.600	**.018***

*p<.05

According to Table 1, only the decrease in the speaking time of the teacher coded T15 was significant (p<.05). Although there was a decrease in the speaking time rate of T3, T4 and T11 coded teachers, this decrease was not significant (p>.05) at the 95% confidence level. According to this result, it is seen that dialogic discourse makes a statistically significant contribution to one teacher's class in terms of speaking time.

Contribution of Dialogical Discourse-Based Instruction to the Formation of Different Ideas

In order to see the contribution of the dialogic discourse to the formation of different ideas before and after the training, the number of different solutions/ideas/claims that emerged in the classroom was compared. Observation results of four teachers are given in Figure 2.

Figure 2. Number of different ideas of students before/after training

According to Figure 2, in all four classes, the number of students' different ideas increased. While 11, 14, 11, and 18 different ideas emerged, respectively, in the classrooms of T3, T4, T11, and T15 before the training, 24, 17, 34, and 32 different ideas emerged, respectively, after the training. The chi-square test result, which was performed to determine whether there is a significant difference between these observation numbers, is given in Table 2.

Table 2. Chi-square test result for observation results

Teacher	Before Training	After Training	$\chi^2_{(1)}$	p
T3	11	24	4.829	**.028***
T4	14	17	0.290	.590
T11	11	34	11.756	**.001****
T15	18	32	3.920	**.048***

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

According to Table 2, while the increase in the number of new ideas emerging in the education classes of T3 and T11 and T15 teachers is significant (p<.05), the increase in the number of T4 teachers is not significant (p>.05). According to this result, it is seen that the dialogic discourse contributes statistically significantly in the classroom of 3 teachers in terms of the emergence of different ideas.

Contribution of Dialogue-Based Instruction to the Number of Students Participating the Class

The number of students who answered per question in the classrooms of the participating teachers before and after the training was calculated. To calculate this, the total number of students who answered is divided by the total number of questions asked by the teacher. The number of student answers per question observed in the classrooms of the participant teachers before and after the training is given in Figure 3.
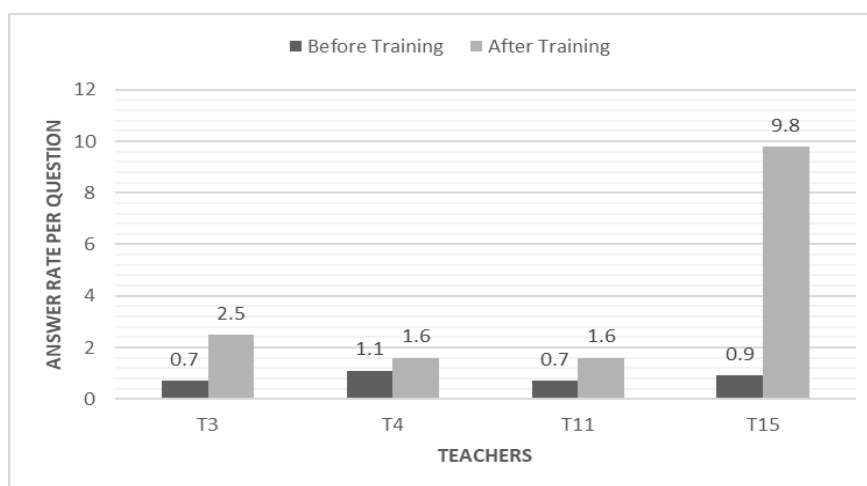
Figure 3. Number of student answers per question asked by the teacher

As seen in Figure 3, in all four classes the number of student answers per question increased. The number of student answers per question was 0.7, 1.1, 0.7 and 0.9, respectively, before the training, and was 2.5, 1.6, 1.6 and 9.8 after the training. The result of the chi-square test performed to determine whether this difference is significant is given in Table 3.

Table 3. Chi-square test result for observation results

Teacher	Before Training	After Training	$\chi^2_{(1)}$	p
T3	0.7	2.5	1.000	.317
T4	1.1	1.6	0.333	.564
T11	0.7	1.6	0.333	.564
T15	0.9	9.8	7.364	.007**

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

As can be seen in Table 3, the number of students who answered per question showed a significant (p<.01) increase only for the teacher coded T15. Although an increase was observed in other teachers, these increases were not significant at the 95% confidence level.

Contribution of Dialogue-Based Instruction to Students' Individual Response Rates

The percentages of individual answers to the questions asked by the students in the classrooms of the participating teachers before and after the training were calculated. These percentages are; the number of individual students' answers to the questions asked by the teachers was determined by dividing the answers given by the teacher, the class and individually by the students. The percentages of students' individual answers to the questions asked by the participant teachers in their classes before and after the training are given in Figure 4.
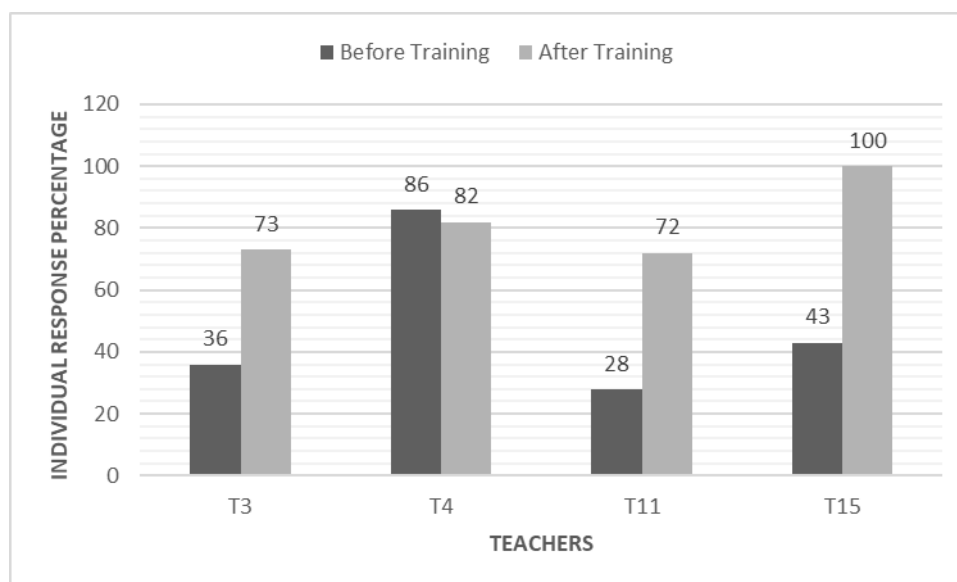
Figure 4. Percentage of students answering the questions individually

As seen in Figure 4, in three classes student individual responses increased. While the percentage of individual answers to the questions in the classrooms of T3, T4, T11 and T15 before the training was 36, 86, 28 and 43, respectively, it was observed as 73, 82, 72 and 100, respectively, after the training. Therefore, a participation of over 70% was achieved by all teachers. There was an increase in 3 of the teachers. The chi-square test result, which was performed to determine whether there is a significant difference between these observation percentages, is given in Table 4.

Table 3. Chi-square test result for observation results

Teacher	Before Training	After Training	$\chi^2_{(1)}$	p
T3	36	73	12.560	**.000****
T4	86	82	.095	.758
T11	28	72	19.360	**.000****
T15	43	100	22.720	**.000****

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

As can be seen in Table 4, the percentages of individual answers to the questions asked by the teacher by the students showed a significant difference (p<.01) for the teachers coded Ö3, Ö11 and Ö15 after the training, while there was a significant difference (p>.05) for the teacher coded Ö4. did not show. According to this result, it is seen that the dialogic discourse makes a statistically significant contribution in the classroom of 3 teachers in terms of individual response.

DISCUSSION

In this study, the contribution of the dialogic discourse-based professional development program, which teachers voluntarily participate in, to the active participation of students in the lesson was investigated. Active participation of students in the classroom; the rate of teacher speaking time, the number of different opinions in the class, the number of students answering per question, and the rate of answering the questions individually were examined. For this purpose, a video-recorded lesson of four

teachers participating in the training before and after the professional development program was compared in terms of indicators of active participation.

As a result of the analysis of the collected data, it was seen that there was a decrease in the speaking time of the teachers compared to the pre-training period. A decrease in teacher speaking time indicates an increase in student speaking time at the same rate; however, this decrease in teacher speaking time showed a significant (p<.05) difference in only one of four teachers. It should not be surprising that different results are obtained in different classes, as the teacher is affected by many external factors such as speaking time, course achievements, subject characteristics, and students' readiness levels. However, according to the TIMSS 1999 report, eighth grade mathematics teachers were found to talk more in class when compared to their own students (Hiebert, et al., 2003, pp.109-110). For example, in the same report, the teacher-student discourse ratio is 16/1 in Hong Kong, 9/1 in Australia, 9/1 in the Czech Republic, and 8/1 in the USA. Considering the teacher-student discourse ratio in this study, it is approximately 2/1 on average. Therefore, it can be said that dialogic discourse contributes to a significant increase in student speaking time compared to the countries mentioned above.

The results also indicated that there was an increase in the students' generating different ideas, the number of students who answered per question, and the individual response rates compared to the pre-training period. While the number of students producing different ideas and their individual response rates showed a significant difference (*p*<.05) in three of the four teachers compared to pre-training, the number of students who answered per question showed a significant difference in only one teacher compared to pre-training. Particular attention should be paid to the individual responses of the students from these results. In the video analyzes conducted within the scope of this study, it was determined that the questions asked by the teacher were answered in three ways: First, the teacher asked the question and answered it himself, the second was the situation where the teacher asked the question and the students answered it together, and the third was when the student answered the question individually. Answering individually is important in terms of the student's construction of his own knowledge. Because, after the student has expressed his/her own opinion, the discussion and questioning of this idea by other students contributes to the better understanding of his/her own idea by reviewing it and thus its easier structuring on an individual level (Mortimer & Scott, 2003).

In a study conducted by Helme and Clarke (2001) in support of this finding; The fact that students participate in classroom activities in this way and answer the teacher's questions individually by taking the right to speak is an indicator of their cognitive engagement. According to them, there is an important relationship between cognitive participation and learning and motivation. In other words, students' physical participation is an indication that they participate in the lesson mentally. In this respect, dialogic discourse can provide cognitive participation as well as physical participation of students. Therefore, this type of discourse has a very important place in terms of learning. This relationship between dialogic discourse and learning has the potential to be the subject of academic study in future studies.

Supporting the findings of this study, a similar study was conducted by Berekat and Mohammadi (2014) to determine the contribution of teachers' use of dialogic discourse in their classrooms to the development of students' speaking abilities. For this purpose, Berekat and Mohammadi (2014) stated 21 rules of dialogic discourse (for example, some of these rules are; allow students to ask questions, ask long-answer questions, give students the opportunity to think, enable students to listen to both the teacher and their fellow students, express their ideas without hesitation, support them, etc.). Afterwards, teachers were asked to place these rules on dialogic discourse in their classrooms. As a result of these studies, which were carried out in the form of pretest-posttest, they determined that dialogic discourse contributed significantly to the development of students' speaking abilities.

CONCLUSION AND RECOMMENDATIONS

As a result, according to the findings obtained from this study; It can be said that students will actively participate in the lesson when teachers *(i)* want students to explain their individual ideas and thoughts, *(ii)* encourage students to produce new ideas, *(iii)* list the ideas on the board without judgment, and *(iv)* use these ideas by associating them with scientific explanations over certain contexts. In future studies; It is recommended that *(i)* there is a significant improvement in student participation in some classes, while there is no significant improvement in other classes, and *(ii)* the contribution of dialogic discourse to students' academic success and scientific process skills is examined.

Declaration of Conflicting Interests

Statements of publication ethics

Funding

Author contribution statements

The first and second authors developed the theory and performed the computations. The third, fourth and fifth authors collected data, transcribed and analyzed. All authors discussed the results and contributed to the final manuscript.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers.

Ethics Committee Approval Information

Ethics Committee Approval for the research was obtained from Gaziantep University Clinic Researches Ethics Committee with its official letter dated 11/06/2013 and numbered 223.

REFERENCES

Anderson, T., & Shattuck, J.(2012). Design-based research: A decade of progress in education research? *Educational Researcher*, *41*(1), 16–25.

Bakhtin, M.M. (1981). *The Dialogic Imagination: Four Essays*. Austin.TX

Bakker A., van Eerde D. (2015). An Introduction to Design-Based Research with an Example From Statistics Education. In: Bikner-Ahsbahs A., Knipping C., & Presmeg N. (eds). *Approaches to Qualitative Research in Mathematics Education*. Advances in Mathematics Education. Springer.

Berakat, B., & Mohammadi, S.(2014). The contribution of the teachers' use of dialogic discourse pattern to the improvement of the students' speaking ability. *Social and Behavioral Sciences, 98*, 353 – 362.

Billett, S. (1998). Appropriation and ontogeny: identifying compatibility between cognitive and sociocultural contributions to adult learning and development. *International Journal of Lifelong Education, 17*(1), 21–34.

Büyüköztürk, Ş. (2005). *Sosyal bilimler için veri analizi el kitabı (5. Baskı)*. Pegem

Demirbağ, M.(2017). Otoriter ve diyalojik söylem tiplerinin fen bilgisi öğretmen adaylarının argüman gelişimine etkisi. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi, 30*(1), 321–340.

Gillies, R., & Khan, A. (2009). Promoting reasoned argumentation, problem-solving and learning during small-group work. *Cambridge Journal of Education, 39*,7–27.

Hajhosseiny, M. (2012). The effect of dialogic teaching on students' critical thinking disposition. *Procedia - Social and Behavioral Sciences, 69*, 1358 – 1368.

Helme, S., & Clarke, D. (2001). Identifying cognitive engagement in the mathematics classroom. *Mathematics Education Research Journal, 13*(2), 133–153.

Hiebert, J., R. Gallimore, H. Garneir, K. Bogard Givvin, H. Hollingsworth, J. Jacobs, et al. (2004). *Teaching Mathematics in Seven Countries: Results from the TIMSS 1999 Video Study (NCES 2003 13 Revised)*. Washington, DC: U.S. Department of Education, National Center for Education Statistics.

Mercer, N., Dawes, L., Wegerif, R., & Sams.C.(2004). Reasoning as a scientist: ways of helping children to use language to learn science. *British Educational Research Journal, 30*(3), 359–378.

Mercer, N., Dawes, L., & Staarman, J.K. (2009). Dialogic teaching in the primary science classroom. *Language and Education, 23*(4), 353–369.

Mercer, N., Wegerif, R., & Dawes, L. (1999). Children's talk and the development of reasoning in the classroom. *British Educational Journal, 25*(1), 95–111.

Miles, M.B. & Huberman, A.M. (1994). *Qualitative Data Analysis (2nd ed.).* Sage.

Mortimer, E.F. (1998). Multivoicedness and univocality in classroom discourse: an example from theory of matter. *International Journal of Science Education, 20*(1), 67–82.

Mortimer, E.F., & Scott, P. (2000). Analysing discourse in the science classroom. In Leach, J., Millar, R. & Osborne, J. (Eds). *Improving Science Education: the contribution of research*. Open University Press.

Mortimer, E. F. (2005, January 19). Dialogic and authoritative discourse: A constitutive tension of science classroom. http://icar.cnrs.fr/ecole_thematique/analyse_video/documents/Dialogic_and_authoritative_discourse.pdf

Mortimer, E.F., & Scott, P. (2003). *Meaning making in secondary science classrooms*. Open University Press.

Pratton, J., & Hales, L. W. (1986). The effects of active participation on student learning. *Journal of Educational Research, 79*, 210–215.

Sağlam, Y., Kanadlı, S., Karatepe, V., Göksu, P. ve Gizlenci, E.A. Dialogic Discourse in the Classroom. *International Journal of Education in Mathematics, Science and Technology, 3*(4), 322–335.

Scott, P.(2008). Talking a way to understanding in scence classroom. In N. Mercer & S. Hodgkinson (Eds*.), Exploring talk in school: Inspired by the work of Douglas Barnes* (pp. 17-36). Sage.

Scott, P., Mortimer, E.F., & Aguiar, O.G. (2006). The tension between authoritative and dialogic discourse: A fundamental characteristic of meaning making interactions in high school science lessons. *Science Education, 90,* 605– 631.

Scott, P. (1998). Teacher talk and meaning making in science classrooms: A Vygotskian analysis and review. *Studies in Science Education, 32*, 45–80.

Vygotsky, L. S. (1930). *Mind and society. Cambridge*. Harvard University Press.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wilson, S. M. & Berne, J. (1999). Teacher learning and the acquisition of professional knowledge: An examination of research on contemporary professional development. *Review of Research in Education, 24*, 173–209.

Yıldırım, A., & Şimşek, H.(2006). *Sosyal bilimlerde nitel araştırma yöntemleri*. Seçkin.

Appendix 1: Code definition table of authoritarian and dialogic discourses

Categories and Codes	Code definitions
1. Authoritarian Discourse Codes	
1.1. Promoting scientific view	Situations where the teacher presents the scientific point of view to the students, asks the students for the scientific point of view, asks them to make explanations with the scientific point of view, the teacher guides the students by giving clues to find the scientific point of view, asks the students for the answers they expect, or asks for their approval,
1.2. Judgement	Situations where the teacher compares the answers of the students with the scientific understanding and judges these understandings as right or wrong, and makes corrections or additions to these understandings,
1.3. Inattention	Situations where the teacher neglects or ignores the answers of the students who are out of scientific understanding,
2. Dialogical Discourse Codes	
2.1. Being open to student view	Situations where the teacher asks students for their individual opinions, asks them to explain their thoughts, asks for alternative ideas, lists these ideas on the board, through a certain context,
2.2. Neutrality	Situations where the teacher listens, repeats and does not judge student responses,
2.3. Use	Situations where the teacher uses student ideas or relates them to scientific explanation.

Appendix 2: In-class dialogs analysis table

Type of Question	Number of question	Question percentage	Number of questions answered by the teacher	Teacher response rate (%)	Number of student answers	Rate of answering questions individually by students (%)	Number of responses in class	The rate of answering the questions by the class (%)	Number of students who answered	Number of students who answered per question	Number of different solutions/ideas/claims of students	Ratio of teacher's speaking time to total time (%)	Ratio of students' speaking time to total time (%)
Confirmation													
Selection													
Describing													
Explanation													
Observation													
Total													

Perceived Language Learning Difficulties by Preparatory School Students: A Case Study

Hazırlık Öğrencilerinin Dil Öğrenmeyi Zorlaştıran Faktörlere İlişkin Algıları–Bir Vakıf Üniversitesi Örneği

Demet Özmat[1], Funda Dörtkulak[2], Ufuk Akdemir[3]

Abstract

The aim of this study is to determine the difficulties that students of English as a foreign language experience in the language learning process. The study also reveals the relationship between language learning difficulties students experience and their achievements, gender and academic levels. The study group of this descriptive study consisted of 340 preparatory unit students. The "Foreign Language Learning Difficulties Scale" developed by Özmat (2017) was used for quantitative data and a semi-structured interview form developed by the researchers was used as a qualitative data source. According to the results of the study, it was determined that the difficulties that preparatory students have at the highest level in the language learning process are related to learning resources, and the difficulties they experience at the minimum level are related to the learning environment (physical and psychological). It was determined that the students had moderate difficulty stemming from the teaching-learning process and from themselves. The qualitative results of the research also support the results obtained from the scale. It was observed that students did not experience much difficulty related to disciplinary or classroom management issues. In addition, students stated that they needed more student-centered practices in class. There was no significant relationship between students' difficulty level, achievement test and gender. It was determined that the difficulties experienced by the students studying at lower levels are higher than the students studying at higher levels. According to the results of the research, suggestions were made for language learning processes and foreign language teaching in preparatory schools.

Öz

Bu çalışmanın amacı yabancı dil olarak İngilizce öğrenen öğrencilerin dil öğrenme sürecinde yaşadıkları zorlukları belirlemektir. Çalışmada aynı zamanda öğrencilerin yaşadıkları zorluklar ile başarıları, cinsiyetleri ve hedef dil düzeyleri arasındaki ilişkiler de ortaya konulmuştur. Betimsel nitelikli bu araştırmanın çalışma grubunu 340 hazırlık birimi öğrencisi oluşturmaktadır. Nicel veriler için Özmat (2017) tarafından geliştirilen "Dil Öğrenmeyi Zorlaştıran Faktörler Ölçeği" ve nitel veriler için araştırmacılar tarafından geliştirilen yarı yapılandırılmış görüşme formu kullanılmıştır. Çalışmanın sonuçlarına göre, hazırlık sınıfı öğrencilerinin dil öğrenme sürecinde karşılaştıkları en yüksek düzeyde zorlukların öğrenme kaynakları ile ilgili olduğu, en az düzeyde yaşadıkları zorlukların ise öğrenme iklimi (fiziksel ve psikolojik) ile ilgili olduğu tespit edilmiştir. Öğrencilerin, öğretme öğrenme sürecinden ve kendilerinden kaynaklanan zorlukları orta düzeyde yaşadıkları belirlenmiştir. Araştırmanın nitel sonuçları da ölçekten elde edilen sonuçları destekler niteliktedir. Öğrencilerin, sınıf ortamına yönelik disiplin ya da sınıf yönetimi bakımından zorluk yaşamadıkları görülmüştür. Buna ek olarak öğrenciler, öğrenci merkezli etkinliklere daha fazla ihtiyaç duyduklarını belirtmiştir. Öğrencilerin yaşadıkları zorluk düzeyi ile başarı testi ve cinsiyet değişkeni arasında anlamlı bir ilişki görülmemiştir. Alt kurlarda öğrenim gören öğrencilerin yaşadıkları zorlukların üst kurda öğrenim gören öğrencilere göre daha yüksek düzeyde olduğu belirlenmiştir. Araştırma sonuçlarına göre, dil öğrenme sürecine ve hazırlık okullarındaki yabancı dil öğretimine yönelik önerilerde bulunulmuştur.

[1] Çankaya University, Department of Foreign Languages, Ankara, TURKEY; https://orcid.org/0000-0001-8936-020X

[2] Middle East Technical University, School of Foreign Language, Modern Languages Department, Ankara, TURKEY; https://orcid.org/0000-0002-1409-2140

[3] Çankaya University, Department of Foreign Languages, Ankara, Ankara, TURKEY; https://orcid.org/0000-0001-7120-3524

INTRODUCTION

For a long time, linguists have been accumulating a considerable amount of information about the nature of language, and this knowledge has had important pedagogical implications for teachers of foreign languages (Scott, 1965). In addition to the methodological improvements in the field, the social and psychological processes in language learning have been attracting substantial attention (MacIntyre & Gardner, 1989; Zhang et al., 2020) because of the potential effect on learner achievement.

In Turkey, studies on English language proficiency levels indicate a lower-than-expected level of language proficiency (The Economic Policy Research Foundation Turkey (TEPAV), 2013; EF, EPI, 2015). Regarding how challenging language learning can be, identifying the social, psychological or pedagogical challenges included is important to better the language proficiency levels of learners. Thus, it can be said that there are many factors which affect teaching and learning a foreign language and these factors require further and deeper analyses to be managed.

McDonough et al. (2013) listed some of the factors affecting language learning, which are (i) what the goals of language learning are and the place of the target language in the home culture; (ii) the teacher's role and qualifications; (iii) the role of educational management; (iv) efficiency of resources and the number of students; (v) allocated time, techniques, methods and assessment techniques; and (vi) learner-related issues such as their proficiency levels, age, interests, motivation, attitude, goals, need , learning styles and strategies.

Chen (2010) found that belief and attitude in learning a language strongly affects the motivational levels of learners, which leads to the final achievement levels. Similarly, Liu and Cheng (2014) pointed out a strong negative correlation between anxiety and motivation, thus, achievement. Chou (2014) focused on the in-class methodologies with results showing that songs, games and stories that keep learners active improve their skills and motivation. Ma et al. (2019) similarly underlined the importance of willingness to communicate in language learning motivation. De Paepe et al. (2019) aimed to present the limitations and opportunities in L2 Dutch courses. The constraints were stated as mostly pertaining to curriculum design while the main opportunities would pertain to teacher qualifications, learner skills and attitudes. Another very recent study, Zhang et al. (2020), stressed the importance of learner motivation and L2 learning to determine whether any difficulties caused by motivational factors existed.

In the Turkish context, Demirtaş and Erdem (2015) discovered that the greatest challenges were the inadequate number of hours allocated in the curriculum. Likewise, Kandemir and Tok (2017) emphasized a need for more teaching hours and an update in the resources used. Özmat (2017) studied the factors that make learning English difficult in secondary and high schools. She classified the factors that affect language learning into four groups: the challenges related to (i) learning/teaching resources, (ii) learning/teaching processes, (iii) learners and (iv) teaching and learning atmosphere.

In Turkey, most universities, whether or not they are English-medium, provide their students with a full-year intensive language program prior to students commencing their studies. Because of the wide-spread existence of these 'preparatory schools of English' and because of the intense efforts to improve them, this study has selected a preparatory school of English as the research context. The aims of this study have been set to determine the perceived difficulties in learning English for preparatory school students and to compare their perceptions of the difficulties they have with their exam scores in their academic levels defined according to the Common European Framework of Reference (CEFR). In this study, possible strategies to overcome perceived difficulties can be determined, and suggestions for the teaching of English as a foreign language process associated with determined difficulties and exam results in higher education can be provided. The results of this study will contribute to English language policy making and curriculum studies for the preparatory schools of universities and for instructors of English in higher education.

What makes this study a considerable and trustworthy one in terms of implications is its effort to analyze students' perceptions of language learning difficulties (PLLD). Considering the limitations of perception studies as well as their advantages, the academic achievement scores of learners were also analyzed with regard to their PLLD scores. In addition to depicting the preparatory school context, this study can provide insights into the different phases of language learning and teaching processes as the points of difficulties can undoubtedly be regarded as points of improvements for higher education institutions with intensive language preparatory education.

To this end, this study addresses the following research questions in order to determine the levels of difficulty of preparatory school students and the relationship with their English exam scores.

1. What is the level of language learning difficulty of preparatory school students in the language learning/teaching process?
   i. What are the perceived difficulties related to learning-teaching resources?
   ii. What are the perceived difficulties related to the learning-teaching process?
   iii. What are the perceived difficulties related to the students themselves?
   iv. What are the perceived difficulties related to the learning-teaching atmosphere?
2. Is there a relationship between PLLD scale scores and students' achievement test results?
3. Is gender a significant factor in determining the PLLD scale scores of the students?
4. Is there a significant difference between the PLLD scale scores of the students in the A2, B1 and B2 levels?

METHOD

This research is a case study, which by its nature focuses on one phenomenon in one specific context. In other words, the main purpose of a case study is to analyze a specific situation in a certain context deeply (Saruhan & Özdemirci, 2016). Thus, the researcher can have a deeper understanding of the topic in a specific setting. Furthermore, according to Woodside (2010), the purpose of a case study is to describe and understand an individual person, group or organization on which the research concentrates.

Design of the Study

In this study, a mixed-methods approach which covers quantitative and qualitative data has been followed to gather the data. On the one hand, the *quantitative* approach enables the researcher to obtain numerical findings regarding the data gathered, which helps to produce statistical findings. With the help of such data collected and explained in numbers, quantitative research focuses on the explanation of a specific situation (Muijs, 2014). On the other hand, the main purpose of the *qualitative* approach is to extract the hidden meanings of people's utterances, attitudes and behavior. In this approach, as Hogan et al. (2009) claims, culture, society and behavior are investigated in many dimensions with the analysis of people's words and/or behaviors by the researcher.

Participants

The participants of this study were the students of an English preparatory school at a private university in Ankara, Turkey. A total of 340 students participated in the study that corresponds to 54.1% of the total number of students. With regard to gender, 43.2% (n = 147) of the students who participated in the study were male and 56.8% (n = 193) were female. The participants were from three different academic levels defined in line with CEFR, namely A2 (8.5%; n = 29), B1 (47.9%; n = 163) and B2 (43.5%; n = 148).

Instruments

Two instruments were applied in this research to gather quantitative and qualitative data. The quantitative data for this study was taken from Özmat's (2017) language learning difficulties scale focusing on PLLD in English language learning in secondary schools and high schools. The scale is one dimensional and as the research occurred at a higher education institution, the items directly relating to secondary and/or high school were not taken into account. The scale consists of two sections with the first section focusing on the demographic information of the participants and the second part consisting of 30 items requiring responses in a five-level Likert scale in the second section.

The one dimensional scale items were grouped in order to interpret the data effectively and in an organized manner. The items were grouped as *Difficulties related to learning materials*, *Difficulties related to the teaching and learning process*, *Difficulties related to the students themselves* and *Difficulties related to the learning environment*. While the content validity of the instrument had been assured by the expert opinion by Özmat (2017), the internal consistency of the items was computed on SPSS in the current study. The value of 0.90 (Table 1) suggests that the instrument has a high level of internal consistency.

Table 1: Internal consistency level of PLLD scale

Cronbach's Alpha	N of Items
0.90	30

As indicated in Table 1, Cronbach's Alpha reliability co-efficient was found to be 0.90. Conventionally, it is suggested that in social sciences a value between 0.60 and 0.80 is acceptable (Green et al., 1977; Spector, 1992). This indicates that the reliability of this research instrument is well above the accepted level.

An exploratory factor analysis was conducted on the 30 items of PLLD scale. The Kaiser-Meyer-Olkin measure of sampling adequacy was .89 and the Barlett's test of sphericity was found to be significant (df = 435, $p < .001$) showing that the correlation matrix produced by the items was factorable. Principle components analysis with oblique rotation (Direct Oblimin) was used and the results showed that one-factor structure explained 27.11% of the variance. All of the items had loadings higher than the cutoff value of .30.

The instrument used to gather qualitative data was a semi-structured interview form developed by the researchers. The form was checked by receiving expert opinions from two faculties in language teaching departments. In the analysis part, to present the data in an objective manner and for internal reliability, direct quotations and individual samples were presented.

The form consisted of two open ended questions about the language learning difficulties that students encountered. The first question asked about the difficulties students encountered and the second question aimed to personalize some of the causes of the difficulties the students mentioned. That is, the aim of the second question was to indicate the problems that the learners would attribute to themselves.

The aim of the qualitative section was to determine the possible difficulties that learners might not have had the opportunity to indicate in the scale.

Data Collection and Analysis

In this study, the data were collected in two forms, namely quantitative and qualitative. Additionally, the participants completed a consent form and all the instruments and forms were approved by the ethics committee of the university at which this study was conducted. While the quantitative data were analyzed on SPSS 25.0, a statistical package tool to analyze numerical data in social sciences, content analysis was applied to interpret the qualitative data.

The instrument used in this research was designed using a five-level Likert scale, ranging from 1 (very low level difficulty) to 5 (very high level difficulty). During the analysis, the range between the levels was accepted as 0.8 determined by the formula: (5-1)/5 = 0.8.

With regard to the quantitative data, different types of analyses, such as descriptive statistics, correlation, independent sample t-test and one-way ANOVA were executed for different aspects of the data based on the research questions. The interviews were audio-recorded and after being transcribed by the researchers, content analysis was applied to the qualitative data. The main objective of content analysis is to provide the researcher with new insights related to a certain context (Krippendorff, 2004). The analyses of both the quantitative and qualitative data were interpreted and presented in the findings section.

RESULTS

Quantitative Findings on the PLLD Level of Preparatory School Students

In order to determine the language learning difficulties of preparatory students, the mean, frequency and percentage values (Table 2) of the PLLD scale were examined. Although the scale is one-dimensional, the items were grouped in order to present the findings in an organized manner.

Table 2: Language Learning Difficulty Scale

Factors that Make Learning English Language Difficult	Disagree		Slightly Agree		Moderately Agree		Agree		Strongly Agree		M
	f	%	f	%	f	%	f	%	f	%	
Difficulties related to learning materials											
1-The reading texts in our English course books are not interesting.	35	10.3	66	19.4	134	39.4	80	23.5	25	7.5	**2.98**
2-The reading texts in our English course books do not include topics about daily life.	68	20	84	24.7	112	32.9	50	14.7	26	7.6	**2.65**
3-I do not like reading texts because there are too many unfamiliar English words.	68	20	81	23.8	94	27.6	67	19.7	30	8.8	**2.74**
11-I am bored when we do listening practice because the topics are not interesting.	61	17.9	66	19.4	110	32.4	54	15.9	49	14.4	**2.89**
Difficulties related to the teaching and learning process											
5-We do not do any reading practice on how to understand a text with the guidance of a teacher.	195	57.4	55	16.2	54	15.9	26	7.6	10	2.9	**1.83**
6-I have difficulty in writing a paragraph as we do not practice often enough in English lessons.	162	47.6	74	21.8	56	16.5	29	8.5	19	5.6	**2.03**
7-It is not clearly explained how to connect the topic and supporting sentences in a writing process.	161	47.4	94	27.6	53	15.6	19	5.6	13	3.8	**1.91**
10-There is no focus on listening strategies or how to understand a recording in English lessons.	153	45	77	22.6	67	19.7	30	8.8	13	3.8	**2.04**
13-I don't make an effort to speak English because we are allowed to speak Turkish in English lessons.	165	48.5	66	19.4	53	15.6	30	8.8	26	7.6	**2.08**
15-We are not given any methods to improve our spoken fluency in English	138	40.6	92	27.1	58	17.1	35	10.3	17	5	**2.12**
18-Our English lessons do not include pronunciation classes.	124	36.5	97	28.5	65	19.1	33	9.7	21	6.2	**2.21**
21-We are not given any strategies to help us remember new English vocabulary.	121	35.6	69	20.3	70	20.6	49	14.4	31	9.1	**2.41**
Difficulties related to the students themselves											
4-I don't like reading as I cannot understand a text without teacher guidance.	97	28.5	92	27.1	79	23.2	48	14.1	24	7.1	**2.44**
8-I cannot make a sentence while writing a paragraph as I struggle with even basic grammatical topics.	131	38.5	108	31.8	65	19.1	24	7.1	12	3.5	**2.05**
9-I have difficulty in writing a paragraph as I lack confidence without teacher guidance.	101	29.7	90	26.5	81	23.8	42	12.4	26	7.6	**2.42**
14-I don't want to speak English because I always have to translate from Turkish first, so it takes me a long time to make sentences.	60	17.6	60	17.6	79	23.2	75	22.1	66	19.4	**3.08**
16-I don't believe I can speak English because I want to speak fluently without making a mistake.	60	17.6	59	17.4	90	26.5	69	20.3	62	18.2	**3.04**
17-I don't feel confident in speaking English.	79	23.2	70	20.6	81	23.8	59	17.4	51	15	**2.80**
19-I have difficulty in speaking English as I don't know enough vocabulary.	62	18.2	73	21.5	94	27.6	61	17.9	50	14.7	**2.89**
20-I don't know how to learn new English words.	126	37.1	78	22.9	68	20	33	9.7	35	10.3	**2.33**
22-I'm not interested in learning English.	216	63.5	57	16.8	46	13.5	11	3.2	10	2.9	**1.65**
23-I don't allocate any time to learn English out of the classroom.	93	27.4	83	24.4	94	27.6	49	14.4	21	6.2	**2.48**
24-I always fall behind in English lessons due to gaps in my knowledge from previous grades.	141	41.5	76	22.4	67	19.7	29	8.5	27	7.9	**2.19**
25-I dislike English lessons because I don't like my English teacher.	257	75.6	47	13.8	28	8.2	7	2.1	1	3	**1.38**
30-I lack confidence in learning English because I have always received low grades in the past.	212	62.4	42	12.4	43	12.6	21	6.2	22	6.5	**1.82**
Difficulties related to learning environment											
12- I avoid speaking in English because when I do, my friends make fun of me.	167	49.1	66	19.4	58	17.1	23	6.8	26	7.6	**2.04**
26-Strong and hardworking students dominate the lessons so I don't want to participate.	219	64.4	62	18.2	34	10	15	4.4	10	2.9	**1.63**
27-I dislike English lessons because our teacher is usually angry and indifferent to us.	279	82.1	31	9.1	25	7.4	4	1.2	1	3	**1.29**
28-I don't enjoy learning English because our lessons are generally boring and monotonous.	127	37.4	87	25.6	68	20	37	10.9	21	6.2	**2.23**
29-I can't learn English because of discipline issues in our class.	241	70.9	47	13.8	30	8.8	14	4.1	8	2.4	**1.53**
Total											**2.34**

*** 1.00-1.80 = very low level difficulty; 1.80-2.60= low level difficulty; 2.60-3.40 = medium level difficulty; 3.40-4.20 = high level difficulty 4.20-5.00 = very high level difficulty

Table 2 shows that the total mean value of the PLLD scale of the preparatory school students is low. It can be said that students have these difficulties at the low level.

As for the difficulties related to learning materials, it can be said that the students have these difficulties at the medium level (M = 2.98). For example, 23.5% of the students stated that the reading texts in their books were not interesting for them (n = 80). 39.5% of the students moderately agreed with this difficulty. The students also stated that they are bored when they do listening practice because the topics are not interesting (M = 2.89). 15.9% of the students agreed and 14.4% of the students strongly agreed with this statement. 36.4% of the students stated that they do not like reading texts because there are too many unfamiliar English words. The students had this difficulty at the medium level (M = 2.74).

With regard to the difficulties related to the teaching and learning process, the students had all these difficulties at a low level (M = 2.07). For example, 57.4% of the students disagreed with "We do not do any reading practice on how to understand a text with the guidance of a teacher." Similarly, 48.5% of the students strongly disagreed with "I don't make an effort to speak English because we are allowed to speak Turkish in English lessons." 47.6% of the students had "I have difficulty in writing a paragraph as we do not practice often enough in English lessons" at a low level (M = 2.08). The students also disagreed with "We are not given any methods to improve our spoken fluency in English." They had this difficulty at a low level (M = 2.12). Only 9% of the students stated that they were not given any strategies to help them remember new English vocabulary. 35.6% of the students strongly disagreed and 20.3% of the students disagreed with this statement.

For the difficulties caused by the students themselves, the students had these difficulties at a low level (M = 2.35). For instance, a few students stated that they cannot make a sentence while writing a paragraph as they struggled with even basic grammatical topics (M = 2.05). Similarly, some students indicated that they did not like reading as they could not understand a text without the guidance of the teacher (M = 2.44). On the other hand, some difficulties related to the students themselves were experienced at a medium level. For example, the students had "I don't want to speak English because I always have to translate from Turkish first, so it takes me a long time make sentence" at a medium level (M = 3.08). 19.4% of the students strongly agreed and 22.1% agreed with this statement. Similarly, 38.5% of the students stated that they could not speak English as they wanted to speak it fluently and without making mistakes (M = 3.04). In addition to these, 41.2% of the students stated that they did not feel confident in speaking English. In other words, the students had this difficulty at a high level (M = 2.80).

32.6% of the students stated that they had difficulty in speaking English as they did not know enough vocabulary. The students had this difficulty at a medium level (M = 2.89). On the other hand, 80.3% of the students disagreed with "I'm not interested in learning English." In other words, the students had this difficulty at a very low level (M = 1.65). Similarly, 65.9% of the students disagreed with "I always fall behind in English lessons due to gaps in my knowledge from previous grades." In addition to these, 89.4% of the students disagreed with this statement: "I dislike English lessons because I don't like my English teacher" (M = 1.38).

For the difficulties regarding the learning environment, the students had these difficulties at a very low level (M = 1.45). For example, only 6.5% of the students stated that they could not learn English because of discipline issues in their classes. In other words, 70.9% of students strongly disagree with that statement. Students had this difficulty at a very low level (M = 1.53). Similarly, 64.4% of the students strongly disagreed that strong and hardworking students dominated the lessons. In other words, the students had this difficulty at a very low level (M = 1.53). In addition to these, 91.2% of the students disagreed with this difficulty "I dislike English lessons because our teacher is usually angry and indifferent to us." In other words, the students had this difficulty at a very low level (M = 1.29). Likewise, 63% of the students disagreed with "I don't enjoy learning English because our lessons are generally boring and monotonous."

Correlation between the Achievement Test Results of the Students and their PLLD Scale Scores

In order to see the relationship between the students' achievement test results and their PLDD scale scores, their correlation coefficient was calculated. The results are shown in Table 3.

Table 3: Correlation between the achievement test results and PLLD scores

		Achievement Test Results	PLLD Scores
Achievement Test Results	Pearson Correlation	1	−0.377**
	Sig. (2-tailed)		0.000
	N	340	340
PLLD	Pearson Correlation	−0.377**	1
	Sig. (2-tailed)	0.000	
	N	340	340

** Correlation is significant at the 0.01 level (2-tailed).

The table shows that there is a negative linear correlation between the achievement test results of the students and their PLLD scores; however, a correlation coefficient of $r = .377$ was calculated. Based on the convention suggested by Cohen (1998), such a value for a correlation coefficient is very close to a medium effect size. That is, only a limited amount of variance can be explained between the variables.

The Relationship between the PLLD Scores of the Students and Gender

Before the t-test, Levene's Test for Equality of Variances was applied to check the homogeneity of variances. The value over 0.05 shows that the group variances can be treated as equal and the data is suitable for a t-test with the difference between them not statistically significant. The results of Levene's Test for Equality of Variances in this study (p = .295) supports the use of a t-test.

The results of the t-test on gender and PLLD scores are presented in Table 4.

Table 4: Independent samples t-test: Gender and PLLD scores

	Gender	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)
PLLD	Male	147	2.2161	0.62530	−0.618	338	0.538
	Female	193	2.2572	0.59464			

The t-test results show that gender is not a factor that affects the difficulties learners experience. There is no significant difference in the PLLD scores of the male students (M = 2.22, SD = 0.63) and female students (M = 2.28, SD = 0.59; t(338) = −0.618, p = .538). These results suggest that gender is not a differentiating criterion with regard to the experienced level of difficulty while learning English.

PLLD Scores of the Students in Different Levels

To determine whether students studying in different academic levels (i.e., A2, B1 and B2) have different levels of PLLD scores, a one-way ANOVA was applied with results shown in Table 5.

Table 5: One-way ANOVA – PLLD scores and levels

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	6.491	2	3.245	9.220	0.000
Within Groups	118.625	337	0.352		
Total	125.116	339			

According to Table 5, a one-way ANOVA (F(2,337) = 9.220, p < .001) was applied and a statistically significant difference between the groups based on the level of the students was found. However, the one-way ANOVA provided a broader picture of the sample. In this respect, so as to see in detail how the students studying at the A2, B1 and B2 levels differed from each other, the multiple comparisons of these levels are referred to in Table 6.

Table 6: Multiple comparisons of the students studying in different levels (Dependent Variable: PLLD Scores, Tukey HSD)

(I) Level	(J) Level	Mean Diff. (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
A2	B1	0.42405*	0.11957	0.001	0.1426	0.7055
	B2	0.51714*	0.12048	0.000	0.2335	0.8008
B1	A2	−0.42405*	0.11957	0.001	−0.7055	−0.1426
	B2	0.09309	0.06736	0.352	−0.0655	0.2517
B2	A2	−0.51714*	0.12048	0.000	−0.8008	−0.2335
	B1	−0.09309	0.06736	0.352	−0.2517	0.0655

*The mean difference is significant at the 0.05 level.

As it can be seen on Tables 6 and 7, the Tukey post hoc test reveals that the PLLD scores are statistically significantly higher among the A2 level students (M = 2.67, SD = 0.63) than among the B1 students (M = 2.24, SD = 0.62, p < .001) and B2 students (M = 2.15, SD = 0.55, p < 0.001). However, there was no statistically significant difference between the B1 and B2 students (p = 0.352).

Table 7: Descriptive statistics of students studying in different levels

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	Upper Bound	Minimum	Maximum
A2	29	2.6678	0.62713	0.11646	2.4293	2.9064	1.13	4.07
B1	163	2.2438	0.62262	0.04877	2.1475	2.3401	1.17	3.90
B2	148	2.1507	0.55213	0.04538	2.0610	2.2404	1.10	3.87
Total	340	2.2394	0.60752	0.03295	2.1746	2.3042	1.10	4.07

Qualitative Findings on the Language Learning Difficulties Level of Preparatory School Students

Apart from the qualitative findings, the quantitative results indicate a number of important factors that affect foreign language learning processes. The qualitative findings can be analyzed in two different tables: responses related to difficulties about the teaching/learning processes and those pertaining to the students themselves.

Findings on the Difficulties related to the Teaching and Learning Process according to the Student Interview Forms

In terms of difficulties in the teaching and learning process, the students' responses were analyzed. The theme, codes, frequency and percentages are presented in Table 8.

Table 8: Theme, codes and frequency of responses related to teaching/learning processes

Theme	Codes	40 f	%
Teaching and Learning	Inadequate number of activities	8	20
	Ineffective teaching strategies	9	22.5
	Classroom management problems	2	5
	Administrative issues	15	37.5
	Ineffective and/or uninteresting material	3	7.5
	NA	3	7.5

As can be seen from Table 8, the responses include administrative issues and teaching strategies. 37.5% of the students stated that they had administrative problems (about the system of the school or the large scale applications of some tasks). These are issues related to school management and classroom methodologies.

> "…while constructing the classes, level could be considered more. Even at the same level, this makes understanding the lesson very difficult. Especially, the fact that language department students and the other departments are in the same class is a disadvantage and the other department students should be shuffled among themselves…"

In addition, the number of activities was a point addressed in the responses with 22.5% of the students stating that they needed more exercises in some or all of the components of the course. An example response is "I need more listening and speaking practice."

These findings are compatible with the scale in this study. The number of criticisms on classroom management or the materials' being uninteresting or dull is similar to the findings in the scale.

Some of the direct sample quotations from the students are presented below:

> "…I think that enough listening exercises are not done in the class and the ones done are not effective and I think enough time is not allocated…"

> "…Because there are students who repeated their levels many times, this affects the flow of the lesson and my psychology a lot. Especially, I am of the opinion that language students should be placed in a different class. I also think that students who repeat many times should be placed in a separate class…"

Findings on the Difficulties related to the Teaching and Learning Process according to the Student Interview Forms

In terms of the difficulties in the teaching and learning process, the students' responses were analyzed. The theme, codes, frequency and percentages are presented in Table 9.

Table 9: Theme, codes and frequency of responses related to the students themselves

Theme	Codes	40	
		F	%
	Unwillingness	2	5
	Lack of Background	1	2.5
Students themselves	Personality Traits	9	22.5
	Learning Difficulties	11	27.5
	NA	17	42.5

According to Table 9, when the issues regarding the students themselves are considered, it can be observed that students attribute the difficulties to their own personality traits and learning difficulties with 27.5% of the students mentioning that their problems were caused by their own learning difficulties. An example is "[Because I feel so much stress and pressure, I am having a lot of difficulty in speaking English, so I withdrew myself myself indeliberately and though I know vocabulary and grammar, my speaking skill is almost zero."

However, it should also be noted that 17 students did not respond to the question on problems caused by the self.

CONCLUSION AND DISCUSSION

This research was designed to determine the factors and the reasons that make the English language learning difficult for preparatory school students. According to the PLLD scores, it was found that students have these difficulties in the low level (Table 2). As for the difficulties related to learning materials, the students stated that they did not find their reading texts in their books interesting. They also stated that they were bored when they did listening practice because the topics were not interesting. Likewise, students stated that they did not like reading texts because there were too many unfamiliar English words (Table 2). These findings are compatible with the results of Özmat's (2017) study on the factors that make learning difficult for secondary and high school students. She found that both 7th and 11th grade students had difficulty with their reading skills because the textbooks were too long to understand and the students would encounter numerous unfamiliar words in them. The results of the interview in this study indicated a difference from Özmat (2017). The findings show that none of the participants indicated that the length and difficulty of the materials were incompatible with their English proficiency levels and that the learners very rarely indicated issues regarding the topic or the content of the materials (7.5%). This can be attributed to the level-based system at the university that this research was conducted. Students are placed in their classes according to their onset levels at the beginning of the academic year and every eight weeks, they would either pass their level to proceed to the following (higher) level or repeat the current level. This helps the materials and objectives to be more compatible with each individual student. Demirtaş and Erdem (2015) also found that the greatest challenges were the inadequate number of hours allocated in the curriculum. Likewise, Kandemir and Tok (2017) emphasized a need for more teaching hours and an update in the resources used. In this study, similar results appeared from the interviews. The criticism was directed not at the inadequate number of hours allocated to language teaching but to the inadequate number of materials provided. This concept of 'materials' refers to the in-house materials produced by the instructors themselves and by the materials unit. As the in-house materials have been very compatible with the achievement tests applied in this institution, the students desired to be able to practice more for the exams. This can be explained with the term 'backwash.' The very close similarity between the materials and the exams had the students value in-house materials very much. The materials and classroom applications used in the classroom are apt to extensive changes in academic success as suggested by Chua and Lin (2020), which showed how the intensity and variety of tasks provided to learners might increase their final achievement. Moreover, the positive effect of integrating different types of materials and technology in teaching was reported in Solak and Cakır (2015).

Based on the findings of this study, it can be said that the learning resources in a preparatory school curriculum need to be reorganized as do the teaching and learning materials in terms of meeting the needs, levels and interests of students.

As for the difficulties related to the teaching and learning process, students had all these difficulties in the "low" level (Table 2). It was observed that students generally disagreed with the difficulties in the PLLD scale. For example, more than half of the students (57.4%) disagreed with "We do not do any reading practice on how to understand a text with the guidance of a teacher". Based on the findings of this study, it can be said that preparatory school students are satisfied with the guidance of teachers in the teaching process. It can be also concluded that English teachers are aware of the language teaching strategies for teaching various language skills.

Similarly, nearly half of the students (48.5%) strongly disagreed with "I don't make an effort to speak English because we are allowed to speak Turkish in English lessons." On the other hand, the findings of this research are not compatible with the results of Özmat's (2017) study in which the same scale was used for different ages. She found that both secondary and high school students had these difficulties related to the teaching and learning process at a high level. According to Özmat (2017), secondary and high school students did not know how to improve reading or speaking skills. In this study, participants did not mention such

concerns; rather, it was interesting to find that they suggested new ways and methods to practice some skills in class. An example student response suggests that "speaking practices should be increased in number and also should be strengthened by adding some games. The difference between Özmat (2017) and this study can be attributed to two factors, the first of which is the age difference of the participants. In Özmat (2017), the participants were children while in this study, a mostly young-adult group was studied. The second important difference may be the fact that this study was conducted in a university context in which every student passed a large-scale university exam and was found eligible to be a university student. Therefore, they can be considered to be 'select students' with better studying and learning backgrounds. In summary, the difference can be accounted for the student profile.

Thus, it can be said that the students in the preparatory school consider themselves to be aware of the strategies on how to be successful in different skills (speaking, reading, writing and listening) in the learning and teaching process with their instructors. It may also say that students are taught language learning strategies and are guided by their teachers in learning these skills.

With regard to the difficulties caused by students themselves, it was found that the students had these difficulties in the low level (Table 2). Despite the overall low level of difficulty stated, there were some considerably higher points of difficulty that were observed in the results. For example, the students stated that they did not want to speak English because they always had to translate from Turkish first, so it took them a long time to make sentences (medium level). Similarly, the students stated that they could not speak English as they wanted to speak it fluently and without making mistakes. In addition to these factors, the students stated that they did not feel confident in speaking English. These findings are compatible with the findings in the interview as the students stated the inadequacy of both the quantity and the variety of speaking exercises. While some students related this to classroom activities and atmosphere, the others related it to the medium of instruction in the classroom.

Similar findings were reported by Mai (2019), showing that the most important factors that would hinder learner participation in class activities pertained to the limited variety of speaking activities and students' unwillingness to communicate in class, that is, students' personal reasons. The results of this are in line with studies that indicate further problems of learners in the same areas. Kurtulus and Arsal report that "The findings of both the students and professor interviews showed that, though the students passed the preparatory class, they were inefficient in speaking and communication in English" (Kurtuluş & Arsal, 2019, p. 1012).

On the other hand, the students disagreed with "I'm not interested in learning English." Likewise, they disagreed with "I dislike English lessons because I don't like my English teacher." Thus, it can be said that students have positive attitudes towards learning English and English teachers, which contrasts with the results of Özmat's study (2017). Masgoret and Gardner (2003) stated that the positive attitudes of students are related to their effort to learn a new language and their motivation. They found that there was a correlation with positive attitudes toward learning a foreign language and success in learning a language.

In Kozikoğlu and Kanat (2018), which looked for students' speaking anxiety and attitude towards English lessons, "it was found that the students' attitudes towards English courses and their engagement in English courses were at a high level and students' English speaking anxiety was at moderate level".

As for the difficulties regarding the learning environment, the students stated that they had these difficulties at the very low level (Table 2). For example, far more than half of the students (70.9%) stated that they disagreed with "I cannot learn English because of discipline issues in our class" (very low level). In contrast to this result, Özmat (2017) found that high school students had high levels of discipline issues in learning English, which was a reported handicap for their learning.

The findings of the interview showed results similar to the scale results. In only one of the responses, a concern about classroom management was mentioned. Moreover, the students state that they do not think that strong and hardworking students dominated the lessons. In addition, the students disagreed with both "I dislike English lessons because our teacher is usually angry and indifferent to us" and "I don't enjoy learning English because our lessons are generally boring and monotonous." This finding is compatible with the interviews. Only 7.5% of the participants claimed that the lessons were monotonous.

According to these findings (Tables 2 and 8), it can be said that students did not think that they had many discipline issues or management problems in their classes. They were mostly content with the atmosphere and management in class. The analysis of both the scale and the interview uncover very few concerns about discipline issues.

It was found that the relationship between the PLLD scores and the students' achievement test scores was not strong (Table 2), from which it can be concluded that those scoring high in the achievement test may have also experienced a certain type and level of difficulty, and the low-achievers may have experienced some sort of difficulty, but may have been unable to express these difficulties properly or simply may not have been aware of them.

Gender was found not to be a differentiating factor with regard to the PLLD scores (Table 4), from which it can be inferred that no discriminating level of difference exists between male and female students' PLLD scores. The results of Özmat (2017) show that there was no meaningful relationship between gender and PLLD scores of secondary and high school students, which is in line with this finding.

No significant difference was found between the B1 and B2 level students; in contrast, a significant difference was observed between the A2 and B1 and B2 level students (Table 7). It can be concluded that the PLLD scores tended to be higher with the low level students. At the same time, in the relatively high B1 and B2 levels, the students would perceive a lower level of difficulty while learning English, as indicated in their PLLD scores.

SUGGESTIONS

Language learning can be a very challenging process for learners as well as for practitioners. Knowing the causes of these challenges can be of great help in any decision-making process and it can ease the process of language learning and teaching for all parties. The main aim of this study is to shed light on some of the important problems learners indicate so that necessary adjustments can be made, among many of which include some of the important implications and suggestions of this study as follows:

The results indicate that students experience a medium level of difficulty in terms of learning materials (Table 2), which calls for a revision and improvement in the learning materials chosen and developed. While teaching English as a foreign language, students' interests and materials' difficulty levels should be carefully adjusted. The lexical sophistication levels of reading texts should be carefully analysed before being used in class.

In terms of the problems regarding the students themselves, it is highlighted that students have self-confidence problems in speaking in English courses because they feel the need to translate to Turkish and they do not feel confident. They also state that they have insufficient vocabulary knowledge to be able to speak in the target language (Table 2). This problem indicates a strong need for more practice in productive skills (i.e., speaking and writing) in class and/or out of class (i.e., extracurricular exercises), which can help them to broaden their active vocabulary knowledge and gain the fluency to *switch* to the target language. An increase in practice can help them to gain self-confidence in English as well. Moreover, the learning and teaching environment should be designed so as to lower the speaking anxiety of learners.

The study also suggests that the higher the academic level of students, the lower the level of difficulty they experience (Table 7). This shows that the low level group of students requires more effective remedies. Among these remedies may be professional development studies provided to instructors to be able to cope with the difficulties that lower level students have.

According to the results of the interview, the students stated the need to receive information about school rules and regulations more frequently and directly (Table 8). Student representatives can take a more active role in strengthening communication between students and administration.

For further research, similar studies can be conducted in different preparatory school contexts to find and observe common problems and work on them in a more collective manner. Moreover, instructors, managers and other stakeholders can be included in the scope of such studies to have more perspectives in the findings. Additionally, experimental studies on the possible solutions to overcome the problems stated can be of help for language practitioners and curriculum designers.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, author-ship, and/or publication of this article.

Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers.

Ethics Committee Approval Information

For the purposes of this research, the participants completed a consent form and all the instruments and forms were approved by the ethics committee of the university at which this study was conducted. Ethical consent was obtained from Çankaya University Ethical Committee, No: 90705970/ 605, Date: 05.27.2020.

REFERENCES

Chen, S. C. (2010). Multilingualism in Taiwan. *International Journal of the Sociology of Language*. 205, 79-104 https://doi.org/10.1515/IJSL.2010.040

Chou, M. H. (2014). Assessing English vocabulary and enhancing young English as a Foreign Language (EFL) learners' motivation through games, songs, and stories. *Education 3-13*. https://doi.org/10.1080/03004279.2012.680899

Chua, H. W., & Lin C.Y. (2020). The Effect of Task-based Language Teaching in Learning Motivation. *International Journal on Social and Education Sciences*, 2(1), 41-48. Retrieved from https://www.ijonses.net/index.php/ijonses/article/view/23/0

Cohen, J. (1988). Statistical Power Analysis for the Behavioral Sciences. New York: Routledge, https://doi.org/10.4324/9780203771587

De Paepe, L., Zhu, C., & Depryck, K. (2019). Development and implementation of online Dutch L2 courses in adult education: educators' and providers' perceptions of constraints and critical success factors. *Innovation in Language Learning and Teaching*, 13(3), 277–291. https://doi.org/10.1080/17501229.2018.1462369

Demirtaş, Z., & Erdem, S. (2015). 5. Sınıf İngilizce Dersi Öğretim Programı: Güncellenen Programın Bir Önceki Programla Karşılaştırılması ve Programa İlişkin Öğretmen Görüşleri. *Sakarya University Journal of Education*, 5 (2), 55-80. https://doi.org/10.19126/suje.59904

EF EPI. (Education First English Proficiency Index) (2015). *The world's largest ranking of countries by English skills*. Retrieved from http://www.ef.co.uk/epi/ (December, 10, 2019).

Green, S. B., Lissitz, R. W., & Mulaik, S. A. (1977). Limitations of coefficient alpha as an index of test unidimensionality1. *Educational and Psychological Measurement,* 37(4), 827-838. https://doi.org/10.1177/001316447703700403

Hogan, J., Dolan, P., Donnelly, P. (2009) 'Introduction', in J. Hogan, P. Dolan and P. Donnelly (eds) *Approaches to Qualitative Research: Theory and Its Practical Application*, pp. 1-18. Cork: Oak Tree Press.

Kandemir, A., & Tok, Ş. (2017). An evaluation of 2nd grade English curriculum within a participant oriented program evaluation approach. Milli Eğitim Dergisi , 46 (215) , 27-67 . Retrieved from https://dergipark.org.tr/en/pub/milliegitim/issue/36134/405892

Kozikoğlu, İ., & Kanat, F. (2018). Lise öğrencilerinin ingilizce dersine katılım durumlarının ingilizce dersine yönelik tutum ve ingilizce konuşma kaygısına göre yordanması. *Kastamonu Eğitim Dergisi*, *26*(5), 1643–1652. https://doi.org/10.24106/kefdergi.2191

Krippendorff, K. (2004). Content Analysis: An Introduction to Its Methodology (2nd ed.). *Organizational Research Methods*. Thousand Oaks, CA: Sage

Kurtuluş, F., & Arsal, S. (2019). English Education Needs of the Preparatory School Students. *Kastamonu Education Journal*, *27*, 1005–1014. https://doi.org/10.24106/kefdergi.2319

Liu, H. J., & Cheng, S. H. (2014). Assessing language anxiety in efl students with varying degrees of motivation. *Electronic Journal of Foreign Language Teaching*, *11*(2), 285–299.

Ma, X., Wannaruk, A., & Lei, Z. (2019). Exploring the relationship between learning motivation and L2 wtc in an efl classroom among Thai efl learners. *English Language Teaching*, *12*(7), 33. https://doi.org/10.5539/elt.v12n7p33

MacIntyre, P. D., & Gardner, R. C. (1989). Anxiety and second-language learning: Toward a theoretical clarification. *Language Learning*, 39(2), 251-275 https://doi.org/10.1111/j.1467-1770.1989.tb00423.x

Mai, L. T. (2019). An investigation into factors that hinder the participation of univeristy students in English speaking lessons. *IOSR Journal Of Humanities And Social Science (IOSR-JHSS),* 24(4), 84-94. https://doi.org/10.9790/0837-2404068494

Masgoret, A.-M., & Gardner, R. C. (2003). Attitudes, motivation, and second language learning: A meta-analysis of studies conducted by Gardner and Associates. *Language Learning*, 53(1), 123-163. https://doi.org/10.1111/1467-9922.00212

McDonough, J., Shaw, C., & Masuhara, H. (2013). Materials and methods in ELT: teachers' guide. Chichester: Wiley-Blackwell.

Muijs, D. (2014). Doing quantitative research in education with SPSS. 2nd edition , London, GB. SAGE Publications (In Press) https://doi.org/10.4135/9781849203241

Özmat, D. (2017). *Factors that Make Learning English Language Difficult*. (Unpublished Doctorate Dissertation) Hacettepe University, Ankara, Turkey.

Saruhan, Ş. C. & Özdemirci A. (2016). Bilim, Felsefe ve Metedoloji. İstanbul: İnkılap Kitapevi.

Scott, C. T. (1965). Teaching English as a Foreign Language. *The English Journal*, *54*(5), 414–418. https://doi.org/10.1080/00131726709338061

Solak, E., and Cakır, R. (2015). Exploring the effect of materials designed with augmented reality on language learners' vocabulary learning. *Journal of Educators Online*, *13*(2), 50–72. https://doi.org/10.9743/jeo.2015.2.5

Spector, P. E. (1992). Summated Rating Scale Construction: An Introduction. Newbury Park, CA: Sage.

http://dx.doi.org/10.4135/9781412986038The Economic Policy Reseach Foundation of Turkey (TEPAV). (2013). *Türkiye'deki devlet okullarında İngilizce dilinin öğretimine ilişkin ulusal ihtiyaç analizi.* Retrieved from https://www.tepav.org.tr/upload/files/13993885191.Turkiyedeki_Devlet_Okullarinda_Ingilizce_Dilinin_Ogrenimine_Iliskin_Ulusal_Ihtiyac_Analizi.pdf (December, 11, 2018)

Woodside, A. G. (2010). Bridging the chasm between survey and case study research: Research methods for achieving generalization, accuracy, and complexity. *Industrial Marketing Management*, 39(1), 64-75 https://doi.org/10.1016/j.indmarman.2009.03.017

Zhang, H., Dai, Y., & Wang, Y. (2020). Motivation and second foreign language proficiency: The mediating role of foreign language enjoyment. *Sustainability (Switzerland)*, *12*(4), 1–13. https://doi.org/10.3390/su12041302
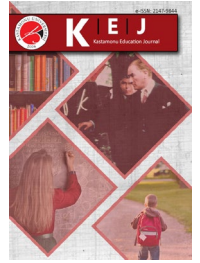
A Thematic Analysis of Keywords in Postgraduate Theses on Children's Literature

Çocuk Edebiyatı Alanında Yapılmış Lisansüstü Tezlerdeki Anahtar Kelimelerin Tematik Olarak İncelenmesi

Bora Bayram[1]

Abstract

Purpose: This study sets out to reveal the thematic distribution of the keywords used in postgraduate theses in the field of children's literature. In this qualitative study, the data were obtained by document review. 358 theses prepared at graduate level on children's literature between 2015-2020 were examined.

Design/Methodology/Approach: Descriptive analysis was used to analyze the data. The obtained keywords in these theses are divided into 14 categories.

Findings: As a result, it was determined that the majority of the keywords in theses are shaped around the concept of children, studies are carried out based on literature rather than acquiring basic language skills, studies on listening, writing and speaking areas are insufficient, and the tendency of text-oriented examination has not changed over the years.

Highlights: It is recommended that further research should focus on diversifying and enriching this in terms of method and subject for the development of basic language skills.

Öz

Çalışmanın amacı: Bu çalışmanın amacı, çocuk edebiyatı alanında yapılmış olan lisansüstü tezlerde kullanılan anahtar kelimelerin tematik olarak dağılımlarını ortaya koymaktır. Nitel bir araştırma olan bu çalışmada veriler, doküman incelemesi yöntemiyle elde edilmiştir. Bunun için 2015-2020 yılları arasında çocuk edebiyatıyla ilgili lisansüstü düzeyde hazırlanmış 358 adet tez incelenmiştir.

Materyal ve Yöntem: Elde edilen verilerin incelenmesinde betimsel analiz yöntemi kullanılmış, veriler frekans değerleriyle tablolar halinde sunulmuştur. Araştırma sonuçlarına göre, söz konusu tezlerde kullanılan anahtar kelimeler toplam 14 kategoriye ayrılmıştır.

Bulgular: Araştırma sonucunda lisansüstü tezlerdeki anahtar kelimelerin büyük çoğunluğunun çocuk kavramı etrafında şekillendiği, çalışmaların temel dil becerileri kazandırmaktan ziyade edebiyat eksenli yürütüldüğü, dinleme, yazma ve konuşma alanlarına yönelik yapılan çalışmaların yetersiz olduğu, metin odaklı inceleme eğiliminin yıllar içinde değişmediği tespit edilmiştir.

Önemli Vurgular: Buna göre çocuk edebiyatı alanında çalışma yapacak olan araştırmacıların temel dil becerilerinin geliştirilmesine yönelik çalışmalarla bu alanın metot ve konu bakımından çeşitlendirilip zenginleştirilmesine; sanatçı, eser odaklı yaklaşım ve değer incelemesiyle sınırlandırılmamasına dikkat etmesi önerilmektedir.

[1] Alanya Alaaddin Keykubat Üniversitesi, Eğitim Fakültesi, Türkçe Eğitimi Anabilim Dalı, TÜRKİYE, bora.bayram@alanya.edu.tr *ORCID:0000-0002-0693-4651*

INTRODUCTION

Literature, which can be defined as the art of shaping events, feelings, thoughts and dreams verbally and in writing through language (TDK, 2000: 316), includes all written works created with aesthetic concerns. It is possible to encounter many classifications of purpose and quality related to literary works, such as educating, teaching, entertaining, benefiting, etc. (Şirin, 2016: 13). One of these classifications is the concept of children's literature covering written and oral products (Oğuzkan, 2000: 2-3) that appeal to the imaginations and thoughts of childhood people. Children's literature products have been an essential tool in the child's educational activities in every aspect. Literary products that are selected with great care at all levels of education, starting from primary education in schools and presented to the benefit of the students and reflecting the intricacies of the Turkish language in the best way, are indispensable, especially in the primary language teaching courses because the use of text in Turkish classes is of great importance for all learning areas of native language education. Education and training activities for not only reading comprehension but also listening, speaking and writing learning areas are mainly carried out through the text. As a matter of fact, thanks to the texts, the child learns to think, interpret, infer besides the rules of the language (Uz Erşahin, 2009: 32). However, the selected texts should respond to the child's interests and needs, appeal to the world of emotions and thoughts, and the stories should be answered in his/her life. Because what the child can get from a text in which s/he cannot find anything of himself/herself will be limited. At this point, the concept of children's literature stands out. Children's literature, which is defined in the current Turkish Dictionary (https://sozluk.gov.tr) as "An educational type of literature that will help children comprehend life, develop imagination, instill a love of reading, children's writing", covers all written and oral products created for the feelings, thoughts, and dreams of childhood according to Oğuzkan (2000:3). According to Dilidüzgün (2004:18), children's literature, which covers literary products prepared for children between the ages of 4 and 12, is a top concept that can be evaluated within the scope of free or compulsory reading in school and consists of texts that address children's realities sensitively and have an artistic value that will give children the love and habit of reading and turn them into qualified readers. Sever's (2003: 10-11) opinions that children's literature products created without sacrificing aesthetics will give children the love and habit of reading. Children can make a reading culture by turning to qualified texts that can be evaluated in the same way.

Children's books contribute to developing the child's language, personality development and cognitive and social development (Sever, 2003: 27). The language used in texts created for children helps the child enrich the presence of words by learning new words and improving their comprehension and narrative skills. It is possible to understand and recognize the intricacies of the child's mother tongue thanks to carefully prepared texts. For this, writers should be aware of the children's world and the child's qualities from time to time regarding development and learning. In other words, it is vital that what is told in children's literature has an equivalent in the child's life and that the text created is suitable for the child.

Children's literature texts also undertake a separate mission regarding the child's personality development and social development. The protagonists of the work, which the child has taken as a role model by putting himself/herself in his/her place, help present social norms to the child by embodying them. In this way, the child learns to socialize and distinguishes the material and spiritual values of the society in which s/he lives. Children's literature text writers should pay attention to their language to reach the child on such an important issue. Otherwise, it should not be forgotten that a children's literature writer is at risk of causing boredom and alienating children from the text, even from reading, with an unnatural and didactic expression.

Using children's literature texts in education is a factor that will increase success for both teachers and students because it is possible to capture the child's world with the texts of children's literature. The children's literature writer removes the obstacles to the child's understanding of the text with the word choices and sentence structures that can be understood by the children in the targeted age group. Otherwise, the child who does not understand the text will move away, and the target gains will not be realized because the targeted interpretation and real-life comparison cannot be made at the end of the text (Uz Erşahin, 2009: 32).

It is necessary to use children's literature texts as a tool in mother tongue education. At the end of a beautiful text read with love and pleasure, education and training can be done in Turkish's essential learning areas, such as speaking, writing, listening, grammar, and vocabulary. In this regard, there are many studies on children's literature of literary and aesthetic nature reflecting the intricacies of the mother tongue in the literature and many articles and graduate thesis on the learning areas of Turkish. Our starting point in this research is to reveal the relationship between postgraduate studies on children's literature and the essential learning areas of Turkish through keywords.

Keywords that provide convenience for researchers when writing titles, abstracts, problem situations and conceptual frameworks (Karagöl, 2018:38) provide conveniences to researchers in terms of examining previous studies and giving ideas for future studies, establishing the theoretical infrastructure of studies, determining materials, and interpreting research results to be compared. With the help of keywords, the researcher gains the advantage of extracting information appropriate for his research subject as soon as possible in a large pile of data in search engines (Tatar and Tatar, 2008: 94). Keywords must be selected correctly so that researchers can access the information they are looking for. Since identifying incorrect keywords in a scientific publication can mislead researchers and cause a waste of time, sensitivity should be shown in opening the publication to purposeful sharing (Sevim and İşcan, 2012: 1864). In terms of the accessibility of research in indexes, keywords should reflect the subject of the study in general and private. However, the English equivalents should be determined correctly to be easily accessible in the literature (Karagöl, 2018: 37).

The use of keywords in scientific publications is excellent convenience for researchers. First of all, it allows us to know the subject headings used in the literature, the most and least studied subjects, the direction of the general trend, and practical guidance on innovations (Sevim and İşcan, 2012: 1864). Based on these advantages of using keywords, this study aims to examine thematically the keywords used in the postgraduate theses made in the last five years in the field of children's literature. In this direction, An attempt was made to find an answer to the question, "How is the thematic distribution of the keywords used in the graduate theses in the field of children's literature between 2015-2020?".

METHOD

Research Model

This research is aimed to examine the keywords used in masters and doctoral thesis in the field of children's literature between 2015 and 2020. The data of this study, which is qualitative research, were obtained by document analysis method. Qualitative research is research in which a qualitative process is followed to determine perceptions and events in a realistic and holistic natural environment. Data collection methods such as interviews, observation, and document reviews are used (Yıldırım, 1999: 10).

Data Collection Tool and Collecting the Data

Postgraduate thesis made between 2015 and 2020 in children's literature was scanned at the National Thesis Center of the Higher Education Council to obtain research data. After the screening using the expressions "Children's literature, children's books, child relativity, youth literature, children's poetry", 358 postgraduate theses were reached. Theses are not limited to just one institute or department. All theses that can be included in the research in different significant disciplines in the Institute of Educational Sciences, Institute of Social Sciences, Graduate Education Institute, Institute of Living Languages, Institute of Health Sciences, Institute of Fine Arts, Institute of Turkic Studies, Ataturk Principles and Revolution History Institutes have been evaluated. However, most of the graduate thesis made in graphic design, art and design, architecture, visual arts, and visual communication design were excluded because they were more interested in the technical dimensions of children's books. In addition, a small number of theses that do not have access permission were not included in the study.

Data Analysis

The data obtained as a result of the research were evaluated by the descriptive analysis method, often preferred in qualitative studies. It aims to reach concepts and relations that can explain the data obtained in descriptive analyses. In this context, processes such as creating a framework, processing the data according to the thematic framework, defining and interpreting the findings are operated (Yıldırım ve Şimşek, 2008).

In this research, the keywords in the related thesis were determined by scanning the graduate thesis made between 2015 and 2020 in the field of children's literature. Then, keywords were classified as thematic, the data was processed into the thematic framework, and the findings were defined and interpreted after the validity and reliability of the data reached were ensured. The conclusions were visualized and analyzed with frequency tables.

Validity and Reliability

To ensure validity and reliability in the research, the keywords mentioned in the postgraduate thesis prepared between the relevant years and analyzed by the researcher were presented to a field specialist in Turkish education. The research findings started to be interpreted by consensus when different opinions were made.

FINDINGS

This section evaluated the keywords used in doctoral or graduate level thesis in children's literature between 2015 and 2020 at YÖK National Thesis Center as thematic. Accordingly, the keywords were divided into 14 categories as *keywords related to literary terms (f= 108), keywords related to literature (f= 256), keywords related to children's literature (f= 24), keywords related to text types (f=134), keywords related to topics and themes (f= 249), keywords related to artists (f= 160), keywords related to works (f=49), keywords related to period/time (f= 34), keywords related to the type of written mass media (f= 102), keywords related to values (f= 94)), keywords related to education and training activities (f= 103), keywords related to the concept of language (f= 29), keywords related to basic language skills (f= 47), keywords related to methodology (f= 65)*. Information about these categories is presented in the tables below.

Table 1. Keywords for literary terms

Category	Keywords	f	Keywords	f
Literature	translation	1	feminist literary criticism	1
	translation literature	1	folklore	1
	translation strategies	1	translation of youth literature	1
	compilation	1	storytelling	1
	dialectic	1	Public storyteller	1
	index	1	oral culture	1
	Literature	23	written culture	1
	literary translation	1	literature	1
	work	1	-	-
Text and Structural Elements	protagonist,	1	topic	3
	conflict resolution	1	fictional text	1
	conflict	1	place	2
	translation text	1	text	4
	environment	2	non-text features	1
	animal characters	1	textuality	1
	content	1	content	1
	dialogue	3	individual staff	1
	image language	1	theme(s)	9
	irony	1	thematic wealth	1
	hero	2	style	1
	character	6	structure	1
	ways to develop characters	1	local discourse	1
	character properties	1	time	2
	character creation	1	-	-
Literary Orientation	movement	1	fictional	1
	magical realism	1	fiction	1
	fantastical narrative	1	fictional reality	1
	fantastic	3	resolling narrative	1
	gothic	1	social realism	1
	thematic	1	social realism	1
	classics	1	literary fiction	1

According to Table 1, 108 keywords related to literary terms have been identified. Under this category, there are three subcategories: *literature (f= 39), text and structure elements (f= 53), literary orientation (f= 16)*. When the sub-categories are examined, *literature* (f=23) in *literature* sub-category, *theme(s)* (f=9), *character* (f=6), *text* (f=4) in *text and structure elements* sub-category, and *fantastic* (f=3) in *literary orientation* sub-category codes are seen to be used more frequently.

Table 2. Keywords for the field of literature

Keywords	f	Keywords	f
Arab	2	Children's games in Kyrgyz folklore	1
Arabic literature	1	Rituals and children in Kyrgyz folklore	1
Western Thrace	1	Kyrgyz folk literature	1
translation children's literature	1	Kosovo	2
children's literature	213	Macedonia children's literature	1
children's and youth literature	2	Macedonian Turkish literature	1
fantastic children's and youth literature	1	Macedonia	1
fantastic literature	1	modern Arabic literature	1
youth literature	4	modern Azerbaijani poetry	1
gothic literature	1	Syria	2
folk literature	1	Turkish	1
Folklore	1	Turkish children's literature	1
Iran children's and youth literature	1	Turkish literature	4
Iranian literature	1	Turkish gothic literature	1
Islamic children's literature	1	Turkish folk literature	1
comparative literature	2	Turkey	1
Kashkay Turks	1		

According to Table 2, 256 keywords related to the field of literature have been identified. *Children's literature* is the most preferred of all keywords with 83%. In this group, it is remarkable in terms of the diversity that the keywords in terms of the field of literature are in a way that evokes the Turkish world such as Kaşkay, Kyrgyz, Azerbaijan, Middle East literatures such as Arab, Iran, Syria, and children's literature products in the remnant Ottoman lands such as Kosovo and Macedonia.

Table 3. Keywords for the field of children's literature

Keywords	f	Keywords	f
translation of children's literature	1	basic principles of children's literature	9
children's literature course	1	basic elements of children's literature	3
children's literature works	1	basic elements of children's literature	1
children's literature texts	1	criteria for children's poetry	1
children's literature history	1	multicultural children's literature	1
children's literature products	1	fictional children's literature	1
aesthetic criteria in children's literature	1	award-winning children's literature works	1

According to Table 3, 24 keywords related to the field of children's literature have been identified. The most commonly preferred of these keywords is *the basic principles of children's literature (f*=9). In this group, there are also different elements *of children's literature (f*=3) that support the same code, albeit with other words, and *basic elements of children's literature (f*=1).

Table 4. Keywords for text types

Categories	Keywords	f	Keywords	f
Informative Texts	memoir	1	prose	1
	biography	3	interview	1
	essay	1	-	-
Event-Driven Texts	Comic	3	fairy tales	13
	children's stories	5	event and emotion-based types	-
	children's fairy tales	4	award-winning novel	-
	children's story	2	story	9
	children's novel(s)	15	popular novel	1
	compiled fairy tale	1	novel	9
	saga	2	historical children's novel	1
	folk tales	1	historical novel	1
	animal story	1	Turkish story	1
	story	21	Turkish story	1
	fictionalized fairy tale	1	Turkish novel	1
	fairy tale types	1	-	-
Poem	Children's poetry in Arabic literature	1	children's poetry(s)	9
	Arabic poetry	1	poem	14
	contemporary children's poetry	1	bunch of poetry	2
Display dependent Texts	children's theatre	3	theater	1
	drama	1	-	-
Other	literary types	4	political humor	1
	dark humor	1	rhyme	1
	humour	5	type	1

According to Table 1, 134 keywords related to text types have been identified. This category includes five subcategories: *informative texts (f= 7)*, *event-based texts (f= 81)*, *poetry (f= 28)*, *display-dependent texts (f= 5)*, *other (f= 13)*. When the sub-categories are examined, *biography* (f=3) in *the informative text category*, *story* (f=21) in *the event-based texts category*, *children's novel(s)* (f=15), *fairy tales* (f=13), *poetry* (f=14) in *the poetry category*, *children's poetry(s)* (f=9), *children's theater* (f=3) in *the category of display texts*, *humor* (f=5) in *the other* category, and *literary genres* (f=4) codes are seen to be used more frequently. However, the codes of the same literary species were included in the table with different nouns. For example, the type of "story" is expressed with codes such as "folk tales, animal story, children's stories, Turkish story, story, children's story, Turkish story".

Table 5. Keywords for Topics and Themes

Category	Keywords	f	Keywords	f	Keywords	f
child concept	Children between 60-72 months old	1	child image	1	children's literature	3
	translation children's book	1	child identity	1	social construction of childhood	1
	child relativity	9	children's book	3	childhood	1
	child relativity principle	1	children's libraries	2	child-preschool	1
	child eligibility	1	children's media	1	childish sensitivity	1
	child	46	child reader	1	development of humor in the child	1
	children's world	2	children's games	1	preschoolers	1
	children's works	1	children's storybook	1	illustrated children's book	1
	child reality	3	children's problems	1	preschool children at risk	1
	children's rights	1	children's design	1	-	-
	children's rights convention	1	children's publications	2	-	-

Category	Keywords	f	Keywords	f	Keywords	f
Individual issues	parents	1	difference	1	game, toy	1
	friend	1	reality	1	death theme	1
	self language	1	reliability	1	health	1
	individualism	1	beautiful	1	page layout	1
	grandfather	1	captain	1	free activity	1
	emotion	1	self-disclosure	1	free events application	1
	emotions	1	fear	1	violence	1
	critical thinking	5	bad twin	1	uncanny	1
	disability issues	1	acceptable citizen	1	Turkish twins	1
	Disabled	1	grandma	1	creative thinking	1
Development issues	bibliotherapy	1	Developmental psychology	1	psychological robustness	1
	cognitive development	1	early youth	1	becoming a role-model	1
	developmental characteristics of the child	1	personality development	2	adult	1
	child development	1	identification	1	mental development	1
	development	1	establishing identification	1	-	-
	areas of development	1	psychology	1	-	-
Cultural issues	multiculturalism	1	cultural elements	1	T.C. ministry of culture	1
	state theaters	1	interculturalism	1	Turkish journalism	1
	book decoration arts	1	national culture	1	Turkish culture	1
	culture	4	narcissistic culture	1	convergence culture	1
	cultural elements	1	oral culture	1	food items	1
Literary and Artistic subjects	translation norms	1	aesthetic	2	criteria	1
	translator and publisher approaches	1	feminist translation	1	illustration	1
	cartoon	1	chart	1	picture-text relationship	1
	cartoon	1	graphic design	2	understanding of art	1
	digital illustration	1	story review		representation	1
	literary text review	1	illustration	4	typography	1
	Aegean writers	1	illustration history	1	-	-
Social issues	family	2	civil war	1	nonverbal communication	1
	discrimination	1	ideology	1	violence and types	1
	west	1	image of women	1	collectivism	1
	gender roles	1	representation of women	1	gender	5
	environment	1	women's and children's problems	1	gender roles	2
	nature	1	female	1	gender-representative motherhood	1
	nature	1	stereotype	2	social criticism	1
	ecocriticism	1	interpersonal conflict	1	social development	1
	masculinity	1	interpersonal communication	1	social events	1
	feminism	1	profession	1	Turkish woman	1
	tradition	1	refugee	1	Turkism	1
	immigration	2	prejudice	1	alienation	1
	immigration	1	refugee	1	bullying	1
	group hostilities	1	-	-	-	-
Religious and historical Issues	Ataturk	1	tales	1	illustrated Moon	1
	religion	1	Quran	1	war	1
	General Francisco Franco	1	School of Manipulation	1	historical reality	1
	revolutions and the establishment of the republic	1	Advertising in the Ottoman Empire	1	historical	1
	Islamic	1	prophetic tales	1	Turkish cinema	1

According to Table 5, 249 keywords have been identified in terms of subjects and themes. Under this category, there are seven subcategories: *child concept (f=93)*, *individual subjects (f= 34)*, *developmental issues* (f = 17), *cultural issues (f= 18)*, *literary and artistic issues (f= 24)*, *social issues (f= 48)*, *religious and historical issues (f= 15)*. When the sub-categories are examined, the *child* (f= 46) in the *concept of child category*, *child relativity* (f= 9), *critical thinking* (f= 5) in the *category of individual subjects*, *personality development* (f= 2) in the *category of developmental subjects*, *culture* (f= 4) in the *category of cultural subjects*, *illustration* (f= 4) in the *category of literary and artistic subjects* and *gender* (f= 5) in the *category of social subjects* are higher. No code stands out in particular in the category of religious and historical issues.

Table 6. Keywords for artists

Keyword	f	Keyword	f	Keyword	f	Keyword	f
Abdulla Şaik	1	Christine Nöstlinger	1	Kemalettin Tuğcu	2	Rıfat Ilgaz	1
Abdulvahap Akbaş	2	Çetin Öner	1	Koray Avcı Çakman	2	Roald Dahl	1
Adnan Özyalçıner	1	Dav Pilkey	1	Manastırlı Mehmet Rıfat	1	Sabiha ve Zekeriya Sertel	1
Ahmet Ümit	1	Durali Yılmaz	1	Mark Twain	1	Sabri Esat Siyavuşgil	1
Ahmet Yılmaz Boyunağa	2	E.B.White	1	Mavisel Yener	4	Samed Behrengi	1
Ali Ekrem Bolayır	1	Else Günther	1	Memduh Şevket Esendal	1	Sara Gürbüz Özeren	1
Ali Nazimâ	1	Enver Tuncalp	1	Mevlana	1	Sedat Girgin	1
Alphonse Daudet	1	Fazıl Hüsnü Dağlarca	1	Mevlana İdris Zengin	2	Serpil Ural	1
Aslı Der	1	Feridun Oral	2	Michael Ende	1	Sevim Ak	2
Aydoğan Yavaşlı	1	Ferzan Gürel	1	Mikayıl Müşfik	1	Sevinç Kuşoğlu	1
Aygen Sibel-Çelik	1	Gülçin Alpöge	1	Miyase Sertbarut	4	Seza Kutlar Aksoy	4
Ayla Kutlu	3	Gülsevin Kıral	1	Mustafa Orakçı	1	Sulhi Dölek	1
Aysel Gürmen	2	Gülsüm Cengiz	1	Mustafa Rahmi Balaban	1	Susan Taghdis	1
Ayşe Kilimci	2	Gülten Dayıoğlu	4	Mustafa Ruhi Şirin	4	Süleyman Bulut	1
Ayşe Yamaç	1	H. Salih Zengin	1	Muzaffer İzgü	3	Şaban Akbaba	1
Aytül Akal	4	Hasan Aycın	1	Müge İplikçi	1	Talip Apaydın	1
Behçet Necatigil	2	Hasan Kallimci	4	Naki Tezel	1	Tarık Dursun K.	1
Behiç Ak	7	Hasan Latif Sarıyüce	2	Nazlı Eray	1	Turar Kocomberdiyev	1
Bekir Yıldız	1	Hûşeng Murâdî-i Kirmânî	1	Necati Güngör	1	Ulviye Alpay	1
Bestami Yazgan	1	Hüseyin Yurttaş	1	Necdet Neydim	2	Üzeyir Gündüz	2
Bican Veysel Yıldız	1	İbrahim Örs	1	Nehir Aydın Gökduman	1	Vladimir Propp	1
Bilgin Adalı	1	İbrahim Ünsal	1	Nel Noddings	1	Yalvaç Ural	3
Birsen Ekim Özen	1	İhsan Oktay Anar	1	Nezihe Meriç	3	Yaşar Kemal	1
Borita Casas	1	İrfan Gürkan Çelebi	1	Numan Kartal	1	Yavuz Bahadıroğlu	2
Cahit Uçuk	1	İsmail Bilgin	1	Nur İçözü	5	Zekeriya Tâmir	1
Cahit Zarifoğlu	2	Jonathan Swift	1	Refik Özdek	1	Zeynep Cemali	3

According to Table 6, 160 keywords were identified in *the keywords category for artists*. Among the relevant years, the most preferred children's literature artists among these keywords are Behiç Ak (f= 7), Nur İçözü (f= 5), Aytül Akal (f= 4), Gülten Dayıoğlu (f= 4), Hasan Kallimci (f= 4), Mustafa Ruhi Şirin (f= 4), Miyase Sertbarut (f= 4), Mavisel Yener (f= 4), Seza Kutlar Aksoy (f= 4). Domestic names are predominantly prominent in children's literature studies, where many local and foreign words are included as keywords. On the other hand, foreign names were preferred primarily on different departments with foreign language branches apart from Turkish education, Turkish Language and Literature Education.

Table 7. Keywords for works

Keyword	f	Keyword	f	Keyword	f
"I Know a Little Girl" Irmak Series	1	Silver Wing	1	Seagull and Fox	1
100 Essential Works	3	The Man Who Repairs the Sun	1	Blue Swallow	1
Woodpeckers	1	Harry Potter	1	Curious Little	1
Antoñita La Fantástica	1	Novels by Hasan Latif Sarıyüce	1	Mathnawi	1
Aysegul books	1	Ghost Village	1	Motor Bird	1
Stories of Aytül Akal	1	Hazine-i Kıraat or Two Hundred Stories for Children	1	Nöstlinger's Mini Series	1
Behiç Ak's children's books	1	Hidayet Karakuş's children's stories	1	Immortal Ece	1
Dede Korkut Stories	2	Hikâyât-ı Müntahabe	1	Robin Hood	1
Letters from My Mill	1	Katıraslan	1	Gum Geranium	1
Full Moon Detectives	2	Kebûter-i Tûy-i Kûze (Pigeon in Jug)	1	Selen's Stories	1
Düşükdon series	1	Kiji-Bürüs	1	Sparrowbird	1
The Cat Who Plays Harmonica at Night	1	Language of Birds	1	Children of the Last Island	1
Stairs Climbing the Past and Cute Friends Hotel 1: All Animals Are Invited	1	Little Prince	1	The Adventures of Tom Sawyer	1
Sky Flowers	1	Little Prince	1	Children's books by Yalvaç Ural	1
Gulliver's Travels	1	Lettres de Mon Moulin	1	Yürek Grandpa and Sultan	1

According to Table 7, 49 keywords were identified in the keywords category related to the works. The works are mostly explicitly selected. However, there are also theses on the same works. For *example, Full Moon Detectives (f*=2) stand out as works

with a different thesis on *Dede Korkut Stories (f*=2)*. On the other hand, it was determined that *100 Essential Works(f*=3)*, which we found correct to be evaluated within this category, were found to have three different thesis studies on them between the primary years of the research.

Table 8. Keywords for period/time

Keyword	f	Keyword	f	Keyword	f
0-36 months	1	Battle of Gallipoli	1	preschool children's literature	2
1940s	1	early childhood	2	preschool period	4
children's literature after 1950	1	early childhood period	1	Soviet Literature	1
21st century	1	II. Legitimacy	2	Tanzimat Period	1
6-10 years	1	Second Legitimacy Period	1	Single-Party Period	1
First World War	1	Primary school	5	new Turkish literature	1
republic	1	National Literary Period	1	-	-
Republican Period	2	preschool	2	-	-

According to Table 8, 34 keywords were identified in the *keywords category for period/time*. The codes that differ in terms of frequency of use in these keywords are *primary school (f*=5) and *preschool period (f*=4). In addition, there are different codes such as *preschool children's literature (f*=2), *preschool (f*=2), *early childhood (f*=2), *early childhood (f*=1). In this case, it can be said that the most preferred keywords in the time/period category refer to the preschool period.

Table 9. Keywords for the type of written mass media

Categories	Keyword	f	Keyword	f	Keyword	f
Book	German children's book	1	storybooks	2	illustrated children's book(s)	11
	children's book(s)	32	book	2	picture book	1
	children's storybooks	1	fairy tale books	2	illustrated children's storybooks	3
	bestseller book	1	preschool storybook(s)	2	Turkish children's book	1
	children's books with religious content	1	popular children's books	1	children's book of written quality	1
Journal	Beyazbulut Magazine	1	magazine (journal)	5	Nûbihar Magazine	1
	children's journalism	1	children's magazines with old letters	4	Ottoman children's magazines	1
	children's magazine(s)	13	Heng Magazine	1	Tomurcuk Magazine	1
	Çocuk Yıldızı magazine	1	Kurdish children's magazines	1	Türkçem magazine	1
	Çocuklara Talim	1	Musavver Çocuk Postası	1		-
Newspaper	Afacan Newspaper	1	Marshall Plan and American board publications	1	Sabah Newspaper	1
	newspaper	1		-		
Other	mobile book apps for children	1	humor press	1	periodicals	1

According to Table 9, 102 keywords related to the type of written mass media have been identified. This category includes four subcategories: *book (f* =62)*, *journal (f*= 33)*, *newspaper (f*= 4)*, *other (f*= 3)*. When the subcategories are examined, *children's book(s)* (f=32) in the *book* category, *children's picture book(s)* (f=11), *children's magazine(s)* in the *magazine* category (f=13), *magazine (journal)* (f=5) and *old-letter children's magazines* (f= 4) codes were used more frequently. I*n the newspaper* and *other* category, there was no particularly prominent code.

Table 10. Keywords for values

Keyword	f	Keyword	f	Keyword	f
morals	2	educational value(s)	5	moral values	2
peace	1	educational dialogue(s)	14	preschool values	2
peace education	2	educational principles	1	peace in preschool education	1
environmental awareness	1	educational concept	1	sensitivity to the ancestors	1
value(s)	35	empathy	5	peace in illustrated children's books	1
value(s) training	20	universal values	3	Schwartz values list	1
sensitivity	2	dialogue(s)	5	historical awareness	1
tutorial dialogue	1	human rights	1	-	-

According to Table 10, 94 keywords were identified in the keywords category for values. The codes that differ from others in terms of frequency of use in these keywords are *value(s)* (*f*= 35), *value(s) training* (*f*= 20) and *educational message(s)* (*f*=14). When the keywords related to the values are examined, it is seen that the value that stands out, in particular, is *empathy (f*=5).

Table 11. Keywords related to educational activities

Categories	Keyword	f	Keyword	f	Keyword	f
Education	mother tongue love and education	1	sensitivity training	1	character training	4
	peace education components	1	education	9	fiction training	1
	environmental education	1	in-service training	1	cultural heritage education	1
	children's education	10	informal training	2	Montessori's understanding of peace education	1
	multicultural education	1	human rights education program	1	preschool education	4
	religious education	1	human rights education	1	Turkish education	18
Teaching	children's literature teaching	1	literature and language teaching	1	curriculum	1
	teaching Turkish as a foreign language to children	1	storytelling	1	Turkish textbook(s)	7
	teaching foreign languages to children	1	benefits	1	Turkish lesson	1
	textbook	1	middle school textbooks	1	Turkish Course (1st- 8th Grades) Curriculum	1
	language and literature teaching	1	secondary school Turkish textbooks	1	Turkish curriculum	1
	interdisciplinary teaching	1	teaching	1	Turkish teaching	14
Other	eco-schools	1	teacher candidates	1	classroom teacher	1
	preschool teachers	1	program development	1	Turkish teacher	1
	parents of students	1	-	-	-	-

According to Table 11, a total of 103 keywords related to educational activities have been identified. This category includes three subcategories: *education* (f= 59), *teaching* (f= 37), *other* (f= 7). When the sub-categories are examined, *Turkish education* (f=18), *child education* (f=10) and *education* (f=9) in the education category, and *Turkish teaching* (f=14) in the *teaching* category are the most frequently used codes. In the *other* category, there was no particularly prominent code.

Table 12. Keywords for the concept of language

Keyword	f	Keyword	f	Keyword	f
recipient language development	1	language and expression	2	Kurdish	1
native language	2	language and expression elements	1	Tuvan	1
compilation linguistics	1	richness of language	2	Turkish Language Reform	1
language	5	linguistics	1	Turkish	2
non lingual items	1	language-thinking relationship	1	Türkçem	1
language development	3	expressive language	1	-	-
in-language extortion	1	expressive language development	1	-	-

According to Table 12, 24 keywords have been identified in the category of keywords related to the concept of language. The codes that differ from others in terms of frequency of use in these keywords are language (f=5), language development (f=3), native language *(f*=2), language and expression *(f*=2), language richness (*f*=2) and Turkish *(f*=2).

Table 13. Keywords for basic language skills

Categories	Keyword	f	Keyword	f	Keyword	f
Reading	emotional literacy	1	reading habits	2	Attitude towards reading	1
	reading activities	1	tendency to read	1	readability	3
	reading	2	reading culture	4	-	-
Vocabulary	proverb	1	word world	1	vocabulary elements	1
	idiom	1	vocabulary	3	vocabulary elements	1
	stereotypical vocab	1	frequency	1	-	-
	concept development	1	vocabulary	13	-	-
Grammar	sentence	1	Syntax	1	Vocabulary	1
	Word types	1	-	-	-	-
Other	listening	1	basic skills	1	writing	1
	writing stories	1	-	-	-	-

According to Table 13, a total of 47 keywords related to basic language skills have been identified. This category includes four subcategories reading (*f* =15), *vocabulary* (f= 24), *grammar* (f= 4), *other* (f= 4). When the sub-categories are examined, *reading culture* (f=4), *readability* (f=3) codes in the *reading* category, *vocabulary* (f=13) and *vocabulary* (f=3) codes in the *vocabulary* category stand out in terms of frequency of use. In *addition,* codes such as vocab elements point to the *vocabulary* code, despite minor differences in its name. In the *other* category and *grammar,* there is no particularly prominent code.

Table 14. Keywords for methodology

Categories	Keyword	f	Keyword	f	Keyword	f
Method/ Technique	alternative methods	1	aesthetic criteria checklist	1	content analysis and artistic analysis	1
	descriptive analysis	2	story elements evaluation scale	1	classification of dialogues	1
	descriptive analysis	1	story map	1	model	1
	formal analysis	1	content analysis	1	image and text analysis	1
	document review	3	content analysis	1	method	1
	dramatic review	1	-	-	-	-
Theory	cognitive literary approach	1	target-oriented translation	2	constructivist approach	1
	translation strategies	1	Maslow's hierarchy of needs	1	constructivism	1
	polysystem theory	3	reader reaction theory	1	structuralism	1
	Multiple intelligence theory	1	Toury's norms	1	mind-reading (theory of mind)	1
	target-oriented translation	1	-	-	-	-
Research	perception	1	empathic tendency	1	positive and negative features	1
	conflict resolution methods	1	awareness	1	custom field associations	1
	conflict resolution	1	philosophy	1	poetry review	1
	translation review	1	communication skills	1	basic scientific concepts	1
	philosophy for children	1	review	6	gifted students	1
	discipline	1	contribution	1	criteria for alienation	1
	interdisciplinary	1	postgraduate thesis	1	reflection	1
	parental attitudes	1	occupational perception	1	structural features	1
	critical thinking skills	1	-	-	-	-

According to Table 14, a total of 65 keywords related to methodology have been identified. Under this category, there are four subcategories: *method/technique* (f= 19), *theory* (f= 16), *research* (f= 30). When the sub-categories are examined, *document analysis* (f=3), *descriptive analysis* (f=2) in the *method/technique* category, *polysystem theory* (f=3) in the *theory category*, *target-oriented approach* (f=2), and *analysis* (f=6) in the *research category* code stands out in terms of frequency of use.

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

In this study, the keywords in the postgraduate theses made in the field of children's literature between the years 2015-2020 were examined thematically. 358 postgraduate theses were examined as a result of the relevant literature review. As a result of the review, it was seen that the keywords used in the thesis were divided into 14 subcategories. These categories are keywords related to literary terms (f= 108), keywords related to literature (f= 256), keywords related to topics and themes (f= 249), keywords related to artists (f= 160), keywords related to text types (f=134), keywords related to educational activities (f= 103), keywords related to type of written mass media (f= 102), keywords related to values (f= 94), keywords related to methodology (f = 65), keywords related to works (f=49), keywords related to basic language skills (f= 47), keywords related to period/time (f= 34), keywords related to language concept (f= 29), keywords related to field of children's literature (f= 24). The most commonly used keywords are; keywords for the field of literature (f= 256), subjects and themes (f= 249) and artists (f= 160); the least used keywords are keywords related to basic language skills (f= 47), period/time (f= 34), language concept (f= 29) and children's literature (f= 24). In this group, the limited use of keywords related to children's literature affects the treatment of children's literature as a subdisciplinary of literature. However, the concept of children and the different categories and codes associated with children's literature was also revealed as a result of the research.

Most of the postgraduate thesis in the year range included in the research in the field of children's literature is a master's thesis. This result coincides with Balcı's (2012:202) research findings on the thesis in the field of children's literature between 1981 and 2010. In other words, there have been more academic studies in this field over the years. This can be explained by the fact that the number of master's programs is higher than the doctoral programs.

The total frequency of keywords used for basic language skills is (f= 47). This number indicates that the four basic language skills and keywords for grammar and vocabulary are among the least used keywords in total. Under this category, there are four subcategories: reading (f= 15), vocabulary (f= 24), grammar (f= 4), and other (f= 4). However, listening and writing were used once, while speaking was never used. As can be seen, studies on listening, writing and speaking in the field of children's literature are insufficient. There are studies in the literature where similar results are obtained. Doğan and Özçakmak (2014), in their study investigating the tendencies of graduate theses between 1998 and 2013, reached only 14 master's theses on listening skills directly. Likewise, Cin Şeker (2020: 137-138) found in his research on postgraduate theses on listening and speaking skills that the number of postgraduate theses prepared for reading and writing is higher than those of listening and speaking. A similar study was produced by Erdem, Gün, Şengül and Özkan (2015:231) with the results of their research on keyword detection on scientific articles. Accordingly, it has been stated that studies on reading and writing are superior to speaking and listening in terms of both quality and quantity. This situation can be interpreted as the insufficiency of postgraduate studies on listening skills in terms of quantity. When it comes to children's literature, it is also in question in the fields of speaking and writing.

Studies are carried out on a literary axis rather than gaining basic language skills. In this context, many keywords are used in categories and subcategories such as literature, text and structure elements, literary orientations, literary field. In the sections related to education, the educational values of the artists' works are more discussed. Similarly, Sevim and İşcan (2012:1871) stated that in their study of keywords in master's thesis between 2005 and 2010, researchers examined children's literature texts in terms of educational messages in the context of the principle of relativity to children in graduate thesis in the field of children's literature. Another finding that coincides with this result is that we look at the most frequently repeated keywords regardless of categories and subcategories. However, the values are in 3rd place (f=35), we see that the concept of value is used more among keywords with codes such as dialogues, educational messages, universal values, values education, etc.

The vast majority of keywords in the graduate thesis examined are shaped around the concept of children. When we look at the keywords used at the level of subjects and themes, it is seen that the concept of children is the sub-theme in which the keyword is used the most as a theme besides individual, developmental, cultural, literary, artistic, social, historical and religious issues. This is a natural result when considering the scope of the research. Likewise, children's literature and children's books are the keywords that stand out in the study in this context. Again, another notable result is the expression of topics such as children's literature authors, works, children's magazines and newspapers, and literary types of children's writing in keywords. This result largely coincides with the findings of Balcı (2012), who examined postgraduate thesis prepared between 1981 and 2010 in the field of children's literature.

In the thesis, which considers the names of artists and works as keywords, most of the works and artists are local artists and works. The artists most mentioned in the keywords are Behiç Ak (f= 7), Nur İçözü (f= 5), Aytül Akal (f= 4), Gülten Dayıoğlu (f= 4), Hasan Kallimci (f= 4), Mustafa Ruhi Şirin (f= 4), Miyase Sertbarut (f= 4), Mavisel Yener (f= 4), Seza Kutlar Aksoy (f= 4). In addition, artists and works from world literature can be found. This is the same as the research results of Balta (2019).

When we look at the keywords, it is seen that the studies made based on the type of text are pretty intense (f=134). Balci (2012:203) made a similar finding in his/her graduate thesis study on children's literature prepared between different periods. This can be interpreted as the text-oriented trend towards studying children's literature at the graduate level has not changed despite the intervening time. Event-based text types (f=81) are particularly prominent in this group in terms of text type. Event-based genres, in which children can get ideas on different topics such as balancing between social and individual life and problem-solving skills for other people and lives, and find traces of themselves and their lives, are preferred by children for many reasons such as the immersion of events and curiosity. According to the results of Temizyürek's (2008:142) research on 8th grade, students' findings that their reading and comprehension score averages for storytelling texts are higher than their reading-comprehension score averages of informative texts may give researchers an idea of why event-based genres are more preferred among children's books.

Another result is using keywords for qualitative review in the method, technical and research subcategories in the category created for methodology. In this regard, children's literature researchers must bring the student involved and turn to practical, experimental studies aimed at improving the basic language skills of the child through qualified children's literature texts in in-class education and training activities.

It has been observed that keywords are not used in some thesis reached. According to Deniz and Karagöl (2017:305), this is a severe problem in academic writing because keyword detection is essential to ensure the accessibility of the research in different citation indexes.

In addition to literature-based studies, researchers who will work in the field of children's literature are recommended to contribute to the enrichment of this field in terms of methods and subjects through the development of listening, reading, speaking, writing skills, which are the main learning areas of mother-tongue teaching, and application-oriented studies. In addition, in graduate studies prepared for artists and their works, it should be done with value reviews and the diversity of subjects should be ensured.

REFERENCES

Balcı, A. (2012). A Meta-Analysis Study on Graduate Thesis on Children's Literature in Turkey. Journal of Mustafa Kemal University Institute of Social Sciences, 9 (17): 195-206.

Balta, E. E. (2019). Content Analysis of Graduate Studies on Children's Literature (2011-2018). *OPUS–Journal of International Community Studies*, 10 (17): 464-489.

Cin Şeker, Z. (2020). A Review on Keywords of Graduate Thesis on Listening and Speaking Skills: Descriptive Analysis. *RumeliDE Journal of Language and Literary Studies*, (19): 128-140.

Deniz, K. and Karagöl, E. (2017). Thesis Writing Guides in Terms of Academic Writing. *Journal of Native Language Education*, 5(2): 287-312.

Dilidüzgün, S. (2004). Contemporary children's writing. Istanbul: Morpa Yayınları.

Doğan, Y. ve Özçakmak, H. (2014). Evaluation of Graduate Thesis on the Education of Listening Skills. *Journal of Native Language Education*, 2(2): 90-99.

Erdem, M. D., Gün, M., Şengül, M., Özkan, E. (2015). A Content Analysis on Keywords in Scientific Articles written in the Field of Teaching Turkish as a Foreign Language. *Mehmet Akif Ersoy University Journal of Faculty of Education,* 34(1): 213-237.

https://sozluk.gov.tr (accessed 10.07.2020)

Karagöl, E. (2018). Graduate Thesis in Terms of Academic Writing. Unpublished doctoral thesis, Gazi University Institute of Educational Sciences, Ankara.

Oğuzkan, F. (2000). Children's literature Ankara: Anı Yayıncılık.

Sever, S. (2003). Children and literature Ankara: Kök Yayıncılık.

Sevim, O. and İşcan, A. (2012). A Keyword-Oriented Content Analysis in Master's Thesis in the Field of Education and Training of *Turkish, Turkish Studies*. 7(1): 1863-1873

Şirin, M. R. (2016). Literature and Children's Literature, Purpose and Function of Literature. *Turkish Language*, CX (780), 12-31.

Tatar, E. and Tatar, E. (2008). Analysis of Science and Mathematics Education Researches-1: Keywords. *İnönü University Journal of Faculty of Education,* 9(16): 89-103.

TDK (2000). School Dictionary. Ankara: Türk Dil Kurumu Yayınları.

Temizyürek, F. (2008). The Effect of Different Types of Texts on Reading Comprehension in Primary 8th Grades. *Eurasian Journal of Educational Research*, (30): 141–152.

Uz Erşahin, I. (2009). Evaluation of Children's Literature Texts in Turkish Textbooks in terms of Contemporary Children's Literature Principles and Educational Recommendations. Unpublished master's thesis, Istanbul University Institute of Social Sciences, Istanbul.

Yıldırım, A. (1999), Basic Features of Qualitative Research Methods and their Place and Importance in Educational Research. *Education and Science*, (23): 7-17.

Yıldırım, A. and Şimşek, H. (2008). Qualitative research methods in social sciences. Ankara: Seçkin Yayıncılık.

| Research Article / Araştırma Makalesi|

An Investigation of the Knowledge of Teaching Mathematics of Novice Primary School Teachers[1]

Mesleğe Yeni Başlayan Sınıf Öğretmenlerinin Matematiği Öğretme Bilgisinin İncelenmesi

Furkan KELEŞ[2], **Gönül GÜNEŞ**[3]

Abstract

Purpose: This study, it is aimed to examine the knowledge of classroom teachers who are just starting out in the profession to teach mathematics in the field of data processing learning.

Design/Methodology/Approach: The research was carried out for the purpose of specific case study from qualitative research methods. The data was obtained from 100 classroom teachers who have not completed 5 years in their professional life. The data were obtained with the data collection tool developed for the data processing learning area. The researchers used the rubric they developed for data analysis. All questions were evaluated and scored within the scope of "correct", "partially correct", "wrong" and "irrelevant" answers, and the frequency of answering each question was kept. Subsequently, the proficiency levels of the teachers were determined and the teaching knowledge was examined within the framework of these levels.

Findings: It has been revealed that primary school teachers who have just started their profession have deficiencies in teaching mathematics and its sub-components, content knowledge, student and content knowledge, teaching and content knowledge, and curriculum knowledge. In the topics determined within the framework of the knowledge of teaching mathematics, it was observed that the field knowledge of the classroom teachers is sufficient but close to the lower limit of the specified level, the student, teaching and content knowledge is of moderate proficiency and the curriculum knowledge is the lowest compared to other components. In line with the results, it has been determined that classroom teachers have deficiencies in teaching knowledge of data processing learning area.

Highlights: It has been determined that there are deficiencies in the knowledge of classroom teachers who are just starting out in the profession to teach mathematics. It has been observed that the deficiencies in the curriculum knowledge of the classroom teachers are greater than in other components. It has been observed that classroom teachers have misconceptions about table and graphic concepts.

Öz

Çalışmanın amacı: Bu çalışmada mesleğe yeni başlayan sınıf öğretmenlerinin veri işleme öğrenme alanına ilişkin matematiği öğretme bilgisinin incelenmesi amaçlanmıştır.

Materyal ve Yöntem: Araştırma, betimsel amaçlı olup nitel araştırma yöntemlerinden özel durum çalışması yöntemi ile yürütülmüştür. Veriler, meslek hayatında 5 yılını doldurmamış 100 sınıf öğretmeninden elde edilmiştir. Veriler, veri işleme öğrenme alanına ilişkin geliştirilen veri toplama aracı ile elde edilmiştir. Araştırmacılar, veri analizi için kendi geliştirdikleri rubrikten yararlanmışlardır. Tüm sorular "doğru", "kısmen doğru", "yanlış" ve "alakasız" cevap kapsamında incelenerek puanlandırılmış, her sorunun cevaplanma frekansı tutulmuştur. Devamında öğretmenlere ait yeterlilik düzeyleri belirlenmiş ve öğretme bilgisi bu düzeyler çerçevesinde incelenmiştir.

Bulgular: Mesleğe yeni başlayan sınıf öğretmenlerinin matematiği öğretme bilgisi ve alt bileşenleri olan alan bilgisi, öğrenci ve içerik bilgisi, öğretim ve içerik bilgisi, müfredat bilgisindeki eksikliklerinin olduğunu ortaya çıkarmıştır. Matematiği öğretme bilgisi çerçevesinde belirlenen başlıklarda sınıf öğretmenlerinin alan bilgisinin yeterli düzeyde ancak belirlenen düzeyin alt sınırına yakın, öğrenci, öğretim ve içerik bilgisi orta yeterlilikte ve müfredat bilgisinin ise diğer bileşenlere oranla en düşük yeterlilikte olduğu görülmüştür. Ortaya çıkan sonuçlar doğrultusunda sınıf öğretmenlerinin veri işleme öğrenme alanı öğretme bilgisinde eksiklikleri olduğu belirlenmiştir.

Önemli Vurgular: Mesleğe yeni başlayan sınıf öğretmenlerinin matematiği öğretme bilgilerinde eksikliklerin olduğu belirlenmiştir. Sınıf öğretmenlerinin müfredat bilgilerindeki eksikliklerin diğer bileşenlere oranla daha fazla olduğu görülmüştür. Sınıf öğretmenlerinin tablo ve grafik kavramları hakkında kavram yanılgıları olduğu gözlenmiştir.

INTRODUCTION

The number of qualified individuals in a society is measured by the quality of the level of education in that society. One of the most basic elements that will increase the quality in education is the quality of the teacher. For professional competence, a teacher must have field knowledge and knowledge of teaching the field within the scope of professional knowledge. As a matter of fact, the Ministry of National Education (MEB, 2017) also announced "Teaching Professional Qualifications" and "Teaching Special Field Qualifications" in its report. The report emphasized the need for teachers to have professional knowledge (content knowledge, content education knowledge, regulatory knowledge), professional skills (planning for education, developing a learning environment, managing, measuring and evaluating the learning process) and professional values (national, spiritual and universal values) within general qualifications. In the special field qualifications of MEB classroom teaching, it is important to adopt 'learning-teaching environment and development', 'monitoring and evaluation', individual and professional development – social relations, art and aesthetics, developing language skills, scientific and technological development, individual responsibilities and socialization, physical education and safety qualifications. The fact that teachers develop and equipp themselves with these qualities will allow them to educate individuals who can express themselves, question themselves and produce different solutions. Considering that the success of teachers in education and training reflects positively on the achievements of the students (Hill, Rowan & Ball, 2005), it is obvious that the qualified teacher will train qualified students.

Considering the important role of educators in the training of students, their success and preparation for life, teachers should have field knowledge, field education knowledge and legislative knowledge, as stated in the report of the Ministry of National Education (2017), in order to provide qualified education. By many researchers (An, Kulm and Wu 2004; Ball, Thames & Phelps, 2008; Bluff, Gustafsson &Shavelson 2015; Fennema & Franke, 1992; Shulman, 1986, 1987) explained these types of information with various models. Information that the teacher must have in the model of Shulman (1986), which describes the qualifications of the teacher; field knowledge, field teaching knowledge and curriculum information. Shulman (1987), who explained his pedagogical field knowledge as determining the preliminary knowledge of the students before the lesson, making different educational explanations, using effective materials, and correcting the misconceptions of the students, continued his studies in this regard.

Studies on the teacher's teaching knowledge gained momentum after Shulman's (1987) work and guided other researchers. Hawkins (2012) studied mathematics education, Park &Oliver (2008) studied science, and Ball et al. (2008) studied classroom education. Some researchers also emphasized that teachers' beliefs influenced teaching knowledge in math teaching in An and his colleagues (2004), Baki (2018) and Fennema and Franke (1992). In addition, teaching knowledge was at the heart of all of these studies and teaching knowledge was supported by components such as technology, curriculum, pedagogy, cognitive comprehension, content, mathematics knowledge. Bluömeke and his colleagues (2015) also stated that teachers should see the sensory characteristics of the students in addition to seeing, feeling and correcting the mistakes of the students in the name of teaching.

Ball et al. (2008) created a model in his study that would appeal more to classroom teachers. While drafting teaching knowledge, they focused on what teachers should know and how to apply for effective mathematics teaching. At the end of the study, they revealed the "Mathematical Knowledge for Teaching" model. This model is shown in Table 1.

Table 1. Mathematical knowledge model for teaching (Ball et al., 2008)

Mathematical Information Model for Teaching	
Content Knowledge	**Pedagogical Content Knowledge**
• Common Content Knowledge	• Knowledge of Content and Students
• Horizontal Content Knowledge	• Knowledge of Content and Teaching
• Specialized Content Knowledge	• Curriculum Information

When the model is examined in Table 1, teaching knowledge, content knowledge and pedagogical content information are divided into two sections. It has also divided content knowledge and pedagogical content knowledge into subcomponents. content knowledge includes the teacher's knowledge of mathematical subjects, finding and resolving the points where students have difficulty solving problems, and connecting lower and upper grade subjects (Ball et al., 2008). Researchers agree on the need for robust and comprehensive field knowledge for qualified mathematics teaching (Ball, 1990; Maa, 1999; Shulman 1986,1987). Student and content knowledge, which is a component of pedagogical content knowledge, refers to getting to know students, predicting at what points when students are asked a question, predicting which students will have difficulties, and predicting how students will respond to homework they do at home. Teaching and content knowledge requires knowing the most effective teaching method for teaching any subject, knowing which impressions will be more useful at which stage of the course. Curriculum knowledge includes knowing the objectives of the applied curriculums (Ball et al., 2008). When studies on teaching knowledge are examined, the researchers (An et al,2004; Ball et al., 2008; Park and Oliver, 2008; Shulman, 1986) is to know the field in which the teacher will teach expectations, to know the students, to know different method techniques related to the subject he will teach, to be able to keep the course flow and to be aware of the curriculum he teaches. Teaching knowledge is also expressed as a mixture of all these types of knowledge, in other words, the most effective and practical way to teach. In addition, Ball et al. (2008) developed some questions to measure teachers' teaching knowledge. The Teacher Education

and Development Study in Mathematics (TEDS-M) project examines the teaching knowledge of primary and secondary school math teachers in 60 countries. During this examination, questions are asked about the knowledge, interpretation and application of all learning areas in mathematics. The TEDS-M project also used the questions in the work of Ball et al. (2008) while preparing these questions (TEDS-M, 2008). In this study for classroom teachers, Ball et al. was evaluated within the scope of the teaching knowledge model developed. Although many researchers have considered and evaluated teaching knowledge in different ways, the common idea of researchers is that teachers must have a comprehensive teaching knowledge in order to teach a qualified mathematics.

The majority of the studies carried out within the scope of mathematics teaching were carried out with teacher candidates (Aksu, 2013; Aydın, 2015; Baki, 2012; Gökbulut, 2010; Hacıömeroglu, 2013; Pırasa, 2009; Yıldırım ve Boz, 2015). However, it is known that examining teachers' teaching knowledge or even identifying their shortcomings in this subject will contribute positively to teaching knowledge (Lee, Brown, Luft and Roehrig, 2007). Especially when the domestic literature is examined, the researches mostly investigate the feelings, thoughts and attitudes of the candidates of the class teachers regarding mathematics teaching (Arseven, Arseven & Tepehan, 2015; Çağırtan-Gülten, 2011; Hacıömeroglu & Şahin-Taskın, 2010; Cesur, 2008), investigating the concerns of class teacher candidates about math teaching (Elmas, 2010; Küçük-Demir, Cansız, Deniz, Çevik-Kansu and, 2016) studies have been observed. It has been noted that studies investigating the pedagogical and mathematical knowledge of the classroom teacher and explanations of mathematics teaching (Aksu & Konyalıoğlu, 2014; Baki, 2013; Işık & Baran-Kaya, 2017; Toluk-Uçar, 2011) were generally conducted with teacher candidates. It was observed that the studies in which the pedagogical field knowledge of the incumbent classroom teachers were investigated were carried out in limited numbers in the fields of Mathematics Education (Şen, 2019), Science Education (Aydın, 2015) and Social Sciences Education (Kılınç, 2012).

In the international project "Teacher Education and Development Study in Mathematics" (Project TEDS-M), scenario type questions were used in the Teaching Content Knowledge exams applied in our country. In addition, some domestic studies (Bütün, 2005; Hacıömeroğlu, 2013) tried to examine the mathematics teaching knowledge of teachers or prospective teachers with scenario-type open-ended questions. The current research with classroom teachers will be an original study in this context with scenario-type open-ended questions. In addition, scripted open-ended questions offer the opportunity to examine teachers within the framework of a single scenario, by placing the components of mathematics teaching knowledge, which cannot be examined directly during the course of the course, or which will not be easy to examine (Bütün, 2005, 2011).

When the studies on mathematics teaching knowledge in our country are examined (Aksu, 2013; Baki, 2013; Bütün, 2005; Hacıömeroğlu, 2013; Pırasa, 2009), it is seen that the researches are generally on areas such as fractions, four-operation skills and numbers. However, in this study, data processing learning was studied within the scope of the subject of graphics that are used a lot in science, life information and social studies courses, which form the basis of visual reading that students will use frequently in all educational life in their daily life. The field of data processing learning provides students with analytical thinking, interpretation and cognitive reading skills in primary schools for the purposes of creating tables, charting and reading, and achieving results by examining data (MEB, 2017). In addition, learning graphic reading and interpretation will create a preliminary preparation for other courses (Life Knowledge, Science) on behalf of students, as well as improving students' visual intelligence and accelerating their conceptual learning, making the field of data processing learning valuable. Considering the value of the designated learning area, the teaching information of the classroom teachers who will organize teaching activities in this field is also very important (Beyazit, 2011). Within the scope of the research, only data processing learning studies have been carried out, giving the opportunity to examine in detail and providing the opportunity to put a realistic framework in the middle.

Another benefit of the research to the literature is that it will provide a self-evaluation opportunity about the pedagogical field education of the classroom teachers trained in the education faculties of our country. From another point of view, the research is necessary and important in that it will benefit the professional development of classroom teachers and fill an important place in the field of data processing learning in the literature.

Teacher's Professional Development

Teachers are one of the most important factors in the education life where students learn by doing, question life, and aim for good and beauty. The role of teachers in education increases as they equip themselves. The importance of pre-service and in-service training is quite high in the training of a competent teacher. In addition, pre-service education is primarily important in the upbringing of a qualified teacher. Teachers' professional development studies (Huberman, 1989; Bakioglu, 1996) and it was seen that the studies were usually examined by breaking down into certain years of service. Bakioglu (1996) divided the developmental stages of teachers into 5 periods into their professional years and determined as follows: Career Entry Phase /1-5 years, Rinsing Phase / 6-10 years, Experimentalism/Activism Phase / 11-15 years, Specialization Phase / 16-20 years, Calmness Phase / 21 years and above.

Huberman (1989) named the professional development stages of teachers as apprenticeships, middle career stages and late career stages in his work. In addition, it has included teachers with less than 10 years of professional seniority in the apprenticeship phase. He described the teachers who had just started their careers as candidate teachers in meb and removed the teachers who had completed one year in their professional life from the status of candidate teachers (MEB, 2017). When we

look at the studies, the first 5 years of teachers' professional lives are considered as the rookie years of the profession. In addition, it is known that teachers lack more knowledge during their novice years. For this reason, the knowledge of teachers in the first 5 years of their professional life to teach mathematics in the field of data processing was examined.

Data Processing Learning Area

Data Processing learning field is included in the curriculum published by MEB (MEB, 2009, 2015, 2017) from the 1st grade. Data processing is also associated with learning areas such as learning area (Numbers and Operations, Geometry, Measurement) and courses such as (Science, Social Studies, Life Knowledge). Data Processing learning area; It consists of four main topics: "creating researchable questions", "data collection", "processing and analyzing data", "interpreting results". When these stages are taken into account in data processing teaching, it is aimed to read tables with few data groups from the first grade, collect and make this data about a researchable question in the second grade, read overdates tables in the third grade, and draw and interpret column charts in the fourth grade. In addition, it is aimed to design problems related to daily life using the information obtained from the graphs and to search for answers to these problems (MEB, 2017).

In the name of effective education, teachers need to know the stages determined for data teaching and transfer these stages to their lessons. According to the primary school mathematics curriculum, the field knowledge of the classroom teachers should be sufficient in relation to table and graphic reading and interpretation from the 1st grade. In addition, it is very important for teachers to associate examples of the process of collecting data, presenting data with tables or graphs with the student's life, i.e. using pedagogical field knowledge during the teaching process. Within the scope of "General and Special Competence Fields" published by the Ministry of National Education (2017), it is necessary for classroom teachers to make students who encounter data teaching for the first time like this field, to make them look at mathematics positively, to understand and guide students by speaking their language. In order to increase qualified education, it is necessary to know and implement the curriculum related to the field of "Data processing" learning as another equipment. In addition to these duties and responsibilities of the classroom teachers, the teachers who teach this course should be equipped in terms of scientific literacy, considering that the field of data processing learning improves the statistical literacy and scientific thinking skills of the students (MEB, 2017).

Within the scope of the specified reasons and qualifications, it is aimed to examine the knowledge of classroom teachers who have just started the profession to teach mathematics in the field of "Data Processing" learning. Within the scope of this purpose, the following questions were sought. These:

1. What level of field knowledge is the field information regarding the data processing learning area of classroom teachers who have just started their profession?
2. What level of student and content information about the data processing learning area of the classroom teachers who have just started their profession?
3. What level of teaching and content information about the data processing learning area of classroom teachers who have just started their profession?
4. What level of curriculum information about the data processing learning area of classroom teachers who have just started their profession?

METHOD

Research Methodology

In this study, the case study method, one of the qualitative research methods, was used. The main thing in the case study is to examine an event in depth through a person or persons (Yin, 2003; Ekiz, 2009). Thanks to the data obtained through detailed examination, the smallest details about the examined situation and the relationships between the variables are easily reached (Çepni, 2009). In this study, a special case was examined for descriptive purposes and an existing situation was revealed. This special case covers the teaching knowledge of mathematics and the learning area of data processing of primary school teachers who have just started their profession. Mathematics teaching knowledge of primary school teachers related to data processing learning area has been examined in detail in this study.

Participants

100 classroom teachers (77 women and 23 men) who are working in a province in the Eastern Anatolia Region, where a lot of appointments were made as the first place of duty, constitute the participants of this study. The fact that one of the researchers worked as a classroom teacher in this region, the high number of classroom teachers assigned to this region, and the fact that the teachers working in the region were in the first years of their professional life were instrumental in selecting the participants from this district. While choosing the classroom teachers, attention was paid to the fact that they did not complete 5 years in their professional life and that they were volunteers. When we look at the schools where the participants work, 82 of them teach in full-time and 15 of them half-day schools, and 3 participants teach in multigrade classes. The classes that the participants taught; 1st grade is 33, 2nd grade is 26, 3rd grade is 27, 4th grade is 14. The majority of participants are 1 and 2 year teachers. When the universities where the teachers attended the faculty of education were examined, many different university graduate participants took part in the research. In the 2017-2018 academic year, the measurement of math teaching knowledge

with classroom teachers who have not completed 5 years in their profession is also limited to the field of Data Processing learning.

Data Collection Tools

The data in the research were collected with the "Test on the Data Processing Learning Area". In the personal information part of the data collection tool, personal information such as gender, professional experience, the university they graduated from, the school they work in and the class they teach were asked to be answered. This information is interpreted in the discussion section within the scope of teaching mathematics knowledge. It is also used to describe the participants.
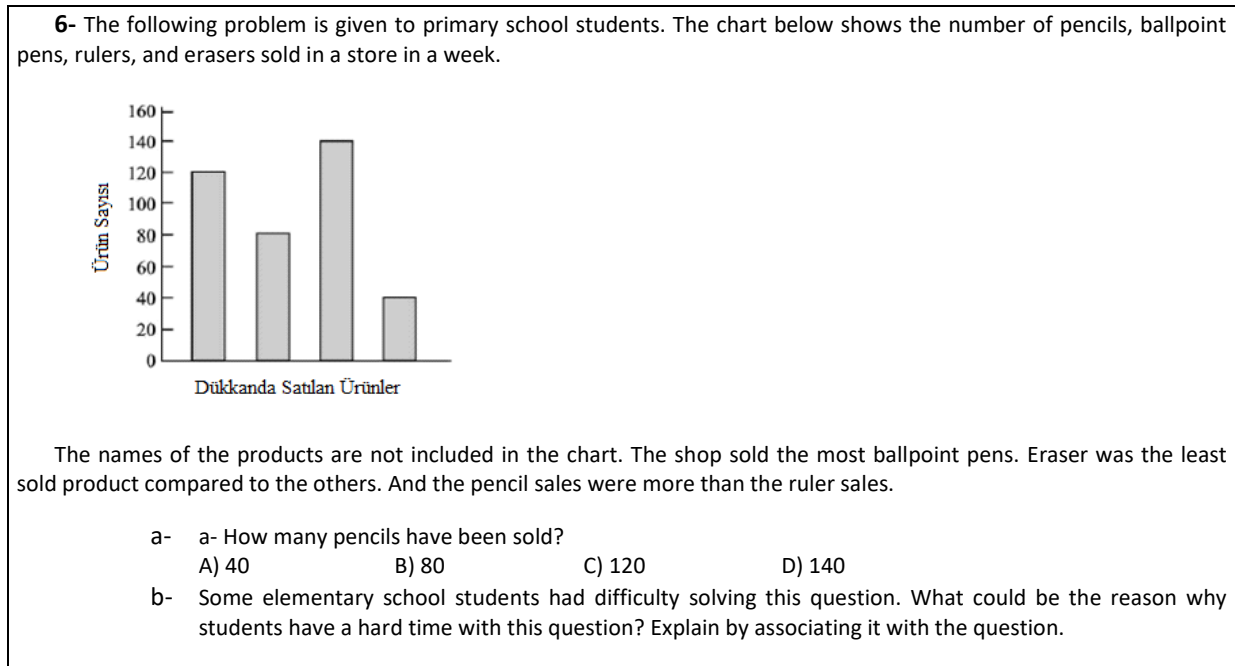
Test for Data Processing Learning Area

In the process of creating this test, studies related to teaching knowledge were scanned (An et al., 2004; Ball, 1988; Bütün,2005, 2012; Hacıömeroglu, 2013) questions measuring teachers' teaching knowledge were examined. Then, the questions in the TEDS-M project, which measures the teaching knowledge of teachers internationally, and meb books and auxiliary source books were examined by the researcher. In addition, some questions adapted to Turkish were used by TEDS-M project questions (Ertaş, 2014). Within the scope of all this literature, field information questions, scenario-type open-ended questions were developed by the researchers and a pool was created with appropriate questions from the TEDS-M project. In the continuation of the study, all these questions are categorized within the scope of the teaching steps of the data processing learning field and the "Mathematical Information for Teaching" model. The question distribution in accordance with the specified model is presented in Table 2.

Table 2. Distribution of questions in accordance with the mathematical knowledge model for teaching

Content Knowledge	Knowledge of Content and Students	Knowledge of Content and Teaching	Curriculum Information
1a		1b	
2a,2b		3	
	4a		4b
5			
6a	6b		
	7		
		8	
9a,9c		9b	
10a			10b
11			
	12a	12b	
13a			13a,13b
	14		

The prepared questions were submitted to 3 expert mathematics educators, taking into account the opinions of the expert, the expression deficiencies in some questions (explain by associating them with the question), the narrative disorders were eliminated. Some scenario questions have been added. For example, if you want to use In question 12, Zeynep teacher's 4. The expression 'using the type of chart you want' is added to the graphic drawing question of the class students. One of the questions within the scope of the curriculum information is organized by adding a sub-article as 'What stage comes in data teaching after the step of creating researchable questions'. After the feedback of the experts, some questions in the question pool were eliminated. In the continuation of the study, the opinions of a classroom teacher who had a master's degree in mathematics education were taken about the questions. In addition, for scenario type open-ended questions, the opinions of an expert mathematics educator were taken again. After all stages, expert opinions were reflected in the questions and the data collection tool was prepared and the pilot study was applied with 17 questions and sub-articles. ith the pilot study, it was tried to determine whether teachers understood the questions, narrative disorders in the questions, spelling mistakes, lack of expression, and the time to answer them. For these purposes, the pilot work was carried out with 5 classroom teachers. After the study, a question to read a column chart similar to article a of question 6 from the questions measuring the same information was removed from the data collection tool, and visual arrangements were made by adding sub-articles to the 9th question. After the feedback from the teachers, some questions were edited in terms of grammar and narrative disorder and sub-articles were added. For example, if you want to use "In article 9 of the measuring tool, teachers were asked to find the number of boys and girls in the shape chart. In item b of the question, it was stated that the students had difficulty in converting

the figure graph to the scoreboard and the teachers asked the students, "How would you help? "The question has been asked. After the feedback, item c was added to the 9th question and the teachers were asked to draw a scoreboard table for the question. Following the feedback, statements such as "explain, why" were added to a few questions (4,7,10) in the measurement tool. After the teachers' feedback, the data of some questions were reduced to small numbers. With the pilot study, the response time of the measurement tool was determined as 1 hour. In the continuation of the study, the distribution of questions covering all subjects (Table 2) was provided, and the scope of the study was increased, and the data collection tool was finalized with the feedbacks from the teachers. Since the research has no generalization purpose, validity requirements have been provided (Ekiz, 2009; Yin, 2003). The reliability of the study was increased by specifying the characteristics of the participants, the environment in which the study was carried out and scoring twice. The data collection tool was prepared as 14 questions and sub-item questions and scripted teaching questions, questions measuring field and curriculum knowledge, and a total of 23 questions in a single test. The sample question for the data collection tool is shown in Figure 1.

6- The following problem is given to primary school students. The chart below shows the number of pencils, ballpoint pens, rulers, and erasers sold in a store in a week.

The names of the products are not included in the chart. The shop sold the most ballpoint pens. Eraser was the least sold product compared to the others. And the pencil sales were more than the ruler sales.

- a-   a- How many pencils have been sold?
       A) 40   B) 80   C) 120   D) 140
- b-   Some elementary school students had difficulty solving this question. What could be the reason why students have a hard time with this question? Explain by associating it with the question.

Figure 1. Question 6 in the test

The question shown in Figure 1 is taken from the TEDS-M project. Item a of the question was prepared to measure teachers' content knowledge on the Data Processing learning field. With item b of the question, it was prepared to measure teachers' student and content knowledge.

Data Collection Process

The data collection process of the research was planned in November 2017. In the specified planning, the number of participants to be applied to the research, data collection tools and how to examine the collected data are regulated. While collecting the data of the study, the Primary School Mathematics Curriculum published in 2017 was taken into consideration and the questions of the data collection tool were prepared in this context. The data collection tool was applied to the classroom teachers who did not complete 5 years of age, who volunteered at the teacher seminars at the beginning of the semester in the district where one of the researchers worked as a classroom teacher, by obtaining the necessary permission from the national education and informing the responsible persons, on the day and time determined. It has been observed that teachers who have just started their profession are both volunteers and willing. The continuation of the study was carried out in another seminar held in the district in the middle of the semester, with the same permissions. Both applications were carried out in the same hall under the observation of the researcher, and the teachers were provided with distance to avoid being affected by each other. In the second application, it was noted that the same teachers were not tested twice. Teachers have been given an hour to answer the test with the experience gained from the pilot application.

Analysis of Data

Qualitative and quantitative data were obtained from the "Data Processing Learning Area Test", the data collection tool of the research. The quantitative data of the study were analyzed using analytical scoring rubrics inspired by the TEDS-M project. The rubric prepared by the researchers was used in the analysis of the qualitative data obtained from the scripted questions and open-ended questions. The teachers who were participants in the study were "Ö1, Ö2, Ö3..." is encoded in the form of. While preparing the rubric, assistance was obtained from an expert teacher who had a postgraduate education in the field of mathematics education for the detailed analysis of the answers of the teachers, and the opinions of 3 academicians who were experts in the field of mathematics education were consulted to finalize the rubric.

With these measures taken to increase the validity and reliability of the research, the data was reviewed twice and scoring was performed twice to ensure scoring reliability. After the first scoring was done by the researcher, it was expected for three months and then the second scoring was performed. By looking at these analyses and comparing, scoring reliability was ensured. In cases where undecided, the opinion of the second researcher was applied and a joint decision was reached. In the analysis of some of the questions in the test, the correct answers were scored as 1, and the wrong, empty and irrelevant answers were scored as 0 points. When analyzing scenario open-ended questions, the exact correct answer to the questions such as "why" and "explain" is scored as 2 points, partly as the correct answer as 1 point, and the wrong, empty and irrelevant answers as 0 points.

Table 3 shows the scoring used for the analysis of item a of the question in Figure 2 in the data collection tool, and Table 4 shows the scoring prepared for item b of the same question as an example. Scoring in item a, which measures teachers' content knowledge, and item b, which is used to test higher-level skills, are similar for other questions.

Table 3. The rubric for item a of question 6 in the test

1 Point	Correct answers	(C option 120)
0 Point	Wrong answers	(a option 40, b option 80)
0 Point	Empty answers	

Table 4. The rubric of item b of question 6 in the test

2 Point	The answers that the concepts such as 'at least' and 'most' used in the question are not understood by the children and that the children's association skills do not develop. • For example (E.g); The language used in the question is quite heavy Example; The complexity of concepts such as "less than others", "most" and "less" made it difficult for students to understand the question. • They have difficulties because they have to edit the chart, interpret it, and re-correlate the data.
1 Point	Answers that express the points that children have difficulty in the question in general and do not specify why they have difficulties • E.g; They have difficulty reading the graph. • They have difficulty in the language used in the question.
0 Point	Wrong answers, Irrelevant answers • The chart is easy to read and understand. (Wrong answer) • I don't know, I have no idea. (Irrelevant answer)
0 Point	Empty answers

While analyzing the data of the study, teachers were defined as proficiency level. For this purpose, the points ranges and the qualification levels that should be determined are determined. While determining the proficiency levels (Ekiz 2009; Kılınç, 2012; Kutlu, 2018) the literature was used. Scores of proficiency levels were calculated separately for each component of teaching knowledge. For example, if you want to use The score ranges and proficiency levels of the mathematics teaching knowledge of the class teachers in the field of data processing learning are presented in Table 5.

Table 5. Distribution of grades of primary school teachers in the test related to the learning area of data processing

Points Ranges	Proficiency levels	f	%
0 – 7,8	Quite inadequate	0	0
7,9- 15,6	Insufficient	16	16
15,7- 23,4	Medium enough	49	49
23,5- 31,2	Sufficient	34	34
31,3- 39	Quite enough	1	1

When table 5 is examined, the general scores and proficiency levels of the teachers from the test are presented. The score ranges for teachers' knowledge of mathematics teaching were calculated as 7.8. Point Range = (Maximum Value - Lowest Value)/5) =(39-0)/5=7.8. Evaluation intervals of teachers' score averages; 0-7.8 is "quite inadequate", 7.9-15.6 is "inadequate", 15.7-23.4 is "medium sufficient", 23.5-31.2 is "sufficient", 31.3-39 is "quite adequate". Rather inadequate, inadequate, and moderately adequate levels are not at the desired level, but sufficient and quite adequate levels are determined as the desired level. Each teaching information component score intervals are calculated using the same formula. The score intervals for the field information component of the teaching knowledge are calculated as 3.2. Point Range= (Maximum Value - Lowest Value)/5)= (16-0)/5=3.2. The score intervals for the student and content information component of the teaching knowledge are calculated as 2. Point Range= (Maximum Value - Lowest Value)/5)= (10-0)/5=2. The score ranges for the teaching and content information component of the teaching knowledge were calculated as 1.8. Point Range= (Maximum Value - Lowest Value)/5)= (9-0)/5=1.8. The score intervals for the curriculum knowledge component of the teaching knowledge are calculated as 1. Point Range= (Maximum Value - Lowest Value)/5)= (5-0)/5=1. In this context, the lowest score to be taken from the test measuring

the knowledge of mathematics teaching is 0 and the highest score is 39. If the scores of the teachers are at the desired level, it is interpreted that the math teaching knowledge is sufficient and the mathematics teaching information is not sufficient if the teachers' scores are not at the desired level.

FINDINGS

In the study, the knowledge of classroom teachers who had just started their profession to teach mathematics in the field of data processing learning was examined through a test. While examining the teaching knowledge of classroom teachers, sub-components of this type of knowledge were used. The scores and proficiency levels of the teachers from the test are shown in Table 6.

Table 6. Distribution of grades of primary school teachers in the test related to the learning area of data processing

Points Ranges	Proficiency levels	f	%
0 – 7,8	Quite inadequate	0	0
7,9- 15,6	Insufficient	16	16
15,7- 23,4	Medium enough	49	49
23,5- 31,2	Sufficient	34	34
31,3- 39	Quite enough	1	1

When the scores of the classroom teachers were examined, it was determined that the accumulation was moderately sufficient. In addition, it was observed that there was a very sufficient level of 1 teacher and there was no teacher at a very inadequate level.

Findings Related to Content Knowledge of Classroom Teachers

The average score obtained from the answers given to the questions about the content knowledge, which is a component of teaching knowledge, is shown in Table 7.

Table 7. Teachers' field knowledge average score

Points Ranges	Proficiency levels	f	%
0-3,2	Quite inadequate	0	0
3,3- 6,4	Insufficient	7	7
6,5- 9,6	Medium enough	30	30
9,7-12,8	Sufficient	48	48
12,9-16	Quite enough	15	15

According to the data obtained from the answers given by the primary school teachers to the questions covering the content knowledge, it was seen that the teachers generally got adequate scores, but close to 9.7 points, which is the lower limit of the sufficient level.

The 5th question, which is one of the questions covering content knowledge, and the answer of teacher Ö59 are shown in Figure 2 and Figure 3.

5- Suppose two elementary school students in a class prepare the following images to show the number of teeth their classmates have dropped.

Meltem draws pictures of his classmates on the cards to prepare the chart below. Seda cuts paper in the shape of

teeth.
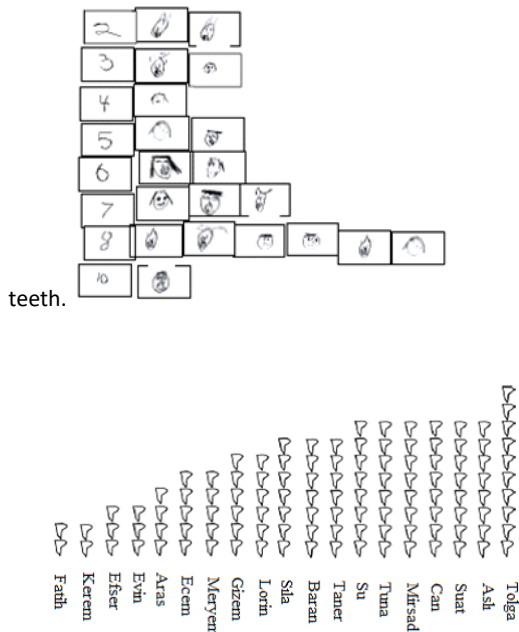
In terms of data presentation, how do these two impressions have similarities and differences? Type in the relevant spaces.

Similarities:

Differences:

Figure 2. Question 5 in the test
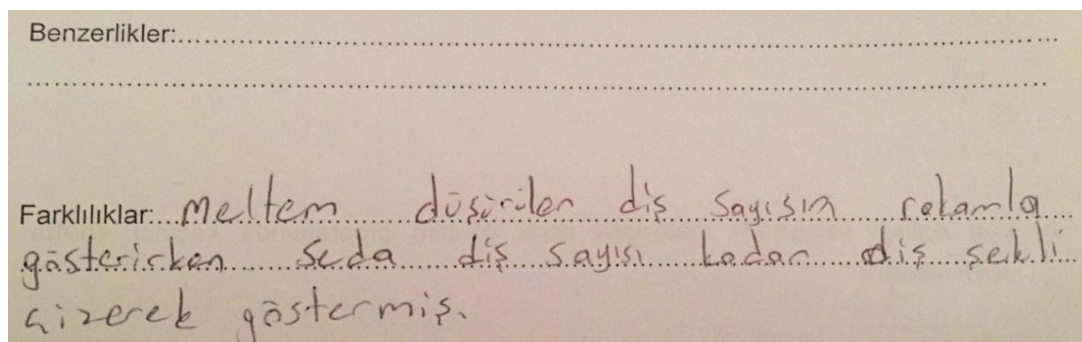
Figure 3. The answer given by the teacher coded Ö59 to the 5th question

Considering the answer of teacher numbered Ö59, information was given about the similarities and differences between the two representations, only the differences. In general, teachers answered this question in this way. The answers of the teachers who gave such answers were evaluated as partially correct and calculated as 1 point. Another question in the test 2. It was observed that the teacher numbered Ö94 gave the correct answer in the answer to item a of the question. The teacher with the code Ö87 answered the question as follows: "I would choose the object and figure graph." has answered. When the answer of the teacher coded Ö87 was examined, it was seen that the teacher did not give any justification for choosing the object or figure graphic. When the answers given by the teachers to item a of Question 2 were examined, it was observed that most of the teachers gave correct answers, but some teachers could not explain why they chose the graphic type they chose.

Figure 4. The answer given by the teacher coded Ö94 to item a of the 2nd question

Findings Regarding the Student and Content Knowledge of Classroom Teachers

The average scores obtained from the answers to questions related to the student and content information, another component of the teaching knowledge, are shown in Table 8.

Table 8. Students and content knowledge average scores of teachers

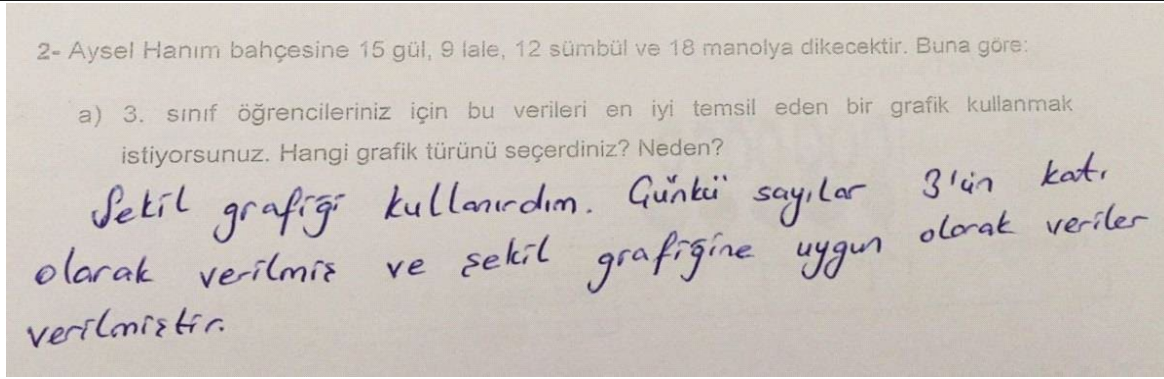| Points Ranges	Proficiency levels	f	%
0-2	Quite inadequate	8	8
2,1-4	Insufficient	28	28
4,1-6	Medium enough	44	44
6,1-8	Sufficient	19	19
8,1-10	Quite enough	1	1

According to the data obtained from the answers of the classroom teachers to the questions covering the student and content information, it was observed that the teachers received moderate scores in general. It was remarkable that 1 teacher got a point at a fairly sufficient level. Considering the answers given to the 14th question, which covers student and content information, 38 of the teachers answered the question completely, while 43 teachers answered the question incompletely. When looking at the answer of the teacher with the code Ö50 who answered the question in full, it is seen that the students answered the preliminary information necessary to convert the information in the column chart into a tally and frequency table in the form of being able to read the column chart, create a tally and frequency table. The teacher, code Ö50, replies: "It must have the foreground of being able to read the column chart, create a tally table, create a frequency table.". Looking at the answer of the teacher with the code Ö22, who partially answered the question, it is seen that the students answered the preliminary information necessary to convert the information in the column chart into a tally and frequency table as incomplete in the way they read and interpret the column chart. The answer of the teacher code Ö22 is shown in Figure 5.
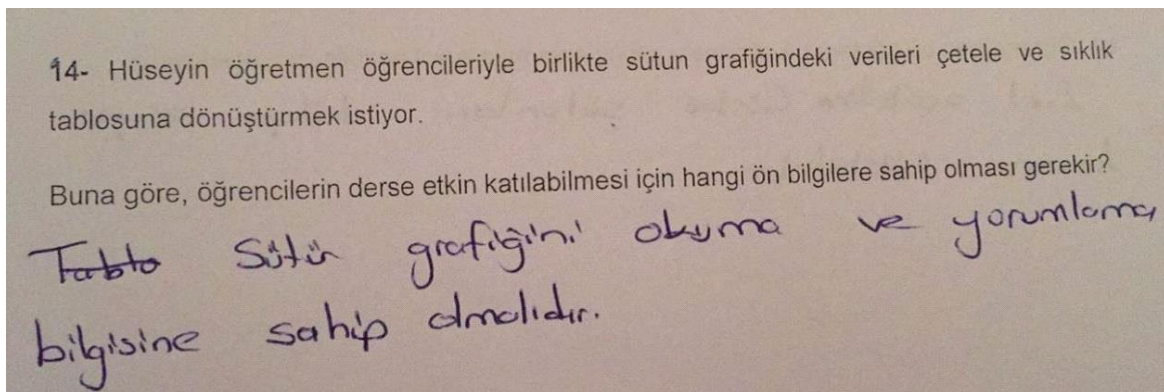
Figure 5. The answer given by ö22 coded teacher to item a of question 2

When the answers of the classroom teachers to the questions regarding the student and content information were examined, it was seen that the teachers did not respond at the desired level in general.

Findings on Teaching and Content Knowledge of Classroom Teachers

The average score obtained from the answers given to the questions about teaching and content knowledge, which is another component of teaching knowledge, is shown in Table 9.

Table 9. Teachers' teaching and content knowledge average score

Points Ranges	Proficiency levels	f	%
0-1,8	Quite inadequate	5	5
1,9-3,6	Insufficient	32	32
3,7-5,4	Medium enough	44	44
5,5-7,2	Sufficient	16	16
7,3-9	Quite enough	3	3

According to the data obtained from the answers given by the classroom teachers to the questions covering the teaching and content information, it was observed that the teachers generally scored at a moderate level. It was noted that 3 teachers scored at a very adequate level. One of the questions covering teaching and content information, question 8 and the answer of teacher Ö45 are shown in Figure 6.

> **8-** Hülya teacher gives the following research question to 3rd grade students. He asks his students to convert this data into a graph (object or figure graph) by making a tally and frequency table.
>
> Ayşe and Sema asked their classmates the following question and determined who liked which animal the most.
>
> *What's your favorite animal?*
>
> *Chick (   ) (4 votes)*
>
> *Turtle (   ) (8 votes)*
>
> *Dog (   ) (10 votes)*
>
> *Lion (   ) (6 votes)*
>
> The student named Buse cannot create the graph although she has created the table related to this question. If you were the teacher, how would you help your student? Explain in relation to the question.
>
> açıklayınız.
> Hayran resimlerinin sıktısını alırdım. Öğrencime renkli bir fon kartonu ve şıktıları verirdim. Öğrenciye resimleri makasla kesmesini söylerdim.
> - Kaç kişi civcivi seviyor Buse? diye sorar ve diyaloğa şöyle devam ederdim.
> - 4 kişi öğretmenim.
> - O zaman hadi grafiğimizi yapalım. Önce hayvanların isimlerini alt alta yazalım.
> - Şimdi civcivin karşısında kaç tane civciv resmini yapıştırmamız gerekiyor?
> - 4 tane öğretmenim.
> - Aferin Buse. Hadi bakalım diğerlerini de yap bu şekilde. Sonra beraber kontrol edelim olur mu?
> - Tamam öğretmenim.
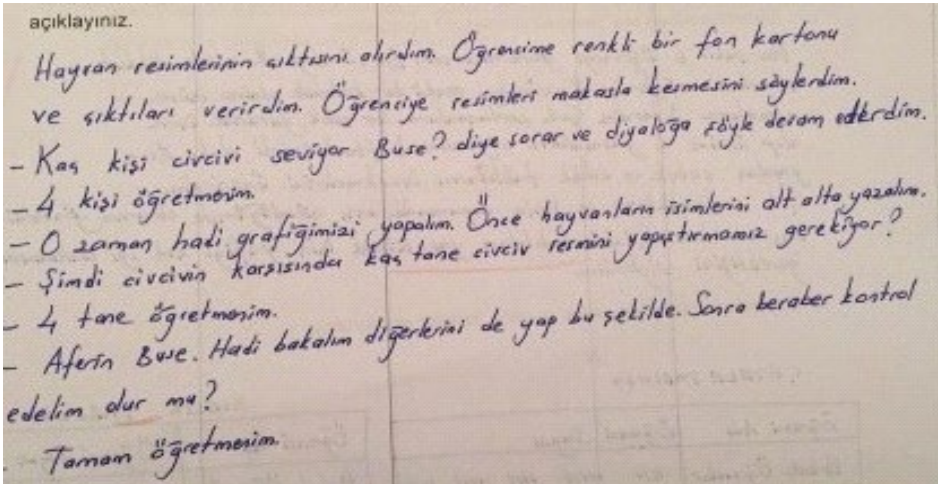
Figure 6. The answer of teacher Ö45 to question 8

When the answer of teacher Ö45 is looked at, it is seen that the teacher responds correctly to the student who asks for help, both by observing the steps of creating graphics and by using a suitable teaching language. However, teachers in general answered this question partially correctly. The answer of Ö6 from the teachers who answered partially correctly is shown in Figure 7.

Figure 7. The answer given by teacher number Ö6 to question 8

Looking at the answer of the teacher coded Ö6, it is seen that she helped her student in creating a graph, but after determining the number of animals in the graph, she immediately asked the student to draw a graph. However, since the teacher wanted to convey the steps of creating the graph to the student in the question, such answers were partially accepted as correct answers.

Some of the teachers who answered the question incorrectly explained the solution of the problem with the scoreboard and frequency table instead of helping the students in drawing object or figure graphs. Some teachers stated that they would help students by explaining the subject again. The answer of the teachers with the code Ö5 regarding the question is shown in Figure 8.

Figure 8. The answer given by the teacher coded Ö5 to the 8th question

Nearly all of the teachers (12%) who answered the question irrelevantly answered that "I do not know how to help the student". The teacher with the code Ö29 first represented the X expression with 2 votes, then tried to create the graph, but stopped creating graphics and answered "I don't know". Teachers have been shown not knowing how to help a student who can't create a chart when creating an object or shape chart. The answer of the teacher code Ö29 regarding the question is shown in Figure 9.
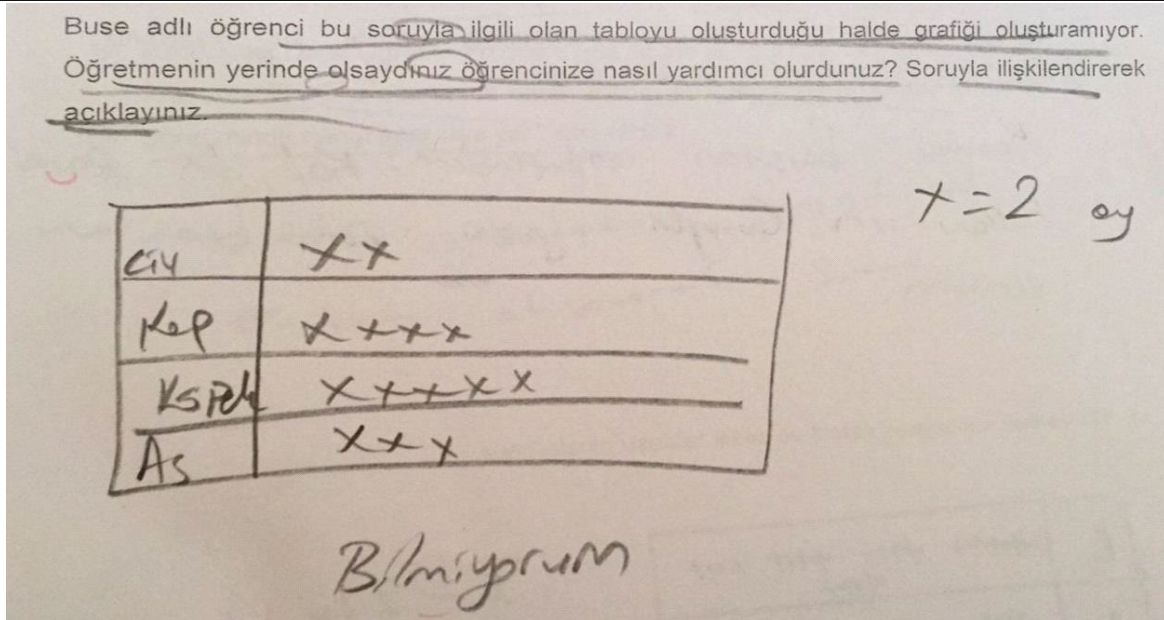
Figure 9. The answer given by the teacher coded Ö29 to the 8th question

Findings Regarding the Curriculum Knowledge of Classroom Teachers

The average score obtained from the answers to the questions about curriculum knowledge, which is another component of teaching knowledge, is shown in Table 10.

Table 10. Curriculum knowledge average scores of teachers

Points Ranges	Proficiency levels	f	%
0-1	Quite inadequate	34	34
1,1- 2	Insufficient	31	31
2,1- 3	Medium enough	19	19
3,1-4	Sufficient	14	14
4,1-5	Quite enough	2	2

According to the data obtained from the answers of the classroom teachers to the questions covering the curriculum information, it was observed that the teachers scored quite inadequately in general. One of the questions covering curriculum information, question 4 and the answer of teacher Ö77 are shown in Figure 10.
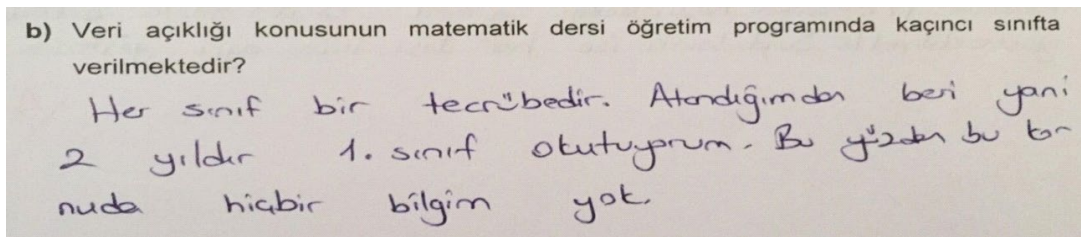
Figure 10. The answer given by the teacher coded Ö77 to item b of question 4

When looking at the answer of teacher Ö77, it states that the teacher has been teaching first grade for 2 years and therefore has no knowledge of the question. All of the teachers (27%) who answered the question irrelevantly gave this answer to the question. When looking at the answers of the teachers who answered the question incorrectly (36%), the majority stated that the data openness was the subject of the 4th grade.

As a result of the findings obtained from item b of question 10, which is one of the questions containing curriculum information, nearly half of the teachers (47%) correctly answered that the step of data collection comes after the step of creating a researchable question. While 38 teachers answered the question incorrectly, 12 teachers answered the question irrelevantly and 3 teachers left the question unanswered. The teachers who answered the question irrelevantly answered the question as "I have no idea, I don't know". Most of the teachers who answered the question incorrectly stated that the hypothesis-thesis stage came after the researchable question formation step. The answer of the teacher with the code Ö89 regarding the question is shown in Figure 11.

Figure 11. The answer given by teacher Ö89 to item b of question 10

According to the findings obtained from item b of question 13, which is one of the questions containing curriculum information, 63% of the teachers answered that the column chart should be taught after the figure chart. 31 teachers answered the question incorrectly. When looking at the answers of the teachers who answered the question incorrectly, it is seen that the answers that "after the teaching of the figure chart should be started, the tally chart, the tally and frequency table, the circle chart should be taught". The answers of the teachers with the code Ö68 and Ö17 are shown in Figures 12 and Figure 13.

Figure 12. The answer given by the teacher coded Ö68 to item b of the 13th question

Figure 13. The answer of Ö17 coded teacher to item b of question 13

When we look at the answer of the teacher coded Ö68, he says that he will start teaching the frequency and scoreboard after the figure graph. However, in the primary school mathematics curriculum, it is seen that the figure graph, which includes the scoreboard and the frequency table, is taught from the 2nd grade onwards. In addition, when the answer of the teacher coded Ö17 was examined, it was seen that the teacher stated the scoreboard table as a type of graphic. 31% of the teachers have been a remarkable finding that cannot be discriminated between the table and graphics.

DISCUSSION

Researchers have done many studies in order for teachers to teach effectively, efficiently and qualityly (An et al., 2004; Ball et al., 2008; Shulman, 1986,1987). The common conclusion from these researches is that teaching knowledge must be sufficiently advanced in order to have a qualified education (Ball et al., 2008; Fennema & franke, 1992; Hawkins, 2012). When the answers of the teachers to the questions prepared in the designated learning area were examined, it was generally seen that they scored at a moderate level. In fact, it was determined that only 1 teacher scored at a very adequate level. In this respect, it was seen that the teachers who had just started the profession had deficiencies in the knowledge of teaching mathematics, teaching, understanding the student and curriculum. Especially in teaching information questions, it was determined that teachers did not explain enough detailed explanations to the students about the points that the students did not understand. For example, if you want to use many teachers used general expressions in such questions to answer "I would re-explain the question", "I would do homework on the question", and it was determined that they did not provide explanations that would allow students to learn conceptually. In a similar study, Kutlu (2018) stated that secondary school math teachers who had just started their profession had similar deficiencies in their teaching knowledge and were not aware of their deficiencies in teaching. In another study, Aylar (2017) examined the teaching knowledge of class teacher candidates and found that they could not put the information of teacher candidates into practice. When we look at the researches, it is seen that these deficiencies in the teaching knowledge of both teacher candidates and teachers who have just started the profession are a negative situation for a qualified education. When the teachers looked at the field information in the designated learning area, it was seen that they confused concepts such as tables and graphics. The fact that 31 percent of the class teachers who participated in the study responded as a tally chart instead of a column chart, frequency chart can be considered as an indication that teachers lacked

knowledge of the basic concepts of data processing learning. Şahinkaya and Aladağ (2013) supported teachers in their studies on graphics by mixing graphic and table concepts. In a similar study, Ertaş (2014) stated that teachers who compared the mathematical knowledge of math teacher candidates with international averages with the questions related to the TEDS-M project were below average in data processing alone. In addition, when the net averages of the "2018 and 2019 Teacher Field Knowledge Test "(20.32) of the classroom teachers are looked at, it is seen that the teachers did not answer half the questions correctly. In another study, Küçük et al. (2012) examined the readiness levels of prospective classroom teachers for the field of data learning. In the light of the information obtained from the results of these two studies, it was seen that the mathematical knowledge of the classroom teachers about data processing while taking courses at the faculty of education was at a moderate level, and after graduating from education faculties, their mathematical knowledge of this area continued at the same level. In studies that emphasize the importance of content knowledge for a qualified mathematics teaching (Ball, 1990; Even, 1993; Shulman, 1986), it has been stated that comprehensive content knowledge positively affects teaching knowledge.

Teachers' knowledge of students and content was measured with questions containing sub-items of understanding the student, estimating what the student knows and how much, and being able to predict where the students will have difficulty in the subject and where they will understand more easily. As a result of the answers of the teachers in the study, it was determined that the general knowledge of the students and content of the teachers was not sufficient. Particularly, the teacher's answers to some questions drew attention. For example, if you want to use In question 7, teachers were asked at what points the student was struggling to solve the question, and the majority of teachers did not answer the question correctly. In item a of the 12th and 14th questions regarding the knowledge of knowing the student, the fact that the minority of the teachers answered the question as "I don't know" shows that the teachers who have just started their profession are insufficient in recognizing and understanding the student. Karal-Eyüpoğlu (2011) stated that teacher candidates lacked in predicting the preliminary information of the students and predicting which part of the problem the students would struggle with. In the study Yurtyapan (2018), which produced similar results, he investigated the knowledge of secondary school mathematics teachers to recognize the student about triangles and quadrilaterals and found that the teachers were very lacking. Kutlu (2018), which examined the teaching knowledge of mathematics teachers at the same seniority as the current study, repeated that teachers were inadequate in recognizing students. In his research, Açıksöz (2017) compared experienced teachers and inexperienced teachers within the scope of knowing the student. As a result of the research, it was determined that inexperienced teachers knew the students and knew which students had difficulties in which subject, but they were insufficient to understand why the students had difficulties in the determined subjects. Likewise, in the study conducted, it was observed that the teachers identified student mistakes in most of the questions, but they could not provide sufficient explanations for why they made these mistakes.

The partly accurate answer of teachers' teaching questions also shows that they are not helping their students enough. Teachers' teaching and content knowledge were examined within the scope of guidance at points where students were confused, the way students answered different questions, and the ability to show different solutions to a problem. Teachers' short, simple and inadequate answers in the form of solving more examples in general, doing homework and recounting the subject in order to help students with difficult questions show shortcomings in teachers' teaching knowledge. In addition, the fact that some teachers have been teaching for 1-2 years but have not made any time for this learning area shows that teachers do not realize the importance of this field. In the first years of teaching, it is obvious that teachers have difficulty especially in teaching. In the study applied, the shortcomings of teachers in teaching were repeated. In a similar study, Şen (2019) said that teachers use a limited number of methods and techniques in their teaching knowledge about quadrilaterals and that they cannot remember the name of some of these methods and techniques they applied. Looking at the literature within the scope of teaching knowledge, Aksu and Konyalıoğlu (2014) stated that the classroom teachers were inadequate in teaching the subject of transactions with fractions, and in the Bütün (2012) study, teacher candidates were not sufficient for teaching when explaining a partition process to their students, and in the Toluk-Uçar (2011) study, teachers knew the four procedures rules related to fractions but could not explain why these rules were used. In a different study, Aydın (2015) observed that classroom teachers generally use traditional methods in the teaching of science classes and do not benefit from contemporary methods.

It is a great concern that classroom teachers who have just started the profession score at a very inadequate level in curriculum knowledge, which is another component of teaching knowledge. In fact, the fact that some teachers have been teaching first grade for 2 years, so I don't know about this subject, shows that teachers do not learn enough about curriculum knowledge at university. When the studies examining the curriculum information are examined (Aksu, 2013; Aydın, 2015) teachers are generally inadequate in this information component. Kutlu (2018) stated in her study that the curriculum information of secondary school mathematics teachers in the first years of their profession was insufficient, and Açıksöz (2017) stated that novice teachers should increase their curriculum knowledge. As Gess-Newsome (1999) states, the first steps of teaching knowledge are taken in educational faculties. The education that teachers receive here affects the whole professional life in a positive or negative way. For this reason, courses containing curriculum knowledge in education faculties should be reviewed again. It is thought that another reason for this deficiency in teachers' curriculum information is that MEB constantly changed the mathematics curriculum in 2009, 2015 and 2017. As a result of all this information, it was seen that the teacher had shortcomings in the types of information determined for effective teaching. In the pre-service period, teacher training institutions and academicians working in these institutions have a great responsibility in eliminating the deficiencies of teachers in this regard. In addition, the Ministry of National Education and teachers should also do their part in this regard.

CONCLUSION AND RECOMMENDATIONS

According to the results of the study, the knowledge of classroom teachers who are just starting out in the profession to teach mathematics in the field of data processing is not sufficient. In the light of the data obtained in the answers of teachers, the lack of teaching knowledge is noticeable in the majority of teachers. Although teachers' field knowledge scores were lacking, they were found to be better than other components. Within the scope of student and content information, it was determined that teachers were particularly lacking in getting to know students. In fact, it has been determined that new teachers cannot express themselves to students. It was determined that the explanations they gave to the students were not sufficient due to the general inexperience of the teachers within the scope of teaching and content knowledge. In addition, the fact that the teachers generally gave partially correct answers to the instructional knowledge questions showed that they did not have sufficient knowledge about the concepts of graphics and tables. Within the scope of curriculum knowledge, which is another component of teaching knowledge, it has been determined that teachers are very lacking.

Considering all these shortcomings, it is thought that classroom teachers should be able to cooperate with groups, participate in workshops and in-service activities, and even improve themselves by continuing postgraduate education. As a result of the study, it may be recommended to increase the course hours of the courses such as "Mathematics Teaching I-II" and "Teaching Practice" or to make new arrangements for the applications of the courses in order to compensate for the shortcomings of the newly started classroom teachers in the field of teaching before starting the profession. In order to eliminate the shortcomings of teachers in field knowledge, the field knowledge at the elementary school level should be taken into account more in the content of the "Basic Mathematics" or "Mathematics in Primary School" courses given in the faculties of education. In addition, in order to eliminate the deficiencies in teachers' curriculum knowledge, courses called "Elementary School Curriculums" can be added in the courses in the faculties of education. At the same time, when there is a change of program, seminars should be organized for teachers and the new program should be introduced in detail.

As seen in the study, it was observed that the academic knowledge levels of teachers were not sufficient in some basic concepts. Therefore, it is thought that the preparation of guidebooks that help the teacher with the necessary explanations for the basic conceptual misconceptions that MEB classroom teachers often encounter in mathematics teaching will benefit the teaching.

Researchers who will be inspired by the study and will work within the scope of this subject in the future can be studied in different learning areas and different data collection tools will be used to measure teaching knowledge. Such studies can be applied to teachers in different branches. This study was evaluated within the framework of the "Mathematical Knowledge for Teaching" model developed by Ball et al. (2008). Other researchers can conduct studies using different models. Studies can be carried out comparing the teaching knowledge of experienced teachers with inexperienced teachers or even teachers who are at certain periods of their professional life (1-5-10). By identifying fewer participants, the development of teachers who have just started the profession can be examined according to the years. Within the scope of the information obtained from the results of the study, studies can be carried out to eliminate the deficiencies of teachers in teaching knowledge.

REFERENCES

Açıksöz, A. (2017). *Deneyimli fen bilimleri öğretmenleri ile aday öğretmenlerin pedagojik alan bilgisi açısından karşılaştırılması* (Yayınlanmamış yüksek lisans tezi). Çanakkale Onsekiz Mart Üniversitesi, Çanakkale.

Aksu, Z ve Konyalığlu, A. C. (2014). Sınıf öğretmen adaylarının kesirler konusundaki pedagojik alan bilgileri. *Kastamonu Üniversitesi Kastamonu Eğitim Dergisi, 23*(2), 723-738.

An, S., Kulm, G. and Wu, Z. (2004). The pedagogical content knowledge of middle school, mathematics teacher in China and the U.S. *Journal of Mathematics Teacher Education, 7*, 145–172.

Aydın, E. (2015). *Sınıf öğretmenlerinin fen ve teknoloji dersine yönelik pedagojik alan bilgilerinin araştırılması* (Yayınlanmamış yüksek lisans tezi). Mehmet Akif Ersoy Üniversitesi, Burdur.

Aylar, E. (2017). Sınıf öğretmeni yetiştirme sürecinde problem çözmeye dair pedagojik alan bilgisine ilişkin çıkarımlar. *Mersin Üniversitesi Eğitim Fakültesi Dergisi, 13*(2), 744-759.

Baki, A. (2018). *Matematiği öğretme bilgisi*. Ankara: Pegem Akademi.

Bakioğlu, A. (1996, Eylül). *Öğretmenlerin kariyer evreleri.* II. Ulusal Eğitim Bilimleri Sempozyumu'nda sunulan bildiri, Marmara Üniversitesi, İstanbul.

Ball, D. L. (1988). Knowledge and reasoning in mathematical pedagogy: Examining what prospective teachers bring with them to teacher education (Unpublished doctoral dissertation). University of Michigan State, East Lansing, MI.

Ball, D. L., Thames, M. H. and Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education 59*(5), 389-407.

Beyazıt, İ. (2011). Öğretmen adaylarının grafikler konusundaki bilgi düzeyleri. *Gaziantep Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 10*(1), 1325 - 1346.

Blömeke, S., Gustafsson, J. E. and Shavelson, R. J. (2015). Beyond dichotomies: Competence viewed as a continuum. *Zeitschrift für Psychologie, 223*(1), 3-13.

Bütün, M. (2005). *İlköğretim matematik öğretmenlerinin alan eğitimi bilgilerinin nitelikleri üzerine bir araştırma* (Yayınlanmamış yüksek lisans tezi). Karadeniz Teknik Üniversitesi, Trabzon.

Bütün, M. (2011). Matematik öğretmenlerinin alan eğitimi bilgi yapılarının incelenmesinde senaryo tipi mülakat sorularının kullanımı. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi, 16 (*2011) 105-115.

Bütün, M. (2012). *İlköğretim matematik öğretmeni adaylarının uygulanan zenginleştirilmiş program sürecinde matematiği öğretme bilgilerinin gelişimi* (Yayımlanmamış doktora tezi). Karadeniz Teknik Üniversitesi, Trabzon.

Çepni, S. (2009). *Araştırma ve proje çalışmalarına giriş* (4. Baskı). Celepler Matbaacılık, Trabzon.

Ekiz, D. (2009) *Bilimsel Araştırma Yöntemleri* (Geliştirilmiş 2. Baskı) , Ankara: Anı Yayıncılık

Ertaş, F. (2014). *A Way To compare mathematics teacher candidates mathematical knowledge for teaching:Teds–M released tests* (Yayınlanmamış yüksek lisans tezi). Boğaziçi Üniversitesi, İstanbul.

Even, R. (1993). Subject-matter knowledge and pedagogical content knowledge: Prospective secondary teachers and the function concept. *Journal for Research in Mathematics Education, 24*(2), 94-116

Fennema, E. and Franke, M. L. (1992). Teachers knowledge and its impact. In: D.A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp.147-164). New York: Macmillan Publishing.

Gess-Newsome, J. (1999). Pedagogical content knowlege: An introduction and orientation. In J. Gess-Newsome and N.G. Lederman (Eds.), *Examining Pedagogical content knowlege:* PCK and science education (pp.3-17). Netherlans: Kluwer Academic Publisher.

Gökkurt-Özdemir, B., Yıldız, C., ve Koçak, M. (2017, Temmuz). İlkokul öğretmenlerinin öğrenciler hakkındaki bilgilerinin öğrenme geoemetrisi alanında incelenmesi. *15. Ulusal Geometri Sempozyumu'nda sunulan bildiri*, Amasya Üniversitesi, Amasya.

Hacıömeroğlu, G. (2013). Sınıf öğretmeni adaylarının öğretim için matematiksel bilgisi: öğrencilerin toplama ve çıkarma işlemlerine ilişkin çözümlerinin analizi. *Eğitim ve Bilim, 38*, 168.

Hawkins, W. J. (2012). An investigation of primary teachers' mathematical pedagogial content knowledge (Unpublished doctoral dissertation). University of Canberra, Canberra.

Hill, H. C., Rowan, B. and Ball, D. L. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. *American Educational Research Journal, 42*(2), 371-406.

Huberman, M. (1989). "The Professional Life Cycle of Teachers." *Teachers College Record.*

Işık, A.ve Baran-Kaya, T. (2017). Sınıf öğretmenliği programı öğrencilerinin matematiksel alan bilgilerinin incelenmesi. *Erzincan Üniversitesi Eğitim Fakültesi Dergisi,19*(1), 117-145.

Karal-Eyüpoğlu, I. (2011). *Fizik öğretmenlerinin pedagojik alan bilgilerinin gelişimi*. (Yayınlanmamış doktora tezi). Karadeniz Teknik Üniversitesi, Eğitim Bilimleri Enstitüsü, Trabzon.

Kılınç, A. (2012). *Sınıf öğretmenlerinin milli mücadele dönemi konusuna ilişkin pedagojik alan bilgileri* (Yayınlanmamış yüksek lisans tezi). Gaziantep Üniversitesi, Gaziantep.

Kutlu, D. (2018). *Göreve yeni başlayan ortaokul matematik öğretmenlerinin pedagojik alan bilgilerinin incelenmesi* (Yayınlanmamış yüksek lisans tezi). Karadeniz Teknik Üniversitesi, Trabzon.

Küçük-Demir, B., Cansız, Ş., Deniz, D., Çevik-Kansu, C ve İşleyen, T. (2016). Sınıf öğretmeni adaylarının matematik öğretmeye yönelik kaygılarının farklı değişkenler açısından incelenmesi (Bayburt Örneği). Bayburt Eğitim Fakültesi Dergisi,11(2), 379-390.

Lee, E., Brown, M.N., Luft, J. A. and Roehrig, G. H. (2007). Assessing Beginning Secondary Science Teachers' PCK: Pilot Year Results. *School Science and Mathematics, 107*(2). 52-60.

Ma, L. (1999). *Knowing And Teaching Elementary Mathematics: Teachers' Understanding Of Fundamental Mathematics In China And The United States.* Mahwah, NJ: Erlbaum.

Milli Eğitim Bakanlığı [MEB]. (2015). *İlkokul 1-4.sınıflar matematik dersi öğretim programı*, Ankara: Milli Eğitim Müdürlüğü Basımı.

Milli Eğitim Bakanlığı [MEB]. (2017). *İlkokul 1-8.sınıflar matematik dersi öğretim programı*, Ankara: Milli Eğitim Müdürlüğü Basımı.

Milli Eğitim Bakanlığı (MEB). (2017). *Öğretmen yeterlilikleri: Öğretmenlik mesleği genel ve özel alan yeterlikleri.* Ankara: Milli Eğitim Bakanlığı Öğretmen Yetiştirme ve Geliştirme Genel Müdürlüğü. http://oygm.meb.gov.tr/www/ogretmenlik-meslegi-genel-yeterlikleri/icerik/39 adresinden 26 Şubat 2018 tarihinde edinildi.

Park, S. and Oliver, J. S. (2008). Revisiting the conceptualisation of pedagogical content knowledge (PCK): PCK as a conceptual tool to understand teachers as professionals. *Research in Science Education, 38,* 261–284.

Pırasa, N. (2009*). Sınıf öğretmeni adaylarının matematik öğretimiyle ilgili bilgilerinin değişim sürecinin incelenmesi* (Yayınlanmamış doktora tezi). Karadeniz Teknik Üniversitesi, Trabzon.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harwerd Educational Review, 57*, 1-22.

Şahinkaya, N. ve Aladağ, E. (2013). Sınıf öğretmeni adaylarının grafikler ile ilgili görüşleri. Adıyaman Üniversitesi Sosyal Bilimler Enstitüsü Dergisi (2013): 309-328

Şen, M. (2019). *Sınıf öğretmenlerinin dörtgenler konusundaki pedagojik alan bilgileri* (Yayınlanmamış yüksek lisans tezi). Gaziosmanpaşa Üniversitesi, Tokat.

Şimşek, N. ve Boz. N. (2015). Sınıf öğretmeni adaylarının uzunluk ölçme konusunda pedagojik alan bilgilerinin öğrenci kavrayışları bağlamında incelenmesi. *Cumhuriyet International Journal of Education 4*(3), 10-30.

Teacher Education and Development Study in Mathematics (2008). *Council of Ministers of Education. Reston*, VA: Author.

Toluk–Uçar, Z. (2011). Öğretmen adaylarının pedagojik içerik bilgisi: Öğretimsel açıklamalar. *Turkish Journal of Computer and Mathematics Education, 2*(2), 87-102.

Türnüklü, B. E. (2005). Matematik Öğretmen Adaylarının Pedagojik Alan Bilgileri ile Matematiksel Alan Bilgileri Arasındaki İlişki. *Eurasian Journal of Educational Research*, *21*, 234 - 247.

Uşak, M. (2005). *Fen bilgisi öğretmen adaylarının bitkiler konusundaki pedagojik alan bil*gileri. (Yayınlanmamış Doktora Tezi), Gazi Üniversitesi, Ankara.

Yin, R. K. (2003). *Case study research: Design and methods*. (3rd Ed.). Sage, Thousand Oaks.

Yurtyapan, M. İ. (2018). *Ortaokul matematik öğretmenlerinin üçgenler ve dörtgenler konusuna ilişkin pedagojik alan bilgilerinin incelenmesi* (Yayınlanmamış yüksek lisans tezi). Bülent Ecevit Üniversitesi, Zonguldak.
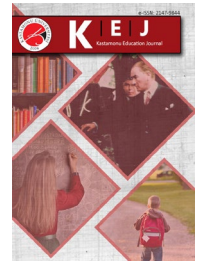
An Evaluation on Turkish Language Teachers' Views About Visual Reading

Türkçe Öğretmenlerinin Görsel Okumaya İlişkin Görüşleri Üzerine Bir Değerlendirme

Bircan Eyüp[1], **Saniye Aslıhan Karakaş**[2]

Abstract

Purpose: The aim of this study is to determine and evaluate Turkish language teachers' views on visual reading skills.

Design/Methodology/Approach: The study was designed as a case study, one of the qualitative research methods. The research group consists of 10 Turkish language teachers working in secondary schools affiliated to the Ministry of National Education in the city center of Trabzon. The data were collected through a semi-structured interview form. In the first part of the interview form, there are three questions for identifying teachers, and in the second part, there are eleven questions for determining teachers' visual reading skills. All of the teachers in the study group participated in the study voluntarily. Content analysis technique was used in the analysis of the data.

Findings: In the study, it was determined that the connotations of Turkish language teachers towards visual reading are interpreting something seen and understanding and expressing related questions. It was determined that the most used material in the visual reading of the teachers was the textbook. It was revealed that the reasons for using the textbook were that they were ready and do not require additional preparation. It has been determined that teachers usually do visual reading activities when they see it in the textbook. According to teachers, visual reading mostly improves students' interpretation skills. It was determined that students had problems in visual reading activities due to the lack of attention and reading habit. It was determined that teachers prefer open-ended and multiple choice questions in the assessment and evaluation process for visual reading studies. It was concluded that most of the teachers found the visual reading activities in the textbooks insufficient. While visual reading sounds more fun, enjoyable and easy for students, reading a written text is more boring. It shows that these also affect teachers' preferences in class. It has been determined that teachers think that technology and visual reading show an intertwined and parallel development. It is concluded that visual reading studies eliminate boring in the lesson, motivate students to the lesson, and enrich the lesson. In addition, it was concluded that some of the teachers have perceptions that visual reading is not important except for the exam.

Highlights: Especially teachers need training on visual reading and therefore it is necessary to provide training on visual reading skills to teachers through in-service courses.

Öz

Çalışmanın amacı: Bu araştırmanın amacı, Türkçe öğretmenlerinin görsel okuma becerisine ilişkin görüşlerinin belirlenip değerlendirilmesidir.

Materyal ve Yöntem: Araştırma, nitel araştırma yöntemlerinden durum çalışması olarak desenlenmiştir. Araştırmanın örneklemini Trabzon il merkezinde MEB'e bağlı ortaokullarda görev yapmakta olan on Türkçe öğretmeni oluşturmaktadır. Veriler araştırmacılar tarafından hazırlanan yarı yapılandırılmış görüşme formu ile toplanmıştır. Görüşme formu iki bölümden oluşmaktadır. Birinci bölüm öğretmenlere dair demografik bilgileri içeren bilgi formu ve ikinci bölüm öğretmenlerin görsel okumaya yönelik görüşlerini belirlemeye yönelik soruların olduğu görüşme formudur. Verilerin analizinde içerik analizi tekniği kullanılmıştır.

Bulgular: Çalışmada, Türkçe öğretmenlerinin görsel okumaya yönelik çağrışımlarının görülen bir şeyi yorumlama ve ilgili soruları anlama ve ifade etme olduğu tespit edilmiştir. Öğretmenlerin görsel okuma çalışmalarında en çok kullandıkları materyalin ders kitabı olduğu belirlenmiştir. Ders kitabını kullanma sebeplerinin ise ellerinde hazır olması, ek bir hazırlık gerektirmemesi olduğu ortaya çıkmıştır. Öğretmenlerin genellikle ders kitabındaki görsel okuma etkinliklerini yaptıkları belirlenmiştir. Öğretmenlere göre görsel okuma en çok öğrencilerin yorumlama becerisini geliştirmektedir. Çoğunlukla öğrencilerin dikkat eksikliğinden ve okuma alışkanlığının olmamasından dolayı görsel okuma etkinliklerinde problem yaşadığı tespit edilmiştir. Öğretmenlerin görsel okuma çalışmalarına yönelik ölçme değerlendirme sürecinde açık uçlu ve çoktan seçmeli soruları tercih ettikleri belirlenmiştir. Öğretmenlerin çoğunun ders kitaplarındaki görsel okuma etkinliklerini yetersiz buldukları sonucuna ulaşılmıştır. Görsel okuma öğrencilere daha eğlenceli, zevkli ve kolay gelirken yazılı bir metni okuma daha sıkıcı gelmektedir. Bunların da öğretmenlerin sınıf içi tercihlerini etkilediği görülmektedir. Öğretmenlerin teknoloji ile görsel okuma iç içe ve paralel bir gelişme gösterdiğini düşündüğü belirlenmiştir. Görsel okuma çalışmalarının derste sıkıcılığı ortadan kaldırdığı, öğrencileri derse motive ettiği, dersi zenginleştirdiği sonucuna ulaşılmıştır. Ayrıca öğretmenlerin bir kısmının ise görsel okumanın sınav haricinde bir önemi olmadığı yönünde algıları olduğu sonucuna ulaşılmıştır.

Önemli Vurgular: Ulaşılan sonuçlardan hareketle özellikle öğretmenlerin görsel okumaya yönelik eğitimlere ihtiyaç duyduğu ve bu sebeple de hizmet içi kurslarla öğretmenlere görsel okuma becerisine yönelik eğitimler verilmesinin gerekli olduğu düşünülmektedir.

[1] **Corresponding Author,** Trabzon University, Fatih Faculty of Education, Department of Turkish Language and Social Sciences Education, Trabzon, TURKEY; bircaneyp@gmail.com, https://orcid.org/0000-0001-8061-1159
[2] Trabzon University, Fatih Faculty of Education, Department of Turkish Language and Social Sciences Education, Trabzon, TURKEY; aaslikarakas@gmail.com, https://orcid.org/0000-0003-1426-1749

INTRODUCTION

Today, most of the children who are involved in education and training are those who have grown up with technology. Starting from the early childhood, these children are exposed to technological tools that are mainly characterized by visuality, such as TV, smartphones, tablets and computers, and spend long periods of time with these tools. It can also be suggested that these tools usually become a child's toys. Accordingly, these tools always attract children's attention as they offer them an unlimitedy audio-visual world. The children who come across the visuals a lot in their daily lives also frequently come across the visuals in their education and training life as well. Particularly with COVID-19 pandemic, students undergo a process in which they are intertwined with visual materials like never before in distance education process. As children are engaged in visuals in daily life to such a great extent, the term of visual literacy has been distinguished more, which showed the necessity that students should be equipped with this skill.

Although visual literacy dates back to two thousand five hundred years as a skill, it is a newly coined term with only forty-fifty years of history (Balun, 2008, p. 37). This term has been used first by John Debes in 1968. Debes (1969, p. 26) argues that visual literacy is a group of vision competence that a person can develop visually as well as by combining and integrating other sensory experiences. When these competencies are developed adequately, any person with visual literacy is expected to distinguish and to interpret natural or man-made visual actions, objects and symbols. Burns (2006) specifies that visual literacy is the skill to decode, understand and analyze images to achieve a meaning by visual presentations of ideas and concepts. In addition, Yeh (2008) defines visual literacy as learned knowledge and skills, which are required to understand, interpret, analyze visual messages properly and to create such visual messages. In the broadest sense, visual literacy is described as a series of competences in reading, writing and thinking (Thompson, 2019, p. 111). Akyol (2009) asserts that visual literacy has many benefits for students as follows: it develops all kinds of verbal skills, improves personal expression skills, ensures the organization of ideas, can help to find anything appropriate for reading skills of students at different mental and developmental levels, contributes to the comprehension of a big picture that cannot be expressed in words, helps to make sense, is effective for disadvantaged children in social and economic respects, children with emotional problems, those with mental disabilities, dyslexia and speech problems (Akyol, 2009). Güneş (2007) suggests that visual literacy develops thinking, understanding, learning and allows students to integrate information.

Visual literacy education started to be included in curricula in Australia, Europe and the USA as of the early 1990s (Felten, 2008). In Turkey, it was first introduced as a learning domain with visual presentation in the curriculum of Turkish Language prepared by the Ministry of Education in 2004. In this program, visual literacy referred to reading, understanding and interpreting figures, symbols, pictures, graphics, tables, body language, nature and social events, which were not considered written texts, as well as mass media and information technologies (Ministry of National Education, 2005). However, visual literacy is not a separate learning domain in the 2019 curriculum of Turkish Language, which is still applied. In this respect, the achievements for visual reading are included among the achievements related only to language skills (Ministry of National Education, 2019).

It is important that there are achievements related to visual literacy in curricula. However, teachers have the most important role in students' acquisition and use of visual reading skills properly and effectively. Teachers are responsible to allow students to gain this skill in classrooms. Therefore, it is necessary for teachers to have a certain education on this and to become ready and willing to provide students with this skill. In this respect, a teacher's knowledge, skills and attitudes affect the quality of applications in a classroom (Akpınar, 2009, p. 40). Incompetence or negative attitudes of a teacher regarding this may cause negative results in students' having adequate visual literacy. This may result in raising individuals, who could not act in accordance with today's world where communication channels have changed, information is presented in various forms, digitalization has increased, artificial intelligence has become widespread and many other rapid changes are ongoing. Competence, willing and positive attitudes of teachers on this concept will have a significant role in raising qualified future generations.

The relevant literature indicates that the studies on visual reading skill in Turkish education have generally focused on experimental studies on visual reading, students' competencies, program development and teachers' views. In the studies conducted on teachers, researchers have mostly engaged in teachers' views on textbooks (Bozkurt, 2011; Güldaş, 2012, Kırbaş, Orhan & Topal, 2012; Ünver & Genç, 2013) and curricula (Balun, 2008; Kuru, 2008; Akpınar, 2009; Bozkurt, 2011; Bozkurt & Ulucan, 2014) regarding visual reading, to what extent they used visuals (Aslan, 2015; Brugar, 2017), and how can be improve students' visual reading skills (Kaya, 2011). It is observed that these studies have subjected mostly primary school teachers. In the study carried out by Ateş, Sur and Demir (2020) on the Turkish language teachers working at middle schools, education received of teachers on visual reading, their level of knowledge, their views on textbooks and the achievements in the curriculum regarding visual reading, the visual reading studies they did in a lesson and the materials they used and the problems they had in lessons were discussed. However, any study could not be found on the connotations of Turkish teachers related to the concept of visual reading, the factors affecting their material choices, how often they do visual reading activities in classrooms, whether they do different visual reading activities according to grade levels, the problems students have in visual reading activities, the tools they use to assess and evaluate visual reading skills, the contributions of these activities to lessons. In addition, any study could not be identified on the investigation of the Turkish teachers' views regarding the relationship

between visual reading and technology as well as the difference between a visual text and a written text. The COVID-19 pandemic, rapid development in technology and students' encountering more visuals make it necessary to focus on the awareness of Turkish teachers on this subject and their activities on this skill. This research differs from previous studies regarding the aforementioned questions for which answers were sought in this study. The conclusions of this study are expected to raise awareness of the Turkish language teachers, to contribute to in-class activities of Turkish language teachers, teacher training process and the process of the Ministry of National Education to determine the needs of teachers and to develop training for these needs regarding visual reading.

The Purpose of the Study

In this study, it was aimed to determine the views of Turkish language teachers about visual reading skills. In this regard, answers were sought for the following questions:

1. What are the connotations of Turkish language teachers regarding the term visual reading?
2. What materials do Turkish language teachers use in visual reading activities? What are their reasons for choosing these materials?
3. What is the frequency of Turkish language teachers including visual reading activities?
4. To what extent do Turkish language teachers do visual reading activities according to grade levels? What is the effect of grade levels on the effectiveness of these activities?
5. What are the problems students experience in visual reading activities according to Turkish language teachers, and what are the causes of these problems? What are the visual reading activities that students have difficulty most?
6. What are the tools used by Turkish language teachers in the assessment and evaluation process of visual reading studies?
7. What are the benefits of including visual reading activities in classrooms for students according to Turkish language teachers? What are the contributions of visual reading activities to lessons?
8. Do Turkish language teachers think that the visual reading activities in textbooks sufficient? What are their reasons?
9. What are the differences between reading a visual and a written text according to Turkish language teachers? Do these differences affect their choices?
10. Do Turkish language teachers think that there is a relationship between visual reading and developing technology? If so, what are these?

METHOD/MATERIALS

This study is designed as a qualitative research. Qualitative research refers to investigations, in which a qualitative process is followed to present perceptions and cases in a realistic and holistic manner in the natural environment (Yıldırım & Şimşek, 2008, p. 39). In this process, it is of importance to focus and understand the special language, meanings and concepts created and used by the people subjected to research and to try to reveal what they mean to the person being researched (Ekiz, 2017). This study was designed as a case study, one of the qualitative research methods, in order to understand and make sense of what are the views of Turkish language teachers on visual reading skill in detail. The case study aims to examine in depth a subject whose boundaries are determined by the researcher (Creswell, 2018; Merriam, 2018). In the study, data were collected by interview method. It is advantageous in providing useful information and details of participants in cases where participants could not be observed directly (Creswell, 2017). In addition, one of the reasons for being used frequently is the fact that it is based on speaking, which is the most widespread communication tool (Yıldırım & Şimşek, 2008, p. 127).

Study Group

The sample of the study consisted of 10 Turkish language teachers, who were working at state middle schools in the center of Trabzon province in the 2019-2020 school year. The sample group was selected using the convenience sampling method, which is one of the purposeful sampling methods. The convenience sampling, used frequently in qualitative studies, contributes to studies regarding speed and practicality. Moreover, convenience samples cost less than other samples (Yıldırım & Şimşek, 2008, p. 113). In this study, the Turkish language teachers, who were working in the center of Trabzon province and willing to participate in the study voluntarily, were selected by considering accessibility conditions due to the COVID-19 pandemic. Descriptive information about the teachers is presented in Table 1.

Table 1. Descriptive information about Turkish language teachers

Code	Gender	Years of experience in the profession	Training status for visual reading
T1	Female	17	No
T2	Female	28	No
T3	Female	18	No
T4	Female	17	No
T5	Female	19	No
T6	Female	26	No
T7	Male	17	No
T8	Male	15	No
T9	Male	15	No
T10	Male	11	No

Data Collection Tools

In this research, data were gathered by semi-structured interview form. The semi-structured interview technique enables the researcher to obtain more systematic and comparable information as it provides the opportunity to prepare questions in advance. In addition, it also provides researchers and participants with flexibility regarding time (Yıldırım & Şimşek, 2008, p. 123). Researchers firstly carried out a literature review and then created a question pool in this study. Questions with similar contents or out of study purpose were excluded from the question pool, and the views of three academics on Turkish Education were received for the remaining questions. Expert opinion is obtained during the preparation of a question form in order to increase the content validity of a study (Çepni, 2012). The semi-structured interview form was developed in line with the expert opinions. Regarding the pilot application of the question form, it was interviewed with two Turkish language teachers. The questions they had difficulty in understanding or repeating were removed, and the form was finalized. While the first part of the interview form consisted of questions regarding the descriptive information of teachers, the second part included questions on their views and experiences in using visual reading.

In this study, which was conducted to determine the views of Turkish language teachers on visual reading, all teachers participated in the study voluntarily. The interviews were made face to face at the schools of participating teachers by taking required measures and recorded with a voice recorder. Teachers were not restricted regarding time. The interviews averagely lasted for 20-30 minutes. The teachers were asked whether they had anything to add to the subject. And, the data collection were finalized. The obtained data were first transferred to the computer software and the interview form of each teacher was transcribed.

Data Analysis

In the analysis of obtained data, descriptive analysis and content analysis were utilized. The data summarized and interpreted in the descriptive analysis are subject to a more detailed process in content analysis, and any concept and theme that could not be recognized by descriptive approach are discovered as a result of this analysis (Yıldırım & Şimşek, 2008, p. 227). The main aim of content analysis is to gather similar data under certain concepts and themes and to organize and interpret them in a way that readers can understand (Yıldırım & Şimşek, 2008, p. 227). In this study, the transcribed interviews were read several times by researchers, and it was tried to obtain meanings. Important points were written down in this process. Later on, coding started. The purpose of coding is to obtain meanings from available data, to divide them into text or visual parts, to label these parts with codes, to examine whether codings are overlapped or used unnecessarily, and to narrow down these codes with broad themes (Creswell, 2017, p. 314-315). Researchers coded data separately and then tried to identify similarities and differences by comparisons. Views on differences were shared and common points were achieved. After completing codings, themes were created by bringing similar codes together. Names of participating teachers were not disclosed, and they were coded as T1, T2, T3… The findings obtained as a result of the analysis are presented in tables and interpreted. The views of teachers were directly conveyed where appropriate.

FINDINGS

In this section, the views of Turkish language teachers on visual reading skill are provided and interpreted.

The results of the connotations formed by Turkish teachers regarding the concept of visual reading are shown in Table 2.

Table 2. The connotations of Turkish language teachers regarding the concept of visual reading

The connotations regarding the concept of visual reading	Teachers	f
Interpreting something seen	T1, T3, T7, T9	4
To understand and express visual reading questions	T4, T8, T10	3
Perception of real-world equivalent / concrete image of text-related visuals	T2	1
The ability to describe/express a visual	T1	1
To make sense of everything other than written texts	T5	1
Short, punchy, effective	T6	1
To follow any information about a graphic, table and to achieve a truth	T7	1
To embody an example	T8	1
A high-level skill	T9	1

There are differences in the answers given by Turkish language teachers regarding the connotations that the term visual reading causes them to form. It was identified that the connotation created most was to interpret a visual. Teachers mean pictures, graphics, tables, physical characteristics of a person, landscape photographs by the term visual. For example, T1 expressed her thoughts as follows: *"Reading now is not just reading what is written in the book. To be able to describe what you see. Being able to interpret something you see. It means being able to recognize and describe a picture, a landscape, or the physical characteristics of a person."* T7, on the other hand, stated that *"it appears as making comments about the picture, following the information about the graphic table and catching the truth."* Another connotation that teachers had was understanding and answering visual reading questions. It is seen that three teachers responded in this respect. When considering these answers, it is understood that teachers considered visual reading as a field of study only for exams. T4 stated this as follows: *"I definitely think that visual reading questions are more effective in understanding and expressing them, but visual reading questions should be more effective, more explanatory and more understandable. ... Now that I look, we see that visual reading questions are on the increase in books, compared to the past."* T10 also stated the following: *"Visual reading requires some attention of students because when we look at visual reading, when we ask, many students cannot perceive some things. That's why students who are a little more attentive and have a good interpretation power do these kinds of questions better."*

A connotation was also developed by the perception of the real-world equivalent and concrete image of a visual reading through visual-related text. One teacher stated that visual reading associated with the ability to describe, to express a visual properly. The connotation that another teacher had was to make sense of everything other than written texts. In this regard, it is seen that all unwritten materials are considered visual. There was a teacher expressing the term visual reading as short, punchy, effective. The connotation of following any information about a graphic, table and to achieve a truth had in parallels with the connotation to embody an example. It was also seen that visual reading was considered a high-level skill.

The results of the materials used by Turkish language teachers in their activities for visual reading skill are shown in Table 3.

Table 3. The materials used by Turkish language teachers in their activities for visual reading skill

Teachers	Textbook	Smart board	Additional visuals brought to classroom	Test books
T1	√	√	√	
T2	√	√		
T3	√	√		√
T4	√	√		
T5	√		√	
T6	√			
T7	√		√	
T8	√			
T9	√		√	
T10	√	√		
Total	10	5	4	1

Table 3 displayed that Turkish language teachers used a wide range of materials in the activities regarding visual reading skill. It is also seen that the basic materials of teachers for visual reading were textbooks. All participating teachers stated that they used visuals in the textbooks. They expressed that they frequently interpreted the visuals related to a text, especially in visual reading studies. One of the teachers (T2) described the studies she fulfilled by textbooks as follows: *"Yes, we conduct visual reading activities but these are the activities in our books. They are our basic materials as they are common. First of all, we interpret the pictures given in texts so that children have predictions about a text before reading it."* It is seen that the most used

material by Turkish language teachers was the smartboard. Using a smartboard, T2 described what she did during in-class studies as follows: *"We all use social media… I save any type of image I see there on my phone and have my students watch them on a smartboard at school."* T4 expressed that she mostly used online education portals as follows: *"We use Eba, our education portal. There are also Okulistik, Morpa Kampüs. We use visuals there in our lessons."* It was determined that teachers brought additional visuals to lessons in order to attract the attention of students. Of the teachers bringing additional visuals to lessons, T5 described the materials she used in classroom: *"In creative writing lessons, I ask them to write a caricature or only a visual and write an article based on it."* In addition, it was seen that test books were used in visual reading activities.

The results obtained regarding the reasons for Turkish language teachers to choose these materials during in-class activities for visual reading are demonstrated in Table 4.

Table 4. The reasons for Turkish language teachers to choose the materials they use in visual reading activities

Materials	Reasons	Teachers	f
Textbook	Availability of textbooks	T2, T4, T5, T9, T10	5
	Lack of different materials	T1, T6, T8	3
	Preparation for exams	T7	1
	Being more effective on children	T8	1
Smartboard	Providing the opportunity to find visuals for a text	T1	1
	Availability of visuals for children's interest	T2	1
	Children like studies done on the smart board more	T3	1
	Providing the opportunity to use online portals	T4	1
	Presence of various visual reading questions for exams	T10	1
Additional visuals brought to classroom	Enriching studies on a subject	T5, T9	2
	Attracting students' attention	T1	1
	Cooperation with other disciplines	T7	1
Test books	Activities related to exams	T3	1

The reasons for Turkish language teachers to choose textbooks for visual reading studies may be categorized as follows: teachers have textbooks, these books prepare for exams, they are more effective on children and there is no material other than textbooks. In particular, most of the teachers stated that they used textbooks as they already had them and there was not any other material in this field. In this respect, T6 stated her thoughts as follows: *"There is no material that I have prepared. There is no material prepared by any of the teachers in my group on this subject at school. Unfortunately, most of us take the easy way out and chooses what is already prepared. We carry out as much evaluation as there are visual readings in the books provided to us by the National Education, so it cannot be said that we have made much choice."* The reasons for Turkish language teachers, who choose a smartboard in visual reading skills activities, are categorized under five themes. These are as follows: the opportunity provided by teachers to find visuals for a text, the visuals for children's interest, children like studies done on a smartboard more, providing the opportunity to use online portals and presence of various visual reading questions for exams. For example, T1 stated: *"Since visual reading has emerged more recently, it has been emphasized more, and various materials are not available. But I can think like this; any image, even the view we go out and show the students, can be enough for visual reading. In other words, visual reading material can be found anywhere, in any form. We use materials related to interpreting images related to any topic or text, for this we use books and often use the smart board. Other than that, we don't have many varieties in terms of material."* Other teacher T3 said: *"We use the smart board because children like technology, they like the activities done on the smart board more, but it is not as efficient as looking on paper."* The reasons for teachers bringing additional visuals to classroom for visual reading studies are as follows: enriching any subject discussed, attracting students' attention and cooperation with other disciplines. T7 expressed that they made cooperation especially in visual reading course. He said: *"We prepare children for the exam based on the activities given in the textbooks about visual reading. We warn and guide children on how to carefully follow the visual, graphic or table. In addition, we can get help in the visual arts class to make comments on the pictures, children can be guided in that way to make comments."* It is also seen that test books were preferred as they provided activities related to exams. When examining these reasons, it can be argued that the exam anxiety of teachers is an important reason in the selection of materials even in visual reading studies.

The results on how often Turkish language teachers use studies on visual reading skills in their lessons are demonstrated in Table 5.

Table 5. The frequency of Turkish language teachers using activities for visual reading in-classroom activities

Frequency of using in courses	Teachers	f
When I see in a textbook	T1, T3, T6, T7, T8, T9, T10	7
While solving questions for an exam every week	T3, T4, T10	3
I use in every lesson	T2	1
In writing exercises once a week	T5	1

Table 5 showed that a significant number of Turkish teachers used visual reading studies in classroom only when they saw them in a textbook. In this regard, the frequency of visual reading activities in textbooks determines the frequency of teachers' using visual reading studies in lessons. For example, T1 stated: *"For us, there are definitely visuals in the text of every lesson for Turkish. I have those texts interpreted before the student reads the text beforehand. In other words, we definitely work on visual reading for one or two hours a week. In this visual work, I often include these works, asking what is the relationship between the text and the title of the text."* T6 answered similarly: *"The more often it is included in the National Education books, the more we place it, I think it is beneficial."* Some teachers stated that when they solved questions for an exam every week, they also solved questions about visual reading. For this, T3 expressed: *"There are also visual reading activities in the books sent to us by the National Education, but not too many. One hour a week, I have the children solve tests. I include as many visual reading activities as possible there, and I think it increases the attention of children since they are exam-oriented and visual reading questions are also asked. But in general, we prepare students in accordance with the examination system in accordance with the system."* One of teachers carried out visual reading activities once a week in writing studies. However, one teacher stated that she always used visual reading activities in her lessons.

The results of the Turkish language teachers' opinions about the benefits students have when they use visual reading studies in classroom are provided in Table 6.

Table 6. The benefits students have when Turkish language teachers' use visual reading activities in classrooms

Benefits provided	Teachers	f
Developing interpretation skills	T1, T2, T6, T7, T8, T9, T10	7
Developing problem-solving skills	T3, T4	2
Developing creativity of students	T5	1
Developing higher-order thinking skills	T9	1
Attention increase	T3	1
Developing relationship establishment skills	T9	1

When examining Table 6, the Turkish language teachers thought that the most important benefit of their using visual reading activities in classrooms regarding students was the development in interpretation skill of students. T9 stated how visual reading activities developed the interpretation skill of students by the following sentences: *"They try to describe what is on a visual. We emphasize that we all see a visual but when we look at that visual we all think something different and try to find it. By doing so, children try to remember what they have learned before, try to interpret them, try to combine parts related to the things they see and reach a whole, thus their interpretation skill develops."* It is considered that performance of visual reading activities in a classroom develops students' visual reading-based problem-solving skills. As there are questions related to visual reading in exams, students are required to solve such questions in lessons. Therefore, they stated that this contributed to students when solving questions. T3 expressed the followings on this: *"I have students take tests one hour a day in a week. I use visual reading activities as much as possible, and I consider that they can solve visual reading questions more easily because children are exam-oriented."* Some Turkish language teachers considered that visual reading activities developed students' creativity, relationship establishment and higher-order thinking skills, and increased their attention.

The results of Turkish language teachers' views regarding using visual reading activities at all grade levels and implementing different activities between classes, whether there is any difference in terms of grade levels in the effectiveness of activities are summarized in Table 7.

Table 7. The performance of Turkish teachers to do visual reading activities in line with grade levels

Teachers	Using at all grade levels	Doing different activities between classes	The effect of grade levels on the effectiveness of activities
T1	√	√	√
T2	√	√	√
T3	√	√	√
T4	√		√
T5	√	√	√
T6	√	√	√
T7	√	√	√
T8	√	√	√
T9	√	√	√
T10	√	√	√

Table 7 showed that all Turkish language teachers used the activities related to visual reading activities at all grade levels (5th, 6th, 7th, 8th grades). When they were asked to do different activities between classes, all teachers excluding one stated that they carried out visual reading activities in line with grade levels. T1 expressed that she used different visuals in different grade levels as follows: *"It is necessary to apply different activities according to grade levels. Because levels are not same, in this case, we do different activities."* T2 stated that *"Activities are same, but I try to choose visuals which are a little more understandable for the fifth-grade students and a little more abstract for the eighth-grade students in accordance with their levels."* On the other hand, T4 indicated why she did not conduct different activities in different grades: *"The levels of grades are almost same."*

Turkish language teachers stated that there was a significant difference in terms of grade levels in the effectiveness of the activities on visual reading skills. T3 explained the effectiveness of activities in different grade levels: *"A child in the fifth grade cannot perceive much, does not know what to do, she comes and asks. She goes and then asks again. It is more difficult, when they group, it becomes easier."*

T2 specified the important role of the ability to read and imagine as a reason for the difference above-mentioned: *"Older students understand better, if they want to understand. If reading and imagining skills are advanced, I notice that they understand visuals better."*

The views of Turkish language teachers about their students' problems with visual reading and the reasons for these problems are shown in Table 8.

Table 8. The problems students have regarding visual reading skill and the reasons for these problems according to Turkish language teachers

Problems	Reasons	Teachers	f
Yes, have problems	Attention Deficit	T7, T10	2
	No reading habit	T1, T2	2
	Academic failure	T3, T6	2
	Nonthinking desire	T9	1
	Difficulty in interpretation	T7	1
	Insufficient vocabulary	T1	1
	Inadequate primary education	T6	1
	Insufficiency of the tools used	T10	1
	Socio-economic status	T6	1
	Age	T3	1
Have problems partially	Difficulty of understanding	T4	1
	Lack of perception	T8	1
No, do not have any problem		T5	1

When examining Table 8, most of the Turkish language teachers stated that students had difficulties in visual reading activities. The reasons for the problems were gathered under nine titles. Attention deficit, no reading habit and academic failure are the most faced ones of these problems. Emphasizing especially no reading habit of students, T2 indicated why students had difficulty in reading by the following sentences: *"They sometimes could not even express what they see. I see that they have difficulties even with very simple visuals. The mind of a student not reading does not work. Everything we read is received by our*

brains as a raw material. That raw material works that machine we call brain. I always mention about this to children. You will provide it with material, and it will process. When children do not read a book, they cannot imagine it. I say them that When you make a description, imagine it in your mind. As a student not reading cannot do this, naturally s/he cannot see any detail in a visual or cannot understand what is aimed to be given." Other reasons for these problems are as follows: students' desire for nonthinking, difficulty in interpretation, insufficient vocabulary, inadequate primary education, insufficiency of the tools used, socio-economic status of students and their ages. For example, T1 expressed her views as follows by emphasizing insufficient vocabulary: *"Vocabulary is of paramount importance in understanding what you see. When I ask, what do you see here on a visual picture or what does it evoke, children can use one word or two at the most."* Mentioning about inadequate primary education, T6 shared her thoughts: *"The primary school teachers are very effective on our students graduated from primary school. You must fill the gap of the inadequate students in secondary school."*

Two Turkish language teachers stated that students had problems partially in visual reading activities, which was resulted in their difficulty in understanding and lack of perception. Only one teacher stated that her students had no problems with visual reading activities.

The results of visual reading activities with which students have problems most according to Turkish language teachers are shown in Table 9.

Table 9. The visual reading activities with which students have problems most according to Turkish language teachers

Visual reading activity	Teachers	f
Reading a graphic	T1, T2, T3, T4, T7, T8, T10	7
Interpreting the visuals of a text	T1, T9	2
Caricature	T5, T6	2

Table 8 indicated that students had the most difficulty with reading a graphic among visual reading activity according to Turkish language teachers. T2 stated this about it: *"I think they have a hard time with graphs, maybe there is a bias because they consider it more of a Mathematics subject. Or there may be a lack of interpretation, they may think that it is not necessary because they do not encounter such things in their daily lives. Maybe they will understand better if they have to try harder."* T7, one of the teachers who emphasized graphic reading, also said: *"They have more difficulty with graphics that require very detailed information because they have to put them in a certain order and say them in sentences. It wants to understand the meaning of the sentence, that is, at the point of the sentence. Being able to put the given information into a sentence, to be able to approve it in the sentence, for example, when we look at a graphic or table question, the way of putting it into a sentence sometimes the child cannot impose this in his own mind. In other words, it is a very good feature to be able to put that graphic into a sentence to reflect it well, actually, this is a goal we want, but sometimes they can't do it."* It is also observed that there were teachers thinking that students had difficulty in interpreting the visuals of a text and cartoons. Expressing the difficulty experienced while interpreting the visuals of a text, T9 said: *"When students look at the picture, they try to say what they see in the picture. However, in visual reading, one has to establish a relationship between what he sees in that picture and reach a conclusion. That's what they do all the time, we have to warn about it. The reason for this is a chronic reason anyway, they don't want to think about it. This is difficult for them. They choose the easy one."* T5, one of the teachers who expressed the cartoons, also stated the following: *"If it is a very difficult cartoon, eighth graders may not be able to understand this meaning. If there is such an extreme, metaphorical meaning, they may not be able to make much sense, but they are generally students with a low academic level anyway."*

The types of tools used by Turkish language teachers for visual reading in assessment and evaluation activities during and at the end of the term are provided in Table 10.

Table 10. Tools used by Turkish teachers in assessment and evaluation process of visual reading

Teachers	Assessment and Evaluation Tools					
	Open-ended questions	Multiple-Choice	Oral exam	Activity papers	Post theme questions	Writing a composition
T1		√		√		
T2	√					√
T3		√				
T4	√		√			
T5	√	√				√
T6	√	√				
T7		√			√	
T8	√	√				
T9	√	√				√
T10	√					
Total	7	7	1	1	1	3

Table 10 showed that all Turkish language teachers carried out activities regarding visual reading in assessment and evaluation process. It is observed that teachers mostly preferred open-ended questions and multiple-choice exams to assess students' visual reading skills. It was identified that teachers assessed visual reading skills of students by urging them to write compositions over visuals. There were also teachers who used oral exams, activity papers and only post-theme assessment questions to evaluate students' visual reading skills. It was concluded that while two teachers used three different tools when assessing visual reading skill, six teachers utilized two different tools in this process. Remaining teachers were observed to have used only one type of assessment and evaluation tool. Using three different types of tools in assessment and evaluation process, T9 described his tools as follows: *"We mostly use multiple-choice assessment tools. There are always questions based on visuals in these tools. We also hold classical exams. We have compositions, we definitely ask them to write a composition based on a visual. Children don't consider a graphic and painting as a visual. They perceive it as a mathematics question, and think about why it is used in a Turkish language lesson. They have more difficulties when giving a visual and they are asked which may be removed, which cannot be removed in establishing a relationship, what can be said, what cannot be said."* Using two different tools, T1 described what she did in assessment process: *"In our test questions, there are generally tables or caricatures. We ask at least one or two questions on what is described in a caricature. In addition, we frequently distribute study papers. Especially in new generation questions, there is a lot of visual reading. We frequently try to raise awareness of children with study papers."*

The status and reasons to what extent Turkish language teachers find the visual reading activities in Turkish language textbooks sufficient are demonstrated in Table 11.

Table 11. The status and reasons to what extent Turkish language teachers find the visual reading activities in Turkish language textbooks sufficient

Status of finding sufficient	Reasons	Teachers	f
Sufficient	Sufficient number of activities	T1, T10	2
Partially sufficient	Sufficient in number but insufficient in terms of quality	T6, T8	2
	Good in quality but insufficient in number	T2	1
Insufficient	Not insufficient activity	T3, T7	2
	Activities are not proper for children's level	T4, T9	2

It is seen in Table 11 that the Turkish language teachers generally found the visual reading activities in Turkish language textbooks insufficient or partially sufficient. Only two teachers considered textbooks sufficient. The reasons for those finding the textbooks insufficient were categorized under two main titles: insufficient activities and activities are not proper for children's level. The teachers, who found them partially sufficient, considered activities in textbooks sufficient in number but insufficient in terms of quality. On the other hand, it was concluded that some of the teachers, finding textbooks partially sufficient, assessed the activities in books sufficient in terms of quality and insufficient in terms of number. It is seen that those, find textbooks sufficient, assessed them only in terms of number. Finding the activities in the textbooks sufficient in terms of quality and insufficient regarding number, T2 emphasized that recent books were more quality compared to previous textbooks: *"There are good things now, there were a few caricatures drawn without much control years ago. Naturally, everything given should be in*

accordance with children's level, level of knowledge and level of morality. Those problems are not seen this year, but there are not many visual reading activities. Is it sufficient? No. There should be a little more, by the way, they should provide us with training." Another important point in T2's statement is the fact that teachers need training on this issue. Drawing attention to level problem, T4 expressed her thoughts as follows: *"The visuals in the books are not proper for children's age levels, but address to lower age groups. A small visual is given at the beginning of a text, visuals are definitely not enough. The visuals are unfortunately far below the level. The books other fifth grade ones need much criticism."*

The differences between visual reading and reading a written text according to Turkish language teachers, and the results regarding the effects of these differences on their choices are shown in Table 12.

Table 12. The differences between reading a visual and reading a written text according to Turkish teachers, and the effects of these differences on their choices

Differences	Effect on choices			
	Yes, effective		Partially effective	
	Visual	Written	Visual	Written
Visual reading is funnier	T1			
Written text gives more freedom to imagination		T2		
A ready text is read in a written text while a visual text requires attention and thinking	T9		T3	
Visual reading offers the opportunity to interpret without knowledge	T4			
Visual text is more attention-grabbing while written text requires reading one by one, which is boring.	T5			
Visual text conveys a message more quickly and effectively	T6			
While a visual is described, it is actually transformed into a written text			T7	
Visual reading is easier, reading written text is based on reading and comprehension	T8			
While a visual makes a written text easier to understand, it becomes difficult to understand a visual without a written text.		T10		

As it is seen in Table 12, the Turkish language teachers considered that there were various differences between reading a visual and reading a written text. While most of the teachers had a positive view on reading a visual, only two teachers expressed positive views on reading a written text. Teachers stated that reading a visual was more funny, remarkable, effective, easy, provides the opportunity to make an interpretation without knowledge, and gives related message in a short time compared to a written text. However, they indicated that reading a written text was a process, which was more boring, time-consuming, based on reading and understanding a ready text. They expressed that these were effective in their selection of texts based on visual reading in classes. T6 stated that s/he considered the visual reading more effective: *"While you can give a same message with too long paragraphs by a written text, you can fulfil this much shorter and much more effective in visual reading."* On the other hand, the teachers, who reported positive views for a written text, expressed that a written text was more effective in developing students' imagination compared to a visual, and it was difficult to understand a visual without a written text. In this respect, T2 shared his/her thoughts as follows: *"In visual reading, I think visuals try to impose something directly on me without allowing imagine it. However, when I read something, I am free to imagine. I have all control. If there is a visual, I can't add much to it, because it's there. You are free while reading a book, something is said and described that is right, but I can add whatever I want to it."*

In the classroom activities, it is seen that teachers' views about a visual and written text affect their choices. When examining Table 11, most of teachers preferred visual texts. Only two teachers preferred written texts.

The results about whether there is a relationship between developing technology and visual reading according to Turkish language teachers are provided in Table 13.

Table 13. The relationship between developing technology and visual reading according to Turkish language teachers

Relationship status		Teachers	f
Presence of Relationship	Technology and visual reading are integrated	T1, T2, T6, T8	4
	Visual reading is in a parallel development with technology	T4, T7, T10	3
	Students are more curious about visuals. They access easily by technology	T3, T5	2
No Relationship	Students do not use technology and visual reading in association with each other.	T9	1

When examining Table 13, most of the teachers considered that there was a relationship between rapidly developing technology and visual reading. While four teachers evaluated technology and visual reading integrated, three teachers argued that technology and visual reading developed in parallel. Two teachers stated that students were more curious about visuals and technology provided them with these visuals. T1 indicated how students' curiosity was combined with their desire to see, and

technological devices were their most important assistants at this stage by the following thoughts: *"The smartboard is our most important assistant regarding visual reading. We can reach almost everything. Students are curious, they say I will find it immediately on smartboard, I will show it, my teacher, let's open it, let's see it alive, they like it."* Teachers considered that students were more successful in visual reading, as they were more accustomed to technology. For example, T4 expressed his/her positive view on this subject as follows: *"They influence each other positively, the speed of children in visual reading has increased with technology. They are better than us, now they are superior than us. I have been working as a teacher for twenty-four years. When compared to us, children interpret visuals better, they can perceive them very well."* On the other hand, T3 argued that although there was a strong relationship between technology and visual reading, this does not contribute students in cognitive respect: *"Particularly, phone means internet for children. Naturally, they look at visuals rather than text. They almost never use text. There is a strong relationship between technology and visual reading, but this does not develop them. They can't, because technological era refers somewhat to speed, they only slide visuals. As they only look at a certain point, they cannot interpret that visual either."* Only one teacher indicated that there was no relationship between technology and visual reading. T9 stated this as follows: *"Everything based on thinking is too difficult for children. They do not use the developing technology in order to associate it with visual reading anyway."*

The results regarding the contribution of visual reading to lessons according to the teachers are shown in Table 14.

Table 14. The contributions of visual reading to lessons according to Turkish language teachers

Contributions	Teachers	f
Removing boredom	T1, T3, T5, T8	4
Allows students to focus on lessons	T3, T4, T8	3
Develops students' thinking skills	T5, T7, T9	3
Enrich lessons	T1, T6	2
Enabling students to become active	T1, T8	2
Allow students to view a subject from different angles	T5, T10	2
Develops interpretation power of students	T1, T9	2
Develops imagination power of students	T2	1
Enriching lessons	T2	1

Table 14 presented the views of Turkish language teachers on the contributions of visual reading activities to lessons are generally collected under nine categories. There was an agreement that visual reading activities removed boredom in lessons, allow students to focus on lessons and develop their thinking skills. It was seen that T1 evaluated the contributions of visual reading activities to lessons in several respects: *"In the past, teachers would go to board and lecture verbally, we would be bored. Now, I think at least this boringness has been eliminated. Students were bored with verbal speaking, now, we have enriched Turkish lessons more with visual readings, we have made Turkish lessons funnier. We enable students to spend time in lessons in a funnier way."* Teachers also stated that visual reading activities enriched lessons, enabled students to become active, allowed students to view a subject from different angles and developed their interpretation power. It was also identified that there were teachers thinking that visual reading activities developed imagination and expression skills of students.

CONCLUSION AND DISCUSSION

The study was conducted to identify the views of the Turkish language teachers regarding visual reading skill. Included in the curriculum for the first time in 2005 in Turkey, visual reading skill is a skill area that was delayed and neglected. However, rapid development in technology and visual elements encountered by children growing up with technology is increasing the significance of visual reading. For this reason, the views of Turkish language teachers on visual reading and the activities conducted by them on this skill are of importance. The conclusions of this study are expected to contribute teacher training process, in-service training for teachers and especially in-classroom activities of Turkish teachers, who play an important role in enabling students to acquire this skill properly.

There are achievements regarding visual reading among the achievements for four basic language skills in the Turkish language curriculum. Therefore, it is expected to carry out visual reading activities in Turkish language lessons. Based on this, it was aimed that the connotations of Turkish language teachers were identified towards the concept of visual reading. It is considered that a concept that is not clearly formed in the mind will cause problems in practice. It concluded that the connotations of teachers regarding the term of visual reading are to interpret something seen, to understand and express visual reading questions. It determined that they used actions, such as interpretation, comprehension, expression, explanation and concretization for the concept of visual reading. In this respect, the connotations of teachers regarding the term visual reading may be interpreted as very limited. As they did not receive any education on this skill, this may be ranked as an effective factor for their low awareness regarding the term of visual reading. One more significant point is the fact that visual reading has

associated with only exam questions for some of the teachers. This may be based on the fact that some teachers perceived visual reading only as a study area for exams. The continuous emphasis of the teachers in interviews shows that the skill perceived as a question type that should only be fulfilled in order to be successful in exams. It is a significant question mark to what extent the visual reading activities performed for exams may be effective in gaining this skill.

It was found that Turkish language teachers mostly conducted visual activities based on the visuals in textbooks. Teachers also used smartboards and additional visuals they brought to classrooms. One teacher identified to use test books during in-classroom activities. The reasons for choosing to use textbooks is they already provided to teachers. However, there are also teachers stating that they preferred textbooks, as there was no various material on this subject. This is a significant conclusion. Yet, there are many different materials on visual reading (Sarıkaya, 2017). This may be interpreted that insufficient knowledge of teachers on this issue caused teachers to complain about lack of material. When examining the literature in this respect, Ateş, Sur and Çelik (2020) reported that Turkish language teachers mostly used textbooks in visual reading activities. In addition, it is also a significant conclusion obtained in our study that only half of the Turkish language teachers benefit from a smartboard. Teachers is expected to use smart boards more in visual reading activities especially today, when students encounter more visuals due to technology. However, the conclusion on the use of smart boards at low levels by teachers can be interpreted as teachers could not keep up with technological developments to an adequate extent.

It was concluded that a significant number of Turkish language teachers used only textbooks in visual reading activities in classrooms. This is a parallel conclusion with the result that teachers stated that they used mostly textbooks in visual reading studies. It determined that some of the teachers carried out visual reading activities every week while solving questions, while one teacher performed visual reading activities in writing activities once a week. Only one teacher identified to teach lesson and to conduct visual reading activities. Kuru (2008) reported that most of the 5th-grade teachers asked students to interpret visuals in textbooks in visual reading activities. Kuru also added that most of the teachers consider that they do a sufficient number of activities in classrooms.

It was concluded that it was mostly agreed on the fact that the visual reading studies done in the classroom develop students' particularly interpretation skill. Teachers also considered that these activities develop students' question-solving skills, creativity, higher-order thinking skills, relationship establishment skills, and increase their attention. In this regard, Güneş (2007) emphasizes that visual reading develops especially thinking, understanding, learning. Akpınar (2009, p. 47) argues that teachers considered that the visual reading activities develop students' higher-order thinking and creative thinking skills, and adds that the visuals restrict learning by inactivating senses, weaken vocabulary and reduce text-based reading. There was also a teacher in the current study stating that making visual reading instead of a written text weakens students' imagination skill.

It achieved that all Turkish language teachers conducted visual reading activities at all grade levels. It determined that all other teachers except one teacher perform different activities between grades. All teachers considered that grade levels have an effect in the effectiveness of visual reading activities.

The Turkish language teachers expressed that there are students who have problems in visual reading activities. It was specified that students have problems especially due to attention deficit, no reading habit and academic failure. In addition to these, students' desire for nonthinking, difficulty in interpretation, insufficient vocabulary, inadequate primary education, socio-economic status, ages, difficulty in understanding and lack of perception are ranked other problems students have. Moreover, insufficiency of the tools used in classrooms causes students to have problems. Ateş, Sur and Çelik (2020) reported that teachers have problems in visual reading activities as students do not read much book, their inadequate verbal expression skills and insufficient course materials. It was concluded in this study that students have problems due to similar reasons. Only one teacher stated that the students do not have any problem.

Most of the Turkish teachers stated that students have problems most in reading graphics. Durgun and Önder (2019) found out that a significant number of students received zero point in the exam of sciences. In his study on the problems of 7th-grade students while reading visuals, Kranda and Akpınar (2020) urges that students have problems as they find graphics complex, difficult and boring. In addition to reading graphics, there are also teachers indicating that students have problems in reading text visuals and caricatures.

It was observed that most of the Turkish language teachers prefer open-ended questions and multiple-choice exams to assess students' visual reading skills. There were also teachers preferring to make assessment by compositions. It was achieved that there are teachers performing assessment and evaluation by oral exams, study papers and post-theme questions. It is a significant conclusion that although teachers did not use various and a lot of materials regarding visual reading during classes, have not received education on visual reading and find themselves insufficient in this respect, they always ask questions about visual reading. in assessment and evaluation process. This may be interpreted that teachers prepare exams mostly in accordance with the exams students will take in transition to high school. The Turkish language teachers have generally found the textbooks they use in lessons insufficient or partially sufficient. Only two teachers have been identified to evaluate the activities in textbooks sufficient. Teachers consider that activities are insufficient in terms of both quality and number. In a similar vein, Ateş, Sur and Çelik (2020) reported that most of the Turkish language teachers find the visual reading activities in textbooks insufficient. In the study carried out by Balun (2008) with 550 classroom teachers, it has been found out that teachers evaluate the activities in textbooks insufficient. Based on these issues, it can be urged that the visual reading activities in the textbooks do not have desired quality, although more than ten years have passed. In addition, this shows that while Turkish textbooks have

focused on the activities for reading a written text, visual reading activities have been neglected. However, it has become an important necessity for children, who are exposed to visuals at any time in their lives, to be competent in this issue. For this reason, it can be argued that it has become compulsory to include activities of visual texts as much as written texts in reading activities. Other significant point is the fact that although teachers find books insufficient in terms of visual reading activities, their tendency to use a different material in their lessons is quite low. This may be interpreted that although teachers are aware of a lacking issue, they could not leave their habits.

It was concluded that the visual reading activities remove boredom in lessons, allow students to focus on lessons and develop their thinking skills according to the Turkish language teachers. In addition to these, it has been found out that these activities enriched lessons, enabled students to become active, allowed students to view a subject from different angles and developed their interpretation and imagination power.

Turkish teachers evaluate reading a visual as funnier, easier, more effective and attractive compared to reading a written text. However, some teachers have stated that a written text provides students with more imagination opportunity compared to a visual text. On the other hand, some teachers have evaluated a written text as a readily provided reading exercise that does not require the effort of students. The Turkish language teachers have been generally found to have more positive views on visual reading. This leads them to prefer visuals more during in-classroom activities.

New technological tools enter people's lives and change many things each passing day. In order to adapt this change, visual literacy is needed as well as oral literacy (Balun, 2008, p. 43). In this respect, it is needed to read and comprehend a visual with every new technological tool. In this study, most of the Turkish teachers consider that there is a general relationship between developing technology and visual reading. They have stated that technology and visual reading are developing in parallel, they are integrated and they can provide access to visuals by technological tools as students are more curious about visuals. Only one teacher has expressed that there is no relationship between technology and visual reading. However, it is considered an important finding that some teachers stated that although there is a relationship between technology and visual reading, this does not improve the visual reading skills of students, on the contrary, it even regresses their thinking skills.

RECOMMENDATIONS

As visuals are seen more with technology every passing day, the importance of visual reading skill is increasing at schools. This skill is drawn attention when students encounter more visuals in distance education in the period of COVID-19 pandemics. For this reason, it should be emphasized on visual reading in all curricula.

Visual reading has been first included in curricula in 2005. The reflection of this has been observed later on undergraduate programs. It is seen that there are still no direct courses for visual reading in many teacher training programs, but they are included in reading education or as an elective course. In this regard, the courses directly addressing visual reading should be included in undergraduate programs in order to train more developed teachers in this respect. In addition, illustrated children's books are getting widespread nowadays. Accordingly, an elective course, such as illustrated children's books, can be included in undergraduate programs.

It has been identified during interviews that teachers considered themselves inadequate in this respect and need training on this subject. Therefore, teachers should be given the training they need by in-service courses and various training to be organized by the Ministry of National Education. It has been also found out that teachers do not properly use technological tools, such as smart boards in visual reading activities. However, it is necessary to benefit from technology as much as possible while providing education to today's children who grow up with technology. To this end, teachers should be given various practical training and seminars regarding the technological tools they can use in training-education environments.

Teachers should spend more time on visual reading activities in their lessons and allow students to acquire this skill in the most accurate way with purposeful activities.

Students should be provided with the opportunity to read a visual from different perspectives by including interdisciplinary activities in visual reading studies in lessons by teachers.

Children encounter visuals at every stage of their lives. For this reason, in order to raise the awareness of particularly families in this respect, various public service announcements, training programs and applications should be prepared under the leadership of the Ministry of National Education. These programs and applications should be published on social media tools and television channels that families may watch and follow.

Declaration of Conflicting Interests

Funding

Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The authors formed the research idea together. The first author took part in the literature review, data collection, data analysis, data interpretation and reporting. The second author took part in the collection of data and data analysis.

Ethics Committee Approval Information

An ethics committee approval has been obtained from Trabzon University, Social Sciences and Humanities Research and Ethics Committee on 12.06.2020 and under protocol number: 81614018-000-E.187 regarding this research.

REFERENCES

Akpınar, B. (2009). An evaluation of visual reading and presentation learning domain in Turkish language curriculum in the 1st-5th years of primary school. *Education and Science*, 34(154), 37-49.

Akyol, H. (2009). Görsel okuma (Visual Reading). A. Kırkkılıç & H. Akyol (Ed), in *İlköğretimde Türkçe Öğretimi* (*Teaching Turkish Language in the Middle School*), (p.165- 195). Ankara: Pegem. Akademi.

Aslan, H. (2015). Tarih öğretmenlerinin görsel kullanma durumları ve bunun lise öğrencilerinin görsel okuma becerilerine yansıması (Yayımlanmamış Doktora Tezi), [Status of history teacher's visual usage and its reflection on high school students' visual reading skills (Unpublished doctoral thesis)]. Atatürk Üniversitesi, Eğitim Bilimleri Enstitüsü, Erzurum.

Ateş, M., Sur, E., & Çelik, H. (2020). Evaluation of Turkish teachers' views on visual readings. Journal of Education, Theory and Practical Research, 6(1), 1-15. doi:10.38089/ekuad.2020.0

Balun, H. (2008). İlköğretim I. kademede uygulanan görsel okuma ve görsel sunu öğrenme alanının Türkçe öğretiminde kazanımlara ulaşmadaki etkililiği (Bingöl-Elazığ-Diyarbakır örneği) (Yayımlanmamış Yüksek Lisans Tezi) [The efficiency of visual reading and visual presentation learning field which is applied on the grades 1-5 in primary education in reaching the attainments of Turkish language instruction (Unpublished master thesis)]. Fırat Üniversitesi, Sosyal Bilimler Enstitüsü, Elâzığ.

Bozkurt, E. (2011). İlköğretim 1. sınıf Türkçe ders programı görsel okuma-görsel sunu kazanımlarının ve ilk okuma yazma öğretiminde kullanılan görsellerin etkililiğinin incelenmesi (Yayımlanmamış Yüksek Lisans Tezi) [Examination of achievements gained through visual reading-visual presentation of first grade Turkish lessons at primary schools and the efficiency of visual aids used in teaching basic reading and writing (Unpublished master thesis)]. Fırat Üniversitesi, Eğitim Bilimleri Enstitüsü, Elâzığ.

Bozkurt, E., & Ulucan, M. (2014). Examining visual reading-visual presentation achievements in the program of primary education 1st class Turkish lessons. *Turkish Journal of Educational Studies*, 1(2), 22-60.

Brugar, K. A. (2017). "We don't have students colour maps anymore ..." a survey of social studies teachers use of visiual materials. *Journal of Visual Literacy*, 36 (3-4), 142-163. doi.org/10.1080/1051144X.2017.1397380

Burns, M. (2006). A thousand words: Promoting teachers' visual literacy skills. *Multimedia & Internet @ Schools,* 13 (1), 16–20.

Creswell, J. W. (2017). Eğitim araştırmaları (Educational research). İstanbul: Edam.

Creswell, J.W. (2018). Nitel araştırma yöntemleri-beş yaklaşıma göre nitel araştırma ve araştırma deseni (Qualitative inquiry and research design: choosing among five approaches) (3. baskı), (M. Bütün & S. B. Demir Çev. Ed.). Ankara: Siyasal.

Çepni, S. (2012). Araştırma ve proje çalışmalarına giriş (Introduction to research and project work). Trabzon: Celepler.

Debes, J. L. (1969). The loom of visual literacy. *Audiovisual Instruction,* 14(8), 25-27.

Durgun, E., & Önder, İ. (2019). The relationship between the science achievement of secondary school seventh grade students and reading comprehension, graph reading, problem Solving Skills. *Journal of Individual Differences in Education*, 1(1), 1-13.

Ekiz, D. (2017). Bilimsel araştırma yöntemleri (Scientific research methods). Ankara: Anı.

Felten, P. (2008). Visual literacy. Change: The Magazine of Higher Learning, 40(6), 60-64.

Güldaş, G. (2012). İlköğretim birinci sınıf Türkçe kitaplarındaki görsel okuma etkinlikleri ile ilgili öğretmen görüşleri (Yayımlanmamış Yüksek Lisans Tezi) [Teacher opinions about visual reading activities in the Turkish books of teh first class students in primary school (Unpublished Master Thesis)]. Uşak Üniversitesi, Sosyal Bilimler Enstitüsü, Uşak.

Güneş, F. (2007). Türkçe öğretimi ve zihinsel yapılandırma (Turkish language teaching and mental structuring). Ankara: Nobel.

Kaya, M. F. (2011). Geography teachers' views and practices for development of visual literacy skills on students. *Turkish Studies-International Periodical For The Languages, Literature and History of Turkish or Turkic*, 6(2), 631-644.

Kırbaş, A., Orhan, S., & Topal, Y. (2012). Teachers views moving visual elements in elementary Turkish a critical look at textbooks. Turkish Studies, 7(4), 2225-2235. doi:http://dx.doi.org/10.7827/TurkishStudies.3804

Kranda, S., & Akpınar, M. (2020). Students' views about difficulties they are experienced with in graphic reading and drawing. *Hacettepe University Journal of Education*, 35(2), 415-427. doi: 10.16986/HUJE.2019050634

Kuru, A. (2008). İlköğretim beşinci sınıf Türkçe dersi öğretim programında yer alan görsel okuma ve görsel sunu becerilerinin öğretmen görüşleri doğrultusunda incelenmesi (Yayımlanmamış Yüksek Lisans Tezi) [An investigation of visual reading and visual presentation skills of the elementary school fifth grade Turkish course program in the light of teachers point of views (Unpublished master thesis)]. Çukurova Üniversitesi, Sosyal Bilimler Enstitüsü, Adana.

Ministry of National Education, (2005). İlköğretim Türkçe dersi öğretim programı ve kılavuzu (1-5. sınıflar) (Primary education Turkish lesson curriculum and guide (Grades 1-5)). Ankara: MEB.

Ministry of National Education, (2019). Türkçe dersi öğretim programı (İlkokul ve ortaokul 1, 2, 3, 4, 5, 6, 7 ve 8. sınıflar) (Turkish language lesson curriculum (Primary and secondary school grades 1, 2, 3, 4, 5, 6, 7 and 8.)). Ankara: MEB.

Merriam, S. B. (2018). Nitel araştırma: desen ve uygulama için bir rehber (Qualitative research: a guide to design and implementation), (3. baskı), (S. Turan Çev. Ed.). Ankara: Nobel.

Sarıkaya, B. (2017). Visual **r**eading in Turkish teaching. *Journal of Social Sciences of Mus Alparslan University*, 5(3), 779-796. https://doi.org/10.18506/anemon.298912

Thompson, D. S. (2019). Teaching students to critically read digital images: a visual literacy approach using the DIG method. *Journal of Visual Literacy*, 38(1-2), 110-119. doi: 10.1080/1051144X.2018.1564604

Ünver, Ş., & Genç, A. (2013). The power of visuality: lecturer views on visuality in german language textbooks. *Hacettepe University Journal of Education*, 28(1), 393-404.

Yeh, H. T. (2008). Visual literacy: An investigation of how pre-service teachers interpret and analyze instructional visual materials. Unpublished doctoral dissertation, University of Northern Colorado, Greely, Coloroda, United States.

Yıldırım, A., & Şimşek, H. (2008). Sosyal bilimlerde nitel araştırma yöntemleri (Qualitative research methods in the social sciences). Ankara: Seçkin.

Exploration of Science Teachers' Views About Socioscientific Issues

Fen Bilimleri Öğretmenlerinin Sosyobilimsel Konular Hakkındaki Görüşlerinin Incelenmesi

Türkan Nur Metin[1]**, Dilek Karışan**[2]**, Nilgün Yenice**[3]

Abstract

The aim of this study is to explore the views of inservice science teachers on Socioscientific issues (SSI). The research was carried out by using the phenomenological research, which is one of the qualitative research methods. The participants of the study was formed by using the criterion sampling method, which is one of the purposeful sampling methods. The participants were 6 inservice science teachers working in the western part of Turkey. In present study, the interview form, developed by the researcherswere used as data collection tools. The data obtained from the research were transcribed. Written documents obtained were analyzed mature by content analysis in accordance with the qualitative research philosophy. As a result of the research, it has been observed that science teachers have different ideas about what SSI mean and have difficulties to get out of certain subjects in giving examples to SSI. When the place of SSI in science education was examined, it was found that the science teachers' opinions about the inclusion of SSI in science teaching is positive. It was seen that the participants had difficulty in giving examples to SSI that should not be discussed in the classroom. Suggestions were made in the light of the findings obtained from the present study.

Öz

Bu çalışmanın amacı, fen bilimleri öğretmenlerinin sosyobilimsel konular hakkındaki görüşlerini belirlemektir. Araştırma, nitel araştırma yöntemlerinden olgubilim deseni kullanılarak gerçekleştirilmiştir. Araştırmanın çalışma grubu, amaçsal örnekleme yöntemlerinden ölçüt örnekleme yöntemi kullanılarak oluşturulmuş olup, Türkiye'nin batısında İl Milli Eğitim Müdürlüğü bünyesinde görev yapan 6 Fen Bilimleri öğretmeninin katılımıyla gerçekleştirilmiştir. Araştırmada veri toplama aracı olarak araştırmacılar tarafından oluşturulan ve fen bilimleri alanında uzman iki öğretim üyesinin görüşleri alınarak son hali verilen görüşme formu uygulanmıştır. Araştırmadan elde edilen veriler transkript edilmiştir. Elde edilen yazılı dokümanlar araştırma problemine cevap olacak şekilde nitel araştırma felsefesine uygun olarak içerik analizi ile incelenmiştir. Araştırma sonucunda, fen bilgisi öğretmenlerinin sosyobilimsel konuların ne anlama geldiği konusunda farklı fikirlere sahip olduğu ve sosyobilimsel konulara örnek vermede belli konular dışına çıkmakta zorlandıkları görülmüştür. Öğretmenlerin gözünden sosyobilimsel konuların fen eğitimindeki yeri incelendiğinde ise fen bilgisi öğretmenlerinin sosyobilimsel konuların fen öğretimine dâhil edilmesi konusundaki fikirleri olumlu yönde olduğu tespit edilirken katılımcıların sınıf içerisinde tartışılmaması gereken sosyobilimsel konulara örnek vermekte zorlandıkları görülmüştür. Araştırmadan elde edilen bulgular ışığında önerilerde bulunulmuştur.

[1] **Corresponding Author,** Aydın Adnan Menderes University, Science Institute, Aydın, TÜRKIYE, tnmetin5@gmail.com , https://orcid.org/0000-0002-3753-8790
[2] Aydın Adnan Menderes University, Faculty of Education, Department of Mathematic and Science Education, Aydın, TÜRKIYE, dilekkarisan@gmail.com , https://orcid.org/ 0000-0002-1791-9633

[3] Aydın Adnan Menderes University, Faculty of Education, Department of Mathematic and Science Education, Aydın, TÜRKIYE, nyenice@gmail.com, https://orcid.org/ 0000-0002-7935-3110

INTRODUCTION

1.1 Socıoscıentıfıc Issues

Through the rapid advances in technology and changes in science affect the society and social experiences faster. This change has also led to the emergence of dilemmas about many issues in terms of society. The issues that are considered as controversial issues we encounter as a result of the developments in science and technology and which are considered from different angles by different individuals in the society and of which positive and negative effects are evaluated in multiple ways are generally called socioscientific issues (Sadler, 2004; Topçu, 2015). In other words, socioscientific issues are those which cannot be easily described and ill-structured issues that do not have a single answer enabling the society to have different perspectives on the moral and ethical dimensions as well as the scientific dimension related to the subject. In order for a topic to be regarded as a socioscientific issue, it is not only necessary to include scientific and moral dimensions, but also to include the effects of developments in science and technology on social life. Socioscientific issues involve many dimensions such as science, social and ethical. These issues also play an important role in individuals' development and effective completion of their decision-making process. Such issues help individuals to develop effective discussion skills and to better understand the nature of science concepts such as critical thinking, problem solving, and conscious decision making (Erduran and Aleixandre, 2007).

In the study on socioscientific issues by Zeidler, Sadler, Simmons and Howes, (2005) it is emphasized that these issues may contribute to individuals' ability to think about scientific issues taking into consideration the ethical points. These are among the most popular and interesting issues of the 21st century in that they are mostly current issues, which, by their nature, involve scientific developments closely related to society and are covered in daily life and in education (Atalay and Çaycı, 2017). There are several studies on the socioscientific issues. For instance, Sadler and Zeidler (2004) considered individuals' ability to discuss and analyse socio scietific issues as one of the complementary elements of science literacy. The authors argued that socioscientific issues should be included in science education programs at the levels of secondary and university education. Türkmen, Pekmez and Sağlam (2017) argue that pre-service teachers should learn more socioscientific issues in the courses dealing with the correlations of the science-technology-society context which should employ student-centered methods and techniques provided that they start to learn such issues from basic education. Cebesoy and Dönmez Şahin (2013) examined whether the attitudes of pre-service science teachers on socioscientific issues significantly vary in relation to different variables and concluded that there was no such significant difference. Sezer (2017) compared the self-efficacy and attitudes towards socioscientific issues and self-efficacy towards science among two groups of teachers, namely in-service teachers and those who were not appointed. In the study the data were collected through the ''scale of self-efficacy in science teaching'' and the ''scale of socioscientific attitudes''. It is found that both groups of teachers have similar self-efficacy in regard to socioscientific issues and attitudes towards such issues. Türköz and Öztürk (2020) examined the pre-service science teachers' decisions and their justifications for these decsions concerning some socioscientific issues. They conclude that most of the preservice teachers, although they differ in relation to the subjects, take different dimensions into consideration when making their decisions and try to make decisions by considering the subject in a multi-dimensional holistic manner. Varal and Belge Can (2020) examined the qualifications of pre-service science teachers about the pedagogical content knowledge in the context of socioscientific issues. They conclude that the participants do not have adequate qualifications about the pedagogical content knowledge in terms of "students' comprehension of science" and "teaching strategies". Akbulut and Demir (2020) carried a study on a sample of science teachers to analyse their views on the methods and techniques used to teach socioscientific issues and on the effective teaching of these issues. The authors found that the most frequently used method is class discussions in the teaching of socioscientific issues and that the number of socioscientific issues covered in textbooks is not at the desired level. They suggested that such issues should be included more frequently in textbooks. El Arbid and Tairad (2020) examined the views of th science teachers in regard to the inclusion of the socioscientific issues in educational programs. They conclude that the participants have positive views concerning the inclusion of the socioscientific issues in educational programs. They also examined the positive and negative factors affecting the inclusion of the socioscientific issues in educational programs. In this regard they found that for the participants both teaching strategies and having necessary knowledge about these issues are two factors that faciliate the inclusion of the socioscientific issues in educational programs. For the participants the factors that make the inclusion of the socioscientific issues in educational programs difficult, including the cultural differences among students and their varying maturity levels. Nida, Rahayu and Eilks (2020) dealt with the Indonesian science teachers' experience and perceptions about science education involving the socioscientific issues. Nearly half of the participants are found to be familiar with the science education involving the socioscientific issues. The participants reported that major barriers in delivering science with socioscientific issues include limited student skills, the lack of knowledge and expertise among teachers and the centralized educational programs. They suggest that in order to reduce such problems sources on science teaching based on socioscientific issues should be designed and continous inservice training activities should be organized. Bayram- Jacobs et al. (2018) developed and implemented teaching materials on socioscientific issues to improve science teachers' pedagogical knowledge. In the study, convincing findings were obtained indicating that science teachers can improve their pedagogical content knowledge for socioscientific issues using a single module.

Majority of the studies on socioscientific issues carried out in Turkey focus on the views of the preservice teachers (Akbulut and Demir, 2020; Atalay and Çaycı, 2017; Kıvanç and Görgülü Arı, 2019; Sevim and Ayvacı, 2020; Türkmen, Pekmez ve

Sağlam, 2017) and rare of them focused on elementary students' views on SSI (Yıldırım and Bakırcı, 2020) whereas international studies on socioscientific issues collect data from the inservice science teachers (Bosser ve Lindahl 2020; Friedrichsen, Ke, Sadler and Zangori, 2020; Gürbüzkol and Bakırcı, 2020; Tekgöz and Ercan Yalman, 2020). Although there are some studies in the latter group which analysed the views of the pre-service teachers' on socioscientific issues, the studies carried out in Turkey rarely deal with how socioscientific studies can be integrated into the courses. The socioscientific issues were first introduced among the science, technology, society and environment skills under the science education program in 2013. This group of skills aims at "making students capable of using their knowledge, skills and understandings acquired in science courses in the fields of economy, social relations and personal relations, to make informed evaluations about the actual scientific activities and to internalize the ecological, economical, social and cultural dimensions of the sustainable development". The science teachers are expected to integrate social scientific issues into secondary education courses and to provide efficient teaching of these issues. The aim of the study is to examine whether the opinions of the science teachers about teaching socioscientific issues differ based on their professional experience. In parallel to this aim the study attempts to answer the following research question:

What are the views of the inservice science teachers with varying professional experience about socioscientific issues?

METHOD

Since the aim of this study is to determine the views of the inservice science teachers about the teaching of the socioscientific issues, the phenomenology design, one of the qualitative research methods, was used in the study. In the phenomenological design the data are collected from the participants' views. In other words, phenomenology deals with the analysis of individuals' experience or their subjective evaluations about an event (Lester, 1999 cited in Özen and Karamustafaoğlu, 2019). In such studies the data analysis focuses on the individual experiences and the meanings attached to the phenomenon. The data collected are analysed using descriptive approach and direct quotations are frequently included. In additionthe findings obtained within the framework of emerging themes and patterns are explained and interpreted in such designs (Yıldırım and Şimşek, 2013). The focus in the study is the views of the science teachers concerning the teaching of socioscientific issues. The phenomenon analysed in the study is the views of the science teachers about the teaching of socioscientific issues.

2.1 Participants

In the phenomenological studies the participants should be selected with caution in that they should have direct experience on the topic at hand. The participants of the study are six science teachers working at public schools in Aydın. They were chosen using the criterion sampling method which is one of the purposive sampling. In criterion sampling the participants to be selected should bear some qualities. The participants are chosen based on these criteria (Büyüköztürk, Kılıç-Çakmak, Akgün, Karadeniz and Demirel, 2011). The criteria used were gender and having varying levels of professional experience. Therefore, three female and three male participants were selected. Concerning the professional experience the participants were divided into three categories: less experiences, medium-level experienced and very experienced. Less experienced teachers are those with a teaching experience of 1-10 years. Those with the medium-level experience have been teaching for the period of 10-20 years. Those classified as very experienced have a teaching experience of 20 years or more. Only one male participants was working at a village school and the others at urban schools. One of the female participants is a graduate of chemistry department. Demographical characteristics of the participants can be seen in Table 1.

Table 1. Demographical characteristics of the participants

Codes for the teachers	Gender	Professional experience	Working place
T1	Male	1 year (less experienced)	Village school
T2	Female	6 years (less experienced)	Central school
T3	Male	11years (medium-level experienced)	Central school
T4	Female	15 years (medium-level experienced)	Central school
T5	Male	25 years (very experienced)	Central school
T6	Female	23 years (very experienced)	Central school

2.2 Data Collection Tool

Data were collected through an interview form which was developed by the authors and reviewed by two specialists in science teaching. Based on the feedback from the reviewers the form was finalized. Before the development of the interview form the studies on the teaching of the socioscientific issues were analysed and the missing points were identified in relation to the teacher views. The probing items were developed by a faculty member with speciality on science teaching who has studies on the teaching of the socioscientific issues and is an advisor of two master's thesis on the subject and a science teacher who

took a course on the teaching of the socioscientific issues and is a graduate student. The items were reviewed by two other faculty members who have studies on the teaching of the socioscientific issues. Following the review by these specialists the form was also examined by another faculty member with speciality on Turkish language in terms of grammatical features and meaning. Then the interview form was reviewed. The interview form was administered to a science teacher who also had the qualities that were used to choose the participants. Following this the form was also used with three other science teachers in an interview. The final version of the interview form is composed of eight items (See Table 2).

Table 2. Themes used in the analysis and the related items

Theme	Items
Definition of the socioscientific issues	Could you please define the socioscientific issues? Could you please give examples to socioscientific issues ?
The place of the socioscientific issues in science education	Should socioscientific issues be part of science education? Why? Do you allocate time to teach socioscientific issues in the class? If you think that the teaching of the socioscientific issues is important, what are the best ways to integrate them into the science education?
The place of the socioscientific issues in the class	What are the socioscientific issues to be taught in the class? Which points do you emphasize in teaching the socioscientific issues? Which methods and techniques do you use in making students aware of the socioscientific issues?

Interviews are one of the most frequently employed data collection tools in qualitative studies. Although it seems to be much easier way of collecting data, both the data collection and data analysis should be carried out carefully. First the interview form should be designed well. Interview forms can be defined as forms that are developed to collect the views of individuals about the same topic. The items in the interview forms should cover all the points expressed in the research questions (Yıldırım ve Şimşek, 2013). The first author conducted the interviews in a silent office and the interviews were recorded. Each interview lasted nearly for 15-20 minutes.

2.3 Data Analysis

The interview data were first transcribed. Then these data were examined using the content analysis. The major goal in content analysis is to reveal the concepts and correlations about the topic at hand. In the data analysis similar concepts are coded and grouped under the themes (Yıldırım and Şimsek, 2013). Content analysis produces much deeper examination of the data in contrast to descriptive statistics. The coding were done by each author seperately. Then these codes were analysed and those which were mutually agreed were identified. Those for which the authors had different codings were further reviewed. Interrater reliability was found using the formula developed by Miles and Huberman (1994). The interrater reliability coefficient was found to be 75% in the first analysis. Following the review of the codings which were evaluated by the authors differently the analysis was repeated giving the reliability coefficient as 90%. When the interrater reliability formula by Miles and Huberman (1994) is used, the coefficients higher than 70% indicate the desired reliability. Therefore, the interrater reliability coefficient found in the study suggests that the study is reliable. In addition, direct quotations are included to improve the reliability of the study. Due to the ethical concerns, teachers names are not given instead the codes such as T1, T2, etc. were given to each teacher.

The awareness of the science teachers concerning the socioscientific issues is divided into three groups: high, medium and limited awareness groups. Of them the first group includes those who defined the socioscientific issues as the ones which cover both scientific and social dimensions and which are open-ended, mostly controversial and have no single answer. The second group refers to the participants who related socioscientific issues with society, but whose definitions lacked other significant characteristics of the socioscientific issues. The others were categorized in the third group, namely limited awareness group (Table 3).

FINDINGS

This section presents the discussion of the findings. It is organized around the interview items concerning the *definition of the socioscientific issues, the place of the socioscientific issues in science education and their perceptions about these issues in regard to their place in classroom*.

3.1 Definitions of The Socioscientific Issues

In order to reveal the perceptions of the participants they were asked to define the socioscientific issues in the interviews.

Table 3. Inservice science teachers' socioscientific issues definitions

Awareness level	Codes	Teacher codes
Limited awareness	Issues not covered in the educational program	T4
	More appropriate for the society	T6
	İssues that damage the structure of society	T5
	Disclosure of controversial scientific issues	T1
Medium-level awareness	Issues that are intertwined with society	T5
	Issues open to incorrect or correct ideas	T1
	Environmental problems	T2
	Issues that are related to both social studies and science	T2
High-level awarenessa	Controversial issues (Useful or not)	T3
	Issues that make it possible to gain different perspectives	T3
	Issues with no clear results	T4
	Issues which have scientific origins and are directly related to people	T5

Only one of the participants provided a comprehensive definition of the socioscientific issues and was categorized as having high level of awareness about these issues. This science teacher had a medium-level of teaching experience. His views are given as follows:

…It should be socioscientific; some people argue that such issues are useful, but there are others who regard them as not useful… (T3)

It is found that three participants cannot use the concepts efficiently while defining the socioscientific issues. They are all classified as having medium-level awareness about these issues and have medium-level teaching experience. Direct quotations from their reports are given as follows:

… İssues that are initiated as scientific issues but become factors distorting the social structure of the society… (T5)
… having correct or incorrect views about a topic…(T1)
…social scientific issues should cover both social sciences and science. For instance, environmental problems… (T2)

There are two participants who did not provide any definition of the socioscientific issues. These were very experienced science teachers, and they were not sure about their answers to the item. Their reports are given as follows:

… these issues may be those which are covered in the education progra, for instance, it may be evolution-related issues or should I think about the points related to the content of our courses?… (T4)

Table 4. Examples of SSI given by the inservice science teachers

Theme	Examples	Teacher codes
Science	Cloning	T5-T6
	One Type Human	T4-T6
	Stem cells	T4
	DNA Replication	T4
	Gene Transfer	T6
	Gene Therapy	T6
Technology	Technology addiction	T2-T5
	Social media addiction	T2
Energy sources	Geothermal Energy	T3-T1-T6
	Hydroelectric Energy	T1
	Wind turbines	T1
Nutritions	Genetically modified organisms	T5-T3-T6
	Pesticide	T3-T6
	Reclamation	T6
Environmental problems	Global warming	T2
	Greenhouse effect	T2
	Environmental pollution	T2
Other	Theories	T4
	Issues related to evolution	T4

The second interview item asked the participants to give examples of the socioscientific issues. Half of the participants gave the examples of these issues such as geothermal energy or genetically modified organisms. They also provided other examples,

including technology addiction, pesticides, cloning and single-type human beings (Table 4). These examples indicate that the participants perceive the socioscientific issues based on their observations about social events. There are also much more technical examples reported by the participants such as stem cell, DNA replication and gene transfer.

... I am not sure but I think the examples include genetically modified organisms, cloning and smart phones... (T5)

...Can environmental problems be given as examples? Global warming, greenhouse effect, environmental pollution. I think these are the examples of the socioscientific issues... (T2)

... cloning or genetically modified organisms are the examples. Should I give other examples?... (T6)

3.2 The Place of The Socioscientific İssues in Science Education

In order to determine to what extent the participants in the study were aware of the importance of socioscientific issues in science education and to reveal their perceptions about the place of these subjects in science education, the items in the interview form were asked.

Table 5. Views of the inservice science teachers about the place of the socioscientific issues in science education

Views	Reasons	Teacher codes
These issues should be part of the science education	science and socioscientific issues are interwoven	T1-T5-T3
	socioscientific issues make it possible for students to acquire distinct perspectives	T4-T3
	socioscientific issues make the teaching environment much more efficient	T6
	socioscientific issues attract student interest	T6-T1
	socioscientific issues improve students' reasoning skills	T3
	socioscientific issues should be taught in a seperate course	T2
	socioscientific issues make students to ready for daily life	T2-T5
These issues should not be part of the science education	-	0

Concerning the fact that the socioscientific issues are part of the science education all participants confirmed this view. More specifically, three of them reported that science and socioscientific issues are interwoven whereas two participants focused on the characteristics that may be taught to the students through such issues (Table 5). In addition, one participant reported that although the socioscientific issues are part of the science education, such issues can be taught in a seperate course. This teacher focused on environmental issues as can be seen in Table 3. Male participants mostly argued that that science and socioscientific issues are interwoven.

...I think it should be a mandatory course that should be given to everyone...(Ö2)

Another item asked to the participants during the interviews was follows: *If you think that the teaching of socioscientific issues is significant, what is the best way to integrate them into science teaching?*

The answers to this item are divided into four areas (Table 6). While increasing the number of seminars and conferences on socioscientific issues is the leading practice for students and parents, it is also reported by the participants that teachers should encourage students to make research on socioscientific issues, and the participants also argued that socioscientific issues should be included in the educational program more.

Table 6. Suggestions by the inservice science teachers to integrate the socioscientific issues into the science education

Related groups	Practices	Teacher codes
Students	Making students much more involved in social events	T5
	Organizing visits	T1-T2
	Seminars	T1-T2
	Conferences	T1-T2
Teachers	Directing students to make research	T4-T6
	Identifying the outcomes and then, teaching them around the socioscientific issues	T3
	socioscientific issues should be taught not only in science courses but also in other courses	T2
Parents	Seminars	T1-T2
	Conferences	T1-T2
Educational programs	Covering the socioscientific issues more in the educational programs	T3

It is observed that those teachers who are in the early years of their professional teaching experience reported the view that studies to be conducted for students and parents will facilitate the inclusion of socioscientific issues in science teaching.

Teachers with moderate professional experience have the idea that the work to be done should be directed to teachers and the educational program. Very experienced teachers think that the studies should focus on students and teachers. Some direct quotations on this regard are given as follows:

…You know what we can do some activities such as seminars, conferences, and these can be given to the parents and the students to make them informed about socioscientific issues.… (T2)

…related acquisitions can be determined, first we can start by determining the outcomes. Then, by integrating these acquisitions in appropriate courses, they can be taught in the lessons.… (T3)

In order to reveal the views of the participants concerning the place of socioscientific issues in the teaching of science lessons, the item *"Do you allocate time for teaching the socioscientific issues in your class?"* was asked to the participants.

Tablo 7. Reasons for covering the socioscientific issues in science courses

View	Reason	Teacher codes
Exactly refers SSI in Science lessonsissues	Students like it	T1-T6
Refers SSI in science lessons	It requires the ability to make decisions based on scientific data	T3-T5
	Issues from daily life	T3
Limited refers SSI in science lessons	within the educational program	T2-T4
	Time constraints	T2

While all of the participants stated that they allocate time for socioscientific issues in their lessons, it is determined that the time they allocated for the teaching of such issues differs according to some variables. While two of the participants emphasized that the students liked these issues, another two participants stated that they devoted time to such issues in their lessons since these issues improved the reasoning skills of their students. Two teachers, who said that they spend less time on socioscientific issues compared to other teachers, stated that they had difficulty in allocating time to these issues due to the intensity of science lessons. It is noteworthy that the teachers who have difficulty in allocating time to socioscientific issues in their lessons are female teachers who are at the early and middle stage of their careers. The participants devote time to these subjects in lessons in that these subjects contribute to the acquisition of some skills by students (Table 7). Some related direct quotations are given as follows:

… For example, our issues are already bio-technology and genetic engineering, and children like these issues very much… (T1)

… Children can at least learn through the real scientific data, not through the hearsay information, and they can form a mindset accordingly. Therefore, they may evaluate the positive and negative dimensions of these issues based on their mindset.… (T3)

… Although I allocate time to teach these issues, it may not be sufficient due to the fact that the content of our course is very demanding and there is time restrictions…(T2)

3.3 The Place of Socioscientific Issues in Class

Answers of the participants to a few questions in the interview form were evaluated together to reveal how the participants perceived the place of socioscientific issues in the classroom and how they implemented them.

Tablo 8. Socioscientific issues that should and should not be discussed in science classes

Views	İssues	teacher codes
Should be discussed	genetically modified organisms	T3-T6
	pestices	T3
	DNA	T1-T4
	Organ donation	T4-T2-T6
	Renewable energy (GPP, HEPP, RES)	T1
	Technology addiction	T2-T4
	Social media addiction	T2
	Consanguineous marriage	T1
Should not be discussed	Child abuse	T2
	political issues	T5

The findings indicate that the issues taught in the class by four participants and their examples for the socioscientific issues are consistent (See Tables 4 and 8). There are two participants who stated that such issues as child abuse and political issues should not be discussed in the class. Given that the socioscientific issues do not cover such points, it is possible to argue that these participants seem to have misconceptions about the socioscientific issues (Table 8). The latter group of participants includes a novice female teacher and an very experienced male teacher. The related direct quotations are given below:

…I think there are some scio scientific issues that should not be discussed in the classroom, such as child abuse…(T1)

… There are some political implications of some issues, and I avoid discussing or mentioning them in the classroom… (T5)

Another item in the interview form is as follows: *While teaching the socioscientific issues in the classroom which points do you take into consideration?*

Table 9. Points to be considered in teaching of the socioscientific issues

Views	Reason	Teacher codes
Should not be discussed	These issues improve the children's perspectives	T4-T5-T6
	These issues make them ready for daily life	T2-T3-T1
	These issues are consistent with social norms	T5
Should not be discussed	Problematic	T6-T4
	controversial issues in terms religious beliefs	T4
	political issues	T5

Half of the participants agreed that discussing the socioscientific issues in the classroom would improve students' horizons and prepare them for daily life, while the other half of the participants reported that discussing some issues in the classroom would be troublesome, especially when these issues are concerned with students' religious beliefs and political views (Table 9).

Those teachers who did not provide any example for the socioscientific issues argued that the discussion of some issues in the classroom should be done with caution (see Tables 8 and 9). As can be seen in Table 9 such sensitivity is mostly expressed by very experienced teachers in contrast to less and middle-level experienced teachers. Some related quotations are given as follows:

…As you said in such different comments, it is a subject that is questioned in terms of religion, but we are comfortable to discuss such issues… (T6)

…There are some political implications of some issues, and I avoid discussing or mentioning them in the classroom…(T5)

… Accordingly, they can shape their lives or direct their thoughts…(T3)

The interview item which is about the methods and techniques to teach the socioscientific issues is as follows: *Which methods and techniques do you use to teach the socioscientific issues ?'*

Table 10. Methods and techniques

Category	Methods and techniques	Teacher codes
Methods	Discussion	T3-T6
	Debates	T3-T6
	Verbal lectures	T1-T4
	Case studies	T3
Techniques	Question-answer sessions	T1
	Brainstorming	T1-T5
Other	smart boards	T5-T6
	Visuals	T1-T4-T6
	Cause-effect relations	T6
	Observations	T2
	Research	T1-T4

The answers of the four participants did not include any method and technique. Instead, they stated that they employed smart borads, visuals and inquiry strategies in teaching the socioscientific issues. Half of the participants reported that they used such methods and techniques as lectures, class discussions, debates and brainstorming, etc. (Table 10).

Those participants with less or middle-level teaching experience seem to be much more aware of the methods and techniques whereas those who are very experienced in teaching are found to less mention methods and techniques (Table 10).

DISCUSSION

In this study, the views of a group of inservice science teachers teaching at public schools in a province in Turkey's western region about the teaching of the socioscientific issues were analysed in relation to some variables, including gender, professional teaching experience, the location of the school they are working at and their educational background. The views of the teachers participating in the study on the socioscientific issues, which have an important role in raising the sensitive citizens of future, were examined. In this study, the questions asked to the science teachers were categorized under three main themes.

The first theme is the definition of the socioscientific issues. It is observed that the science teachers have different ideas about what the socioscientific issues mean and that they have difficulty in going beyond certain subjects while giving examples concerning the socioscientific issues. It is also found that most of the science teachers are aware that the socioscientific issues include scientific subjects, but they have difficulty in associating these issues with the society and social issues. Teachers who

associate the socioscientific issues with society reported that the socioscientific issues are of a nature that disrupts the structure of society. Many of the teachers participated in the study appear to think this way. The reason for that may be that like most of the people the participants consider the national and international natural events, wars and theft, harassment and moral crimes etc. under this heading (Türkmen, Pekmez and Sağlam, 2017). It is found that highly experienced teachers have more difficulty in defining the socioscientific issues than teachers with low and intermediate professional experience. The reason for this can be that the socioscientific issues were first included in the science education program under the title of science-technology-society-environment in the 2013 program developed by the Ministry of Education. When the examples given as socioscientific issues were examined, it is seen that the examples given were concentrated within the framework of social issues that can be observed in the living environment. In other words, the participants mostly reported examples from their immediate environment. It is seen that individuals take a more active role in solving socioscientific problems in their immediate surroundings and are less concerned about socioscientific issues in their distant environment. Şama (2003) reports similar findings in the study which was carried out on sample of preservice teachers and which analysed their attitudes towards environmental probblems. The middle-level and highly experienced teachers who participated in the study gave more examples of the science-themed socioscientific issues compared to teachers with less experience. Teachers with less teaching experience gave environmental issues as an example of these issues. This situation can be attributed to the multidimensional nature of the socioscientific issues. Particularly the rapid changes and developments in science and technology affect social life directly and indirectly over time (Atalay and Çaycı, 2017). It can be related to the fact that teachers with low and medium level professional experience witness scientific changes compared to very experienced teachers who witness the effects of these changes on the environment and society. This may explain why less experienced teachers more frequently provided examples of the socioscientific issues such as environmental problems compared to intermediate and very experienced teachers.

The second main theme is the place of the socioscientific issues in science education. Science teachers' opinions about the inclusion of the socioscientific issues in science teaching are positive. Especially, it is seen that they mostly reported that the science and socioscientific issues are intertwined. It is also noteworthy that the socioscientific issues are used as a tool to attract teachers' attention in science education. The use of the socioscientific issues for this purpose is commonly stated in the related studies. In the study conducted by Karman, Yılmaz-Tüzün and Zeidler (2018) on the examination of the reflective reasoning skills of the preservice teachers in the science laboratory applications about the socioscientific issues, it was observed that the socioscientific issues directly connected to the lives of the participants, initiated their curiosity and encouraged their active participation and personal participation. Another reason why teachers want the socioscientific issues to be a part of science teaching is the idea that the skills to be acquired by students through such issues will be beneficial for them to become conscious individuals. As a matter of fact, it is supported to include discussions on socioscientific issues in the classroom in many studies conducted so far (Acar, Türkmen, & Roychoudhury, 2010; Zeidler et al., 2005). The activities to be done for the inclusion of the socioscientific issues in science teaching in the classroom were examined under four headings. It is observed that less experienced teachers who are in the first years of their careers have the view that activities should be done for students and parents, and those with moderate experience argued that such activities would facilitate the inclusion of the socioscientific issues in science teaching. Very experienced teachers think that the activities should focus on students and teachers. Nida, Rahayu, and Eilks (2020) in their study investigating the experiences and perceptions of Indonesian science teachers towards science teaching based on the socioscientific issues found that the main obstacles to the socioscientific issues are the limitations in students' skills, teachers' lack of knowledge and expertise, and the standard educational program. Although it does not explain the reason for the disagreement of moderately experienced and highly experienced teachers, it explains why the socioscientific issues are gathered in this framework at the point of including science teaching. In the study of Nida et al. (2020) it is also determined that designing science learning materials focused on the socioscientific issues and continuous professional development seminars on the use of these designs are the best option to overcome these obstacles. However, the significance of the science education focused on the socioscientific issues is increasing today. In addition, it has become even more important for teachers to be experienced individuals who are interested in these issues that they frequently encounter in the media or their environment and can give the necessary feedback to their students (Sadler, 2011). As a result of the interviews with the participants, the fact that there are teachers who have difficulty in allocating time to the socioscientific issues due to the intensity of the educational program suggests that the changes to be made in the educational program will be more effective in covering the socioscientific issues in science teaching. Those with moderate experience argued that activities should focus on teachers and students to facilitate the inclusion of the socioscientific issues in science teaching. This situation may indicate that the teachers participated in the study can not go beyond the objectives covered in the educational program and therefore, it supports the idea that the socioscientific issues should be emphasized much more frequently. It is also observed that all teachers who participated in the study devoted time to the socioscientific issues in the class, but those who had difficulty in using their time for such issues compared to the other teachers were less experienced and moderately experienced female teachers.

The third themes about the place of the socioscientific issues in the class. It is noteworthy that the participants gave similar answers in regard to the socioscientific issues that need to be addressed in the classroom. However, when asked about the socioscientific issues that should not be discussed in the classroom, it is observed that most of the teachers had difficulty in giving examples of such issues. There are other participants who provided irrelevant examples such as child abuse and political issues suggesting that they have some misconceptions concerning the socioscientific issues. It is important to note that the

participants did not consider the socioscientific issues as controversial issues in which the positive and negative effects of developments in science and technology are evaluated, and instead, they consider those issues that do not have a scientific basis as socioscientific issues. Teachers who are expected to improve students' reasoning skills by carrying science-based controversial issues to the classroom ignore the science-based feature of the socioscientific issues. They also consider only socially based issues as the socioscientific issues and argue that it is not appropriate to discuss such issues in the classroom. All of these misunderstandings create an obstacle to the transfer of the socioscientific issues to the educational practices. Therefore, it becomes difficult to acuire the skills such as critical thinking, scientific discussion, and effective communication, which are expected to be added to students through the socioscientific issues. It is also observed that highly experienced teachers are more sensitive concerning the socioscientific issues compared to less and moderately experienced teachers. The reason for this may be that teachers who have more professional experience have been more exposed to such situations and are more sensitive to those issues that may cause problems in the classroom over time. Gündüz and Çelikkaleli (2009) examined the beliefs of school psychological counselors in their professional competencies based on the variables of service duration, and found that psychological counselors with more experience were more competent in using their skills than psychological counselors with less experience.

In addition, regarding the methods and techniques used for teaching the socioscientific issues it is found that the participants mostly used smart boards, visual sources and observations, etc. It is seen that they gave answers not directly related to the methods and techniques used in the teaching of the socioscientific issues. It is seen that these participants are mostly those teachers with high and medium level experience. It is also observed that some of the teachers benefited from the methods and techniques such as lectures, class discussions, debate, and brainstorming in teaching the socioscientific issues.

It is clearly seen that the science teachers who participated in the study have some opinions about the socioscientific issues, but they did not have enough information to express their opinions about the three major themes. It is also observed that less experienced teachers were more conscious in explaining the socioscientific issues, determining their place in science teaching and in the classroom. It is found that most of the teachers avoided the effects that the ethical and moral dimensions of the issues covered in the classroom, and they particularly avoided handling such issues in the classroom.

CONCLUSION AND SUGGESTIONS

The number of participants can be increased to obtain more generalizable results. The opinions of not only science teachers but also teachers who teach in other branches (e.g. social studies) that may be related to socio-scientific issues can be taken on these issues. In addition, by increasing the number of participants, the demographic characteristics of science teachers can be diversified, and teachers' opinions can be analysed based these variables. Those socio-scientific issues specified by the teachers who participated in the study can be used to increase students' individual decision-making and reasoning skills. In addition, the factors of teachers and parents stated in the findings can be taken into consideration, and the effects of these components on the teaching of socio-scientific issues can be examined more deeply.

In line with the suggestions of the science teachers who participated in the current study, teachers can be given seminars on the content of the revised science education program, its learning areas, practical examples concerning the various methods and techniques, practical in-service trainings and learning approaches that may be employed. Quantitative studies can be conducted by developing data collection tools to determine science teachers' perceptions about the socio-scientific issues and their opinions on teaching these subjects. In this way, a wider impact can be achieved by reaching more participants. A teaching model for this activity can be developed in Turkey, and its efficiency can be evaluated. Those socio-scientific issues related to the science education can be added to undergraduate programs in the form of elective or compulsory courses. Within the scope of this course, pre-service teachers can be given an opportunity to be informed about these issues, to be aware of the subjects and to gain experience about the methods and techniques to be used in teaching the subjects before starting the teaching profession. Practical examples related to socio-scientific issues can be added to the science education program.

Researchers' contribution rate

First Author conceived of the presented idea. Second Author contributed to the theoretical framework. Third Author verified the analytical methods. Second and Third Author encouraged first author to investigate the research with in-service teachers and supervised the findings of this work. All authors discussed the results and contributed to the final manuscript.

The study was conducted and reported with equal collaboration of the researchers.

Ethics Committee Approval Information

Name of the Institution: Aydın Adnan Menderes University
Date: 09/07/2020
Number: 84982664-604.01.02
Subject: Resolution 2020/10-III

Ethics Committee Approval for the research was received with an official letter dated 09/07/2020 and numbered E.36160 from Aydın Adnan Menderes University Scientific Educational Research Ethics Committee that decision numbered 2020/10-III.

REFERENCES

Acar, O., Türkmen, L. ve Roychoudhury, A. (2010). Student Difficulties in Socio-Scientific Argumentaation and Decision-Making Research Findings: Crossing The Borders of Two Research Lines. *International Journal of Science Education*, *32*(9), 1191-1206.

Akbuluti H.İ. ve Demir, O. (2020). Science Teachers' Views of Socio Scientific Issues. *International Journal of Progressive Education*, *16*(1), 237-256.

Atalay, N. ve Çaycı, B. (2017). Sınıf Öğretmeni Adaylarının Sosyobilimsel Konular Hakkındaki Görüş ve Tutumlarının Farklı Değişkenlere Göre İncelenmesi. *Estüdam Eğitim Dergisi*, *2*(2), 35-45.

Bayram Jacobs, D., Henze, I., Evagorou, M., Shwartz, Y., Aschim, E. L., Alcaraz-Dominguez, S., Barajas, M., & Dagan, E. (2019). Science teachers' pedagogical content knowledge development during enactment of socioscientific curriculum materials. *Journal of Research in Science Teaching*, *56*(9), 1207-1233.

Bosser, U. ve Lindahl, M. (2021). Teachers' Coordination of Dialogic and Authoritative Discourses Promoting Specific Goals in Socioscientific Issue-Based Teaching. *International Journal of Science and Mathematics Education*, *19*, 461-482.

Büyüköztürk, Ş., Kılıç-Çakmak, E., Akgün, Ö.E., Karadeniz, Ş. ve Demirel, F. (2011). *Bilimsel Araştırma Yöntemleri*. (8. Baskı). Ankara: Pegem Akademi

Cebesoy, B.Ü. ve Dönmez-Şahin, M. (2013). Fen Bilgisi Öğretmen Adaylarının Sosyobilimsel Konulara Yönelik Tutumlarının Çeşitli Değişkenler Açısından İncelenmesi. *M.Ü Atatürk Eğitim Fakültesi Eğitim Bilimleri Dergisi*, *37*(37), 100-117.

El Arbid, S. S., & Tairab, H. H. (2020). Science Teachers' Views about Inclusion of SocioScientific Issues in UAE Science Curriculum and Teaching. *International Journal of Instruction*, *13*(2), 733-748.

Erduran, S. ve Jiménez-Aleixandre, M. P. (2007). *Argumentation in Science Education: Perspectives from Classroom-Based Research*. Springer.

Friedrichsen, P.J., Ke, L., Sadler, T. D. ve Zangori, L. (2020). Enacting Co-Designed Socio-Scientific Issues-Based Curriculum Units: A Case of Secondary Science Teacher Learning, *Journal of Science Teacher Education*.

Gündüz, B. ve Çelikkaleli Ö. (2009). Okul Psikolojik Danışmanlarında Mesleki Yetkinlik İnancı. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, 5 (1), 119-133.

Gürbüzkol, R. ve Bakırcı, H. (2020). Fen bilimleri öğretmenlerinin sosyobilimsel konular hakkındaki tutum ve görüşlerinin belirlenmesi. YYÜ Eğitim Fakültesi Dergisi, *17*(1), 870-893.

Karışan, D., Yılmaz-Tüzün, Ö. ve Zeidler, D.L. (2018). Pre-Service Teachers' Reflective Judgment Skills in The Context of Socio-Scientific Issues Based Inquiry Laboratory Course. *Turkish Journal of Education, 7*(2), 99-115.

Kıvanç, Z. ve Görgülü-Arı, A.(2019). Fen Bilgisi Öğretmen Adaylarının Biyoteknoloji ve Genetiği Değiştirilmiş Organizma (GDO) Konularında Tutumlarının Değerlendirilmesi. *Adnan Menderes Üniversitesi Eğitim Fakültesi Eğitim Bilimleri Dergisi*, *10* (1), 37-57.

Miles, M, B., ve Huberman, A. M. (1994). *Qualitative data analysis: An expanded Sourcebook*. (2nded). Thousand Oaks, CA: Sage.

Milli Eğitim Bakanlığı Talim ve Terbiye Kurulu Başkanlığı, (2013). *İlköğretim Fen ve Teknoloji Dersi (6, 7, 8. Sınıflar) Öğretim Programı*. MEB Ankara.

Nida, S., Rahayu, S., & Eilks, I. (2020). A survey of Indonesian science teachers' experience and perceptions toward socio-scientific issues-based science education. *Education Science*, 10(2), 1-15.

Özen, H. ve Karamustafaoğlu, O. (2019). *Eğitimde Araştırma Yöntemleri*. (1. Baskı). Ankara: Pegem Akademi.

Sadler, T.D. (2004). Informal Reasoning Regarding Socio-Scientific İssues: A Critical Review Of Research. *Journal of Research in Science Teaching*, *41*, 513-536.

Sadler, T. D. ve Zeidler, D. L. (2004). The Morality of Socioscientific Issues Construal and Resolution of Genetic Engineering Dilemmas. *Science Education, 88*(1), 4-27.

Sadler, T. D. (2011). *Situating Socio-Scientific Issues in Classrooms as A Means of Achieving Goals of Science Education. T. D. Sadler (Ed). Socio-Scientific Issues İn The Classroom: Teaching, Learning And Research* (pp. 1-10). New York: Springer.

Sevim, S. & Ayvacı, H. Ş. (2020). Öğretmen adaylarının sosyo-bilimsel konulardaki inançları: Nükleer enerji. *Eskişehir Osmangazi Üniversitesi Türk Dünyası Uygulama ve Araştırma Merkezi (ESTÜDAM) Eğitim Dergisi*, 5 (1), 25-39.

Sezer, K. (2017). *Görev Yapan ve Atanmamış Fen Bilimleri Öğretmenlerinin Sosyobilimsel Konularla İlgili Öz Yeterlilik ve Tutumlarının Belirlenmesi (Samsun İli Örneği).* Yüksek Lisans Tezi, Ondokuz Mayıs Üniversitesi, Samsun.

Şama, E. (2003). Öğretmen Adaylarının Çevre Sorunlarına Yönelik Tutumları. *G.Ü. Gazi Eğitim Fakültesi Dergisi*, *23*(2), 99-110.

Tekgöz, T., & Ercan-Yalman, F. (2020). Nükleer santraller hakkında fen bilgisi öğretmenlerinin görüşü: Akkuyu örneği. *Muğla Sıtkı Koçman Üniversitesi Eğitim Fakültesi [MSKU Journal of Education], 7*(2), 144-158.

Topçu, M. S. (2015). *Sosyobilimsel Konular ve Öğretimi*. Ankara: Pegem Akademi.

Türkmen, H., Pekmez, E., ve Sağlam, M. (2017). Fen Bilgisi Öğretmen Adaylarının Sosyobilimsel Konular Hakkındaki Düşünceleri. *Ege Eğitim Dergisi*, *18*(2), 448-475.

Türköz, G. ve Öztürk, N. (2020). Fen bilgisi öğretmen adaylarının bazı sosyo-bilimsel konularla ilgili kararlarının çok boyutlu bakış açısı ile incelenmesi. *Cumhuriyet International Journal of Education*, *9*(1), 175-197.

Varal, E. ve Belge Can, H. (2020). Fen Bilgisi Öğretmen Adaylarının Sosyobilimsel Konular Bağlamında Pedagojik Alan Bilgilerinin İncelenmesi. *Mehmet Akif Ersoy Üniversitesi Eğitim Bilimleri Enstitüsü Dergisi*, *8*(10), 21-42.

Yıldırım, İ., & Bakırcı, H. (2020). Ortak Bilgi Yapılandırma Modeline Dayalı Fen Öğretiminin Sekizinci Sınıf Öğrencilerinin Sosyobilimsel Konular Hakkındaki Görüşlerine Yansımasının İncelenmesi. *İnönü Üniversitesi Eğitim Fakültesi Dergisi*, *21*(2), 1051-1070.

Yıldırım, A.ve Şimşek, H. (2013). *Sosyal Bilimlerde Nitel Araştırma Yöntemleri*. (9. Baskı). Ankara: Seçkin Yayınevi.

Yücel, M., Altunkasa, F., Güçray, S., Uslu, C. ve Say, N.P. (2006). Adana'da Çevre Duyarlılığı Düzeyinin ve Geliştirme Olanaklarının Araştırılması. *Akdeniz Üniversitesi Ziraat Fakültesi Dergisi*, *19*(2), 217-228.

Zeidler, D. L., Sadler, T. D., Simmons, M. L. ve Howes, E. V. (2005). Beyond STS: A research-based framework for socioscientific issues education. *Science Education*, *89*(3), 357-377.
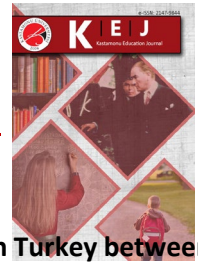
|Araştırma Makalesi / Research Article|

Content Analysis of Theory-Based Graduate Theses Published in the Field of Distance Education in Turkey between 2008-2020

2008-2020 Yılları Arasında Türkiye'de Uzaktan Eğitim Alanında Yayımlanan Kurama Dayalı Lisansüstü Tezlerin İçerik Analizi

Mehmet YILDIZ[1], **Sinem ÇİLLİGÖL KARABEY**[2], **Selçuk KARAMAN**[3]

Abstract

Purpose: To examine the trends in theory-based graduate theses published between 2008-2020 in the field of distance education in Turkey.

Methodology: In this study, which aims to examine theory-based graduate theses published in the field of distance education in Turkey between 2008-2020, systematic literature review was adopted and content analysis technique was used in the analysis of data. 483 theses with access permission in the Council of Higher Education (YOK) national database were examined and 150 theses that were suitable for the research criteria were included in the study. Theses were categorized using the "Thesis Review Form", which has different fields such as thesis type, thesis title, the year the thesis was published, the university where the thesis was published, the variables used in the theses, the science fields of the theses, the theory / model used in the theses, the sample level of the theses and the sample sizes. The data of 150 theses, which are theory-based, were analyzed with the descriptive content analysis technique.

Findings: When the theses included in the study are examined, it has been determined that one of every three theses published in the field of distance education are based on theory. Considering the theoretical basis of the theses, it has been seen that the theories of Social Presence, ARCS Motivation and Interactional Distance were given the most place. While Anadolu University and Gazi University were the universities where the most theses were published, Computer Sciences emerged as the field where the most theses were published. It was seen that academic success and attitude were the most studied variables in the theses. It was concluded that the sample group studied in the theses mostly consisted of students studying at undergraduate and primary education level, and 31-100 participants were preferred more as the sample size.

Highlights: In the study, 150 graduate theses published between 2008-2020 in the field of distance education in Turkey and meeting the research criteria were examined and it was determined that one of these three theses was theory-based. Since this number has been determined to be quite small, it is thought that the findings obtained from this study will be useful for a deeper understanding of the theses that have a theoretical basis in distance education, by providing suggestions for future research, and to contribute to the thesis work or research planned to be done in the future on this subject.

Öz

Çalışmanın Amacı: Türkiye'de uzaktan eğitim alanında 2008-2020 yılları arasında yayınlanan kurama dayalı lisansüstü tezlerdeki eğilimlerini incelemektir.

Yöntem: Türkiye'de uzaktan eğitim alanında 2008-2020 yılları arasında yayınlanan kurama dayalı lisansüstü tezlerin incelenmesini amaçlayan bu çalışmada sistematik alanyazın taraması benimsenmiş ve verilerin incelenmesinde içerik analizi tekniği kullanılmıştır. Yuksek Oğretim Kurumu (YOK) ulusal veri tabanında erişim izni olan 483 tez incelenmiş ve bunlar arasından araştırma kriterlerine uygun olan 150 tez çalışma kapsamına alınmıştır. Tezler; tez türü, tez başlığı, tezin yayınlandığı yıl, tezin yayınlandığı üniversite, tezlerde kullanılan değişkenler, tezlerin bilim alanları, tezlerde faydalanılan kuram/teori/model, tezlerin örneklem düzeyi ve örneklem sayısı gibi farklı alanlarının olduğu "Tez İnceleme Formu" kullanılarak kategorize edilmiştir. Kuramsal bir temele dayalı olan 150 teze ait veriler, betimsel içerik analizi tekniği ile analiz edilmiştir.

Bulgular: Çalışmaya dahil edilen tezler incelendiğinde, *u*zaktan eğitim alanında yayınlanan her üç tezden birinin kurama dayalı olduğu tespit edilmiştir. Yapılan tezlerin kuramsal temellerine bakıldığında, Sosyal Bulunuşluk, ARCS Motivasyon ve Etkileşimsel Uzaklık kuramlarına en fazla yer verildiği görülmüştür. Hazırlanan tezlerin çoğunluğunun yüksek lisans tezinden oluştuğu ve 2014 yılından itibaren ise uzaktan eğitim alanında yayınlanan tez sayısında bir düşüş olduğu tespit edilmiştir. Anadolu Üniversitesi ve Gazi Üniversitesi en çok tezin yayınlandığı üniversiteler olurken, Bilgisayar Bilimleri en çok tezin yayınlandığı alan olarak ortaya çıkmıştır. Akademik başarı ve tutumun ise tezlerde en çok incelenen değişkenler olduğu görülmektedir. Tezlerde çalışılan örneklem grubunun ise en fazla lisans ve ilköğretim düzeyinde öğrenim gören öğrencilerden oluştuğu, örneklem sayısı olarak da 31-100 sayıda kişinin daha çok tercih edildiği sonucuna ulaşılmıştır.

Önemli Vurgular: Çalışmada Türkiye'de uzaktan eğitim alanında 2008-2020 yılları arasında yayınlanan, araştırma kriterlerine uyan 150 lisansüstü tez incelenmiş ve bu tezlerden her üçünden birinin kurama dayalı olduğu belirlenmiştir. Bu sayının oldukça az sayıda olduğu tespit edildiğinden, bu çalışmadan elde edilen bulguların, gelecekteki araştırmalar için öneriler sunarak uzaktan eğitim konusunda kuramsal dayanağı olan tezleri daha derin bir şekilde anlama, bu konuda ileride yapılması planlanan tez çalışması veya araştırmalara katkıda bulunma noktasında faydalı olacağı düşünülmektedir.

[1] Sakarya University of Applied Sciences, Distance Education Application and Research Center, Sakarya, TURKEY; https://orcid.org/0000-0002-9523-3805
[2] **Corresponding Author,** Ataturk University, Open Education Faculty, Erzurum, TURKEY; https://orcid.org/0000-0002-8925-9486
[3] Haci Bayram Veli University, Management Information Systems, Ankara, TURKEY; https://orcid.org/0000-0002-0493-3444

INTRODUCTION

In recent years, there have been great changes in technological and scientific developments in our country and in the world. One of the most affected areas by these changes is education (Akpınar, 2003). Intensive studies are carried out on the integration of the facilities offered by technological developments into education (Arat & Bakan, 2011). One of the interdisciplinary applications of the integration of technology into education is distance education. Distance education is spreading rapidly in higher education institutions as well as in all fields with technological developments and offers new opportunities for learners. The main factors affecting this are the features of distance education such as providing opportunities for economy, lifelong learning and individual learning, and being away from the limitations of traditional methods (flexibility, time and place dependence, etc.). With the increasing importance and spread of distance education in different disciplines, studies in this field have started to increase. (Özkul & Aydın, 2013). With this increase, distance education has been compared with face-to-face education and its effectiveness has been discussed, especially in studies (Gökmen et al., 2017; Uygun, 2019). It is stated that distance education, which is seen as a different aspect of the traditional classroom model, can be as effective as face-to-face applications when appropriate technology and methods are used (Bernard et al., 2004; Ward et al., 2010).

The effectiveness of distance education with appropriate technology and methods also depends on being based on comprehensive theories (Moore, 1973). Understanding change, dynamics and perspective in the field of distance education is possible by knowing the theory and practice of the applications in the field (Bozkurt et al., 2015a). In order to be successful in the future in any discipline, it is necessary to understand the past and the present and therefore take advantage of the current situation (Aydın et al., 2020). In this perspective, it is of great importance to reveal the theories in distance education research and to determine to what extent these theories are used. Because the lack of theoretical basis of distance education studies is seen as one of the most important problems in this field (Phipps & Merisotis, 1999). Distance education theories provide guidance for more effective studies by providing a specific perspective on the field (Bozkurt et al., 2019). Including studies with a theoretical basis allows more meaningful questions to be asked and the emergence of studies that will contribute to the field (Holmberg, 2005; Phipps & Merisotis, 1999).

When the studies published in distance education are reviewed, it is stated that the rate of examining the journals and theses published in this field in terms of various variables has increased with the distance education applications that are becoming increasingly widespread today (Gökmen et al., 2017). In these studies, generally; It is seen that variables such as scope, study subjects, methods, theories, data collection tools, data analysis methods etc. are examined. It has been determined that the theoretical structure analysis used in the theses in the distance education studies conducted in our country is limited and the studies conducted abroad are more comprehensive (Anglin & Morrison, 2000; Babur et al., 2016).

In the studies conducted in the literature, studies in which distance education research conducted in terms of tendency were examined. In Table 1, 19 studies in the field of distance education and the content of these studies are summarized chronologically.

Table 1. Content analysis studies in the field of distance education

Order	Author(s)	Studies Reviewed	Language	Scope	Number of Studies	Distribution by Years	Research Method	Sample	Data Collection Tool	Variables	Subject Area	Theoretical Dimension
1.	Koble and Bunker, (1997)	Article	English	1987 1995	129	-	✓	-	-	✓	-	✓
2.	Berge and Mrozowski, (2001)	Article and Thesis	English	1990 1999	890	✓	✓	-	-	-	-	-
3.	Lee, Driscoll and Nelson, (2004)	Article	English	1997 2002	383	-	✓	-	-	✓	-	-
4.	Davies, Howell and Petrie, (2010)	Thesis	English	1998 2007	308	✓	✓	-	✓	✓	✓	-
5.	Zawacki-Richter, Bäcker and Vogt, (2009)	Article	English	2000 2008	695	✓	✓	-	-	✓	-	-
6.	Tuncay and Uzunboylu, (2010)	Article	English	1972 2008	160	✓	-	-	-	✓	✓	-
7.	Ozarslan, Balaban-Sali and Demiray, (2012)	Article	English	2000 2010	582	✓	✓	-	✓	-	✓	-

Order	Author(s)	Studies Reviewed	Language	Scope	Number of Studies	Distribution by Years	Research Method	Sample	Data Collection Tool	Variables	Subject Area	Theoretical Dimension
8.	Horzum, Ozkaya, Demirci and Alpaslan, (2013)	Article	Turkish	2005 2011	35	✓	✓	✓	✓	✓	-	-
9.	Bozkurt et al., (2015a)	Thesis	English	1986 2014	61	✓	✓	✓	✓	✓	✓	✓
10.	Bozkurt et al., (2015b)	Article	English	2009 2013	861	✓	✓	✓	✓	✓	✓	✓
11.	Babur et al., (2016)	Article	Turkish	2009 2013	1233	✓	✓	✓	✓	-	-	-
12.	Durak et al., (2017)	Thesis	English	1986 2015	285	-	✓	✓	✓	✓	✓	✓
13.	Gokmen et al. (2017)	Thesis	English	2005 2014	360	✓	✓	✓	✓	-	✓	-
14.	Zawacki-Richter, Alturki and Aldraiweesh, (2017)	Article	English	2000 2015	580	✓	✓	-	-	✓	✓	✓
15.	Aydın, Kaya, Işkol and Işcan, (2019)	Thesis	Turkish	2002 2018	81	✓	✓	✓	✓	-	✓	✓
16.	Uygun, (2018)	Article	Turkish	2017	41	✓	✓	✓	✓	-	-	-
17.	Bozkurt, Zawacki-Richter and Aydin (2019)	Proceeding	English	2000 2015	784	-	-	-	-	-	-	-
18.	Uygun, (2019)	Article	Turkish	2017 2018	41	✓	✓	-	-	✓	-	-
19	Aydin, Zawacki-Richter and Bozkurt (2020)	Proceeding	English	2000 2015	784	-	✓	-	-	-	-	✓
					TOTAL	14	17	8	10	11	9	7

In the content analysis studies given in Table 1, it is seen that mostly articles (12) were examined, most of the studies were in English, and there are many articles or theses published since 1972. Considering the type of theses analyzed in the studies, it was determined that mostly master's theses were included. (Davies et al., 2010; Gökmen et al., 2017; Aydın et al., 2019). Considering the years, it is seen that there are studies covering different years and periods, firstly starting from the study of Koble and Bunker (1997), and then to the present day.

In most of the content analysis researches on the field of distance education, distribution by years and research methods were discussed. It is stated that quantitative research, one of the research methods, is used more widely in distance education. Approximately half of the examined content analyzes included sample size and sample group. It was concluded that the sample group consisted mostly of undergraduate students, lecturers and teachers while the sample distribution was generally in the range of 31-100 (Aydın et al., 2019; Bozkurt et al., 2015a; Horzum et al., 2013). When the most used data collection tools in the studies are examined, it is seen that questionnaires and scales are generally used and interviews are frequently included (Davies et al., 2010; Gökmen, 2017; Horzum et al., 2013; Uygun, 2018).

It can be concluded that the variables frequently used in the analysis process of distance education studies are generally attitude, interaction, opinion, academic achievement, motivation and perception (Bozkurt et al., 2015a; Durak, 2017; Lee et al., 2004; Uygun, 2019). Under the fields of subject title, it is stated that there are mostly Computer Science / Engineering, Education and Training, Science and Technology etc. fields (Bozkurt et al., 2015a; Durak, 2017; Gökmen et al., 2017).

When Table 1 is examined, it is seen that only seven of the 19 studies examined the theoretical dimension/theoretical framework. Although it has an important place in the field of distance education, it is remarkable that the theories are not sufficiently utilized in the studies (Davies et al., 2010). Considering the theories included in content analysis studies; In the study conducted by Aydın et al. (2019), the learning theory, distance education theory and communication theories, in the study by Bozkurt et al. (2015a) technology acceptance model, androgogy, diffusion of innovation theories, in the study by Durak et al. (2017) cognitive learning theory, transactional theory distance and constructivism theories are seen to be used more. In the theoretical dimension, it has been determined that the studies in our country are weak in terms of the theoretical framework

(Horzum et al., 2013). Due to the lack of studies in the field that are not constructed on a theory, there is a need for studies that deal with the theoretical dimension (Davies et al., 2010). Although there were studies that included content analysis in articles or theses in the field of distance education until 2008, no studies have been found that deal with master's and doctoral theses together and examine them with their theoretical dimensions since this year. Bozkurt et al. (2015a), in their content analysis study, examined the doctoral theses in the field of distance education in Turkey between the years 1986-2014 in terms of various variables.

Purpose of the Research and Research Questions

This study differs from the others in that it includes master's theses in addition to doctoral theses and examines current studies in line with digital transformations in education. Because the way to progress in distance education and to carry out more effective studies depends on determining the situation we are in right now (Hauser, 2013). For this reason, it is believed that this study will contribute to a deeper understanding of the theses that have a theoretical basis on distance education by offering suggestions for future research, and to the thesis or research that is planned to be done in the future on this subject. In this context, the aim of the research is to examine the trends in theory-based graduate theses published between 2008-2020 in the field of distance education in Turkey. The study is limited to the open-access theses related to distance education in the national database of YOK. In this direction, the following research questions will be answered within the scope of the study:

Theory-based graduate theses published between 2008-2020 in the field of distance education in Turkey;

1. How is the distribution according to the types?
2. How is the distribution by years?
3. How is the distribution according to the university it is done?
4. What is the distribution of theory/model used
5. What is the distribution of subject areas?
6. What is the distribution of the variables used?
7. What is the distribution according to sample groups?
8. How is the distribution according to sample size?

METHOD

In this section, the research model, sample, data collection process and data analysis are discussed.

Research Model

In this study, which aims to examine theory-based graduate theses published in the field of distance education in Turkey between 2008-2020, systematic literature review was adopted and content analysis technique was used in the analysis of data. Content analysis is a method that enables the reader to understand and interpret the written texts by converting them into numerical data (Bauer, 2003) and classifying these quantities according to certain characteristics (Creswell, 2012). Content analysis enables different types of documents such as articles, books, magazines, novels and pictures to be analyzed in depth for specific purposes (Fraenkel et al., 2012). In addition, the content analysis method is a reproducible method that enables the texts to be analyzed within certain rules and converted into categories (Stemler, 2001).

Sample

The population of this research consists of theses related to distance education in the national thesis center database of YOK. In the research, purposive sampling was used in order to reach a sufficient sample size and to work with current theses. Purposeful sampling is used to select facts, events and situations with certain characteristics and to explore and explain them in depth (Büyüköztürk et al., 2012). In this respect, the sample of the research consisted of a total of 150 distance education theses with open access published between 2008 and 2020. Theses that are not open to access are excluded from the scope of the research due to the difficulty and time consuming of access through YOK or related institutes.

Data Collection Process

As a data collection tool, the "Thesis Review Form" was created in which the theses were recorded according to the determined categories. In this form, which was created through the Microsoft Excel 2016 software, the titles; order number, thesis code, author, thesis name/type, sample number, sample type, variables, subject area, university, theory/theory/model were included respectively. Before the finalization of the categories in the Thesis Review Form, a preliminary study was carried out in order to determine the suitability of the form and its missing parts. In the preliminary study, each reviewer coded 15 randomly selected theses and a total of 30 theses using the Thesis Review Form.

In the process of collecting data within the scope of the research, before entering the search term in the advanced search section of the national thesis center of YOK, the options "scanning the search term in the entire tag of the thesis (thesis name, subject, index, abstract) and the theses published between 2008 and 2020" were selected. In order not to have any thesis that could not be reached, 15 different searches were made by crossing the keywords shown in Figure 1. As a result, a total of 604

theses were found. Since many concepts are used interchangeably in distance education (Guri-Rosenblit, 2005), different keywords were searched in order to reach more studies. The theses reached as a result of the searches were recorded with the thesis code in order to avoid conflict with the theses with similar names and to avoid data loss.
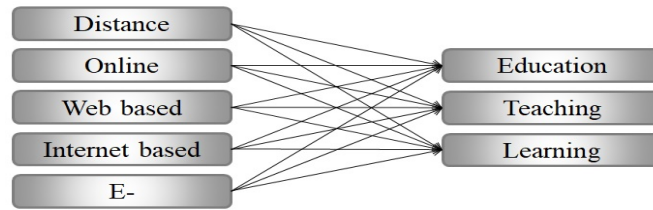
**Figure 1. Crossover of search terms**

Since the search term was used on a large scale in the systematic search process given in Figure 2, 604 theses were downloaded from the YOK thesis center database by the researchers. The download process was carried out between 05.05.2020 and 15.05.2020. 150 theses were included in the study, with the removal of studies that could not be accessed, that had the same thesis code or that were not related to the field of distance education, and studies that were not based on a specific theory/theory/model.
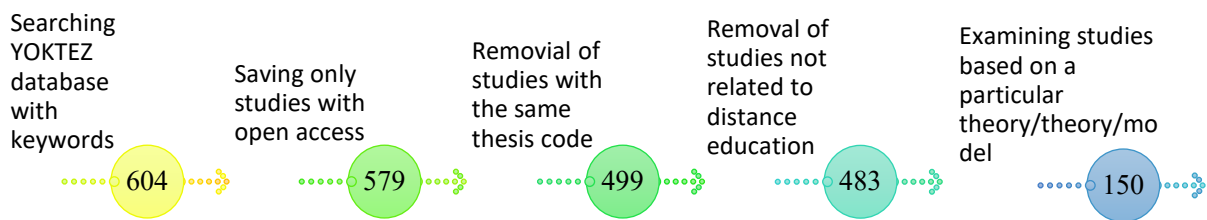
Figure 2. Systematic search process

Analysis of Data

The graduate theses that constitute the data of the study were analyzed by one of the researchers and it was aimed to increase the reliability of the analyzes by controlling them by another researcher. The theses were read carefully and the "Thesis Review Form" prepared for each thesis was filled in separately. Then, the information in the form was converted into codes, categories and graphics using the Microsoft Excel software. In this study, the data of the theses examined by the content analysis method are presented descriptively through graphics and tables. The research and analysis process, which summarizes the collection, analysis and interpretation of study data, is summarized in Figure 3.
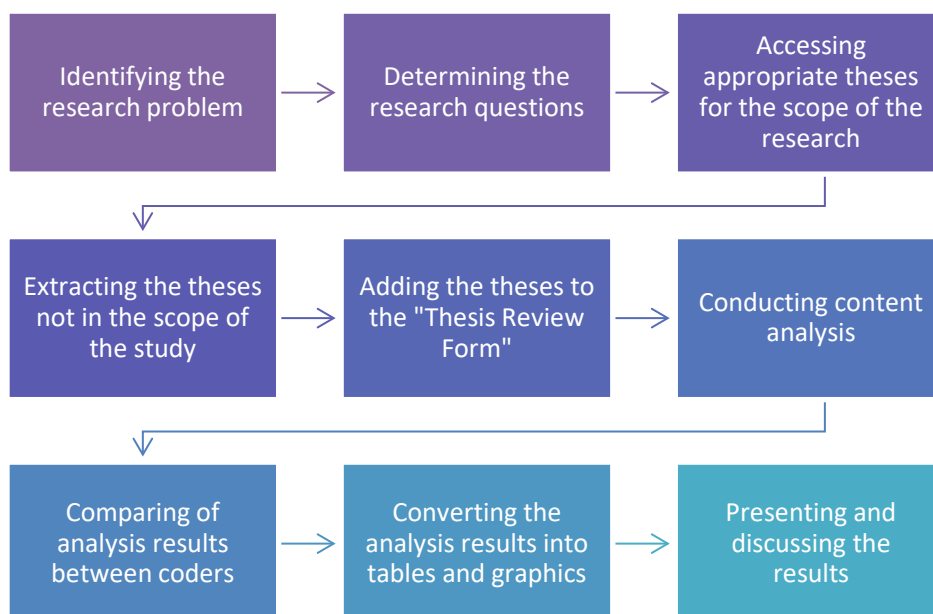
Figure 3. Research and analysis process

Validity and Reliability

Various measures were taken to ensure the validity and reliability of the study. In this context, the data obtained in order to ensure reliability in the study were coded separately by two different researchers and the results were compared. As a result of the comparison, the Cohen Kappa coefficient was calculated in order to determine the reliability. This coefficient expresses the consistency between different raters (Cohen et al., 1996). The following formula was used for the calculation, as suggested by Sim and Wright (2005), where Pr(a) is the total proportion of the observed fit for the two evaluators, and Pr(e) is the probability of this fit occurring by chance.

$$K = \frac{\text{Pr(a)} - \text{Pr(e)}}{1 - \text{Pr(e)}}$$

In the study, the Cohen Kappa coefficient was found to be 0.80, with Pr (a) =0.84 and Pr (e) = 0.17, and this rate shows that the study is reliable (Cohen et al., 1996).

Both internal and external validity were taken into account in ensuring the validity of the study. In order to ensure internal validity, which means a clear expression of the path followed in the research process (Yıldırım & Şimşek, 2011), data collection tools, data collection process and analysis stages were written in detail. Within the scope of external validity which is expressed as the generalizability of the research results (Frankel et al., 2011), the study findings were found to be parallel with the literature.

FINDINGS

In this study, which aims to examine the trends in theory-based graduate theses published between 2008-2020 in the field of distance education in Turkey, the data collected through the Thesis Review Form were analyzed in the context of the sub-problems of the study. In this section, the findings obtained in the study are presented in tables under sub-titles in parallel with the research problems.

Distribution of Theses According to Their Types

The types of theory-based graduate theses in the field of distance education in Turkey are presented in Figure 4. When Figure 4 is examined, it is seen that the number of theses done on this subject are mostly at the master's level (79), while the number of theses done at the doctorate (71) level are close to the master's theses.
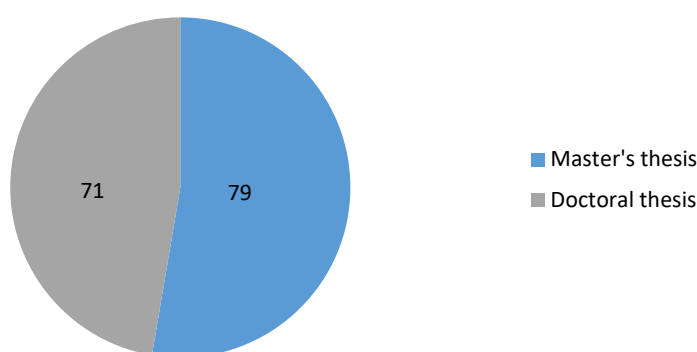

Figure 4. Distribution of theses according to their types

Distribution of Theses by Years

Distribution of graduate theses done in the field of distance education in Turkey and graduate theory-based theses by years is as shown in Figure 5. As it can be seen in Figure 5, the theses done as theory-based (150) out of the graduate theses (483) done in the field of distance education were included in the study because they were suitable for the research criteria. When Figure 5 is examined, it is seen that the highest number of graduate theses on distance education were done in 2010 (60), 2012 (59) and 2014 (55), respectively, and the least number of studies were done in 2016 (23) and 2018 (26). Since theses were accessed on May 2020 (2), the number of graduate theses included in this year is the lowest. The number of theory-based theses was the highest in 2012 (19), 2014 (18) and 2009 (17), respectively; In 2008 (7), 2013 (8) and 2018 (8) it is seen that the number is the least.
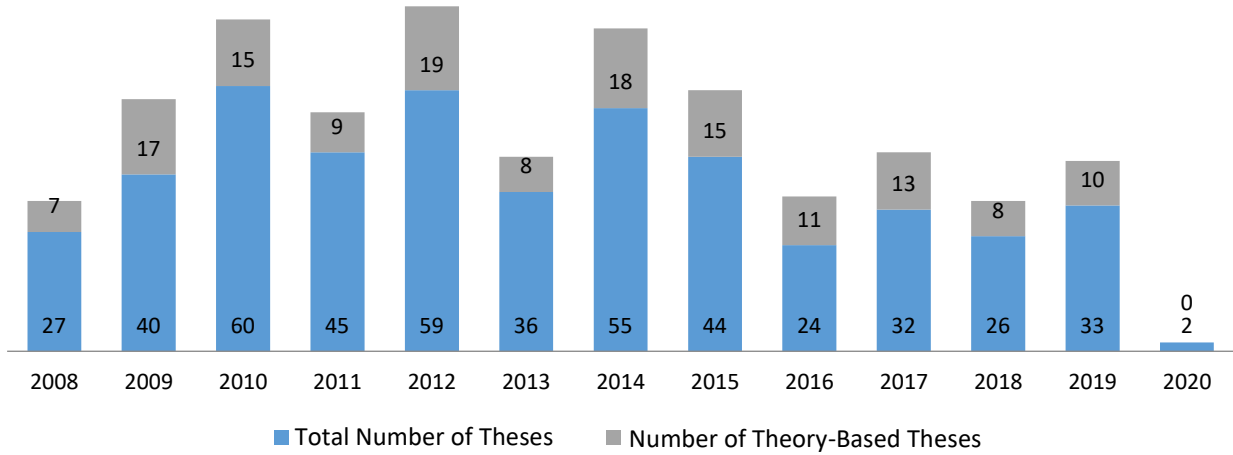
Figure 5. Distribution of theses and theory-based theses by years

Distribution of Theses by Universities

The distribution of the graduate theory-based theses in the field of distance education in Turkey by universities is presented in Table 2.

Table 2. Distribution of theses by universities

Name of University	f	%
Anadolu University	32	21,33
Gazi University	20	13,33
Hacettepe University	10	6,67
Fırat University	8	5,33
Marmara University	8	5,33
Karadeniz Teknik University	7	4,67
Atatürk University	7	4,67
Sakarya University	5	3,33
Ankara University	4	2,67
Middle East Technical University	4	2,67
Dokuz Eylül University	4	2,67
Çukurova University	3	2,00
Samsun On Dokuz Mayıs University	3	2,00
Yeditepe University	2	1,33
İstanbul University	2	1,33
İnönü University	2	1,33
Bahçeşehir University	2	1,33
Ege University	2	1,33
Balıkesir University	2	1,33
Mersin University	2	1,33
Adnan Menderes University	2	1,33
Trakya University	2	1,33
Dumlupınar University	2	1,33
Others	15	10,00
Total	150	100.0

When Table 2 is examined, it is seen that the most of the theory-based are in Anadolu (32) and Gazi (20) Universities. After these universities, it has been revealed that the least number of theses were done in Yeditepe, Istanbul, İnönü, Bahçeşehir, Ege, Balıkesir, Mersin, Adnan Menderes, Trakya and Dumlupınar Universities (2).

Distribution of Theory/Models Used in Theses

The distribution of theory/models used in theory-based graduate theses in the field of distance education in Turkey is presented in Figure 6.
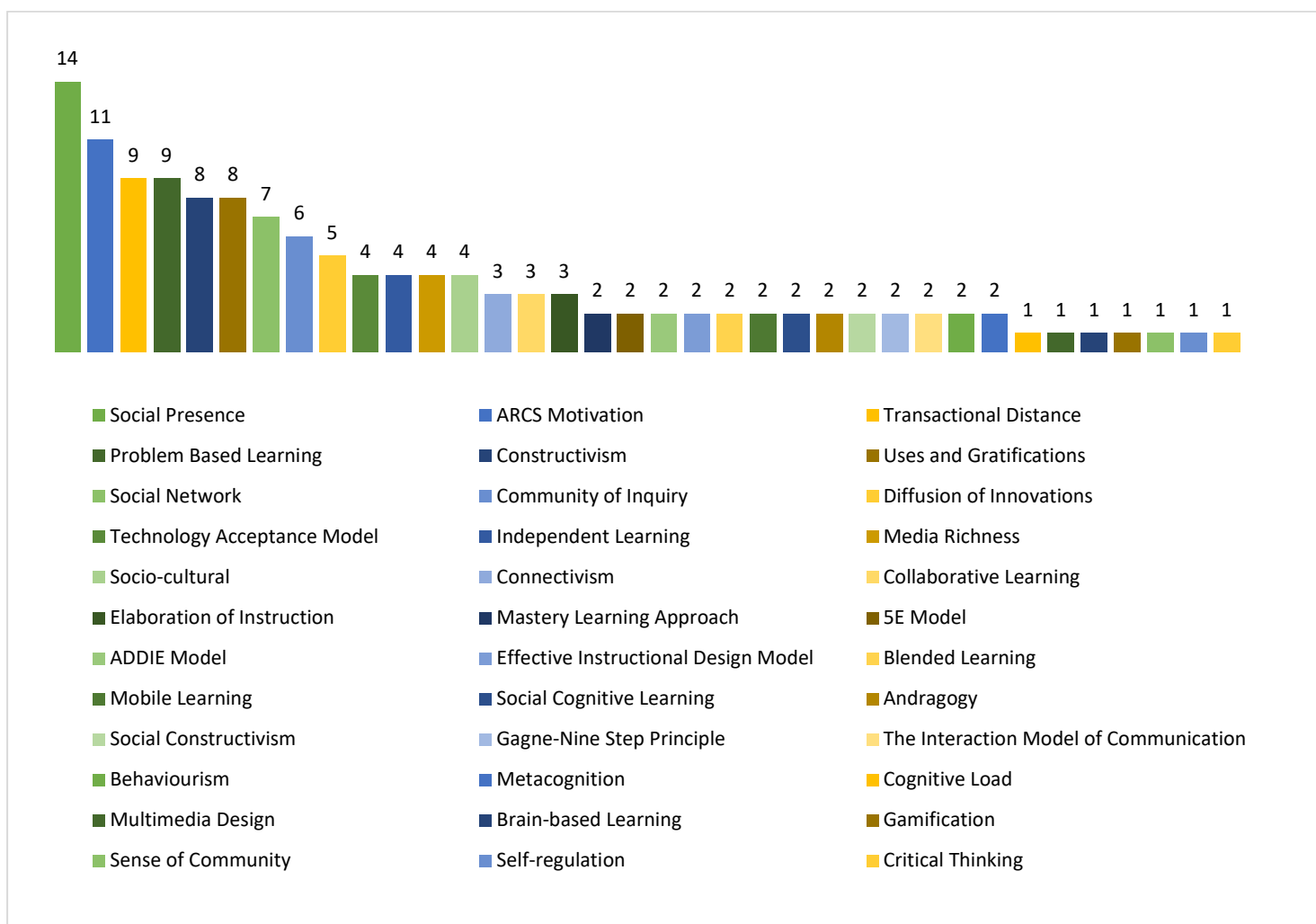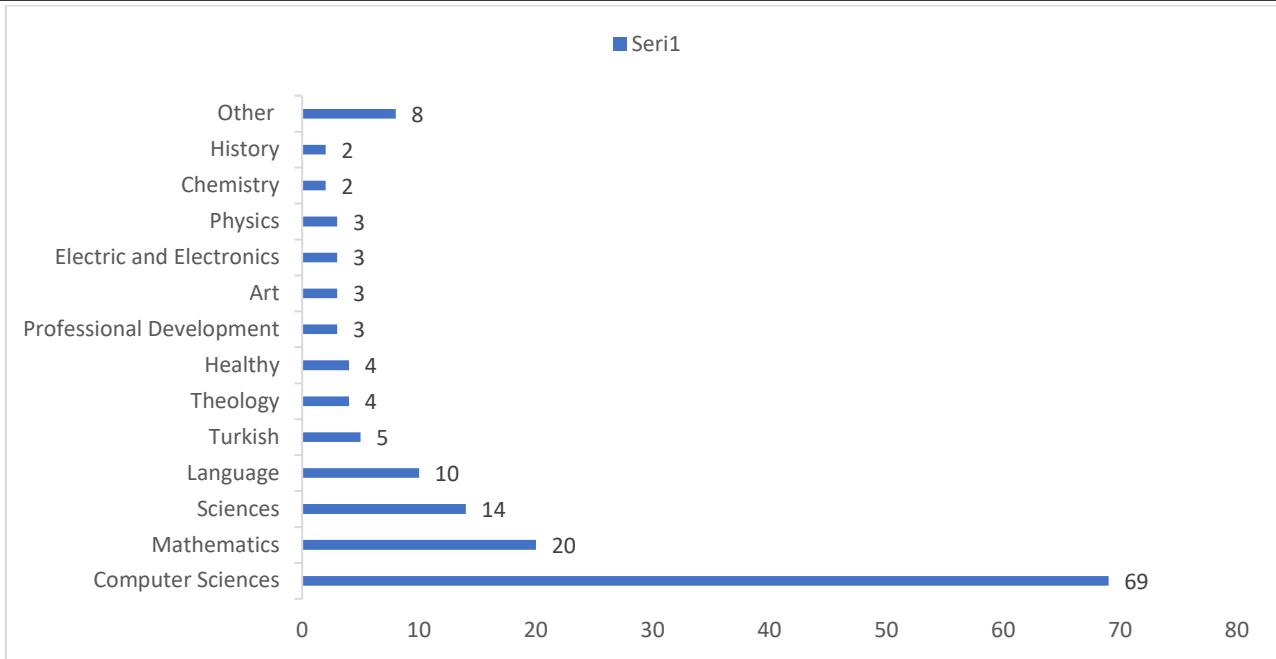

Figure 6. Distribution of theory/models in theses

When Figure 6 is examined, it is seen that the theoretical framework used in theory-based theses mostly consists of Social Presence (14), ARCS Motivation (11) Interactional Distance (9) and Problem-Based Learning (9) theories. Cognitive Load, Multimedia Design, Brain Based Learning, Gamification, Sense of Community, Self-regulation and Critical Thinking theories appear to be at least number(1) in the theses.

Distribution of Theses by Disciplines

The distribution of graduate theory-based theses in the field of distance education in Turkey by disciplines is presented in Figure 7.

Figure 7. Distribution of theses by disciplines

According to Figure 7, when the disciplines of the graduate theory-based theses in the field of distance education are examined, the highest number of theses are in the field of Computer Science (Computer and Instructional Technology Education, Information Technologies and Software, Information and Communication Technologies, Computer Engineering, etc.) (69), and followed by Mathematics (20) and Science (14). On the other hand, it has been revealed that the number of theses done in the fields of Chemistry and History is 2.

Distribution of Variables Used in Theses

The distribution of variables used in the graduate theory-based theses in the field of distance education in Turkey is presented in Table 3.

Table 3. Distribution of variables used in theses

Name of Variables	f	%
Academic achievement	50	33.33
Attitude	23	15.33
Attendance to lesson	17	11.33
Motivation	16	10.67
Permanence	10	6.67
Perception	7	4.67
Metacognitive thinking/Awareness	6	4.00
Cognitive presence	6	4.00
Social Presence	5	3.33
Self-efficacy	3	2.67
Transactional distance perception	4	2,00
Incentive	3	2,00
Opinion	3	2,00
Self-regulation	3	2,00
Evaluation	3	2,00
Transferability	3	2,00
Problem solving	2	1,33
Cognitive load	2	1,33
Learner autonomy	2	1,33
Satisfaction	2	1,33
Trend	2	1,33
Professional development	2	1,33

When Table 3 is examined, it is seen that academic achievement (50) and attitude (23) variables are mostly examined in theory-based theses in the field of distance education. It has been determined that the variables of problem solving, cognitive load, learner autonomy, satisfaction, disposition and individual development are the least (2) examined variable types. More than one variable has been discussed together in almost all of the theses.

Distribution of Sample Sizes in the Theses

The findings obtained as a result of the content analysis for determining the sample levels studied in the graduate theory-based theses in the field of distance education in Turkey are presented in Table 4.

Table 4. Sample levels in the theses

Sample Level	f	%
Undergraduate education	72	48.0
Primary education	24	16.0
Associate education	15	10.0
Teacher	13	8.7
Instructor/lecturer	11	7.3
Secondary education	8	5.3
Graduate	4	2.7
Document	3	2.0
Total	150	100.0

When Table 4 is examined, it is seen that the majority of the theory-based theses in the field of distance education were conducted with students at the undergraduate level (72) and students studying at the primary level (24). It is seen that the number of theses done with students at secondary education level (8) and students studying at graduate education level (3) is limited. It is seen that the number of theses carried out as document analysis is 1.

Distribution of Sample Sizes in Theses

The findings obtained as a result of the content analysis for the determination of the sample sizes in the graduate theory-based theses in the field of distance education in Turkey are presented in Table 5.

Table 4. Sample sizes in the theses

Sample Size	f	%
1-10	8	5.6
11-30	18	12.5
31-100	66	45.8
101-300	45	31.3
1000+	7	4.9
Total	144	100.0

According to Table 5, when the sample sizes of the theory-based theses in the field of distance education are examined, it is seen that 31-100 participants were studied in most of the theses (66), followed by a maximum of 101-300 participants in 45 theses. It has also been revelaed that 8 theses were conducted with 1-10 participants while 7 theses were conducted with 1000+ participants.

DISCUSSION

In this study, in which the types, numbers, university distributions, used theories, subject areas, variables and sample groups and sizes of theory-based graduate theses published between 2008-2020 in the field of distance education in Turkey were examined, 150 theses were reached and analyzed in accordance with the research criteria in the YOK thesis center. The theoretical tendencies and research topics of the examined theses were evaluated in detail.

According to the results of the research, when the theory-based graduate theses in the field of distance education are examined, it is seen that there are more master theses than doctoral theses. It can be said that this finding is related to the fact that the number of master's programs and students is higher than doctoral programs, the duration of master's education is shorter, and the conditions required for entry and graduation are easier (Gökmen et al., 2017, Aydın et al., 2019).

When we look at the number of theses related to distance education, it is seen that there has been an increase from 2008 to 2012 and a decrease since 2012. In these years, the new widespread and low number of distance education institutions/programs in universities may have led to the low number of distance education researches. The decrease in the number of studies over time

may have been caused by the closure of distance education programs, the tendency to new subjects and the decrease in interest in distance education programs (Martin et al., 2011).

When the universities with the most distance education studies are examined, it is seen that Anadolu University ranks first, and after Anadolu University, theory-based graduate theses are done at Gazi University and Hacettepe University, respectively. The reason for this can be shown as the high number of distance education programs in these universities (Ateş, 2014). In addition, the fact that Anadolu University has a long-established open and distance learning faculty can be seen as one of the reasons why it is prominent in this regard. The fact that Gazi University has more than one education faculties, and the number of doctorate and master's programs is high, has enabled these two universities to do more studies. In addition, the fact that there are universities with distance education centers and actively using distance education technologies may have increased the number of theory-based theses.

Within the scope of the study, it is seen that the rate of theory-based theses in the total theses is low. Approximately one of every three theses examined is theory-based. According to these results, considering that the use of theory/theories in distance education graduate theses has increased since 2008 and has a long history in Turkey, it can be concluded that the low number of theory-based theses is generally due to the recent maturation of the theoretical/conceptual frameworks, the theses done at the descriptive level of distance education (Bozkurt et al., 2015b). It can be thought that the theses that are not theory-based are either a technology development focused or a literature study, and the findings in the theses other than these are not discussed within any theoretical framework.

It is seen that the theories such as **"Social Presence"**, **"ARCS Motivation"**, **"Interactive Distance"** and **"Problem-Based Learning"** take place the most in graduate theory-based theses. It is seen that these theories are mostly approaches that put the student in the center with today's teaching and learning approaches. Developing theories for different fields and contributing to the field of distance education can contribute to distance education studies being a scientific field of study. Scientific studies constructed in a theoretical framework affect both practice and research dimensions and provide strong support for researchers to explain and understand the relationships of a phenomenon in a broader perspective (Bozkurt et al., 2015a). Theories enable researchers to see the big picture and see their practice and research from a broader perspective. This broad perspective helps researchers connect with the study of others, facilitate coherent frameworks and understand their actions more deeply, and perhaps most importantly, transfer experience gained in one context to new experiences and contexts (Anderson, 2008).

When the research subject areas of theory-based graduate theses published between 2008-2020 in the field of distance education in Turkey are examined, it is seen that computer science is the most frequently used subject area. Disciplines such as Mathematics, Science and Foreign Language also stand out as the most used subject areas. When the subject areas/disciplines included in the distance education studies in the literature are examined, it is seen that generally similar areas are used in the studies, although there are small differences (Tuncay & Uzunboylu, 2010; Gökmen et al., 2017; Bozkurt et al. 2015). It can be thought that distance education programs are mostly opened in computer departments and include computer science courses, which leads to more studies in this field.

When we examine at the variables in the theses examined within the scope of the study, it is seen that academic success is the most examined variable type, and variables such as attitude, class participation and motivation are the variables that take place most in the studies. It has been revealed that concepts such as academic achievement, attitude, perception and satisfaction are commonly used in distance education studies. The frequent use of these variables in theses can be seen as a comparison of the effectiveness of face-to-face education and distance education in terms of these variables (Saba, 2000; Horzum et al., 2017).

It is seen that the sample group in the theses is mostly undergraduate students, and document/document analysis is the least used sample group. The fact that distance education centers and programs are mostly in universities may have led researchers to study more with university students (associate, undergraduate and graduate) (Varışoğlu et al., 2013). In addition, the fact that researchers prefer sample groups with easier access when choosing a study group may be a reason for this situation. At the same time, the group studying with distance education is generally expected to have high technology literacy, readiness for independent learning and self-control. For this reason, the fact that the sample group studied in distance education generally consists of adults supports this result (Bozkurt et al., 2015a; Demir-Kaymak & Horzum, 2013; Gökmen et al., 2017). In addition, it is predicted that distance education will enter the field of distance education in sample groups at primary and high school levels, as it offers lifelong learning opportunities and enters all levels of education due to the current pandemic conditions. It is seen that sample size is generally in the range of 31-100 participants. As Erdoğmuş (2009) stated, this may also be due to the limited time of researchers, official and ethical process procedures, and their aim to reach data in a shorter time and more easily.

CONCLUSION AND RECOMMENDATIONS

As a result, this study is important in terms of guiding future researchers by examining theory-based graduate theses in the field of distance education in Turkey. In the study, 150 graduate theses published on this subject and meeting the research criteria were examined and it was determined that one of each of these three theses was theory-based. It can be said that this number is quite small and studies on this subject should be increased. As a result of this study, it was determined that most of the theory-based graduate theses published between 2008-2020 in the field of distance education consisted of master's theses, there was a serious decrease in the number of theses since 2014, the most common field of theses was computer science, academic

achievement and attitude were the most frequently used variables in theses. On the other hand, it was concluded that theories such as Social Presence, ARCS Motivation, Interactive Distance and Problem-Based Learning were included, undergraduate students were preferred as the sample group in the theses, and groups of 31-100 participants were more preferred as the sample size.

It is thought that the findings obtained from this study will be useful for a deeper understanding of the theory-based theses in distance education, by offering suggestions for future research, and contributing to the thesis or research that is planned to be done in the future on this subject. Based on the findings obtained from the study, some suggestions are offered to the researchers:

- Considering that the theory-based distance education graduate theses mostly consist of master's theses, incentives can be made for the establishment of distance education departments in universities and the employment of instructors who will carry out educational activities in order to do doctoral theses with higher quality and scientific value.

- Considering that the theory-based distance education graduate theses are generally insufficient, the fact that the academicians encourage their students to make theory-based theses can strengthen the thesis to be prepared on this subject and increase its contribution to the field.

- It is seen that the theories such as Social Presence, ARCS Motivation, Interactional Distance and Problem-Based Learning are mostly included theories in the graduate theory-based theses. In general, in addition to these theories, future studies should focus on the use of theories that directly guide distance education and ensure the effectiveness and functionality of distance education applications.

- It is seen that nearly half of the theses published in the field of distance education were conducted in two or three universities. In this respect, it can be ensured that different universities encourage graduate theses covering both the practice and theory of distance education, and experienced instructors can take part as guides in universities.

- In the theses examined, it is seen that the undergraduate students are mostly studied as the sample group. Considering the increasing importance of distance education at every education level, the use of random sampling methods will enable the selection of sample groups at primary and high school levels and to obtain more generalizable results. For this reason, conducting theory-based theses in different education levels can be a source for producing different solutions for the problems in this field.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Statements of publication ethics

We declare that the study has not unethical issues and that research and publication ethics have been observed.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers

Ethics Committee Approval Information

Since the document review was carried out, no permission was needed.

REFERENCES

Akpınar, Y. (2003). Öğretmenlerin yeni bilgi teknolojileri kullanımında yukseköğretimin etkisi: İstanbul okulları örneği. *The Turkish Online Journal of Educational Technology*, *2*(2), 79-96.

Anderson, T. (Ed.). (2008). *The theory and practice of online learning*. Athabasca University Press.

Anglin, G. & Morrison, G. (2000). An analysis of distance education research: ımplications for the instructional technologist. *Quarterly Review of Distance Education*, *1*(3), 180-194.

Arat, T., & Bakan, Ö. (2011). Uzaktan eğitim ve uygulamaları. *Selçuk Üniversitesi Sosyal Bilimler Meslek Yuksekokulu Dergisi*, *14*(1-2), 363-374.

Ateş, Ö. T. (2014). Yükseköğretimde uzaktan eğitimin sayısal verilerle değerlendirilmesi. *Bayburt Eğitim Fakültesi Dergisi*, *9*(1), 22-40.

Aydın, E. İ., Kaya, S., İşkol, S., & İşcan, A. (2019). Anadolu üniversitesi uzaktan eğitim bölümünde yayınlanmış yüksek lisans ve doktora tezlerinin içerik analizi. *Journal of Higher Education & Science/Yükseköğretim ve Bilim Dergisi*, *9*(3).

Aydın, C. H., Zawacki-Richter, O., & Bozkurt, A. (2020). A review and content analysis of the Turkish online journal of distance education publications between 2000 and 2015. In *proceedings of EDEN Annual Conference 2020: Human and artificial intelligence for the society of the future* (pp. 217-225). Politehnica University Timisoara, Romania.

Babur, A., Kiper, A., Çukurbaşı, B., Özer, E. A., Tonbuloğlu, İ., Küçük, Ş., ... & Horzum, M. B. (2016). 2009-2013 yılları arasında uzaktan eğitim dergilerinde yayınlanan makalelerin yöntemsel açıdan incelenmesi. *Sakarya University Journal of Education*, *6*(1), 123-140.

Bauer, M. W. (2003). Classical content analysis: A review. In M. W. Bauer & G. Gaskell (Eds). Qualitative researching with text, image and sound (131-151). London: Sage Publication.

Berge, Z. L., & Mrozowski, S. (2001). Review of research in distance education, 1990 to 1999. *American Journal of distance Education*, *15*(3), 5-19.

Bernard, R. M., Abrami, P. C., Lou, Y., Borokhovski, E., Wade, A., Wozney, L., & Huang, B. (2004). How does distance education compare with classroom instruction? A meta-analysis of the empirical literature. *Review of Educational Research*, *74*(3), 379–439.

Bozkurt, A., Kumtepe, E. G., Kumtepe, A. T., Aydın, İ. E., Bozkaya, M., & Aydın, C. H. (2015a). Research trends in Turkish distance education: A content analysis of dissertations, 1986-2014. *European Journal of Open, Distance and E-learning*, *18*(2), 1-21.

Bozkurt, A., Akgun-Ozbek, E., Yilmazel, S., Erdogdu, E., Ucar, H., Guler, E., ... & Dincer, G. D. (2015b). Trends in distance education research: A content analysis of journals 2009-2013. *International Review of Research in Open and Distributed Learning*, *16*(1), 330-363.

Bozkurt, A., Zawacki-Richter, O., & Aydin, C. H. (2019, October). Using social network analysis to review the research in open and distance learning. In *Proceedings of The Association for Educational Communications and Technology (AECT) 2019 International Convention* (pp. 38-44).

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2012). *Bilimsel araştırma yöntemleri* (13. bs.). Ankara: Pegem Akademi Yayınları.

Cohen. J. R., Swerdlik M. E., & Phillips, S. M. (1996). Psychological testing and assessment. (3ᵗʰ Ed.). London: Mayfield.

Creswell, J. W. (2012). Researchdesign: Qualitative, quantitative, and mixed methods approaches (4nd ed.). United States: Pearson Education.

Davies, R. S., Howell, S. L., & Petrie, A. (2010). A review of trends in distance education scholarship at research universities in North America, 1998-2007*, International Review of Research in Open and Distance Learning*, *11*(3), 42-56.

Demir Kaymak, Z., & Horzum, M. B. (2013). Relationship between online learning readiness and structure and interaction of online learning students. *Educational Sciences: Theory and Practice*, *13*(3), 1792-1797.

Durak, G., Çankaya, S., Yünkül, E., Urfa, M., Topraklıklıoğlu, K., Arda, Y., & İnam, N. (2017). Trends in distance education: A content analysis of master's theses. *The Turkish Online Journal of Educational Technology*, *16* (1).

Erdoğmuş, F. U. (2009). *Research Trends in CEIT MS and Ph.D. Theses in Turkey: A Content Analysis.* Yayınlanmamış Yüksek Lisans Tezi, Orta Doğu Teknik Üniversitesi, Ankara.

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

Gökmen, Ö., Uysal, M., Yaşar, H., Kırksekiz, A., Güvendi, G., & Horzum, M. (2017). Türkiye'de 2005-2014 yılları arasında yayınlanan uzaktan eğitim tezlerindeki yöntemsel eğilimler: Bir içerik analizi. *Eğitim ve Bilim*, *42*(189).

Guri-Rosenblit, S. (2005). 'Distance education'and 'e-learning': Not the same thing. *Higher Education*, *49*(4), 467-493.

Hauser, L. (2013). Qualitative Research in Distance Education: An Analysis of Journal Literature 2005–2012. *American Journal of Distance Education*, 27(3), 155-164.

Holmberg, B. (2005). Theory and practice of distance education. Routledge.

Horzum, M. B., Özkaya, M., Demirci, M., & Alpaslan, M. (2013). Review of Turkish distance education research. *Inonu Unıversıty Journal Of The Faculty of Educatıon, 14* (2), 79-100.

Koble, M. A., & Bunker, E. L. (1997). Trends in research and practice: An examination of the American Journal of Distance Education 1987 to 1995. *American Journal of Distance Education*, *11*(2), 19-38.

Lee, Y., Driscoll, M. P., & Nelson, D. W. (2004). The past, present, and future of research in distance education: Results of a content analysis. *The American Journal of Distance Education*, *18*(4), 225-241.

Martin, S., Diaz, G., Sancristobal, E., Gil, R., Castro, M. & Peire, J. (2011). New technology trends in education: Seven years of forecasts and convergence. *Computers &Education*, *57*(3), 1893-1906.

Moore, M. G. (1973). Toward a theory of independent learning and teaching. *The Journal of Higher Education*, *44*(9), 661-679.

Özarslan, Y., Balaban-Sali, J., & Demiray, U. (2012). TOJDE: Electronic publishing and a review of ten years' experience in Turkey. *Turkish Online Journal of Distance Education, 13*(3), 316–346.

Özkul, A. E., & Aydın, C. H. (2013). Açık ve uzaktan öğrenmenin temelleri ve araştırmalar. K. Çağıltay ve G. Yüksel, (Eds.), *Öğretim teknolojilerinin temelleri: Teoriler, araştırmalar, eğilimler*. (s. 513-534). Ankara: Pegem A Akademi.

Phipps, R. & Merisotis, J. 1999. "What's the difference? A review of contemporary research on the effectiveness of distance education in higher education". *Institute for Higher Education Policy.* [online]. Erişim adresi: http://www.ihep.com/difference.pdf [Google Scholar]

Saba, F. (2000). Research in distance education: A status report. *International Review of Research in Open and Distance Learning*, *1*(1), 1-9.

Sim, J., & Wright, C. C. (2005) The Kappa statistic in reliability studies: Use, interpretation, and sample size requirements. *Physical Theraphy*, 85(3), 258-268.

Stemler, S. (2001). An overview of content analysis. *Practical Assessment, Research & Evaluation, 7*(17), 1-6.

Tuncay, N., & Uzunboylu, H. (2010). Trend of Distance Education in the last three Decades. *World Journal on Educational Technology*, *2*(1), 55-67.

Uygun, D. (2018). The Turkish Online Journal Of Distance Education: güncel çalışmalara dair bir içerik analizi. *Açıköğretim Uygulamaları ve Araştırmaları Dergisi*, *4*(3), 129-141.

Uygun, D.(2019). Açıköğretim Uygulamları Ve Araştırmaları Dergisi: Güncel çalışmalara ilişkin bir içerik analizi. *Açıköğretim Uygulamaları ve Araştırmaları Dergisi*, *5*(1), 87-96.

Varışoğlu, B., Şahin, A., & Göktaş, Y. (2013). Türkçe eğitimi araştırmalarında eğilimler. *Kuram ve Uygulamada Eğitim Bilimleri*, *13*(3), 1767-1781.

Ward, M.E., Peters, G., & Shelly, K. (2010). Student and faculty perceptions of the quality of online learning experiences. *International Review of Reseach in Open and Distance Learning*, *11*(3), 57-77.

Yıldırım, A., & Şimşek, H. (2011). *Sosyal bilimlerde nitel araştırma yöntemleri*. Ankara, Seçkin Yayıncılık.

Zawacki-Richter, O. (2009). Research Areas in Distance Education: A Delphi Study. *International Review of Research in Open and Distance Learning*, *10*(3).

Zawacki-Richter, O., Alturki, U., & Aldraiweesh, A. (2017). Review and content analysis of the international review of research in open and distance/distributed learning (2000–2015). *International Review of Research in Open and Distributed Learning*, *18*(2), 1-26.

Zawacki-Richter, O., Bäcker, E.M. & Vogt, S. (2009). Review of distance education research (2000 to 2008): Analysis of research areas, methods, and authorship patterns. *In International Review of Research in Open & Distance Learning*, *10*(6), 21-50.

| Research Article / Araştırma Makalesi|

Determination of the Biomimicry Perceptions of Middle School 7th Grade Students through Drawings
Ortaokul 7. Sınıf Öğrencilerinin Biyomimikri Algılarının Çizimler Aracılığı ile Belirlenmesi[1]

Dilara VELİOĞLU[2], **Mehmet YAKIŞAN**[3]

Abstract

Purpose: The aim of the study is to identify the technological products that middle school 7th grade students intend to design inspired by the characteristics of animals through drawings.

Design/Methodology/Approach: Case study, one of the qualitative research methods, was used in this research. The study is conducted in a middle school in the city center of Samsun. The participants of the study consists of 30 students (18 girls, 12 boys) studying in the 7th grade of the related school. The worksheet "I choose it myself, I design it myself" was used as data collection tool. According to the worksheet, students were asked to draw the technological products they thought to design, inspired by the characteristics of the animals, as a picture. Content analysis was used in the analysis of the data of the study.

Findings: When the drawings of the technological products made by the students were examined, it was observed that they were mostly for the designs of military vehicles. It can be stated that the students were impressed by the war games they played on the internet and the war images they saw in the media. In addition, it was determined that students made design drawings of land vehicles and many technological products that they can use in daily life.

Highlights: In the study, it is thought that the students developed their different skills with the technological products they thought to design by detailing the characteristics of the animals they were inspired by and interpreting their own ideas with the theoretical knowledge they learned. It is important for students to be individuals who are interested in living things they encounter in daily life, can use science and technology, produce, question and grow up as science literate. Therefore, biomimicry applications can be increased in STEM education. Thus, students can be enabled to design real technological products inspired by living things.

Öz

Çalışmanın amacı: Ortaokul 7. sınıf öğrencilerinin hayvanların özelliklerinden esinlenerek tasarlamayı düşündükleri teknolojik ürünlerin çizimler aracılığı ile tespit edilmesidir.

Materyal ve Yöntem: Çalışmada, nitel araştırma yöntemlerinden durum çalışması kullanılmıştır. Araştırmaya Samsun il merkezinin bir ortaokulunun 7. sınıfında öğrenim görmekte olan 18'i kız 12'i erkek toplam 30 öğrenci katılmıştır. Veri toplama aracı olarak "Kendim seçiyor, kendim tasarlıyorum" çalışma kâğıdı kullanılmıştır. Çalışma kâğıdına göre öğrencilerden hayvanların özelliklerinden esinlenerek tasarlamayı düşündükleri teknolojik ürünleri resim olarak çizmeleri istenmiştir. Çalışmanın verilerinin analizinde içerik analizi kullanılmıştır.

Bulgular: Öğrencilerin yapmış oldukları teknolojik ürünlere yönelik çizimler incelendiğinde, en çok askeri araçlara ait tasarımlara yönelik çizimler olduğu gözlenmiştir. Öğrencilerin internette oynadıkları savaş oyunları ve medyada gördükleri savaş görüntülerinden etkilendikleri ifade edilebilir. Ayrıca öğrenciler kara araçları ve günlük hayatta kullanabilecekleri birçok teknolojik ürünlere ait tasarım çizimleri yaptıkları tespit edilmiştir.

Önemli Vurgular: Çalışmada öğrenciler, esinlendikleri hayvanların özelliklerini detaylandırarak ve kendi fikirlerini, öğrendiği teorik bilgilerle yorumlayarak tasarlamayı düşündükleri teknolojik ürünler ile farklı becerilerini geliştirdikleri düşünülmektedir. Öğrencilerin günlük hayatta karşılaştıkları canlılara karşı ilgisi olan, bilim ve teknolojiyi kullanabilen, üreten, sorgulayan ve fen okuryazarı olarak yetişen bireyler olmaları önemlidir. Bu yüzden FeTeMM eğitiminde biyomimikri uygulamaları artırılabilir ve böylece öğrencilerin canlılardan esinlenerek gerçek teknolojik ürünler tasarlamalarına imkân sağlanabilir.

[1] This article is derived from the master thesis written by Dilara VELİOĞLU and supervised by Assoc. Prof. Mehmet YAKIŞAN.
[2]**Corresponded Author,** Ondokuz Mayıs University, Institute of Graduate Studies, Department of Mathematics and Science Education, Samsun, TURKEY; dilara.velioglu61@gmail.com, https://orcid.org/0000-0001-9583-0100
[3]Ondokuz Mayıs University, Faculty of Education, Department of Mathematics and Science Education, Samsun, TURKEY; yakisan@omu.edu.tr, https://orcid.org/0000-0002-5359-2826

INTRODUCTION

Education is one of the permanent structures in the provision of social needs. Therefore, the education system should be able to develop in accordance with the current conditions required by the age. In particular, it should not give information to students as it is. In schools, first of all, students should gain new knowledge by producing it themselves. In this respect, it is important to acquire and maintain twenty-first century skills (Louis, 2012). The aim of the renewed curriculum is to educate people with twenty-first century skills such as creativity, innovation and entrepreneurship (Thomas, 2014).

Today, due to the development of twenty-first century technology, it is emphasized that science, technology and economy should be taught with a holistic perspective and interdisciplinary approach studies in the fields of education should be increased (NRC, 2011). Creativity, critical and computational thinking, mathematics and engineering abilities are twenty-first century skills that should be taught to students (Yılmaz, Gülgün, Çetinkaya ve Doğanay, 2018). One of the interdisciplinary approaches that is effective in acquiring twenty-first century skills and producing solutions to the problems encountered is STEM education. STEM stands for science, technology, engineering, and math. These four symbols represent the different areas of STEM education. (Bybee, 2010). It is important that the disciplines of science, technology, engineering and mathematics are integrated. Because STEM education enables students to do research, learn lifelong and become scientifically literate individuals (Çorlu, Capraro ve Capraro, 2014). Therefore, the purpose of STEM education is to enable students to become STEM literate and to provide students with problem-solving skills (Fan ve Ritz, 2014).

In the MEB (2018), Secondary Education Biology Curriculum, one of the goals that should be given to students is to enable students to use the knowledge and skills they learned in the lesson in daily life. In addition, it is to teach students about living organisms and to support them to become aware of technologies developed by being inspired by living things. Similarly, to ensure that students are enthusiastic about technologies. The discipline that represents the development of new technologies inspired by living things is biomimicry. The aim of this discipline is to produce solutions to needs by using nature's methods and imitating its processes. Biomimicry fully or partially imitates the color, texture and functions of living things in nature (Kuday, 2009).

Biomimicry was recognized towards the end of the twenty-first century and includes many disciplines such as anatomy, botany, zoology, physics and chemistry (Banger, 2016). Although biomimicry is often combined with architecture and other disciplines, it is particularly related to the disciplines of nature, biology, technology and engineering. For example, a building made by examining the structural features and circulatory system of an organism creates a product of innovative and sustainable design (Karabetça, 2016). When the designs inspired by nature are examined, many examples of biomimicry have been seen. These are: structures inspired by the branches and roots of the tree in architecture, and ceramic surfaces inspired by corals and bone tissues (Genç, 2013). Living organisms and their characteristic features have been beneficial for the creation of technological products that people need. At the same time, the discipline of biomimicry has started to be used in educational sciences and various researches have been started recently. Yakışan and Velioğlu (2019) and Yıldırım (2019) found in their research that biomimicry has a positive effect on students' twenty-first century skills.

Drawing is one of the best methods used to determine the ideas in the minds of children. The advantages of the drawing method are that its description is shorter in duration and more in terms of information content (Atasoy, 2004). Especially preschool, primary and secondary school students can express their ideas better with drawings and pictures than writing. Therefore, children's pictures are a good communication tool to understand them. In addition, pictures allow students to reflect their knowledge and skills well (Yavuzer, 2010). Ormancı and Balım (2014) used the drawing method to determine secondary school students' ideas about the subject of matter. In the study, students' understanding of the subject and their misconceptions were determined by drawings. Eyceyurt Türk and Tüzün (2017) investigated high school students' images about scientists and the functioning of science. In their studies, the researchers had the students make drawings and revealed the mental pictures of the students. Reflected in the form of pictures are mental images of abstract phenomena that individuals create in their thoughts (Ergen, Boyraz, Batmaz ve Çevik Kansu, 2020). Metaphors are used to reveal mental images of groups such as students, prospective teachers and teachers. Metaphors are pedagogical tools that educators use in concept teaching in recent years (Saban, 2008). Yılmaz and Yanarateş (2020) determined pre-service teachers' metaphorical perceptions about the concept of water pollution through triangulation. At the end of this study that was carried out for the determination of metaphoric perceptions, the perceptions of prospective teachers were analyzed from a fair number of different perspectives. Similarly, Alkış Küçükaydın and Uluçınar Sağır (2018) researched mental images on science learning. The aim of their study is to reveal the mental images and adopted methods and techniques of the preschool teacher candidates towards science teaching and learning. In the study, pre-school teacher candidates made drawings.

Purpose of the Study

The purpose of this research is to determine what kind of technological products 7th grade students can design, inspired by the characteristics of animals, in solving the problems they encounter in their daily lives. In addition, it was aimed to reveal the mental images of the students by asking them to draw the technological products that they thought to design inspired by the

characteristics of animals. Also, it is aimed to integrate the knowledge they have learned in science course with engineering and technology to gain the skills to use them to solve some of the problems they encounter in daily life.

METHOD/MATERIALS

This study is a case study to determine the technological product designs that the students participating in this practise will prepare inspired by the characteristics of animals. Qualitative research method was used in the study, and student drawings made in accordance with the case study were examined.

Research Group

The study was carried out in a public secondary school in Samsun Province in the fall semester of the 2019-2020 academic year. The study group consisted of 30 students, 18 of whom were girls and 12 boys, who were in the seventh grade of the same secondary school. Seventh grade students were preferred for the study because they are in the age range which they can use their imagination in the best way and reveal their creativity. The students who participated in the practise were selected by the appropriate sampling method.

Data Collection

The data of the study were obtained directly from the students who participated in the research. "I choose myself, I design myself" working paper is used for the data collection tool. In the research, firstly, a biomimicry video which contains the characteristics of living things and the technological products designed from these features was shown to the students. Afterwards, the "I choose and design myself" worksheet was distributed to the students. Apart from the creatures and biomimicry products in the video they watched, the students were asked to answer the question "What kind of technological products can be designed specific to the field of biomimicry inspired by the characteristics of animals?" and to select an animal and draw the technological products they intend to design from its features on the worksheet and briefly explain their drawings. In the study, which took one class hour, the students were given the opportunity to express their thoughts by drawing in their own way. No guidance was given to the students in the study and the study was followed monitored by one of the researchers in the classroom.

Data Analysis

In the research, the students explained the technological products that they thought to design inspired by the characteristics of animals, by drawing. Content analysis of the data obtained was made from the pictures drawn by the students and the explanations they wrote. The drawings of different students are categorized according to the similarities of the technological products they intend to design. The frequencies of the categorized technological product designs were determined and tabulated. Student drawing examples of technological product designs in each category are presented by interpreting. The data of the study show parallels with the participants and contexts. The quality of the data was checked by the researchers, and the data that were not related to the drawings that were asked from the students within the framework of the activity were removed and the analysis was carried out accordingly. Expert opinion was taken for the questions and activities in the worksheet included in the practise of the research. A consensus was agreed among the researchers on the place and process of the practise. This research is compatible with the characteristics of the case study design. During the analysis, categories which related to similar designs, were constituted by taking into account the drawings and explanations made by the students. The categories were classified in terms of the inspired animal and the designed product, and were assigned by constituting appropriate codes. The coding of students' drawings for technological products was done separately. Afterwards, the researchers made checks on the suitability of the coding and the categories constituted, and determined that they were largely similar. During these procedures, the codings on which both researchers did not agree were rearranged and largely agreed. In this way, consistency was achieved among the researchers in the analysis of the study's data.

FINDINGS

In the research, the drawings of the technological products that 7th grade students thought to design inspired by the characteristics of animals were analyzed as in Table 1 and interpreted together with their thoughts about their designs.

Table 1. Analysis of technological product drawings designed by students inspired by the characteristics of animals

| Categories	Inspired Animals	Drawn Products	f	Σ f
1. Military Vehicles	Chameleon	Observer	2	
	Ant	Agent	1	
	Millipede	Military vehicle	1	
	Horse	Tank	1	8
	Dog	Military vehicle	1	
	Elephant	Tank	1	
	Turtle	Helmet	1	
2. Land Vehicles	Turtle	Mobile home	3	
	Worm	Underground vehicle	1	
		Mobile home	1	7
	Pitbull	Tractor	1	
	Mouse	Underground vehicle	1	
3. Tools Used in Daily Life	Firefly	Lamp	2	
	Giraffe	Camera	1	5
	Worm	Drill	1	
	Kangaroo	Cleaner robot	1	
4. Tools Specific to the Living Senses	Elephant	Sound device	2	
	Mole	Saw	1	4
	Parrot	Talking robot	1	
5. Underwater Vehicles	Fish	Submarine	1	
		Cleaner	1	3
	Octopus	Cleaner	1	
6. Air Vehicles	Butterfly	Drone	2	3
	Dragonfly	Plane	1	

Technological products designed by secondary school 7th grade students inspired by the characteristics of animals are classified in six categories and shown in Table 1. These are: "Military Vehicles", "Land Vehicles", "Tools Used in Daily Life", "Tools Specific to the Living Senses", "Underwater Vehicles" and "Air Vehicles". The most drawn technological product design was "Military Vehicles" drawn by 8 students. Then, 7 students designed "Land Vehicles" and 5 students designed Tools Used in Daily Life, respectively. In addition, it was determined that 4 students designed "Tools Specific to Their Living Senses", 3 students designed "Underwater Vehicles", and 3 students designed "Air Vehicles".

When Table 1 was examined, it was determined that the most inspired animal by the students was the turtle. In total, 4 students drew their helmet and house designs using the characteristics of the turtle. It has been determined that the second most inspired animal is the elephant and the worm. 3 students were inspired by the elephant and 3 student by the worm.

The drawings and thoughts of the students in the categories of "Military Vehicles", "Land Vehicles", "Tools Used in Daily Life", "Tools Specific to Living Senses", "Underwater Vehicles" and "Air Vehicles" are given below.

1. Findings of Student Drawings in the Military Vehicles Category

When the drawings of the students who were considering designing military vehicles were examined, it was determined that the students were inspired by the chameleon, millipede, ant, horse, dog, elephant and turtle. 1 student designed a military vehicle from a centipede and 1 student designed a military vehicle from a dog, and 1 student designed a tank from an elephant and 1 student designed a tank from a horse. In addition, 1 student drew ant agent technological product and 1 student drew turtle helmet technological product. Students mostly likened chameleon to military vehicles. In total, 2 students designed observers inspired by the chameleon. The drawing of one of the students who designed a chameleon observer is shown in Fig. 1.
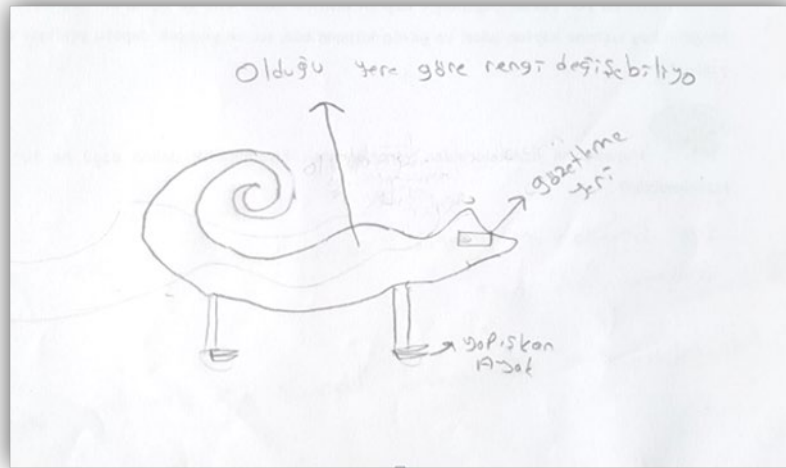
Figure 1. Student drawing of chameleon observer design

As shown in Figure 1, student "Ö.21" designed a watcher by making use of the chameleon's camouflage and its color changing feature. The student attached a camera to the chameleon's eye and added a peephole and sticky feet. The student explained his design as follows: "*When the chameleon observer encounters the terrorists, it will change its color and the weapon inside will not be visible and will shoot the terrorists*". In addition, the student stated that the camera he intended to place in the eye part was hidden and that this camera could be used for documentary shootings.

2. Findings of Student Drawings in the Land Vehicles Category

In the study, students who designed technological products related to land vehicles benefited from the features of turtle, worm, pitbull and mouse. The most inspired animal in this category is the turtle. 3 students designed a mobile home from a turtle.

The design made by one of the 3 students who drew a turtle mobile home from land vehicles is shown in Figure 2.
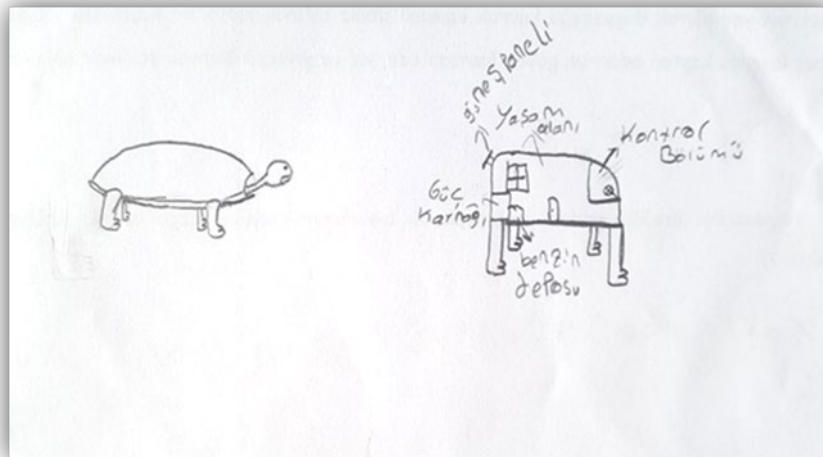
**Figure 2. Student drawing of turtle mobile home design**

Student "Ö.12" thought the outer hard shell of the turtle as the house of the turtle and designed a mobile home. The student explained her design as follows: "*I built a walking house inspired by a turtle. Because if we go to a far place, we can rest, or if we are too tired on the far road, we can pull over and sleep. Since the house is powered by solar panels, it stores energy during the day and can run on gasoline when the weather is bad.*"

In addition, 1 student designed a worm underground vehicle, 1 student a pitbull tractor, 1 student a mouse underground vehicle and 1 student a worm mobile home in this category.

3. Findings of Student Drawings in the Tools Used in Daily Life Category

Students who think about designing tools used in daily life were inspired by firefly, giraffe, worm and kangaroo. The most inspired animal in this category is the firefly and it was designed by 2 students. Students designed a lamp inspired by a firefly. In addition, 1 student designed a giraffe camera, 1 student a worm drill and 1student a kangaroo garbage collector cleaning robot.

The design of the student who made a kangaroo cleaner robot from technological products that can be used in daily life is shown in Figure 3.
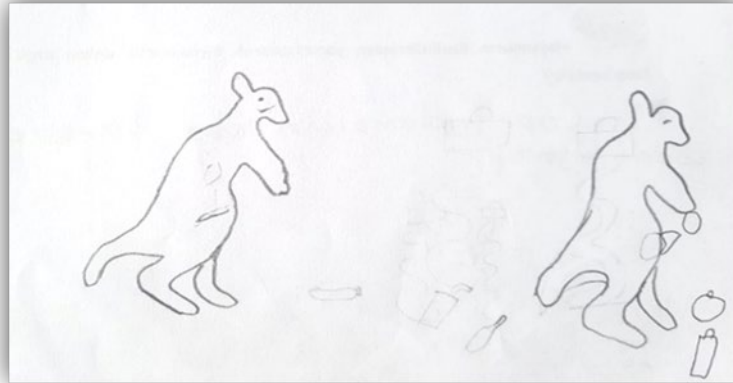

Figure 3. Student drawing of kangaroo cleaner robot design

Student "Ö.23" designed a cleaning robot that collects kangaroo garbage as shown in Figure 3. The student explained her design as follows: *"I was inspired by the kangaroo's ability to carry its baby in its pouch. I made this design to collect garbage, be clean and not have to worry about vacuuming the floor."*

4. Findings of Student Drawings in the Tools Specific to the Living Senses Category

The students who designed the technological products in this category were inspired by the senses of the elephant, mole and parrot. 2 students each designed a sound device inspired by the ears of elephants. Two students each designed a sound device inspired by the ears of elephants. The students thought that elephants hear better because of their large ears. Therefore, students drew their technological products in this way.

The drawing of the audio device designed by one of the students is shown in Figure 4 below.
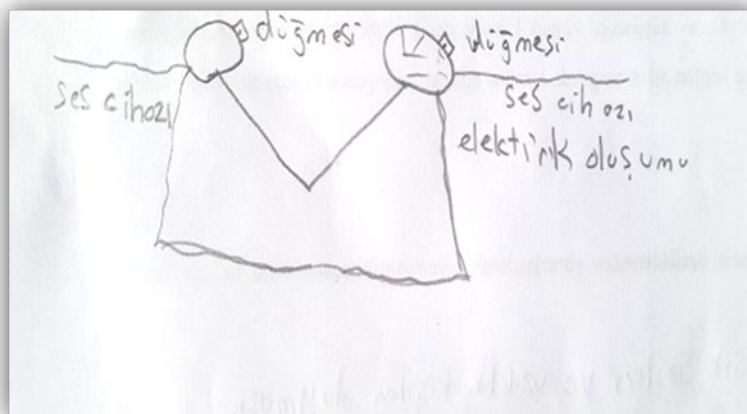

Figure 4. Student drawing of elephant sound device design

The student numbered "Ö.3" who drew the design shown in Figure 4 named the design *"I hear matic"*. The student explained his design as follows: *"I made the audio device to hear distant voices and low voices. This device also allows the elderly to hear very well. The elderly cannot see and hear very well. For example, if the elderly cannot see the car coming in traffic, they can hear the sound of the car and come back thanks to this device."*

In addition, 1 student designed a mole saw and 1 student a parrot talking robot.

5. Findings of Student Drawings in the Underwater Vehicles Category

When the drawings of the students who designed underwater vehicles were examined, it was determined that 2 students were inspired by fish and 1 student was inspired by octopus. The students who inspired by the characteristics of the fish, designed a submarine and a cleaner. The student also inspired by the octopus, drew the cleaning technology product. The drawing of the student who designed a cleaner inspired by fish is shown in Figure 5.
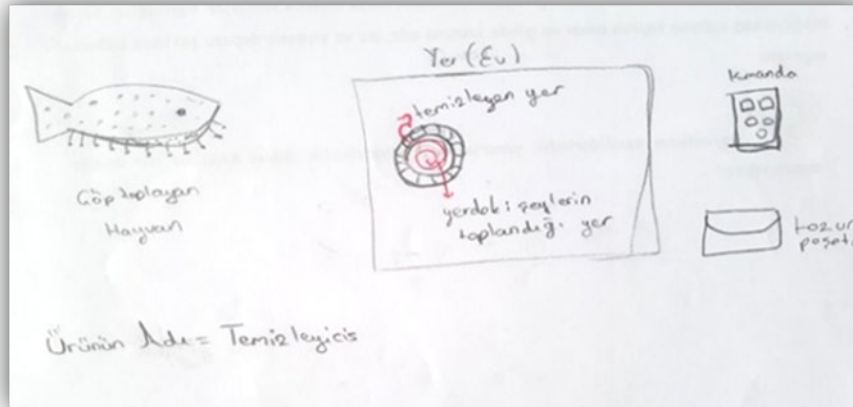

Figure 5. Student drawing of fish cleaner design

As seen in Figure 5, student "Ö.25" drew a fish cleaner design. The student explained her design as follows: *"The technological product I made is the animal robot that collects the garbage in the aquarium. It is a mechanical cleaner that vacuums. The fin is the part where the garbage is collected. Garbage is collected in a bag and this bag is changed when it is full. This mechanical tool works with a remote control. It increases our free time."*

6. Findings of Student Drawings in the Air Vehicles Category

Students designing air vehicles were inspired by various flying animals. The student who inspired by a dragonfly drew an airplane. 2 students who inspired by the butterfly made drone designs. The drawing made by one of the students who designed a butterfly drone is shown in Figure 6.
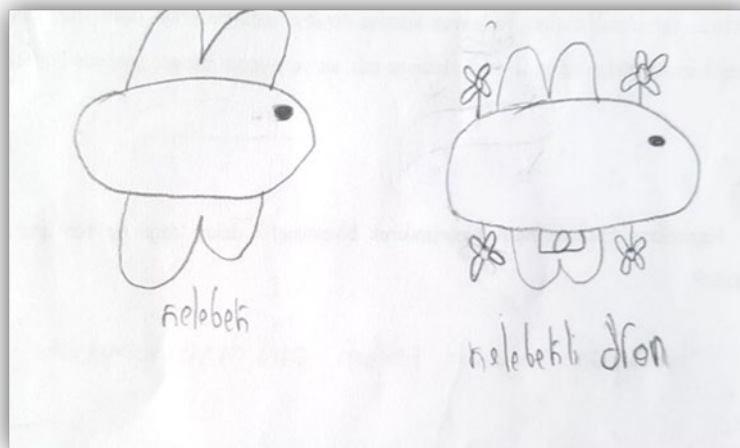
Figure 6. Student drawing of butterfly drone design

The student "Ö.1" explained his design of a butterfly drone as follows: *"My design is a product that helps the police to catch criminals. There is a hidden camera. Terrorists in the mountains will think he's a butterfly. Thanks to the camera, terrorists and criminals in the mountains can be found."*

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

It has been categorized in six groups as "Military Vehicles", "Land Vehicles", "Tools Used in Daily Life", "Underwater Vehicles", "Tools Specific to Living Senses" and "Air Vehicles". Eight designs were made in the military vehicles category, and it was the category with the highest number of designs. This category is followed by the categories of land vehicles design by 7 students and tools used in daily life by 5 students. Also, it was determined that 4 students designed "Tools Specific to Their Living Senses", 3 students designed "Underwater Vehicles", and 3 students designed "Air Vehicles".

It was determined that the students made drawings of the designs of observers, agent, tank, helmet and various military vehicles in the military vehicles category. In particular, it is understood that the students made drawings about war and defense technology designs in parallel with the war images they see in games such as war games and TV news and movies. Because, in the researches on the effects of games played on the internet, it has been determined that children are more interested in violent games (İşçibaşı, 2011). When the literature is examined, similar to our research, Yakışan and Velioğlu (2019) in their study on primary school 4th grade students, concluded that the students were influenced by the war games they played on the internet and the images of war they saw in the media, and they made designs for technological products to protect and defend themselves and people against war.

Following military vehicles, the highest categories are land vehicles and tools used in daily life. Students drew houses, underground vehicles and tractors from land vehicles, and they drew designs of lamps, cameras, drills and cleaners from tools used in daily life. However, in the research, the students drew sound devices, saws, robots from the tools specific to their living senses; submarine and cleaner from underwater vehicles; drones and airplanes from air vehicles. Looking at the drawings of the technological products they have designed, it is thought that the students are influenced by their social environment and draw the designs of the technological products they need. Herdem, Aygün, and Çinici (2014) used the method of drawing cartoons to determine the perceptions of 8th grade students about technology in their studies. It was determined that the students gave examples from their immediate surroundings in the cartoons they drew. The immediate surroundings in which students live in daily life affects their mental images. This study is similar to our study.

Biomimicry discipline is open for improvement and practicable. Biomimicry is a discipline that enables to do more work with less energy and helps to protect nature (Kallioğlu, Karakaya and Durmuş, 2013). It is thought that when the discipline of biomimicry, which is both an innovative and useful field, is applied with STEM education, it can contribute to revealing different ideas by developing creativity, critical thinking and entrepreneurship skills while students design technological products, as in our study. Because, Yıldırım (2019) examined the views of pre-service science teachers about biomimicry practices in STEM education. According to the study, biomimicry practices in STEM education contributed to the development of individuals' creativity, cognitive and psycho-motor skills.

The study suggests that the students detailed the characteristics of the animals they were inspired by. Thus, with the theoretical knowledge they learned, they developed twenty-first century skills such as entrepreneurship, creativity and innovation, etc. with technological products designed by interpreting their own ideas. However, it can be stated that the study contributes to the students' being science literate by producing original ideas and benefiting science and technology. Gencer (2015) research is similar to our research in that science and engineering practice in science education contributes to the development of science literate individuals and the development of twenty-first century skills. When the literature was examined, it was seen that Yavuz (2019) in his study on 4th grade students, the science course applied with STEM education provided students with twenty-first century skills such as critical thinking, creativity and communication. Similarly, Çalışıcı (2018) researched the effect of STEM education on students' scientific creativity in his study. According to the this research, it has been determined that STEM practises had a positive effect on students' scientific creativity by improving their memory, and increased their awareness of technology. These studies on STEM education support our study.

STEM education has recently focused on the necessity of raising science literate individuals. (NST, 2013). Therefore, STEM education is an interdisciplinary approach that combines science-technology-engineering-mathematics and aims to raise individuals who are open to communication and produce (Buyruk & Korkmaz, 2016). In addition, the lessons taught with STEM education practises help students to look from a multi-faceted perspective. Stem should be preferred in schools as it will facilitate the daily life of students. Individuals who are science and technology literate can be more effective when using information, paying attention to the benefits and harms of science and technology, and making decisions and producing something new.

It is important for students to be individuals who are interested in living things which they encounter in daily life, who can use science and technology, who produce, question and grow up as science literate. In this respect, it is necessary to increase biomimicry studies in order to provide students with these competent features. In order to achieve even more effective results, biomimicry studies in STEM education can be applied to individuals of all age groups and can be a guide for all future studies. Because individuals who grow up in this way will be able to offer solutions and increase quality of life to produce the technology that humanity needs and to use it in solving problems related to the future. Therefore, students should be encouraged, supported and guided to produce different technological tools inspired by living things in order to solve real life problems.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, author-ship, and/or publication of this article.

Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was produced from Dilara VELİOĞLU's master thesis. Assoc. Prof. Mehmet YAKIŞAN served as the consultant of Dilara VELİOĞLU in this process and guided the whole work.

Ethics Committee Approval Information

Ethics Committee Approval Certificate was obtained for this study by Ondokuz Mayıs University Social and Human Sciences Ethics Committee with the registration date of 18.04.2019 and the decision number 2019-132.

REFERENCES

Alkış Küçükaydın, M. ve Uluçınar Sağır, Ş. (2018). Okul öncesi öğretmenliği öğretmen adaylarının fen öğretimine yönelik zihinsel imajları ve yöntem-teknik yaklaşımlar. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 33*(4), 953-966. doi:10.16986/HUJE.2018037332

Atasoy, B. (2004). *Fen ve teknoloji öğretimi*. Asil Yayın Dağıtım, Ankara.

Banger, G. (2016). Biyomimikri ya da Biyomimetik, *Biyoteknoloji Yaşam Bilimleri Gazetesi*, 12. Erişim adresi: https://www.biomedya.com/show_file.php?attachid=28

Buyruk, B. ve Korkmaz, Ö. (2016). FeTeMM farkındalık ölçeği (FFÖ): Geçerlik ve güvenirlik çalışması. *Journal of Turkish Science Education, 11*(1), 3-23.

Bybee, R. W. (2010). Advancing STEM education: A 2020 Vision. *Technology and Engineering Teacher, 70*(1), 30-35.

Çalışıcı, S. (2018). *FeTeMM uygulamalarının 8. sınıf öğrencilerinin çevresel tutumlarına, bilimsel yaratıcılıklarına, problem çözme becerilerine ve fen başarılarına etkisi,* (Yayımlanmamış Yüksek Lisans Tezi). Gazi Üniversitesi Eğitim Bilimleri Enstitüsü, Ankara.

Çorlu, M. S., Capraro, R. M. ve Capraro, M. M. (2014). FeTeMM eğitimi ve alan öğretmeni eğitimine yansımaları. *Eğitim ve Bilim*, *39*(171).

Eyceyurt Türk, G. ve Tüzün, Ü. N. (2017). Lise öğrencilerinin bilim insanı imajları ve bilimin doğası mitleri. *Kırşehir Eğitim Fakültesi Dergisi, 18*(2), 19-36.

Ergen, Y., Boyraz, C., Batmaz, O. ve Çevik Kansu, C. (2020). Zihinsel imaj oluşturmaya dayalı öğretimin okuduğunu anlama becerisine etkisi. *Kastamonu Eğitim Dergisi, 28*(1), 72-81. doi:10.24106/kefdergi.3425

Fan, S. C. C. ve Ritz, J. (2014). International views of STEM education. *Proceedings of the pupils attitude toward technology conference,* Orlando, USA.

Gencer, A. S. (2015). Fen eğitiminde bilim ve mühendislik uygulaması: Fırıldak etkinliği. *Araştırma Temelli Etkinlik Dergisi (ATED), 5*(1), 1-19.

Genç, M. (2013). *Doğa, sanat ve biyomimetik bilim.* (Yayımlanmamış yüksek lisans tezi). Hacettepe Üniversitesi, Güzel Sanatlar Enstitüsü, Ankara.

Herdem, K., Aygün, H. A. ve Çinici, A. (2014). Sekizinci sınıf öğrencilerinin teknoloji algılarının çizdikleri karikatürler yoluyla incelenmesi. *Amasya Üniversitesi Eğitim Fakültesi Dergisi, 3*(2), 232-258.

İşçibaşı, Y. (2011). Bilgisayar, internet ve video oyunları arasında çocuklar. *Selçuk Üniversitesi İletişim Fakültesi Akademik Dergisi*, *7*(1), 122-130.

Kallioğlu, M. A., Karakaya H. ve Durmuş, A. (2013). *Enerjiye farklı bir bakış açısı olarak biyomimikri kavramı.* ULIBTK'13 19. Ulusal Isı Bilimi ve Tekniği Kongresi, 9-12 Eylül 2013, Samsun.

Karabetça, A. R. (2016). *Biyomimikri destekli mekân tasarımı ölçütleri ve bu ölçütlerin örnekler üzerinden incelenmesi* (Yayımlanmamış doktora Tezi). Mimar Sinan Güzel Sanatlar Üniversitesi, İstanbul.

Louis, R. C. (2012). A case study exploring technology integration and incorporation of 21st century skilss in elementary classrooms. College of Professional Studies Northeastern University, Boston, Massachusetts.

MEB (2018). *Ortaöğretim biyoloji dersi öğretim (9, 10, 11 ve 12. sınıflar) öğretim programı.* Ankara. Millî Eğitim Bakanlığı Talim ve Terbiye Kurulu Başkanlığı.

National Research Council [NRC] (2011). *Successful K-12 STEM education: Identifying effective approaches in science, technology, engineering, and mathematics*. Washington. Retrieved from http://www.nap.edu/catalog.php?record_id=13158

National Science And Technology Council [NST], (May 2013). *The federal science, technology, engineering, and mathematics (STEM) education 5-year strategic plan.* Committee on STEM Education National Science and Technology Council.

Ormancı, Ü. ve Balım, A. G. (2014). Ortaokul öğrencilerinin madde konusuna yönelik fikirleri: Çizim yöntemi. *İlköğretim Online*, *13*(3), 827-846.

Saban, A. (2008). Okula ilişkin metaforlar. *Kuram ve Uygulamada Eğitim Yönetimi,* 55, 459-496.

Thomas, T. A. (2014). *Elementary teachers' receptivity to integrated science, technology, engineering, and mathematics (STEM) education in the elementary grades* (Unpublished Doctoral dissertation, University of Nevada, Reno). Retrived from https://scholarworks.unr.edu/handle/11714/2852

Yakışan, M. ve Velioğlu, D. (2019). İlkokul 4. sınıf öğrencilerinin biyomimikri algılarına yönelik yaptıkları çizimlerin analizi. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi*, *39*(2), 727-753. doi:10.17152/gefad.547807

Yavuz, Ü. (2019). *İlkokul fen bilimleri dersinin fen, teknoloji, mühendislik ve matematik (FeTeMM) etkinlikleri ile işlenmesi,* (Yayımlanmamış yüksek lisans tezi). Afyon Kocatepe Üniversitesi Sosyal Bilimler Enstitüsü, Afyonkarahisar.

Yavuzer, H. (2010). *Resimleriyle çocuk.* Remzi Kitabevi, İstanbul.

Yıldırım, B. (2019). Fen bilgisi öğretmen adaylarının STEM eğitiminde biyomimikri uygulamalarına yönelik görüşleri. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi*, *39*(1), 63-90.

Yılmaz, A. ve Yanarateş, E. (2020). Öğretmen adaylarının "su kirliliği" kavramına yönelik metaforik algılarının veri çeşitlemesi yoluyla belirlenmesi. *Kastamonu Eğitim Dergisi, 28*(3), 1500-1528.

Yılmaz, A., Gülgün, C., Çetinkaya, M. ve Doğanay, K. (2018). Initiatives and new trends towards STEM education in Turkey. *Journal of Education and Training Studies*, *6*(11a), 1-10.

The Views of Preschool Teachers Working in Turkish Schools Abroad on Teaching Abroad: The Case of Saudi Arabia

Yurt Dışı Türk Okullarında Görev Yapan Okul Öncesi Öğretmenlerinin Yurt Dışı Öğretmenlik Görevine Dair Görüşleri: Suudi Arabistan Örneği

Dilek KARABIBER[1]

Abstract

Purpose: Purpose of this study is to research opinions of pre-school teachers working at Turkish Schools in Saudi Arabia about making teaching duties in a foreign country.

Design/Methodology/Approach: This study, the participants of which were eight pre-school teachers in Saudi Arabia in the 2019-2020 education year, was conducted in the qualitative research approach and data were analyzed through the descriptive method.

Findings: In result part, it was seen that the participants wanted to work in a different country to learn a new culture, a new language and to improve themselves in their professions and they thought that students showed differences in social and cognitive abilities. Besides, it was also mentioned that the participants tried to teach students Turkish the most, they put stress on national values and social abilities. Again, it was mentioned that participants had various difficulties during their duties and especially female teachers had struggles to settle down and adapt.

Highlights: In the study, it was determined that teachers found the content and quality of the orientation seminar held before assignment insufficient, they had difficulties in benefiting from health services, and the substitution of family members due to country conditions created an economic difficulty.

Öz

Çalışmanın amacı: Bu araştırmanın amacı, Suudi Arabistan'daki Türk Okullarında görev yapan okul öncesi öğretmenlerinin yabancı bir ülkede öğretmenlik görevi yapma konusundaki görüşlerini araştırmaktır.

Materyal ve Yöntem: Katılımcılarını 2019-2020 Eğitim Öğretim yılında Suudi Arabistan'da görev yapan sekiz okul öncesi öğretmeninin oluşturduğu araştırmada, katılımcılara altı soru sorulmuştur. Çalışmada nitel araştırma yaklaşımı kullanılmış ve veriler betimsel yolla analiz edilmiştir.

Bulgular: Çalışma sonucunda katılımcıların yeni bir kültürü tanımak, yeni bir dil öğrenmek ve kendilerini mesleki anlamda geliştirmek istedikleri için yurt dışında öğretmenlik yapmak istedikleri, Türkiye ve Suudi Arabistan'daki öğrenciler arasındaki farklılığın en çok sosyal ve bilişsel becerilerde olduğunu düşündükleri sonucuna ulaşılmıştır. Bununla birlikte öğretmenlerin öğrencilere en çok Türkçe öğretmeye çalıştıkları, milli değerler ve sosyal beceriler üzerinde durdukları belirlenmiştir. Yine, katılımcıların görev esnasında yaşadığı çeşitli sıkıntılar ortaya konmuş; özellikle kadın öğretmenlerin göreve ilk başladıkları zaman düzen kurup uyum sağlama aşamasında daha çok zorlandıkları anlaşılmıştır.

Önemli Vurgular: Çalışmada öğretmenlerin görevlendirme öncesi yapılan uyum seminerinin içerik ve niteliğini yetersiz bulduğu, sağlık hizmetlerinden yararlanma konusunda sıkıntı yaşadıkları, ülke şartlarından kaynaklı aile üyelerinin ikamesinin ekonomik zorluk oluşturduğu tespit edilmiştir.

[1] Ministry of National Education, Gaziantep, TURKEY; https://orcid.org/0000-0002-2676-4450

INTRODUCTION

Education, which we can define as the process of changing the behaviors that individuals are born or acquire later and to evolve into a more positive, is a lifelong interaction that can be carried out in a formal or informal way. The formal acquisition of education, which can occur informally in the family, at home, on the street, in the peer, in the workplace, briefly in all areas of life and instantaneously, in an unplanned, unscheduled and unsystematic way, is carried out in educational institutions in a planned, programmed and systematic way. The first place that comes to mind as an educational institution where the most effective behavioral changes are experienced at an early age is undoubtedly schools. The unconditional way for the state, which has various duties in areas such as family, law, health and security, to fulfill these duties and to continue its existence, is the education it provides to individuals, especially through schools. The "Right to Education", which is given to individuals by the state and defined as a "right", has taken Its place among the Basic Principles of Turkish National Education. (National Education Basic Law, 1973)

In today's modern life, where the population is increasing very rapidly, both the widespread use of technology, the emergence of individualism with the individual's becoming self-sufficient, and the voluntary or involuntary adaptation of people to changing living conditions, socialization has become one of the first functions of schools. As a result of socialization defined by Kağıtçıbaşı (2007) as human interaction with the socio-cultural environment in which they live; In this process, they will learn more closely the society they belong to, the customs and traditions, values and rules of the society, whether they live in them or not, and they will enable the society to live with the sense of belonging. The first period of time that this process will begin in a formal way is undoubtedly the preschool years, which have a vital importance in human life. The preschool period is so important and valuable that it cannot be left alone and cannot be ignored because it is critical in terms of the speed of development, the formation and development of personality.

Republic of Turkey; It has included preschool, primary and secondary education institutions, which are among the formal education institutions, both in the country and abroad, and the Ministry of National Education has established the Overseas Organization by providing education in their own language to citizens living abroad. This study has been carried out to examine the opinions of preschool teachers working in Turkish Schools in Saudi Arabia about their teaching duties abroad. In the study, the procedure of determining the teachers to be assigned abroad by the Department of Education and Training Abroad, which is within the Ministry of National Education Overseas Organization and is responsible for Turkish Schools opened abroad, is briefly included. Afterwards, the purpose, method, findings, results and recommendations of the research are included in the study, which mentions the literature on the subject.

Assigning Teachers Abroad

Some of the duties of the Department of Education and Training Abroad, to which International Turkish Schools are affiliated, are to open schools in countries deemed necessary due to the needs of our citizens abroad, to protect the national and cultural identities of our citizens and their children abroad, to ensure their harmony with the society they live in, and to increase their education level and recruiting and planning, selecting and assigning the teaching staff needed by schools abroad. (Foreign Education and Training Department, 2014). In this context, an examination is held every year to select the teacher to be assigned abroad and teachers who meet the following conditions are entitled to take the exam:

1. Being a citizen of the Republic of Turkey,
2. Having provided at least 5 years of service in the education services class on the last day of the application,
3. Being actually working for the staff in the Education and Training Services Class within the Ministry of National Education subject to the Civil Servants Law No. 657 (excluding those who are employed on a contract with substitute teachers),
4. Having completed military service or being exempted from military service,
5. Having at least an undergraduate degree,
6. Not being handicapped with a physical and mental illness or bodily injury that might prevent him from performing his duty and not being a carrier of any contagious disease,
7. Even if the periods specified in Article 53 of the Turkish Penal Code No. 5237 dated 26/9/2004 have passed; Crimes against the security of the State, crimes against the constitutional order and the functioning of this order, embezzlement, extortion, bribery, theft, fraud, fraud, abuse of trust, fraudulent not to be convicted of the crimes of bankruptcy, rigging the tender, rigging the execution of the act, laundering the assets of the crime or smuggling
8. Not having an obstacle to his assignment abroad
9. Not having received a heavier disciplinary action than warnings and reprimands in the last 10 years,
10. To have the ability to represent the service required,
11. For those who were assigned abroad by the Inter-Ministerial Joint Cultural Commission, having been successful in their previous positions abroad and having worked for at least 2 years as of the last day of the examination application from the date of starting their domestic duty.
12. As of the last day of the application for the exam in the foreign language, which is the basis for assignment, for the designated countries, within the last 5 years, at least at the level of "E / 50 Points" from the YDS or YÖKDİL Exam, or as of the last day of the examination application, accepted by ÖSYM and to have a language certificate equivalent to this

score from the exams internationally accepted (TC. Ministry of National Education General Directorate of Higher Education and Foreign Education, 2020).

Although there is no language certificate requirement for Saudi Arabia, all teachers to be assigned abroad are subjected to the Professional Competence Exam and the Representation Ability Exam. Candidates who score 60 or more out of 100 (100) full points are considered successful in the Vocational Qualification Exam held in writing for the determination of professional competence, and among these candidates, success is ranked according to the score superiority, starting from the candidate with the highest score, the number of teachers determined each year to take the Representation Ability Exam are accepted .The Representation Ability Exam is held by the Inter-Ministerial Joint Cultural Commission in the form of an oral exam. The threshold score of the Representation Ability Test is 70. The ranking of success for assignment is determined by taking the arithmetic average of the Vocational Competence Exam and the Representation Ability Exam score among the candidates who get at least 70 points from the Representation Ability Exam conducted by the Inter-Ministerial Joint Cultural Commission. Exam results are valid until the end of the 3rd year following the year in which the exam is held for those who are entitled to be assigned abroad and have not yet been assigned.

Literature Review

Before starting the research, literature on the subject was scanned and no study was found on preschool teachers working abroad. It has been concluded that there are almost no studies on all teachers working abroad.

Written by Tarhan and Peker in 2008, the study titled "The Problems of Educational Consultants, Attachments and Attaché Assistants in Overseas Organization" is noteworthy in terms of its closeness to the subject. In the study, it was concluded that the main problems of the Education Consultants, Attaché and Attaché Aids working in the Ministry of National Education Overseas Organization were caused by the insufficient resources of textbooks, tools, equipment and materials, and the lack of technical equipment reinforced these problems. Again, with this study, it was stated that there are some problems related to the competence and training of the personnel assigned abroad.

Cevahir (2013), in the master's thesis entitled Problems and Solution Suggestions of Teachers Affiliated to the Ministry of National Education assigned Abroad (Germany Example), the orientation seminar before the assignment was not sufficient and appropriate in terms of duration and content, teachers were in financial difficulties, some of them started a new life by going into debt, He concluded that the teachers did not like health facilities and felt lonely.

Gündoğdu (2014), in his study titled "Problems of Teachers Working in Saudi Arabian Turkish Schools", worked with 226 teachers using a questionnaire technique, and as a result of the study, it was concluded that the most important factor in the reason why teachers who participated in the study preferred Saudi Arabia is "sacred places". In the same study, it was determined that the teachers did not find the physical conditions of the schools they work in sufficient for education and they mostly experienced problems related to "health".

In another study named "Problems of Teachers Working in the Organization of Ministry of National Education Abroad", the teachers who participated in the study expressed their perceptions of loneliness and financial problems because they thought that they were not protected as the most important problem; They stated that other problems arise from these problems (Akman, 2017).

Karasu (2018), aimed to determine the reasons lying behind the decision to go abroad for teachers who will be appointed by MEB General Directorate of European Union Foreign Relations in his study titled "The Reasons of Going Abroad by the Ministry of Education" in 2014. In the study,it was concluded that the reasons for teachers to go abroad were to get to know new places,to introduce their culture and to have cultural interaction.

Finally, Gül and Toker Gökçe (2019), in their work titled "Problems in the Management of Abroad Education: Teacher Perspective", in which they aim to determine the problems experienced by the teachers who are assigned in Europe by the Ministry of National Education with the administration in the relevant countries, from their perspective (consultancy and attaché's) problems experienced; They were grouped under two main headings: deficiencies in implementation and administrative deficiencies. Consultancy and attaché's shortcomings in practice; They identified injustices in the distribution of tasks as attitude towards teachers, indifference, lack of communication, lack of guidance, and not having an educator background. Again, administrative deficiencies as a result of the study; permission restriction, unnecessary bureaucracy, incomplete duty of advisor and attaché, management by proxy, problems caused by civil servants and coordinators, and distance.

After the studies examined in the literature, the opinions of preschool teachers who work abroad about their teaching duties abroad emerge as an issue worth examining.

Purpose of the Research

The aim of this study is to examine the opinions of preschool teachers working at Saudi Arabian Turkish Schools on their teaching duties abroad.

Importance of Research

The study is important because it is the only study conducted on pre-school teachers working in Saudi Arabian Turkish Schools based on pre-school teachers in their education duties abroad.

METHOD

Research Model

This research is based on the qualitative research method. Because qualitative research enables the use of data collection methods such as observation, interview and document analysis, and enables a holistic investigation of the subject in the natural environment (Yıldırım & Şimşek, 2013). Again, with this method, it is possible to examine the meanings arising from the experiences of the people studied (Ekiz, 2003). The study was also carried out in case study design, one of the qualitative research methods. In this design, the factors related to a situation are investigated in a holistic manner and how they are affected by the relevant situation and how they affect the situation (Yıldırım & Şimşek, 2013).

Data Collection Tools and Data Collection

Semi-structured interview technique was used as a data collection tool in the study. In the semi-structured interview technique, there is no obligation to adhere to the questions, additional questions can be asked and the questions can be stretched according to the situation of the interview. (Merriam, 2013). The researcher, who also worked as a teacher abroad, had a conversation with teachers from every branch at her school before interviewing with the volunteer teachers who participated in the study, and tried to learn about her views and experiences about her teaching abroad. As a result, he presented the interview questions she prepared to two experts. The interview form consists of two parts, which include the demographic characteristics of the participants, consisting of eight items, and their views on the six-question on teaching abroad. The researcher first answered the questions herself with the suggestion of the first expert, and the interview questions were presented to the second expert opinion in line with the answers she gave. As a result of the arrangements made, the interview questions were made ready. As a result, the researcher informed the participating teachers about herself and the research, and clearly stated that confidentiality and volunteerism are essential. After the briefings, the study was concluded by making face-to-face interviews with two teachers, and with the others via repeated phone calls and teleconferences[2].

Official Data on Research Area

According to the data of the Ministry of Family, Labor and Social Services, 60,500 Turkish citizens live in Saudi Arabia as of 2016 (Ministry of Family, Labor and Social Services, General Directorate of Foreign Relations, 2016). Given the vast size, like all citizens living abroad, in Saudi Arabia, Turkish citizens living in both to adapt to the country they live in and on the fact that they tried to protect their values (Özdemir et al., 2009), in June 2020 by the Republic of Turkey 250 teachers have been assigned in Turkish Schools where 3219 students are educated in KSA. As of this date, there are 242 preschool students studying and 9 preschool teachers working. The distribution of the total numbers in the context of schools is shown in Table 1.

Table 1: Number of teachers and students in Turkish schools in Saudi Arabia (as of June 2020)

	Number of Teachers			Number of Students		
	Pre-school	Primary and Secondary	Grand Total	Pre-school	Primary and Secondary	Grand Total
Jeddah International Turkish School	3	50	53	65	896	961
Riyadh International Turkish School	1	47	48	65	642	707
Medina International Turkish School	1	41	42	16	512	528
Tabuk International Turkish School	1	19	20	24	263	287
Mecca International Turkish School	1	30	31	31	206	237
Taif International Turkish School	1	22	23	16	191	207
Dammam International Turkish School	-	16	16	9	155	164
Abha International Turkish School	1	16	17	16	112	128
Total	9	241	250	242	2977	3219

---

[2]Data collection could not continue face-to-face due to the spread of the Covid-19 outbreak in the country.

Considering the total number of teachers and students in Saudi Arabian Turkish Schools in the 2019-2020 academic year and the importance of each individual in their educational life, the importance of the subject for scientific studies becomes clear.

Participants

The participants of this study were eight preschool teachers working in Saudi Arabia in the 2019-2020 academic year. While one of the nine preschool teachers was the researcher, who were assigned by the General Directorate of Higher Education and Foreign Education through written exams and interviews, the other eight teachers participated in the study on a voluntary basis.

Teachers were coded as T1, T2, T3, ……, T8 in order to protect the privacy of the participants participating in the study and to understand the research findings easily. Demographic information of the participants is presented in Table 2.

Table 2: Demographic Characteristics of the Study Group

	Gender	Age	Marital Status	Number of Children	Graduated University	Province of Staff	Professional Seniority	Seniority Status in Saudi Arabia
T1	Male	30	Married	2	Cumhuriyet University	İstanbul	8	1
T2	Female	44	Married	4	Gazi University	Hatay	23	5
T3	Female	31	Married	2	Kastamonu University	Manisa	9	2
T4	Female	33	Married	2	Selçuk University	Konya	11	1
T5	Female	40	Married	2	İnönü University	Kocaeli	17	2
T6	Female	32	Married	2	Hacettepe University	Malatya	11	4
T7	Female	33	Married	3	Selçuk University	Bitlis	13	3
T8	Female	37	Single	-	Selçuk University	Sivas	11	3

As can be seen in Table 2, one of the eight preschool teachers in the study is male and the rest are female. One teacher is single, the other seven teachers are married, and five of them have two children, one teacher has three children, and one teacher has four children. The age of the teachers is between 30 and 44 years old. Professional seniority years range from eight to twenty-three, and seniority status in Saudi Arabia between one and five years. Again, three of the teachers have graduated from Selçuk University, while the other teachers are graduates of Cumhuriyet University, Gazi University, Kastamonu University, İnönü University and Hacettepe University. Finally, the province where each of the teachers has a staff registration has been determined as Istanbul, Hatay, Manisa, Konya, Kocaeli, Malatya, Bitlis and Sivas.

Data Analysis

Descriptive analysis technique was used in the analysis of research data. The purpose of the descriptive analysis technique is to present the obtained data to the reader as faithful to its essence as possible (Yıldırım & Şimşek, 2013). In the study, it was aimed to reflect the opinions of the interviewed individuals in an effective way by including direct quotations frequently.

FINDINGS

After asking the teachers participating in the study about their demographic information in the first part of the interview form, the second part was passed.

- First of all, the participants were asked: "Why did you decide to teach abroad?" The answers given by the teachers to this question was grouped under the headings of getting to know culture, learning languages and professional development:

Getting to Know Culture

Recognizing a new culture, introducing their own culture to other cultures, ensuring that their children live in an environment where different cultures exist for a while were one of the first reasons participants put forward for their decision to teach abroad:

T3: "We wanted to get to know a new culture, expand our perspective on life, and we wanted to try this way with my wife."

T2: "Although it is the first reason to see new countries and see different cultural experiences, frankly, I decided to teach abroad in order to earn better money."

T8: "Since I graduated, I have wanted to go abroad. I had a desire to get to know a different culture. As a teacher, we do not have a chance for this due to financial reasons and unfavorable working conditions. That's why I decided to apply for a teaching post abroad."

Learning Languages

"Why did you decide to teach abroad?" The question was asked to partıcıpants. Some of the participants answered that they wanted him or his child to learn a new language, live in a foreign environment and study in a multilingual environment:

T5: "We were bored, we wanted innovation. I wanted my children to spend time in a foreign environment and learn the language."

T3: "We wanted to improve ourselves in every sense and learn the language."

T4: "We wanted both us and our children to learn a new language."

Professional Development

Lastly, the answers of the participants to the question "Why did you decide to teach abroad?" were collected under this heading. Participants stated that they made this decision because they wanted to experience it, which is declared as "the peak of teaching" and to improve themselves professionally:

T3: "To improve myself professionally and to learn how our branch works abroad."

T5: "Our life was now monotone. I wanted to improve myself in innovation and professional sense."

T6: "Obviously, we wanted a change in our lives. This is a difference for our profession and added excitement to our lives. "

However, two participants stated that they decided to teach abroad because they wanted to represent their country outside the country and to help children abroad educationally.

- Asked in connection with the first question "Why did you decide to teach in Saudi Arabia?" The question was asked. Teachers stated that the holy lands and Saudi Arabia were mentioned as "safe town" and that there was no language requirement when coming here as two main reasons:

Holy Lands

The fact that the cities of Mecca and Medina, which are sacred for the religion of Islam, are located in Saudi Arabia and their desire to live their spiritual values, especially the opportunity of umrah, caused all of the participants to choose this country for their abroad task. However, some participants said that Saudi Arabia is a "safe town" and stated that they thought that this country would be safer and more comfortable for them when they were alone as a woman when they first arrived and that they could not get the same trust from other countries.

T5: "I've done umrah before and liked it very much. That's why I wanted to come back and do my duty here. The fact that the holy lands are here is an important factor in this decision, too."

T8: "There is Islamophobia in Europe. I live here alone, there is holy land and I'm comfortable. In that sense, it's pretty safe here."

Language Requirement

"Why did you decide to teach in Saudi Arabia?" three teachers stated that there is no language requirement when coming here.

T2: "There is no language requirement when coming here, I know Arabic too, there are people from my family here, I chose this country because I thought we would be comfortable."

T6: "There is no language requirement when coming here. They also love Turkish people. We preferred it because here is a Muslim country."

- The answers given by the teachers to the second question, "What are the most striking differences between students in Turkey and Saudi Arabia?", as follows: language and culture differences and the difference in social and cognitive skills of children:

Language and Culture Differences

"What are the most striking differences between students in Turkey and Saudi Arabia?" The first answer to the question was that the participants had difficulties in communicating because of not knowing Arabic. However, the age group studied are small and therefore they have more frequent contact with families. This situation also revealed the difference between cultures:

T1: "I can say language problem, cultural differences. It is a problem that even children cannot speak the same language among themselves."

T4: "I think eating habits is the biggest difference between the students here and in Turkey. They spend a meal eating chips. Education is viewed differently here. We want children to learn by doing and living. There is no expectation here. They just want teaching children to progress academically. So are the Turkish people living here. Children's Turkish is bad."

T5: "I think the children here are more closed, more timid, more mature, but the children in Turkey are more spoiled. I think those here are more innocent."

T3: "There is not a story clock as in Turkey, questions asked. Although they are citizens of Turkish, they do not speak Turkish, we do not speak Arabic. The class size is large for individual attention. Apart from that, the children staying here are more developed in terms of height and weight. "

T7: "The perception levels of my students here are low. because their social environment is not in active education."

Social and Cognitive Differences

Children's social and cognitive skill levels were noted as the most notable difference between students in the two countries due to differences in cultural and physical, social and seasonal conditions of the country:

T8: "My students here have lower perception levels. They are always at home, the phone is in their hands, it may be a reason for this. Children in Turkey go out, but children here are always watching TV. Children here come to school just because they are bored at home."

T2 and T6 generally expressed with other participants similarly that children in Turkey are more social and active but children here spend their time with televisions, phones, tablets. T2 explained the reasons as follows: there is no climate change here, kids are generally in their flats, they don't even change their clothes, they grow in narrow spaces, and there isn't a neighborhood relationship much among people. T6 added that spending too much time in front of the television, phone and tablet negatively affects children's social skills as well as decreases their perception levels.

- "What do you try to gain the students here most and do you find your professional performance sufficient?" the question was asked to the participants thirdly. Teachers answered the third question, generally emphasizing language development, national values and social skills, and all the participants stated that they found their professional performance adequate or even more than before:

Language Development

When asked what they are trying to acquire the students here, some of the participants stated that they try to teach children the language of the country of their citizenship as a requirement of working at a Turkish school abroad:

T4: "I give priority to language teaching here. I do activities based on words and plan the day. For example, if we learn the word 'rain', I use games, art activities, music and story activities about it and reinforce it. I want my students to gain love of homeland, especially for the ones who have never been to Turkey before."

T2: "In addition to getting Turkish citizenship later, I have students whose parents are Turkish and were born here. As a teacher, I want all of them to speak Turkish properly. I work for this."

T1 also stated that she tries to give children language skills most and emphasizes the aims and learning outcomes of our preschool curriculum.

National Values

Some participants stated that they try to give children love of homeland / nation / flag and to make them feel loyal to the national values of their countries:

T2: "Basically, I emphasize that the child should love school and come willingly. When abroad, he/she should know and love his flag, country. This situation of the child who loves school at this age also affects his/her school success in the future. Sharing is also missing here with children, I'm trying to achieve this."

T8: "What I see missing from the children here is that the children are just at home. They don't know where they live or where they belong. I am trying to encourage them to absorb our national values."

T3 and T6 stated that they mostly try to bring the awareness of Turkishness and love of the homeland to the children here. Also, both participants also expressed that children long for Turkey, so they spend on their efforts to remedy it.

Social Skills

Stating that the social environment of the students here is more limited due to the differences arising from the country's conditions, the participants stated that even the self-perception of the children is behind due to this situation and their self-confidence is lower:

T5: "I focus on social skills. Children grow up in indoor environments and cannot socialize here. That's why I try to teach social skills rather than cognitive skills."

T7: "I especially try to give the feeling that they are enough. Children are pretty shy, because socialization is minimal. As with the love of homeland, respect for parents is secondary. Their self-esteem is low. Also they are extremely aggressive without adult control."

Following the same question, all the teachers answered this question, "Do you find your professional performance sufficient?". All of them found themselves competent professionally. However, T2, T3, T6 and T7 said that their performances are well above their performances in Turkey. The reason for this is that the same student comes to the same school for a few years, the preschool period is not static and there is a difference here, as there is no paperwork problem here, so this has a positive reflection on the performance.

- The fourth question was asked to the teachers who participated in the study: "What are the problems you face professionally and personally and how do you try to solve it?" Because the professional problems encountered in this question were individual, the answers given were gathered under the heading of professional difficulties in pre-school education:

Professional Problems in Pre-school Education

Teachers expressed the professional difficulties they experienced while performing their duties as follows:

T6: "I did not have much trouble in the professional sense. My parents are from Hatay, interested, willing. It was just a problem that the children didn't have much interest in school. I'm trying to get over that too."

T7: "There is no problem for me personally. But the school administration puts forward a problem as if the parents are constantly complaining and uses this situation against us. Actually, there is no problem. Saudi superintendents are constantly coming under supervision, and the administration brings them to the first kindergarten class. It shows us as an advertising board."

T8: "Professionally, I had the most physical difficulties. My classroom was full of mice. My classroom was in the school yard, conditions were poor. This year I have 16 students and I have an assistant. But when I first arrived, Arab superintendents were coming and I was ashamed of my class. Now we have arranged the physical conditions, it is better.".

T1, T2, T3, T4 and T5 expressed that their biggest problems in terms of professional life are the lack of importance given to pre-school education by the family and the environment, the ineffectiveness of family participation activities, the difficulty of getting feedback from parents, the fact that school life is seen as just a souvenir photo, lack of material, and scarcity of story books.

The answers given by the participants, who explained their personal and family problems with the conditions of the country and school in general, were collected under the headings of health, transportation and social life:

Health

Participants who expressed that the health infrastructure in the country where they work is insufficient, the number of contracted hospitals where they can receive treatment is limited and especially the dental treatments are expensive, stated that this situation creates a problem:

T2: "We can only go to our country once a year. The health system here is very bad, undeveloped. Dental treatment is very expensive. We only do it in necessary situations."

T5: "Health is a big problem here. Procedures are long, hospitals are inadequate and insurance is very tiring. We pray not to get sick."

T7, who stated that his son suffers from speech disorder, answered this question that the health and social opportunities that he could take to have his child treated, receive education and support were not sufficient.

Transportation

Indicating that all kinds of transportation in Saudi Arabia are carried out by individual or commercial taxis, the teachers stated that there is a problem if there is no vehicle, and beyond this, it is difficult for families to enter and exit the country continuously when they come with a family visa without substitution:

T1: "It's my first year here. When you first come here, there is a vehicle problem due to the lack of urban transportation. Apart from that, we did not have a big problem, but the family's obligation to enter and exit constantly due to visa is a problem."

T2: "If there is no vehicle, transportation is a problem. But apart from that, it is an advantage to be able to drive around the surrounding countries. We follow the campaigns for the needs, discounts are made, that's good."

T8: "It was the end of September when I got here. The driver's license for women had just been issued. This city where I live is very conservative, closed. The veil thing is boredom. As a woman, I am only a teacher at school. I tried to handle every job myself. I got a driver's license, the biggest problem was solved. Of course, I experienced these difficulties because I am a woman here."

Social Life

The participants indicating that living in KSA as a woman is not difficult in the way people estimate, even it's mostly discriminated against women to make their life easy   added the real issue is for them not to come together with their family at first step:

T3: "Of course, it is difficult to stand clear of the family. I can't take time off my family because of working hours. The school is also a problem for the children. I can not send my children to the school I want. They are with me now. There is only one branch already, children have to be in that classroom."

T4: "It is a problem for us not to know their language at first. We can speak English a little but even so we have difficulty."

T6: "At first I had trouble because of living in a country without my family. I couldn't know their language. It is an issue and these always delay the adaptation to social life. Especially, I had a problem in the hospital because of not knowing the language.

- The fifth question in the form is "When you come to the place of your duty, what kind of issue did you take? What do you want to change?" The teachers mentioned inability of the seminar, time and place of assignment and the cases of their family.

Adaptation Seminar

The participants indicated that they had to take an adaptation seminar before going to the place of their duty, the seminar was so good but it was not good to get them ready for a new life , the place that they would go showed in a dream, so they said that the seminar must be more realistic.

T3: "When we come here, we will have foreigner students. So we have to know their language. At least we must take a course about language. We have to know Arabic. The adaptation seminar should ensure these.

T4: "The adaptation seminar was held before we arrived, it was nice but it was not enough. It should be according to the countries, not general. Because the seminar was a general framework. Experience may be shared by a teacher who works in the country we are going to. A pre-language training is a must. There may be small language booklets. When there was no language, I could not even greet the children when I first came. Also, the assignment time is bad. We came, we started school immediately. If you come before the school is opened, you will find at least home and furniture. The official procedure is difficult, everything is constantly changing. For these, there must be an interested guide here"

T8: "In the seminar, they said to us when we go there, we will be welcomed by everybody. It is not true. A few people and an officer should be to help us. This should be given to someone as a task. They should not say whenever and wherever everybody can help."

Assignment Place and Timing

The participants indicated that they had a big deal because of the assignment time (September), trying to find a house and a car etc. They added that they had to come before one month. Also, sending teachers who will work seriously and not assigning female teachers as the only women in the institution due to country conditions were the points that the participants stated during their assignment:

T3: "When we come here first, finding a house is an issue. Here we are proceeding in a village school logic. We have international school status but we have very lacking. We have to stay somewhere the government will find and we will pay them. Also, due to the conditions of the country, the schools for boys and girls are separate. When the parents' meeting is held, even if there is only one parent and the parent is male, it can become a problem."

T5: "There is a system about first coming. Everyone welcomes each other but it would be more convenient and comfortable for an official to deal with newcomers."

T6: "it is really important that the teachers should study hard and really have to be helpful. They have to know the language because it is a trouble."

T7: "According to me, more attention should be paid to the work performance of the people while being sent here. But I saw many teachers and administrators who did not work. We do not have such a luxury, because children need much more here. Everyone's performance should always be considered in Turkey and here."

T8: "There were teachers who didn't say hello because I was a woman, some teachers are very conservative. I came and every teacher went to Mecca-Medina, I was the only woman in the school, I was able to go two months later. While being assigned, women should not be assigned as the only women in that school. "

Family Members

The participants indicated that it is a problem for them not to be able to come there together with their family at first step and especially the mothers and children took trouble about it. Moreover, teachers' families have to renew their visas at regular intervals. And it looks a problem that teachers say:

T1: "I had a trouble about finding a house and furniture. It is an issue but the real issue is that we are not with our family. For coming here, they can provide us with a five-year passport. It is necessary to solve the substitution problem for family.

T2: "It is difficult for us not to be able to come with our family. The substitution pay is also a big deal. If we pay, it is so expensive, nearly one salary for one person."

T3: "Not being able to come without our family is the most difficulty, especially for the mothers. We need to feel good and be lucky because of being here, but we are not. Because The substitution pay makes us feel bad, especially first year. Family unity is broken."

T6: "We need to come with our family. The ministry can provide us with public housing. They can do better about it. I think that the teachers going to other countries are more comfortable. The other international schools are better but ours not. Even so being here is an experience for us."

T7: "It was so hard to come here without my family. I suckled my baby, handed it into the bed and came here. It was so hard. The women, especially the mothers must come here with their family. Our government must provide it for us."

- When asked here it was difficult or not to work as a preschool teacher, the answers were general and free, so the answers are given under the heading of "Being a Pre-school Teacher in Saudi Arabian Turkish Schools":

Being a Pre-school Teacher in Saudi Arabia Turkish Schools

The female participants indicated that because being a woman was hard. Additionally, one teacher mentioned being alone and having trouble as a pre-school teacher. The other two teachers said that they did not have enough equipment for their class:

T1: "I didn't have any trouble. I had trouble at first because of working as a manager in Turkey, but I got used to. There is no problem for me now and nothing different from other branches."

T3: "It's hard not to have a permanent colleague. It is necessary for us to ask about something and have an exchange of ideas."

T5: "I worked a small class when I came here at first. I fell behind the others friends as a teacher. My class is small and I don't have a helper."

T8: "We are worse than others in the physical area. The class is outside of the school. I don't know about events or celebrations. When I first arrived, they even forgot to add me to the WhatsApp group for administrative information. For school teachers who will have a dinner on teachers' day, they didn't call me as my only female teacher.

DISCUSSION AND THE RESULT

When we analyzed the views of preschool teachers working in Turkish Schools Abroad on Teaching Abroad in Saudi Arabia, the result has been reached that the adaptation seminar is not enough. Teachers take trouble about medical and substitution. This result was similar with research by Akman (2017). Akman, in the study about the teachers' problem in the Abroad Organisation of Education Ministry reached and lacked an adaptation seminar, having trouble with medical, visa and visiting Turkey.

Gündoğdu (2014), also indicated that the teachers took trouble about medicine, because they paid by themselves and then they could not take the pay back in a long process. Moreover, it was found out that "religious belief" and "moral feelings" was effective in wanting to go to Saudi Arabia.

In our study, it was concluded that teachers wanted to work abroad for reasons such as seeing new countries, representing our country abroad, and wanting to go abroad. Karasu (2018), also investigated the reasons for the teachers sent abroad by the Ministry of Education and determined that the participants wanted to go for reasons such as seeing new places, promoting our culture and having cultural interaction. This result also supports our study.

Again, research findings show us that the social skills and perception levels of children living in Saudi Arabia are found to be lower by their teachers; due to differences such as language-culture-expectation, family participation activities cannot be performed as desired, teachers have a shortage of materials, especially books.

General of the teachers stated that they had language problems especially when they first came and they had difficulties in communicating with the children, and stated that there might be a language requirement or language education could be arranged before coming.

Not being able to go to the place where they will work with their families is a problem especially for female teachers. Because their branches are mostly female teachers, preschool teachers experience more difficulties than other branches due to indirect reasons.

The substitution pay for family members is causing a big deal. If they don't want to pay this, teachers' families have to log in and out to the country at certain times. This is also a big difficulty.

In the study, it is concluded that teachers need an officially appointed guidance more. In addition, the adaptation of teachers was delayed because the assignment was on the date when the schools were opened. While getting used to a new place, there are teachers left alone because they are "women" and this also requires additional work.

After the interviews, it was concluded that all the participating teachers were happy to work abroad due to their difficulties. Teachers have said that this experience adds something to people professionally and personally and provides professional satisfaction. The participants stated that it was a great pleasure to speak Turkish as a result of the education chıldren received.

SUGGESTIONS

In the results of study, when considering the processes experienced by teachers before and during their assignment, the following suggestions can be made:

- Adaptation seminars for teachers can be planned not in a general framework, but according to the countries they are assigned to and practical information can be shared as well as theoretical knowledge. For this, one or more teachers who are currently working in that country can share their experiences.
- Teachers can be given language training without going to the countries where they will work.
- Teachers' duty dates can be arranged according to the opening date of schools, and teachers can be given time to set up and adapt.
- Opportunities should be provided for teachers to come with their families to the countries where they will work.
- Officials and civil servants should be provided to guide teachers who go to their places of duty.

- Preschool material, resource books provided by MEB and especially story books should be sent to schools regularly.
- The physical conditions of the classes should be improved.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author received no financial support for the research, author-ship, and/or publication of this article.

Statements of publication ethics

I hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Ethics Committee Approval Information

The research was carried out as of 2020. The research is not an experimental study. Therefore, ethics committee approval was not required.

REFERENCES

Akman, Y. (2017). Issues of teachers who work in the Ministry of Education Organization of Abroad. *Ege Journal of Education,*18, 345-375.

Cevahir, C. (2013). The issues of teachers in the Ministry of National Education assigned abroad and solution suggestions: The example of Germany. Unpublished Master Thesis, Okan University, Istanbul.

Ekiz, D. (2003). Introduction to research methods in educatıon (1st Edition). Ankara: Anı Publishing.

Gül, H. ve Toker Gökçe, A. (2019, June). Issues in the management of education abroad: teacher perspective. EJER Congress Conference Proceedings, Ankara.

Gündoğdu, Y. B. (2014). Issues of teachers working in Arabia Turkish schools. *Journal of National Education,* 201, 125-148.

Kağıtçıbaşı, Ç. (2007*).* Cultural psychology-human and family in the cultural context (1st Edition). İstanbul: Evrim Publishing.

Karasu, M.S. (2018). The reasons for going abroad for teachers who are assigned by the Ministry of Education. *Gumushane University Journal of the Institute of Social Sciences,* 9(24), 177-191.

Merriam, S. B. (2013). Qualitative Research. A guide for pattern and application (Ed. Turan, S.). Ankara: Nobel Academic Publishing.

National Education Basic Law (1973, 14 June). Official Newspaper (Number: 14574). Access address: https://www.mevzuat.gov.tr-/MevzuatMetin/1.5.1739.pdf, (2020, 13 July).

Özdemir S. M., Benzer H., Akbaş O. (2009). A Study on the Education Issues of Turkish Youth 15-19 years old living in Germany (The example of North Ren Vestfalya). Journal of Ahi Evran University Kırşehir Faculty of Education (KEFAD), 10(1), 23-40.

Tarhan, H. ve Peker, S. (2008*).* The issues faced by education counselors, attache and assistant attache in abroad while performing their duties. XVII. National Educational Sciences Congress, Sakarya.

TC. Ministry of Family, Labor and Social Services General Directorate of Foreign Relations (2016). Kingdom of Saudi Arabia. Access address: https://ailevecalisma.gov.tr/digm/contents/dis-temsilciliklerimiz/yabanci-ulke-bilgileri/suudi-arabistan/

TC. Ministry of Education General Directorate of Higher Education and Abroad Education (2020). Reference Guide to Selection Exam for Teachers to be Employed Abroad. Access address: http://www.meb.gov.tr-/meb_iys_dosyalar/2019_12/09174334_OYRETMEN_KILAVUZU.pdf (2020, 18 July).

Yıldırım, A. ve Şimşek, H. (2013). Qualitative research methods in the social sciences (1st Edition). Ankara: Seçkin Publishing.

Foreign Education and Training Department (2014). Yurt Dışı Eğitim ve Öğretim Daire Başkanlığı. Access address: https://yyegm.meb.gov.tr/www/yurt-disi-egitim-ve-ogretim-daire-baskanligi/icerik/30 (2020, 17 July).
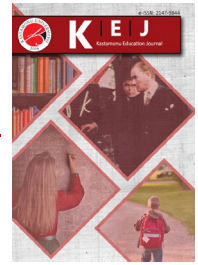
| Research Article / Araştırma Makalesi|

Examination of Preservice Teachers' Skills in Classifying Learning Objectives and Problem Posing Involving Fractions

Öğretmen Adaylarının Kesirler Konusuna Yönelik Kazanım Sınıflandırma ve Problem Kurma Becerilerinin İncelenmesi[1]

Okan Kuzu[2], Osman Çil[3]

Abstract

Purpose: This study investigated how primary school preservice mathematics teachers and preservice classroom teachers classified the learning objectives and problems about fractions in terms of knowledge and cognitive processes. In addition, the study examined how preservice teachers posed problems about the learning objectives regarding fractions and what kind of errors they made in this process.

Design/Methodology/Approach: Designed with the mixed research model, the study was carried out during the 2019-2020 academic year with the participation of 55 preservice middle school mathematics teachers and 101 preservice classroom teachers. It was determined nine objectives about "Fractions" and "Operations with Fractions" from the 2018 Mathematics Curriculum, and the preservice teachers were asked to classify these objectives in terms of knowledge and cognitive process dimensions of the revised Bloom's taxonomy and to pose suitable problems for each of these objectives.

Findings: Analyses conducted in the framework of the study showed that while classifying the learning objectives at the level of understanding and applying, both primary school preservice mathematics teachers and preservice classroom teachers confused the steps of recognizing fractions and using fractions and obtained a low rate in regards to accurate classification. Regarding the knowledge dimension, it was observed that the preservice teachers did not confuse the learning objectives with each other at the conceptual and procedural knowledge level and performed a moderately accurate classification. On the other hand, it was concluded that both preservice middle school mathematics teachers and preservice classroom teachers were able to pose accurate problems in line with the knowledge process and cognitive process dimensions relevant to the learning objectives, but they did not have the same performance in classifying the problems prepared for these objectives. The errors made by preservice teachers in the process of problem posing were collected under three categories as "problems not relevant to the learning objective ", "limitations regarding subject matter knowledge" and "limitations in problem posing skills".

Highlights: it is concluded that it is very important for preservice teachers in the learning and teaching process to problem posing in line with the behavior to be measured in terms of knowledge and cognition by paying attention to the purpose of the learning objective.

Öz

Çalışmanın amacı: Bu çalışmada, kesirler konusuna ait kazanımların ve problerin ilköğretim matematik ve sınıf öğretmeni adayları tarafından bilgi ve bilişsel süreç açısından nasıl sınıflandırıldıkları incelenmiştir. Ayrıca, öğretmen adaylarının kesirler konusuna ait kazanımlara yönelik nasıl problem kurdukları ve problem kurma sürecinde ne tür hatalar yaptıkları belirlenmiştir.

Materyal ve Yöntem: Karma araştırma modeli ile tasarlanan bu çalışma 2019-2020 eğitim öğretim yılında, 55 ilköğretim matematik ve 101 sınıf öğretmeni adayının katılımıyla gerçekleştirilmiştir. 2018 matematik dersi öğretim programında yer alan "Kesirler" ve "Kesirlerle İşlemler" konularına ait dokuz kazanım belirlenmiş ve adaylardan bu kazanımları revize edilmiş Bloom taksonomisinin bilgi ve bilişsel bilişsel süreç boyutları açısından sınıflandırmaları ve bu kazanımlara uygun bir problem kurmaları istenmiştir.

Bulgular: Yapılan analizler sonucunda, bilişsel süreç boyutu açısından hem ilköğretim matematik hem de sınıf öğretmeni adaylarının anlamak ve uygulamak basamağındaki kazanımları sınıflandırırken birbiri ile karıştırdıkları ve düşük oranda doğru bir sınıflandırma yaptıkları görülmüştür. Bilgi boyutu açısından ise adayların kavramsal ve işlemsel bilgi basamağındaki kazanımları sınıflandırırken birbiri ile karıştırmadıkları ve orta oranda doğru bir sınıflandırma yaptıkları görülmüştür. Diğer taraftan, bu çalışmada, hem ilköğretim matematik hem de sınıf öğretmeni adaylarının kazanımın bilgi ve bilişsel süreç boyutuna uygun problem kurabildikleri görülürken, kazanımları ve bu kazanımlara yönelik hazırlanan problemleri sınıflandırmada ise aynı performansı sergileyemedikleri dikkatleri çekmiştir. Adayların problem kurma sürecinde yaptıkları hatalar incelendiğinde ise hataların "kazanım dışı sorular", "alan bilgisine yönelik sınırlılıklar", "problem kurma becerisine yönelik sınırlılıklar" şeklinde üç kategori altında toplandığı görülmüştür.

*Önemli Vurgular: A*dayların problem kurma sürecinde kazanımın eğitsel amacına ve ifadesine dikkat ederek, bilgi ve bilişsel süreç açısından ölçülmek istenen davranışa uygun problem kurulmasının öğrenme ve öğretme sürecinde oldukça önemli olduğu düşünülmektedir.

[1] A part of this study was presented as an oral presentation at the International Online Conference on Mathematics Education in between May 26-29, 2021.
[2] **Corresponding Author,** Kirsehir Ahi Evran University, Faculty of Education, Department of Mathematics and Science Education, Kirsehir, Turkey, okan.kuzu@ahievran.edu.tr, https://orcid.org/0000-0003-2466-4701
[3] Kirsehir Ahi Evran University, Faculty of Education, Department of Primary Education, Kirsehir, Turkey, ocil@ahievran.edu.tr, https://orcid.org/0000-0001-5903-9864

INTRODUCTION

Mathematics, whose importance is increasing day by day, forms the basis of many studies from past to present and it is the common language and thought of people. People learn mathematics based on intuition just as they learn their mother tongue before they learn how to read and write and many mathematical concepts and techniques are listed while thinking, a chain of thinking is formed and creative solutions emerge just as words are ordered in line with certain rules and structures while speaking (Umay, 1996). After this thinking process takes place in the mind, new ideas and ways can be generated thanks to performance-based activities and by using this creativity, alternative solutions can be offered for the problems that are encountered.

Measurement and evaluation approach, which is one of the most important components of the curriculum in recent years, has been adapting itself to improve students' creativity and contribute to their problem-solving skills. Measurement and evaluation is used to evaluate to the extent of achievement regarding the program objectives, whether the course content has been understood or not, the achieved skills and the level of these skills. Measurement is required to ensure that the evaluation is accurate, and a correct measurement tool is needed for the measurement to be done in the correct manner (Akpınar, 2003). Since mathematics includes more cognitive acquisitions (MoNE, 2018a), oral, written (short-answer, long-answer) and objective (multiple-choice, true-false, matching, completion) tests, which are cognitive behavioral measurement tools, may be more appropriate to use.

Oral tests are a type of non-written assessment in which questions and answers are provided orally. Written tests are a type of non-objective test in which questions and answers are presented in writing. Objective tests, on the other hand, are a type of assessment that requires more expertise and knowledge in the preparation stage than oral and written tests and has an objective evaluation. In the objective test type, students' difficulty and discrimination levels can be determined with more ease, and psychometric properties such as validity and reliability can be examined more easily (Umay, 1996). However, it has been argued that objective tests limit students to the given options and hinder the assessment of high-level cognitive skills such as judgment, interpretation, analysis, evaluation and creation (Üstüner & Şengül, 2004), and it is emphasized that the use of oral and written tests is more appropriate to measure these skills (Umay, 1993). In addition, it is stated within the framework of the 2023 Education Vision that measurement tools that support high-level cognitive skills are important for students to achieve high performance in international exams and to associate the problems presented in the learning process with daily life (MoNE, 2018b). For example, international large-scale exams like PISA, do not aim to measure how much the students learn, but how much they reflect the knowledge to the society (OECD, 2007), and this situation is reflected more with open-ended problems (Öksüz & Güven, 2019). Open-ended problems are reported to contribute to students' perception, thinking and implementation skills (Badger & Thomas, 1992; Cooney, Sanchez, Leatham, & Mewborn, 2004), to be more appropriate for measuring higher-order thinking skills than other problem types (Bahar, Nartgün, Durmuş, & Bıçak, 2012) and to allow students to make interpretations and think creatively in the process of solving daily life problems (Akay, Soybaş, & Argün, 2006; Öçal, İpek, Özdemir, & Kar, 2018). The suitability of open-ended problems prepared to measure high-level cognitive skills for students in mathematics is closely related to the creativity levels of educators who prepare these problems (Umay, 1996).

Teachers undertake the responsibility to prepare and implement the problems and to interpret the results correctly to determine students' performance (Küçükahmet, 2006). While teachers prepare their problems, they sometimes change only the figures on the existing, readymade problems and this may prevent the students from thinking creatively and producing new ideas. However, the correct preparation and effective use of problems makes it easier to determine students' understanding levels, to increase their participation and motivation more easily, and to raise their knowledge and cognitive skills to higher levels (Ralph, 1999). For example, problems that have only one correct answer that can be easily figured out cause students and teachers not to use their thinking skills sufficiently, while high-level problems are very useful in developing students' skill to access information, testing their own knowledge, recognizing problems and producing solutions for them (Koray, Altunçekiç, & Yaman, 2005; Feldhusen, 1985). Hence, it would be more appropriate to prepare the problems to fit the purpose and objectives, rather than random selection of items, so that students can develop all the required cognitive skills. Learning objectives have an important place in the regulation, implementation and evaluation of these goals and objectives (MoNE, 2018a). Since primary school mathematics course learning objectives are predominantly cognitive, it would be a more appropriate approach to use a cognitive taxonomy in classifying the problems to be prepared for these outcomes.

Bloom's taxonomy, which has a cognitive structure, is widely accepted by educators in interpreting the standards in mathematics and classifying upper and lower thinking skills (Arı, 2013; Näsström, 2009). Bloom's taxonomy, which has a hierarchical structure from low cognitive skills to high cognitive skills, previously consisted of six steps from simple to complex information, comprehension, application, analysis, synthesis and evaluation (Bloom et al., 1956). Based on the results of the studies carried out over time, it was reported that the one-dimensional classification was insufficient for in-depth analyses and therefore the taxonomy was revised to support a two-dimensional structure (Anderson et al., 2001). It was argued that the synthesis step includes more complex mental processes compared to the evaluation step; the incompatibility between them has been eliminated by changing their places in the taxonomy. In addition, the steps in the cognitive process dimension were named by using verbs (emphasizing the actions) rather than using nouns and rearranged as remembering, understanding, applying, analyzing, evaluating and creating (Anderson et al., 2001). Here, remembering, understanding and applying steps are considered as low-level cognitive processes while analyzing, evaluating and creating steps are accepted as high-level cognitive processes

(Crowe, Dirks & Wenderoth, 2008). In addition, a knowledge dimension consisting of factual, conceptual, procedural and metacognitive knowledge steps has been added to the revised Bloom's taxonomy in order to express cognitive terminology more clearly. Each step in the dimension of knowledge in the vertical column and the dimension of cognitive process in the horizontal column also includes the other steps under it, and abstraction, complexity and scope increase as one moves up to the higher order levels (Krathwohl, 2002).

Table 1. The structure of knowledge and cognitive process dimensions of the revised Bloom's taxonomy (Krathwohl, 2002)

	Cognitive Process Dimension				
Remember	Understand	Apply	Analyze	Evaluate	Create
Retrieving relevant knowledge from long-term memory	Determining the meaning of instructional messages, including oral, written, and graphic communication	Carrying out or using a procedure in a given situation	Breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose	Making judgments based on criteria and standards	Putting elements together to form a novel, coherent whole or make an original product
Recognizing *Recalling*	*Interpreting* *Exemplifying* *Classifying* *Summarizing* *Inferring* *Comparing* *Explaining*	*Executing* *Implementing*	*Differentiating* *Organizing* *Attributing*	*Checking* *Critiquing*	*Generating* *Planning* *Producing*

Knowledge Dimension			
Factual knowledge	The basic elements a student must know to be acquainted with a discipline or solve problems in it.	*Terminology* *Specific details and elements*	
Conceptual knowledge	Interrelationship among basic elements in a larger structure that allows them to function together	*Classifications and categories* *Principles and generalizations* *Theories, models and structures*	
Procedural knowledge	How to do something, methods of inquiry, and criteria for using skills, algorithms, techniques, and methods	*Subject-specific skills/processes* *Subject-specific techniques/methods* *Criteria for determining when to apply suitable procedures.*	
Metacognitive knowledge	Knowledge of cognition in general, awareness and knowledge of one's own cognition	*Strategic knowledge* *Cognitive tasks, appropriate contextual and conditional knowledge* *Self-knowledge*	

The level of problems used to measure higher-order thinking skills is very important (Aslan, 2011). For example, a problem at the level of factual knowledge leads students to remember and memorize, while a problem at the level of metacognitive knowledge leads students to use their existing knowledge and to think effectively with this knowledge (Paul, 1995; Doğanay & Ünal, 2006). The problems used both in textbooks and in the classroom settings from the first years of primary education should be prepared in a manner to improve students' thinking skills (Elder & Paul, 2003; Goatly, 2000). The quality and relevance of these problems contribute to the increase in student motivation for the courses, encourage them and significantly affect their future achievement (Belcastro, 2017; Carr, 1998; Jones, 2008). For this reason, preparing relevant problems for the learning objectives in line with the aims and objectives of the program is believed to be important in developing students' thinking skills and evaluating them accurately. It is also reported that the problems prepared in accordance with the learning objectives classification prevent accumulation in certain steps and help the teacher in determining students' cognitive levels (Büyükalan, 2007; Özden, 1998).

The relevant literature points out that the studies in the field mostly investigated the level of problems prepared to measure the students (Alexander et al., 1994; Aydemir & Çiftçi, 2008; Baysen, 2006; Çalışkan, 2011; Dursun & Aydın-Parim, 2014; Jesus & Moreira, 2009; Koray & Yaman, 2002; Köğce & Baki, 2009; Özcan & Akcan, 2010; Geçit & Yazar, 2010; Gökler, Arı, & Aypay, 2012; Gündüz, 2009; Ülger, 2003). It was observed in these studies that the problems were mostly prepared at the lower levels, and higher level problems that required higher-order thinking skills were not encountered very often. The studies in literature focusing on teachers' skill to prepare problems (Çakıcı, Ürek, & Dinçer, 2012; Erdoğan, 2017; Marbach-Ad & Sokolove, 2000; Yeşilyurt, 2012; Yılmaz & Keray, 2012) were mostly conducted in the fields of Turkish and Science and generally included the classification of

prepared problems. The studies examining students' and teachers' problem posing skills also focused on the fields of Turkish and Science, and the studies examining the problem posing skills for the learning objectives in mathematics were rather limited.

Regarding the fact that mathematics is used as a tool in solving problems encountered in daily life, it may be easily comprehended seen that natural numbers, which are frequently used in daily life, are not enough for some mathematical calculations. For example, if 3 apples are to be shared equally among 2 children, the operation (the number of apples per child) cannot be executed with natural numbers (Baykul, 2014). Also, the set of natural numbers, which are closed under addition and multiplication, is not closed under subtraction and division. The set of natural numbers, which is insufficient in terms of subtraction and division operations, has been expanded and the set of integers has been obtained with an expansion so that subtraction can be done, and the set of rational numbers has been expanded so that division can be done (Baykul, 2005). The set of rational numbers and fractions are presented to students in relation to each other, and at this stage, the part-whole relationship becomes important (MoNE, 2018a). Therefore, fractions are defined as each or a few of the equal parts of a whole (Baykul, 2014). The fact that fractions have their own abstract meanings and are not used much in daily life forms the basis of why it is one of the difficult subjects to learn and teach (Albayrak, 2000; İpek, Işık, & Albayrak, 2005). Similarly, the studies in the literature (Aksu, 1997; Alacaci, 2012; Behr, Lesh, Post & Silver, 1983; Biber, Tuna, & Aktaş, 2013; de Castro, 2008; Işık & Kar, 2012; Işık, Öçal, & Kar, 2013; Kar & Işık, 2015; Kocaoğlu & Yenilmez, 2010; Moss, & Case, 1999; Okur, Çakmak-Gurel, 2016; Olkun & Toluk-Uçar, 2012; Pesen, 2008; Soylu & Soylu, 2005; Soylu, 2008; Stafylidou & Vosniadou, 2004; Tirosh, 2000; Ünlü & Ertekin, 2012; Wu, 1999) demonstrate that students have learning difficulties regarding the concept of fractions as well as the operations related to fractions. In that case, preparing appropriate problems for the subject of operations with fractions can help improve the cognitive levels of students and create a more effective and permanent learning environment since this subject includes an important conceptual expression such as the part-whole relationship and which can be used frequently in daily life problems but is one of the difficult subjects to learn.

This study examined how the learning objectives and problems on the subject of fractions were classified in terms of knowledge and cognitive process dimensions of the revised Bloom's taxonomy by primary school preservice mathematics and preservice classroom teachers. In addition, the study set out to determine how the preservice teachers posed problems about the learning objectives related to fractions and what kind of errors they made during the problem posing process.

METHOD/MATERIALS

Research Model

Quantitative and qualitative data, which had equal importance for the purpose of the research, were collected at the same time in this study which utilized the simultaneous transformational design of the mixed research model. Case study model was used as the quantitative research model while the survey model was selected as the qualitative research model. According to Cresswell (2009), using qualitative and quantitative approaches together enables us to better understand research problems

Participants

The research participants consisted of 55 preservice mathematics teachers and 101 preservice classroom teachers studying at the education faculty of a state university in Turkey during the 2019-2020 academic year. Convenience sampling method was used in the selection of the relevant university while the criterion sampling method, one of the purposive sampling methods, was used in the selection of primary school preservice mathematics and classroom teachers studying at this university. Criterion sampling is the selection of people, objects or situations that are predetermined with certain conditions (Patton, 2002). In this study, the criterion for the selection of the primary school preservice mathematics and classroom teachers was designated as attending a course on teaching mathematics during the undergraduate education process.

Data Collection and Analysis

A test consisting of two items was prepared by the researchers in this study to examine the classification of learning objectives and problem posing skills regarding fractions (see Appendix 1). The first test item included nine objectives about "Fractions" and "Operations with Fractions" from the 2018 Mathematics Curriculum, and the preservice teachers were asked to classify these objectives in terms of knowledge and cognitive process dimensions of the revised Bloom's taxonomy and to pose suitable problems for each of these objectives. The second item included 14 problems on "Fractions" and "Operations with Fractions" and the candidates were asked to classify these problems in terms of knowledge and cognitive process dimensions of Bloom's taxonomy.

Firstly, the 2018 mathematics curriculum was examined while the test was being developed and it was observed that the subject of "Fractions" was taught in grades 1-5 and the subject of "Operations with Fractions" was taught in grades 4-6 under the "Numbers and Operations" learning area. Since including all the learning objectives in the program may cause boredom and result in a loss of interest, attention and motivation for the participants during the implementation, the test focused on a limited number of learning objectives. In this context, all the learning objectives on the subject of fractions and operations with fractions were examined for grades 1-6 and attention was paid to include the learning objectives that serve different purposes or competencies in order to avoid being redundant.

In addition, the more complex learning objective was included in the test when one learning objective was the natural progression of others within the same class level. For example, the learning objective at 6th Grade "*A.6.1.5.6. Performs the division of two fractions and makes sense of them*" is more complex than the following learning objective, since the learning objective presented above is a natural progression of the similar objectives preceding it: "*A.6.1.5.5. Divides a natural number by a fraction and a fraction by a natural number, and makes sense of this operation*". For this reason, the learning objective *A.6.1.5.6* was included in the test. In addition, similar learning objectives that serve the same learning purpose and competence in the program are taught at different grade levels. Since this study focused on primary school preservice mathematics and classroom teachers, test problems were created for the similar learning objectives by paying attention to the learning objective presented in the highest grade level. For example, "*A.1.1.4.1. Shows the concept of whole and half with appropriate models and explains the relationship between the whole and the half*" learning objective at the first grade level is expressed as follows in the second grade "A.*2.1.6.1. Shows the concept of whole, half and quarter with suitable models; explains the relationship between the whole, half, and quarter*". For this reason, the second grade learning objective was taken into account due to being more complex and comprehensive among the similar learning objectives relevant to the subject.

Nine learning objectives presented in the first item of the test and 14 problems related to learning objectives in the second item were coded independently by the researchers, taking into account Krathwohl's (2002) table, which includes knowledge and cognitive process dimensions, and the inter-coder reliability was calculated as .818 using Cohen's kappa statistics (Fleiss & Cohen, 2008). 1973). Kappa statistic takes a value between -1 and +1 and it is recommended to be at least .60. Values between 60 and 80 indicate good agreement between encoders, and values above .80 indicate a very good agreement between encoders (Fleiss & Cohen, 1973; Landis & Koch, 1977; Wood, 2007). In this context, the obtained inter-coder agreement was found to be at a very good level. In addition, the disagreements that occurred after the coding were re-evaluated by the researchers and a consensus was reached for all disagreements.

The test was applied to 55 preservice mathematics teachers and 101 preservice classroom teachers, and the content analysis method was used to analyze the qualitative data regarding the problem posing in the first problem. The two-dimensional table created by Krathwohl (2002) consisting of information/cognitive process dimensions was used as the coding key in the content analysis, and preservice teachers' knowledge and thought processes were investigated. Both the classification and content analysis of the problems posed by the candidates in accordance with the learning objectives were conducted independently by researchers who are experts in primary school mathematics and classroom education, and the agreement between the classifications was found to be .961 with Cohen's kappa statistics (Fleiss & Cohen, 1973). Three categories emerged as a result of the content analysis: problems not relevant to the learning objective", "limitations regarding subject matter knowledge" and "limitations in problem posing skills". Whether the problems represented these categories were calculated with the *consensus/(consensus + disagreement)* formula as .953 (Miles & Huberman, 1994). This value was regarded to be rather good as well in the study.

On the other hand, participants' accurate classification of the objective/problem in the first and second items of the test and their problems in accordance with the objective in the first item were examined and the data was coded as 1 for correct answers and 0 for incorrect or blank answers. The data obtained this way was transferred to SPSS 23 (Statistical Package for the Social Sciences 23) program and the reliability of the test was calculated as .747. In addition, using these quantitative data, the percentages of correct classification of the objectives and problems regarding fractions were examined as well as the percentages of posing the correct problems suitable for the objectives. The findings for this study are as follows: $0 \leq$ percentage ≤ 20: Very low, $20 <$ percentage ≤ 40: Low, $40 <$ percentage ≤ 60: Moderate, $60 <$ percentage ≤ 80: High, $80 <$ percentage ≤ 100. The results were found to be very high

FINDINGS

This section presents the findings about how primary school preservice mathematics and classroom teachers classified the learning objectives and the problems prepared for the subject of fractions, how they posed problems in line with the learning objectives, and what errors were found in the problems they posed.

Quantitative Findings of the Study

This section examined how the candidates classified the learning objectives and the problems on fractions in terms of knowledge and cognitive process dimensions of the revised Bloom's taxonomy and how they posed problems suitable for the learning objectives. The findings are presented below in tables.

Table 2. Percentage distribution of the classification of the learning objectives prepared in the steps of understanding and applying in terms of the cognitive process dimension

Learning objectives Classification	Primary Mathematics Education						Classroom Education					
	R	U	A	An	E	C	R	U	A	An	E	C
Understand	5.90	26.81	25.45	25.90	10.90	2.72	3.21	33.41	39.35	14.85	1.98	-
Apply	4.36	26.54	29.09	17.81	8.00	10.18	6.73	26.33	39.00	13.26	2.17	4.55

R: Remember, U: Understand, A: Apply, An: Analyze, E: Evaluate, C: Create

Table 2 shows that the learning objectives prepared at the level of understanding for the subject of fractions were classified as understanding by 26.81% of the primary school preservice mathematics teachers. Although the majority of the preservice mathematics teachers concentrated on understanding and made the accurate classification, it was observed that 25.45% of the preservice teachers were inaccurate with a percentage close to each other (applying by 25.45% and analyzing by 25.90%). It was seen that the learning objectives prepared at the level of understanding were misclassified as applying by 39.35% of the primary school preservice classroom teachers, and correctly classified by 33.41% of the primary school preservice classroom teachers. On the other hand, it was found that the learning objectives prepared at the level of applying were classified correctly by 29.09% of the primary school preservice mathematics teachers. However, 26.54% of primary school preservice mathematics teachers classified these as understanding and misclassified them with a percentage close to the level of applying. It was observed that 39.00% of primary school preservice classroom teachers classified the learning objectives prepared at the level of applying correctly, while 26.33% of the primary school preservice classroom teachers classified them incorrectly as understanding. In this context, it was observed that both primary school preservice mathematics and classroom teachers confused the learning objectives at the level of understanding and applying with each other and had a low rate of correct classification.

Table 3. Percentage distribution of the classification of the learning objectives prepared in conceptual and procedural steps in terms of the knowledge dimension

Learning objectives Classification	Primary Mathematics Education				Classroom Education			
	F	C	P	M	F	C	P	M
Conceptual	13.63	44.54	27.27	7.72	9.40	57.42	26.23	.49
Procedural	11.27	17.81	50.90	13.81	20.19	15.44	49.90	4.55

F: Factual, C: Conceptual, P: Procedural, M: Metacognitive

Table 3 demonstrates that the learning objectives prepared at the conceptual knowledge level for the subject of fractions were mostly identified to be in the conceptual knowledge level by both primary school preservice mathematics teachers (44.54%) and primary school preservice classroom teachers (57.42%), and were classified correctly. Similarly, the preservice teachers stated that the learning objectives prepared in the procedural knowledge level were mostly in the procedural knowledge level and again the learning objectives were classified correctly. In this context, it was seen that both primary school preservice mathematics and classroom teachers made a moderately correct classification when classifying the learning objectives in the conceptual and procedural knowledge level.

Table 4. Percentage distribution of the steps for which the problems were posed for the learning objectives prepared in the steps of understanding and applying in terms of cognitive process dimension

Learning objectives Classification	Primary Mathematics Education						Classroom Education					
	R	U	A	An	E	C	R	U	A	An	E	C
Understand	.90	78.18	12.27	.45	-	-	-	68.06	8.16	-	-	-
Apply	-	6.54	85.45	-	.72	1.09	-	2.77	66.53	-	-	-

R: Remember, U: Understand, A: Apply, An: Analyze, E: Evaluate, C: Create

Table 4 shows that both primary school preservice mathematics teachers (78.18%) and primary school preservice classroom teachers (68.06%) focused on *understanding* the most and posed correct problems in accordance with the cognitive process step. Similarly, it was determined that the participants mostly focused on *applying* in posing problems suitable for the learning objectives prepared at the level of *applying*, and they posed problems suitable for the cognitive process step. In this context, it was observed that both primary school preservice mathematics and classroom teachers posed a high percentage of correct problems in accordance with the learning objectives prepared at the level of *understanding*. It was determined that primary school preservice mathematics teachers posed correct problems at a very high rate and primary school preservice classroom teachers posed correct problems at a high rate for the learning objectives prepared at the level of *applying*.

Table 5. Percentage distribution of the steps for which the problems were posed for the learning objectives prepared in conceptual and procedural steps in terms of knowledge dimension

Learning objectives Classification	Primary Mathematics Education				Classroom Education			
	F	C	P	M	F	C	P	M
Conceptual	.90	77.72	12.72	.45	.24	67.32	8.16	-
Procedural	.36	13.81	77.81	1.81	-	10.09	58.01	1.18

F: Factual, C: Conceptual, P: Procedural, M: Metacognitive

Table 5 presents that both primary school preservice mathematics teachers (77.72%) and primary school preservice classroom teachers (67.32%) focused on the conceptual knowledge level the most and posed the right problems in accordance with the knowledge level. Similarly, it was determined that the participants mostly focused on the procedural knowledge level in posing problems suitable for the learning objectives prepared in the procedural knowledge level, and they posed problems appropriate

for the knowledge level. In this context, it was found that both primary school preservice mathematics and classroom teachers posed a high percentage of correct problems in accordance with the learning objectives prepared in the conceptual knowledge level. For the learning objectives prepared in the procedural knowledge level, it was observed that the primary school preservice mathematics teachers posed problems at a high rate, while it was determined that the primary school preservice classroom teachers posed correct problems at a moderate rate.

Table 6. Percentage distribution of the level in which the problems prepared for fractions were classified in terms of cognitive dimension

Learning objectives Classification	Primary Mathematics Education						Classroom Education					
	R	U	A	An	E	C	R	U	A	An	E	C
Remember	58.18	17.27	9.09	2.72	3.63	.90	29.20	24.25	28.21	8.91	2.47	-
Understand	11.36	27.72	17.27	20.90	15.90	.45	5.69	40.84	21.78	17.07	8.41	-
Apply	3.03	13.33	38.18	17.57	16.96	4.24	2.97	17.16	51.15	18.81	3.30	.66
Analyze	.90	10.00	18.18	50.00	7.27	10.00	1.98	22.77	42.07	25.74	1.98	-
Evaluate	-	5.45	27.27	18.18	41.81	1.81	-	8.91	37.62	16.83	28.71	.99
Create	-	9.09	4.54	5.45	9.09	66.36	-	12.37	18.31	6.93	.99	55.44

R: Remember, U: Understand, A: Apply, An: Analyze, E: Evaluate, C: Create

Table 6 demonstrates that the problems prepared for the subject of fractions at the level of *remembering* were classified correctly as *remembering* the most by 58.18% of the primary school preservice mathematics teachers. Although it was observed that 29.20% of the primary school preservice classroom teachers classified them correctly as *remembering*, it was determined that 24.25% of the preservice teachers misclassified them with a percentage close to each other (*understanding* by 24.25% and *analyzing* by 28.21%). On the other hand, when the problems prepared in terms of *understanding* dimension were examined, it was seen that primary school preservice mathematics teachers (27.72%) and primary school preservice classroom teachers (40.84%) focused more on *understanding* than other steps and made accurate classifications. Similarly, the preservice teachers correctly classified the problems prepared at the level of *applying* compared to other options. While the problems prepared at the level of *analyzing* were correctly classified by 50.00% of the primary school preservice mathematics teachers, 42.07% of the primary school preservice classroom teachers had erroneous classification by focusing on *applying*. Only 25.74% of the primary school preservice classroom teachers made an accurate classification for the problems prepared at the level of *analyzing*. 22.77% of the primary school preservice classroom teachers made a wrong classification, by focusing on *understanding*, with a very close rate to the correct option. While 41.81% of primary school preservice mathematics teachers made a correct classification for the problems prepared at the level of *evaluating*, only 28.71% of the primary school preservice classroom teachers made a correct classification by qualifying the related problems as *evaluating*. However, 37.62% of the primary school preservice classroom teachers wrongly identified the problems prepared at the level of *evaluating* as *applying* and made a wrong classification. For the problems prepared at the level of *creating*, both primary school preservice mathematics teachers (66.36%) and preservice classroom teachers (55.44%) made a correct classification. In this context, the problems prepared at the level of *understanding* and *applying* were classified by primary school preservice mathematics teachers at a low rate; the problems prepared at the level of *remembering*, *analyzing* and *evaluating* were classified by primary school preservice mathematics teachers at a moderate rate and classified the problems prepared at the level of *creating* correctly at a high rate. On the other hand, primary school preservice classroom teachers correctly classified the problems prepared at the level of *remembering*, *analyzing* and *evaluating* at a low rate while they correctly classified the problems prepared at the level of *understanding*, *creating* and *applying* at a moderate rate. In addition, it was determined that the primary school preservice classroom teachers mixed up the problems prepared at the level of *remembering* with *understanding* and *applying* during classification, and they characterized the problems prepared at the level of *analyzing* and *evaluating* mostly as the level of *applying*.

Table 7. Percentage distribution of the level in which the problems prepared for fractions were classified in terms of knowledge dimension

Learning objectives Classification	Primary Mathematics Education				Classroom Education			
	F	C	P	M	F	C	P	M
Factual	51.81	26.36	11.81	3.63	54.45	17.32	19.30	.49
Conceptual	19.63	37.45	30.18	6.90	15.04	50.29	27.32	.39
Procedural	3.18	10.45	61.36	17.27	3.71	30.19	54.45	6.18
Metacognitive	7.87	15.15	29.09	40.60	2.97	23.76	38.94	26.40

F: Factual, C: Conceptual, P: Procedural, M: Metacognitive

Table 7 displays that the problems prepared at the factual knowledge level on the subject of fractions were classified correctly by 51.81% of primary school preservice mathematics teachers and 54.45% of primary school preservice classroom teachers. Although the problems prepared in the conceptual knowledge level were classified correctly by 37.45% of the primary school preservice mathematics teachers, it was determined that, with a similar percentage, 30.18% misclassified the problems to be

prepared in the procedural knowledge level. On the other hand, it was seen that both primary school preservice mathematics teachers (61.36%) and primary school preservice classroom teachers (54.45%) concentrated on the procedural knowledge level the most in the classification of the problems prepared in the procedural knowledge level. While it was observed that 40.60% of the primary school preservice mathematics teachers made a correct classification for the problems prepared in the metacognitive knowledge level, it was determined that 38.94% of the primary school preservice classroom teachers opted for the procedural knowledge level and made a wrong classification. Only 26.40% of the primary school preservice classroom teachers made a correct classification for the problems prepared in the metacognitive knowledge level.

It was observed that 23.76% of the primary school preservice classroom teachers made a misclassification about the problems as conceptual knowledge, which was a rate close to the rate of teachers who had accurate classification. In this context, the problems at the conceptual knowledge level were classified accurately by preservice mathematics teachers at a low rate; the problems at the factual and metacognitive knowledge level were classified accurately at a moderate rate and the problems at the procedural knowledge level were classified accurately at a high rate. In addition, it was determined that the primary school preservice mathematics teachers confused the problems prepared at the conceptual knowledge level with the problems prepared at the procedural knowledge level during classification, while the primary school preservice classroom teachers identified the problems at the metacognitive knowledge level as procedural knowledge level.

Qualitative Findings of the Study

This section investigated the kind of mistakes made by the primary school preservice mathematics and classroom teachers regarding the problems about fractions and learning objectives, and the findings were presented as examples collected under appropriate categories.

Problems which were irrelevant to the learning objective

Examination of the irrelevant problems posed by the preservice teachers pointed to two problems. The qualitative findings related to these problems are presented below as examples. The first of these problems was related to the fact that preservice teachers posed problems that measured a different learning objective other than the intended one, which was not related to the statement or the level of the learning objective in terms of knowledge and cognitive dimensions. For example, primary school preservice mathematics teacher M2 focused on integers contrary to what was desired in the learning objective, addressed the percentage problem and ignored the cognitively higher level action of posing a problem:

(Problem: In a class, one student gets 60 points and the other student gets 30 points. Since the exam is evaluated out of 100 points, what is the percentage of the total score they get)

It was observed that the preservice classroom teacher C8 posed a problem that could measure the skills of adding with fractions instead of posing a problem that would measure problem solving and posing skills:

(Problem: What is the result of the operation 1/2+3/4+2/6=?)

When the problem posed by the preservice teacher M6 was examined, it was determined that the problem was not suitable for both the purpose of the given objective and the desired level in terms of knowledge and cognitive dimensions. Although the posed problem seemed to be about fractions, it was not related or suitable to the educational actions in the content or purpose of the learning objective, so it was classified as irrelevant:

(Problem: Ali first eats half of the bread in his hand and writes it as a fraction (1/2). Then he eats half of the remaining portion. How much of the bread does Ali have now?)

The preservice teacher M26 asked for the letter in the denominator of a fraction whose numerator and denominator were unknown, and the problem was cognitively at a lower level than the expectations of the learning objective. It was noticed that M26 posed a completely unrelated problem, irrelevant to the statement and the educational purpose of the learning objective which was intended to be measured:

(Problem: Write the letter in the denominator of x/y fraction.)

In addition, with the problem, M26 focused on the pattern instead of four operations in the fractions presented latently in the content of the learning objective, and aimed to measure higher levels in terms of knowledge and cognitive dimensions. Although the term "four operations" was not mentioned in the content of the learning objective, M26 posed an incorrect problem on this subject, since the preservice teacher were informed that the learning objective were prepared on four operations in fractions:

(Problem: 2/3, 1/2, 4/3, 3/4 … complete the pattern on the right.)

It was observed that the problem posed by M19 did not include fractions and/or operations with fractions, it was out of the scope of the statement and the educational purpose of the objective and was a higher level problem terms of knowledge and cognitive dimensions:

(Problem: Prove that $1^1=1^2=1^3=...=1^n$ (n $\in$ Z).

Another problem encountered in the irrelevant problems posed by the preservice teachers is that they posed problems related to the learning objective statement, but the posed problems could not fully measure the educational skills intended to be measured in terms of knowledge and/or cognitive dimensions. For example, the problem posed C50 measured a different learning objective by explaining how the process was realized rather than the prediction of the result of operations with fractions, and it was determined that the problem was cognitively at a higher level:

(Problem: Prove that the result of the fraction 1/2+1/2 is 2/2.)

C52 posed a problem that measured students' subtraction skills in fractions as well instead of posing a problem that measured only the skill to compare and order unit fractions:

(Problem: Do the operation 4/3-1/3, 5/4-1/4 and compare.)

M40, on the other hand, focused on the simple fraction instead of the unit fraction as expressed in the objective and went beyond the purpose of the objective and asked about the relationship between the numerator and denominator of simple fractions. It was identified that the problem posed by preservice teacher was unrelated to both the objective statement and its educational purpose:

(Problem: Write the relationship between the numerator and denominator in simple fractions.)

The structure of the objectives included in the 2018 Mathematics curriculum may be an important reason why the candidates cannot pose problems in accordance with the objectives. For example, the following objective in the program "*Solves and constructs problems that require addition and subtraction with fractions whose denominators are equal or whose denominator is a multiple of the other*" aims to measure more than one educational skill. It was seen that many preservice teachers who posed problems for this objective ignored and/or overlooked the educational skill (constructing problems) of the learning objective. For example, C64 only concentrated on the educational action of problem solving while posing a problem for the aforementioned objective:

(Problem: Melike gave 1/2 of her cake to Melih. Melih had 2/4 of Melike's cake in his hand. How much cake did Melih have in total?)

M1 posed a problem below the cognitive level of the objective by asking how to solve the problem instead of posing a problem with appropriate problem-solving skills for the "Solves problems that require operations with fractions" learning objective statement:

(Problem: Which way do we follow for the subtraction of a half cake from a whole cake?)

M13, on the other hand, posed an irrelevant problem by not asking students to show the relationship with appropriate models, and posing a problem at a higher knowledge and cognitive level with problem solving instead of pointing to the relationship between fractions:

(Problem: Ali will share his cake with his friends. He will take half of the whole cake to himself, will give a quarter of the whole cake to Ayşe, and will give the remaining part to Fatma and Selim equally. How much of the cake will Selim get.)

The fact that some expressions included in the objectives are not clear or observable is another reason affecting the quality of the problems posed by teachers. For example, C54, who tried to pose a problem suitable for the objective of "*Performs the division of two fractions and makes sense of them*", ignored the educational skill of making sense included in the objective, and posed a problem only for the educational action of solving a division problem:

(Problem: Kezban has 12 pencils. She gave half of them to Idris. If she gives 2/3 of the remaining pencils to Ayşe, how many pencils will she have left.)

Limitations regarding subject matter knowledge

Preservice teachers' inability to fully understand the concepts in the learning objectives, their tendency to get confused by the learning objectives or having generally limited problem posing skills are other reasons for the errors encountered the problems in

this study. For example, C54 not only confused the concepts of operation and fraction in regards to the subject of fractions, but also confused the concepts of unit fractions and compound fractions, and posed a problem that could not meet the learning objective:

(Problem: Order the fractions 3/2-1/2, 6/3-3/3 from greatest to least?)

Similarly, M3 posed a problem that did not meet the purpose of the objective as a result of confusing the concepts of unit fraction and simple fraction:

(Problem: Order the fractions 3/8, 4/9, 10/11 from greatest to least.)

The primary school preservice teachers did not only experience confusion in the subjects that include content knowledge such as fraction types, but also confused concepts such as problem sentences and operations with mathematical estimation and mental operations. For example, C67 confused mental processing with mathematical estimation skills:

(Problem: What is 1/3 of 30 apples? 2/3, 3/3, 3/15 (calculate it with your mind))

Similarly, C92 confused the skill to estimate operation results with mental processing skills and posed the problem that did not meet the following objective:

(Problem: 1/5 x 1/2 1/8 : 1/2 4/8 : 1/2 1/10 + 1/5 work out the results of the above operations with your mind.)

In another example, C31 confused the concepts of fractions and operations in fractions and instead of estimating the result of an operation related to fractions, the preservice teacher posed a problem in which fractions should be compared.

(Problem: a. 3/4 b. 2/4 c. 3/5 Guess the order of these operations)

Similarly, preservice classroom teachers often understood the educational action of problem solving as operating with fractions. For example, it was seen that C56 asked students to operate on fractions and find answers instead of creating a problem statement:

(Problem: 2/6+4/6=?, 8/9-4/9=? Find the result of the operation.)

In another example, C71 posed a problem that required only one sum operation in fractions, instead of forming a problem statement, even though the preservice teacher had underlined the words in the objective such as *solves* and *constructs*:

(Problem: 2/4+3/8 Find the result of the operation.)

When the problem posed by M10 was examined, it was seen that instead of using expressions such as 3/5 of a tomato, 2/7 of a lemon and 4/6 of an apple, the preservice teacher used expressions such as 3/5 tomatoes, 2/7 lemons and 4/6 apples by ignoring the fact that the concept of "piece" is used for countable or any number of objects:

(Problem: Ms. Ayşe bought 3/5 piece of tomatoes, 2/7 piece of lemons and 4/6 piece of apples from a grocery store, how many ingredients are in the bag in total?)

Limitations in problem posing skills

Examination of the errors made by the preservice teachers while posing problems about fractions showed that they are limited in displaying meaningful problem posing skills in addition to confusing the concepts with each other. It was determined that some of the problems posed by the preservice teachers did not have a definite solution, and the problem statements of some of these problems were wrong. For example, the problem posed by C12 did not provide information about fractions or the operation to be done with fractions, therefore, this specific problem did not have a definite solution:

(Problem: What type of fractional expression does the result of two simple fractions represent?)

In the following example, the data presented by C16 in the problem and the answer requested in the problem did not match, and therefore there was no definite answer to the problem in problem:

(Problem: Ali will give 2/5 of his pens to Ahmet and Ayşe will give 1/5 of her pens to Ahmet. Ahmed will give 1/10 of the total pens to his brother. How many pencils are there?)

In some cases, it was observed that the unnecessary information provided by the primary school preservice classroom teachers in the problem diverted the problem from obtaining the purpose of the learning objective. For example, in the problem of C41, providing information about the number of slices to be given to everyone made it impossible to observe the skill intended to be measured with the objective:

(Problem: A cake is divided into 10 pieces. Everyone will receive 2 slices of cake. How many slices of cake will there be for 3 people?)

Another problem encountered in the posed problems was related to the operation errors or logic errors. For example, the problem posed by C48 had an operation error since the share of cake slices per person could not be 2/5 even if there were 10 cakes in total or there was one cake divided into ten pieces:

h) Bir çokluğun belirtilen bir basit kesir kadarını belirler.

Hatırlamak ( )   Anlamak ⊠   Uygulamak ( )   Çözümlemek ( )   Değerlendirmek ( )   Yaratmak ( )
Olgusal Bilgi ⊠   Kavramsal Bilgi ( )   İşlemsel Bilgi ( )   Üstbilişsel bilgi ( )

Soru: 10 pasta 5 kisiye esit paylastirilacaktir. Her birine $\frac{2}{5}$ pasta düşmektedir. buna göre 3 kisiye kaç pasta düşer

(Problem: 10 cakes will be shared equally among 5 people. There will be 2/5 slices for each. How many slices of cake will there be for 3 people)

Another problem encountered regarding the problem posing skills of the preservice teachers was related to their providing a clear and plain answer in the problem statement so that students could easily find the answer without spending any effort. For example, the problem posed by M24 asked how many wafers Ayşe bought although it was clearly stated in the problem that Ayşe bought 5 wafers:

g) Bir bütünü eş parçalara ayırarak eş parçalardan her birinin birim kesir olduğunu belirtir.

Hatırlamak ( )   Anlamak ⊠   Uygulamak ( )   Çözümlemek ( )   Değerlendirmek ( )   Yaratmak ( )
Olgusal Bilgi ⊠   Kavramsal Bilgi ( )   İşlemsel Bilgi ( )   Üstbilişsel bilgi ( )

Soru: Ayşe 10 TL'sine tanesi 2 TL den 5 tane gofret almıştır. kaç tane gofreti almıştır.

(Problem: Ayşe bought 5 wafers, each of which is 2 TL for 10 TL. How many wafers did she have.)

In the example below, C20 mixed up simple fractions with compound fractions and overlooked that most of the fraction values given in the problem were more than the total number of students provided by the teacher in the problem:

e) Kesirlerle işlem yapmayı gerektiren problemleri çözer.

Hatırlamak ( )   Anlamak ( )   Uygulamak ( )   Çözümlemek ⊔   Değerlendirmek ( )   Yaratmak ( )
Olgusal Bilgi ( )   Kavramsal Bilgi ( )   İşlemsel Bilgi ⊔   Üstbilişsel bilgi ( )

Soru: Bir okuldaki öğrencilerin toplamı 100 bunların $\frac{4}{3}$ ü erkek $\frac{4}{1}$ i kızdır. Kızların ise $\frac{2}{3}$ ü gözlüklüdür, toplam gözlüksüz kız seyiz kadır.

(Problem: The total number of students in a school is 100; 4/3 of them are boys and 4/1 of them are girls. 2/3 of the girls wear glasses. what is the total number of girls without glasses?)

Similarly, it is understood that C37 posed a problem statement that required dividing a field among three siblings, but according to the data presented in the problems, the piece of field that should be given to only the third sibling is more than the whole field:

e) Kesirlerle işlem yapmayı gerektiren problemleri çözer.

Hatırlamak ( )   Anlamak ( )   Uygulamak ⊠   Çözümlemek ( )   Değerlendirmek ( )   Yaratmak ( )
Olgusal Bilgi ( )   Kavramsal Bilgi ( )   İşlemsel Bilgi ( )   Üstbilişsel bilgi ( )

Soru: Bir köy ağası çocuklarına miras olacak tarla paylaştırırken 1. çocuğuna tarlanın $\frac{3}{8}$ 'ü, 2. çocuğuna $\frac{2}{8}$, 3. çocuğuna da kardeşleri düşen payların toplamının 2 katı kadar miras düşer. 3. çocuğu tarlanın ne kadar düşe

(Problem: When a squire distributes a field to his children as an inheritance, his 1ˢᵗ child inherits 3/8 of the field, his 2ⁿᵈ child 2/8 the field, and his 3ʳᵈ child receives 2 times the sum of the shares of his siblings. How much of the field does the 3ʳᵈ child get?)

When the problem posed by M12 was examined, it was seen the expressions in the problem statement were suitable for the objective, but the problem sentence was not complete and the problem was not plain, understandable and clear. It is clear that the statement in the last sentence "He asks Fatma to show the shapes of these breads" was not directed to the student who was supposed to solve the problem:

d) Bütün, yarım ve çeyreği uygun modeller ile gösterir; bütün, yarım ve çeyrek arasındaki ilişkiyi açıklar.

Hatırlamak ( )   Anlamak ⊠   Uygulamak ( )   Çözümlemek ( )   Değerlendirmek ( )   Yaratmak ( )
Olgusal Bilgi ( )   Kavramsal Bilgi ⊠   İşlemsel Bilgi ( )   Üstbilişsel bilgi ( )

Soru: Elimizde 3 tane ekmek vardır. Ali bir ekmek, Ahmet yarım ekmek Ayşede çeyrek ekmek yemek istediklerini söyler. Bu ekmekleri şekillerinde fatmadan göstermesini ister.

(Problem: We have 3 loaves of bread. Ali says he wants to eat a loaf of bread, Ahmet half a loaf of bread and Ayşe a quarter. He asks Fatma to show the shapes of these breads.)

CONCLUSION, DISCUSSION AND RECOMMENDATIONS

This study examined how primary school preservice mathematics and classroom teachers classified the learning objectives on fractions and the problems prepared for these objectives. In addition, primary school preservice mathematics and classroom teachers' problem posing skills for the learning objectives were investigated and the mistakes encountered in the problem posing process were examined. In this context, primary school preservice mathematics and classroom teachers made a moderately correct classification when classifying the learning objectives in regards to conceptual and procedural knowledge. However they had a low rate of accurate classification when classifying the learning objectives at the level of *understanding* and *applying*, confusing the learning objectives at this stage with each other. This may be due to preservice teachers' perception of the expression or educational purpose in the learning objectives as the necessity to use or apply this information in a given situation while they were intended to be understood or interpreted by students instead. As a matter of fact, the study conducted by Akbulut-Taş and Karabay-Turan (2020) emphasized that preservice teachers could not fully distinguish the knowledge and cognitive process steps from one another in their classifications and that they could associate the actions in the statement of purpose with faulty cognitive processes. The study conducted by Altıntaş and Yanpar-Yelken (2016) reported that the primary school preservice mathematics teachers' skill to classify the learning objectives related to their fields was rather low.

On the other hand, regarding the classification of the problems prepared for the learning objectives in terms of cognitive process dimension, the primary school preservice mathematics teachers were found to correctly classify the problems prepared at the level of *understanding* and *applying* at a low rate; they correctly classified the problems the problems prepared at the level of *remembering*, *analyzing* and *evaluating* at a moderate rate and correctly classified the problems prepared at the level of *creating* at a high rate. The problems posed in these four steps may have been classified more easily because preservice mathematics teachers have a high level of metacognitive awareness (Deniz, Küçük, Cansız, Akgün, & İşleyen, 2014), the level of *remembering* is included in the most basic cognitive process step, and the necessary thinking skills become more advanced with *analyzing*. In addition, compared to primary school preservice classroom teachers, primary school preservice mathematics teachers did not confuse cognitive process steps in classifying problems and made a more accurate classification. This may be related to the primary school preservice classroom teachers' lower level content knowledge on fractions and especially their major shortcomings in presentations and model use (Aksu & Konyalıoğlu, 2015). This study concluded that primary school preservice classroom teachers correctly classified the problems prepared at the level of *remembering*, *analyzing* and *evaluating* at a low rate while they correctly classified the problems prepared at the level of *understanding*, *creating* and *applying* at a moderate rate. In addition, it was determined that the primary school preservice classroom teachers confused the problems prepared at the level of *remembering* with *understanding* and *applying* during classification, and they characterized the problems prepared at the level of *analyzing* and *evaluating* mostly as the level of *applying*.

In regards to classifying the problems prepared for the learning objectives in terms of the knowledge dimension by primary school preservice mathematics teachers and primary school preservice classroom teachers, it was found that the problems at the conceptual knowledge level were classified accurately by preservice mathematics teachers at a low rate; the problems at the factual and metacognitive knowledge level were classified accurately at a moderate rate and the problems at the procedural knowledge level were classified accurately at a high rate. The problems at the factual, conceptual and procedural knowledge level were classified accurately by primary school preservice classroom teachers at a moderate rate while the problems at the metacognitive knowledge level were classified primary school preservice classroom teachers accurately at a low rate. As a matter of fact, the study conducted by Işıksal (2006) reported that problems about operations in fractions could be symbolized and solved by preservice teachers, but they were not successful enough in interpreting and making sense of these problems. In the light of the findings obtained in this study, it was determined that the primary school preservice mathematics teachers mixed up the problems prepared at the conceptual knowledge level with the problems prepared the procedural knowledge level during classification, while the primary school preservice classroom teachers defined the problems at the metacognitive knowledge level as problems at procedural knowledge level. The previous studies showed that preservice teachers lacked knowledge about fractions and operations in fractions (Armstrong & Bezuk, 1995; Ball, 1990; Işık, et al., 2013; Işıksal, 2006; Kılcan, 2006; Ma, 1999; Rosli, et al., 2013; Zembat, 2007) and preservice teachers' operational understanding was much higher than their conceptual understanding (Rosli, et al., 2013). The inability of the preservice teachers to associate a certain type of knowledge with a specific teaching activity or to make a full distinction between the types of knowledge (Akbulut-Taş & Karabay-Turan, 2020) can be seen as a reason for the emergence of errors or confusion in the classification of problems in terms of knowledge dimension. Since designing a learning environment and teaching process that is suitable for the students' understanding is important in making sense of mathematical concepts (Kuzu, Kuzu, & Sıvacı, 2018), student understandings can also be taken into account while designing the education learning process.

Examining preservice teachers' problem posing skills for the learning objectives, this study concluded that the primary school preservice mathematics teachers posed a high percentage of correct problems in accordance with the learning objectives prepared at the level of *understanding* and posed correct problems at a high rate for the learning objectives prepared at the level of *applying*. Primary school preservice classroom teachers were also found to posed correct problems at a high rate for the learning objectives prepared at the level of *understanding* and *applying* as well. In addition, in terms of knowledge dimension, it was observed that primary school preservice mathematics teachers posed a high percentage of correct problems for the learning objectives prepared in the conceptual and operational level, while it was determined that the primary school preservice classroom teachers posed a

high percentage of correct problems for conceptual knowledge level and a moderate amount of correct problems for operational knowledge level. Previous studies emphasized that the preservice teachers achieved high performance in posing problems suitable for low cognitive level learning objectives, and that they could pose more appropriate problems more comfortably (Özcan & Akcan, 2010; Yeşilyurt, 2012). On the other hand, the result of the analyzes conducted in this study showed that while the preservice teachers were able to pose problems in accordance with the knowledge and cognitive process dimension of the learning objectives, they could not exhibit the same performance in classifying the learning objectives and the problems prepared for these learning objectives. Among the reasons for this outcome may be related to the fact that many of the mathematics problems that the preservice teachers encountered during their learning process could not go beyond the application step, that the candidates were more familiar with the variety of problems at this level and thus they could pose a higher number of problems at a similar level. That is, the problems preservice teachers encountered during their learning process whether they were problems prepared by their teachers (Baysen, 2006; Dursun & Aydın-Parim, 2014; Karaman & Bindak, 2017; Köğçe & Baki, 2009a; Köğçe & Baki, 2009b), problems in different large-scale exams (Dursun & Aydın-Parim, 2014; Karaman & Bindak, 2017; Köğçe & Baki, 2009a) or problems in textbooks (Arslan & Özpınarar, 2009; Biber & Tuna, 2017; Üredi & Ulum, 2020), they mainly focused on lower cognitive levels based on *remembering*, *understanding*, and *applying*.

In addition, this study examined the mistakes made by the preservice teachers in the process of posing problems suitable for the learning objectives, and concluded that the mistakes made were grouped in three categories: "*the problems that were not relevant to the learning objective* ", "*limitations regarding subject matter knowledge*" and "*limitations in problem posing skills*". Preparing the learning objectives for a clear educational action aimed at teaching comes to the fore as the most basic and important criterion here (Kennedy, 2006; Kuzu, Çil, & Şimşek, 2019; Öçal, 2017). Preservice teachers posed problems that measured a different learning objective apart from the intended one and problems that were not related to the statement and the level of the objective in terms of knowledge and cognitive dimensions. There were also problems that were related to the statement of the intended learning objective but could not fully measure the desired educational skills in terms of knowledge and/or cognitive dimensions. Examination of the obtained results demonstrated that the preservice teachers ignored or overlooked the educational actions included in the statement of the objective that were not understood in the same way by everyone or were very difficult to observe (such as "makes sense") or made some mistakes while posing problems about these unclear objective statements. For example, the use of two different educational actions together in the learning objective of "*Solves and constructs problems that require addition and subtraction with fractions whose denominators are equal or whose denominator is a multiple of the denominator of one*" not only made the problem posing process more complicated for the preservice teachers, but also became one of the important reasons why they turned to the other educational action, *solving*. Similarly, considering how different the problem-solving skills for operations with fractions and problem posing skills and the educational activities that need to be prepared for these skills, using these educational actions together can make the education process more complex for both teachers and students. For this reason, revising the learning objectives that include more than one educational action or educational actions that are difficult to observe in the 2018 Secondary Education Mathematics Program for the next mathematics program will make these learning objectives more understandable (Kuzu et al., 2019) and it will be possible for preservice teachers to make fewer mistakes while creating problems for the objectives.

It was noted in this study that some of the preservice teachers' knowledge of mathematics was quite limited while posing problems about the learning objectives related to fractions. For example, it was observed that both primary school preservice mathematics and classroom teachers mixed up the concepts of unit fractions and simple or compound fractions, and they experience confusion about these concepts. Experiencing difficulties in understanding and interpreting the concept of fractions (Aksu, 1997; Booker, 1998; Davis, 2003; Hart, 1987; Hasemann, 1981) may cause some mistakes during the problem posing process related to lack of content knowledge. Although both preservice teacher groups were observed to make mistakes in the problem posing process related to limited content knowledge, it was determined that primary school preservice classroom teachers made more mistakes and had difficulties due to shortcomings in content knowledge and conceptual understanding compared to primary school preservice mathematics teachers. Low level of content knowledge on fractions and shortcomings regarding presentations and model representations (Aksu & Konyalıoğlu, 2015) can lay the groundwork for such a situation for primary school preservice classroom teachers.

On the other hand, it was observed that the preservice teachers were limited in demonstrating their problem posing skills, included unnecessary or incomplete information, made operational or logical errors, and, at times, could not prose complete problem sentences. For example, one preservice teacher posed, "Ayşe bought 5 wafers, each of which is 2 TL, for 10 TL. How many waffles has she got?" When the problem was examined, it was seen that the requested answer was given plainly and clearly in the problem, and this answer can be found easily with no effort whatsoever. It is thought that it is important for the preservice teachers to create more meaningful problems suitable for their purpose in this process, so that the learning process can be more effective.

The presentation of many mathematics subjects such as fractions and operations with fractions by enriching them with different activities in primary school mathematics and classroom teaching undergraduate programs can be seen as a solution to the problems that will be encountered in the teaching of the subject of fractions, which is present in the curriculum from the first grade of primary school. It is thought that presenting the most basic information about fractions to the preservice teachers will be effective in limiting the conceptual misconceptions specific to the field of mathematics that the candidates will experience in

the future. It should be ensured that the courses such as Basic Mathematics and Mathematics Teaching are provided more efficiently throughout undergraduate education in order to maximize the future performance of the preservice teachers in teaching hard-to-learn subjects such as fractions and prevent them from making mistakes in the process of posing problems. As a matter of fact, taking the subject matter courses in the undergraduate program will increase preservice teachers' perceptions of teacher efficacy and their personal competencies in the teaching process (Çaycı, 2011). Thus, the importance of matching the knowledge, skills and concepts gained in these courses with the theoretical knowledge obtained in the Measurement and Evaluation course will be apparent. In addition, using process-based teaching approaches that involve the student in the process and ensure active participation instead of traditional methods and transferring mathematical knowledge and skills to daily life will allow more meaningful learning to occur (Çil, Kuzu, & Şimşek, 2019). For this reason, real life problems can be used in teaching fractions and real-life lesson plans, visual teaching materials and in-class/extra-class activities can be prepared to make the subject more understandable and easier to learn. On the other hand, with the integration of technology with digital games and/or stories and integrating it into the education process, a more permanent and effective learning environment will be created (Kuzu & Sıvacı, 2018), more effective and comfortable learning will be provided (Özüdoğru, 2021). Considering this stitation, the use of teaching materials with digital content can be included while preparing the programs and achievements.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, author-ship, and/or publication of this article.

Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers.

Ethics Committee Approval Information

This study was approved for scientific research ethics in accordance with the Kirsehir Ahi Evran University Social Sciences and Humanities Publication Ethics Committee decision dated 01.07.2020 and numbered 2020/2.

REFERENCES

Akay, H., Soybaş, D., & Argün, Z. (2006). Problem kurma deneyimleri ve matematik öğretiminde açık-uçlu soruların kullanımı. *Kastamonu Eğitim Dergisi*, *14*(1), 129–146.

Akbulut-Taş, M., & Karabay-Turan, A. (2020). Öğretmen adaylarının öğretim amaçlarını yenilenen Bloom taksonomisine göre analiz etme becerilerinin incelenmesi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *35*(3), 594–612.

Akpınar, E. (2003). Cognitive levels of the written exam questions of the secondary schools geography courses. *Erzincan Üniversitesi Eğitim Fakültesi Dergisi*, *5*(1), 13–21.

Aksu, M. (1997). Student performance in dealing with fractions. *The Journal of Education Journals*, *90*(6), 375–380.

Aksu, Z., & Konyalıoğlu, A. C. (2015). Sınıf öğretmen adaylarının kesirler konusundaki pedagojik alan bilgileri. *Kastamonu Education Journal*, *23*(2), 723–738.

Alacacı, C. (2012). Öğrencilerin kesirler konusundaki kavram yanılgıları. In E. Bingölbali & M. F. Özmantar (Eds.), *Matematiksel zorluklar ve çözüm önerileri* (pp. 63-95). Ankara: Pegem Akademi Yayıncılık.

Albayrak, M. (2000). *İlköğretimde matematik ve öğretimi*. Ankara: Aşık Matbaası.

Alexander, P. A., Jetton, T. L., Kulikowich, J. M., & Woehler, C. A. (1994). Contrasting ınstructional and structural importance: The seductive effect of teacher questions, *Journal of Reading Behaviour, 26*(1), 19–45.

Altıntaş, Y., & Yanpar-Yelken, T. (2016) İlköğretim 8. sınıf kazanımlarının yenilenmiş Bloom taksonomisine göre analiz Edilmesi. *XVIII International Congress World Association of Educational Research, Teaching and Training Today for Tomorrow*, Eskişehir, Turkey, June 01-04.

Anderson, L.W. (Ed.), Krathwohl, D.R. (Ed.), Airasian, P.W., Cruikshank, K.A., Mayer, R.E., Pintrich, P.R., Raths, J., & Wittrock, M.C. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. New York: Longman.

Arı, A. (2013). Bilişsel alan sınıflamasında yenilenmiş Bloom, Solo, Fink, Dettmer taksonomileri ve uluslararası alanda tanınma durumları. *Uşak Üniversitesi Sosyal Bilimler Dergisi, 6*(2), 259–290.

Armstrong, B. E., & Bezuk, N. (1995). Multiplication and division of fractions: The search for meaning. In J. T. Sowder & B. Schappelle (Eds.), *Providing a foundation for teaching mathematics in the middle grades* (pp. 85-119). Albany, NY: SUNY Press.

Arslan, S., & Özpınar, İ. (2009). Iköğretim 6. sınıf matematik ders kitaplarının öğretmen görüşleri doğrultusunda değerlendirilmesi. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi*, *12*(2009), 97–113.

Aslan, C. (2011). Soru sorma becerilerini geliştirmeye dönük öğretim uygulamalarının öğretmen adaylarının soru oluşturma becerilerine etkisi. *Eğitim ve Bilim*, *36*(160), 236–249.

Aydemir, Y., & Çiftçi, Ö. (2008). Edebiyat öğretmeni adaylarının soru sorma becerileri üzerine bir araştırma. *Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi, 5*(2), 103–115.

Badger, E., & Thomas, B. (1992). Open-ended questions in reading. *Practical Assessment, Research & Evaluation*, *3*(4), 1–3.

Bahar, M., Nartgün, Z., Durmuş, S., & Bıçak, B. (2012). *Geleneksel-tamamlayıcı ölçme ve değerlendirme teknikleri: Öğretmen el kitabı*. Ankara: Pegem Akademi Yayıncılık.

Ball, D. L. (1990). Prospective elementary and secondary teachers' understanding of division. *Journal for Research in Mathematics Education, 21*(2), 132–144.

Baykul, Y. (2005). *İlköğretimde matematik öğretimi (1-5 sınıflar).* Ankara: Pegem Akademi Yayıncılık.

Baykul, Y. (2014). *Ortaokulda matematik öğretimi (5-8 sınıflar).* Ankara: Pegem Akademi Yayıncılık.

Baysen, E. (2006). Öğretmenlerin sınıfta sordukları sorular ile öğrencilerin bu sorulara verdikleri cevapların düzeyleri. *Kastamonu Eğitim Dergisi, 14*(1), 21–28.

Behr, M. J., Lesh, R., Post, T., & Silver, E. A. (1983). Rational number concepts. In R. Lesh, & M. Landau (Eds.), *Acquisitions of mathematics concepts and processes* (pp. 92–126). New York: Academic Press.

Belcastro, S. M. (2017). Ask questions to encourage questions asked. *Problems, Resources, and Issues in Mathematics Undergraduate Studies, 27*(2), 171–178.

Biber, A. Ç., Tuna, A., & Aktaş, O. (2013). Öğrencilerin kesirler konusundaki kavram yanılgıları ve bu yanılgıların kesir problemleri çözümlerine etkisi. *Trakya Üniversitesi Eğitim Fakültesi Dergisi, 3*(2), 152–162.

Biber, A. Ç. & Tuna, A., (2017). Ortaokul matematik kitaplarındaki öğrenme alanları ve Bloom taksonomisine göre karşılaştırmalı analizi. *Ondokuz Mayıs Üniversitesi Eğitim Fakültesi Dergisi*, *36*(1), 161–174.

Bloom, B.S. (Ed.), Engelhart, M.D., Furst, E.J., Hill, W.H., & Krathwohl, D.R. (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook 1: Cognitive domain*. New York: David McKay.

Booker, G. (1998). Children's construction of initial fraction concepts. In A. Olivier & K. Newstead (Eds.), *Proceedings of the 22nd Conference of the International Group for the Psychology of Mathematics Education* (pp 128-135). Stellenbosch, South Africa.

Büyükalan, S. (2007). *Soru Sorma Sanatı.* Ankara: Nobel Akademi Yayıncılık.

Carr, D. (1998). The art of asking questions in the teaching of science. S*chool Science Review, 79*(289), 47–50.

Cooney, T. J., Sanchez, W. B., Leatham, K., & Mewborn, D. S. (2004). *Open-ended assessment in math: A searchable collection of 450+ questions.* Portsmouth, NH: Heinemann Educational Books.

Crowe A., Dirks C., & Wenderoth, M.P. (2008). Biology in bloom: ımplementing bloom's taxonomy to enhance student learning in biology. *CBE Life Sciences Education, 7*(4), 368–381.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: Sage publications.

Çakıcı, Y., Handan, Ü., & Dinçer, E. (2012). İlköğretim öğrencilerinin soru oluşturma becerilerinin incelenmesi. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, *8*(1), 43–68.

Çalışkan, H. (2011). Öğretmenlerin hazırladığı sosyal bilgiler dersi sınav sorularının değerlendirilmesi. *Eğitim ve Bilim*, *36*(160), 120–132.

Çaycı, B. (2011). Sınıf öğretmenliği lisans programındaki alan eğitimi derslerinin öğretmen yeterliği üzerindeki etkisinin incelenmesi. *Mersin Üniversitesi Eğitim Fakültesi Dergisi, 7*(2), 1–12.

Çil, O., Kuzu, O., & Şimşek, A.S. (2019). 2018 Ortaöğretim matematik programının revize edilmiş Bloom taksonomisine ve programın ögelerine göre incelenmesi. *YYÜ Eğitim Fakültesi Dergisi, 16*(1), 1402-1418.

Davis, E. G. (2003). Teaching and classroom experiments dealing with fractions and proportional reasoning. *Journal of Mathematical Behavior, 22*(2003), 107–111.

de Castro, B. (2008). Cognitive models: the missing link to learning fraction multiplication and division. *Asia Pacific Education Review*, *9*(2), 101–112.

Deniz, D., Küçük, B., Cansız, Ş., Akgün, L., & İşleyen, T. (2014). Ortaöğretim matematik öğretmeni adaylarının üstbiliş farkındalıklarının bazı değişkenler açısından incelenmesi. *Kastamonu Eğitim Dergisi*, *22*(1), 305–320.

Doğanay, A., & Ünal, F. (2006). Eleştirel düşünmenin öğretimi. In A. Şimşek (Ed.), *İçerik türlerine dayalı öğretim.* Ankara: Nobel Akademi Yayıncılık.

Dursun, A., & Aydın-Parim, G. (2014). YGS 2013 matematik soruları ile ortaöğretim 9. sınıf matematik sınav sorularının Bloom Taksonomisine ve öğretim programına göre karşılaştırılması. *Eğitim Bilimleri Araştırmaları Dergisi*, 4(1), 17–37.

Elder, L. & Paul, R. (2003). Critical thinking: Teaching students how to study and learn. *Journal of Developmental Education, 27*(1), 36–37.

Erdoğan, T. (2017). İlkokul dördüncü sınıf öğrencilerinin ve öğretmenlerinin Türkçe dersine ilişkin sordukları soruların yenilenmiş Bloom taksonomisi açısından görünümü. *Eğitim ve Bilim*, *42*(192), 173-191.

Feldhusen, J.F. & Treffinger, D.J. (1985). *Creative thinking and problem solving in gifted education*. Dubuque, IA: Kendall Hunt Publishing.

Fleiss, J. L., & Cohen, J. (1973). The equivalence of weighted kappa and the intraclass correlation coefficient as measure of reliability. *Educational and Psychological Measurement*, *33*, 613–619.

Geçit, Y., & Yarar, S. (2010). 9. sınıf coğrafya ders kitabındaki sorular ile çeşitli coğrafya sınav sorularının Bloom Taksonomisine göre analizi. *Marmara Coğrafya Dergisi, 0*(22), 154-167.

Goatly, A. (2000). *Critical reading and writing. An introductory coursebook*. New York: Routledge.

Gökler, Z.S., Arı, A., & Aypay, A. (2012). İlköğretim İngilizce dersi hedefleri kazanımları SBS soruları ve yazılı sınav sorularının yeni Bloom taksonomisine göre değerlendirilmesi. *Eğitimde Politika Analizi*, *1*(2), 114–133.

Gündüz, Y. (2009). İlköğretim 6, 7 ve 8. sınıf fen ve teknoloji sorularının ölçme araçlarına ve Bloom'un bilişsel alan taksonomisine göre analizi. *Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi*, *6*(2), 150–165.

Hart, K. M. (1987). Practical work and formalisation, too great a gap. In J. C. Bergeron, N. Herscovicsi & C. Kieran (Eds.), *Proceedings of the Eleventh International Conference Psychology of Mathematics Education* (pp. 408-415). Montreal: The University of Montreal.

Hasemann, K. (1981). On difficulties with fractions. *Educational Studies in Mathematics, 12*(1), 71–87.

Işık, C., & Kar, T. (2012). 7. sınıf öğrencilerinin kesirlerde toplama işlemine kurdukları problemlerin analizi. *İlköğretim Online*, *11*(4), 1021–1035.

Işık, C., Öçal, T., & Kar, T. (2013). Analysis of pre-service elementary teachers' pedagogical content knowledge in the context of problem posing. *Paper presented at the meeting of Eighth Congress of European Research in Mathematics Education (CERME 8),* Antalya, Turkey.

Isıksal, M. (2006). *İlköğretim matematik öğretmen adaylarının kesirlerde çarpma ve bölmeye ilişkin alan ve pedagojik içerik bilgileri üzerine bir çalışma*. Yayınlanmamış doktora tezi, Orta Doğu Teknik Üniversitesi, Ankara.

İpek, A. S., Işık, C., & Albayrak, M. (2005). Sınıf öğretmeni adaylarının kesir işlemleri konusundaki kavramsal performansları. *Kazım Karabekir Eğitim Fakültesi Dergisi, 2005*(1)*, 537–547.

Jesus, H. P., & Moreira, A. C. (2009). The role of students' questions in aligning teaching, learning and assessment: A case study from undergraduate sciences. *Assessment & Evaluation in Higher Education, 34*(2), 193–208.

Jones, R. C. (2008). The "Why" of class participation: A question worth asking. *College Teaching, 56*(1), 59–63.

Kar, T., & Işık, A . (2015). Ortaokul matematik öğretmenlerinin kesirlerle çıkarma işlemine yönelik problem kurma becerilerinin incelenmesi. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi*, (24), 243–276.

Karaman, M., & Bindak, R. (2017). İlköğretim matematik öğretmenlerinin sınav soruları ile TEOG matematik sorularının yenilenmiş Bloom Taksonomisi'ne göre analizi. *Curr Res Educ, 3*(2), 51-65.

Kennedy, D. (2006). *Writing and using learning outcomes: a practical guide*. University College Cork, Munster.

Kılcan, S. A. (2006). *İlköğretim matematik öğretmenlerinin kesirlerle bölmeye ilişkin kavramsal bilgi düzeyleri*. Yayınlanmamış yüksek lisans tezi, Abant İzzet Baysal Üniversitesi, Bolu.

Kocaoğlu, T., & Yenilmez, K. (2010). Beşinci sınıf öğrencilerinin kesir problemlerinde yaptıkları hatalar ve kavram yanılgıları. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi, 14*(2010), 71–85.

Koray, Ö., Altunçekiç, A., & Yaman, S. (2005). Fen bilgisi öğretmen adaylarının soru sorma becerilerinin Bloom taksonomisine göre değerlendirilmesi. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi*, *17*(17), 33–39.

Koray, Ö., & Yaman, S. (2002). Fen bilgisi öğretmenlerinin soru sorma becerilerinin Bloom taksonomisine göre değerlendirilmesi. *Gazi Üniversitesi Kastamonu Eğitim Dergisi, 10*(2), 317–324.

Köğce, D., & Baki, A. (2009a). Matematik öğretmenlerinin yazılı sınav soruları ile ÖSS sınavlarında sorulan matematik sorularının Bloom taksonomisine göre karşılaştırılması. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi*, *26*(26), 70–80.

Köğce, D., & Baki, A. (2009b). Farklı türdeki liselerin matematik sınavlarında sorulan soruların Bloom taksonomisine göre karşılaştırılması. *Kastamonu Eğitim Dergisi, 17*(2), 557–574.

Krathwohl, D.R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into Practice. 41*(4), 212–218.

Kuzu, O., Çil, O., & Şimşek, A.S. (2019). 2018 Matematik dersi öğretim programı kazanımlarının revize edilmiş Bloom taksonomisine göre incelenmesi. *Erzincan Üniversitesi Eğitim Fakültesi Dergisi*, *21*(3), 129–147.

Kuzu, O., Kuzu, Y., & Sıvacı, S. Y. (2018). Preservice teachers' attitudes and metaphor perceptions towards Mathematics. *Cukurova University Faculty of Education Journal, 47*(2), 897–931.

Kuzu, O., & Sıvacı, S. Y. (2018). Dijital oyun bağımlılığı ile teknoloji okuryazarlığı arasındaki ilişki. İçinde *I. Uluslararası multidisipliner dijital bağımlılık kongresi tam metin e-kitap*, (ss. 69-78). Bursa: Kuzgun Kitap.

Küçükahmet, L. (2006). *Öğretimde planlama ve değerlendirme*. Ankara: Nobel Akademik Yayıncılık.

Landis, J., & Koch, G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*, 159–174

Ma, L. (1999). *Knowing and teaching elementary mathematics*. Mahwah, NJ: Lawrence Erlbaum Associates.

Marbach-Ad, G., & Sokolove, P.G. (2000). Can undergraduate biology students learn to ask higher level questions?. *Journal of Research in Science Teaching, 37*(8), 854–870.

MEB (2018a). *Matematik dersi öğretim programı*. Milli Eğitim Bakanlığı, Ankara.

MEB (2018b). *2023 Eğitim Vizyonu*. Milli Eğitim Bakanlığı, Ankara.

Miles, M.B. & Huberman, A.M. (1994). *Qualitative data analysis*. London: SAGE Publication.

Moss, J., & Case, R. (1999). Developing children's understanding of the rational numbers: a new model and experimental curriculum. *Journal for Research in Mathematics Education*, *30*(2), 122–147.

Näsström, G. (2009). Interpretation of standards with Bloom's revised taxonomy: A comparison of teachers and assessment experts. *International Journal of Research & Method in Education, 32*(1), 39–51.

Okur, M., & Çakmak-Gürel, Z. (2016). Ortaokul 6. ve 7. sınıf öğrencilerinin kesirler konusundaki kavram yanılgıları. *Erzincan Üniversitesi Eğitim Fakültesi Dergisi*, *18*(2), 922–952.

Olkun, S., & Toluk-Uçar, Z. (2012). *İlköğretimde etkinlik temelli matematik öğretimi*. Ankara: Anı Yayıncılık.

Öçal, M. F., İpek, A. S., Özdemir, E., & Kar, T. (2018). Investigation of elementary school students' problem posing abilities for arithmetic expressions in the context of order of operations. *Turkish Journal of Computer and Mathematics Education, 9*(2), 170–191.

Öçal, T. (2017). Comparing Turkish early childhood education curriculum with respect to common core state standards for mathematics. *Eğitimde Nitel Araştırmalar Dergisi, 5*(3), 155–171.

Öksüz, Y., & Güven Demir, E. (2019). *Açık uçlu ve çoktan seçmeli başarı testlerinin psikometrik özellikleri ve öğrenci performansı açısından karşılaştırılması. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 34*(1), 259–282.

Özden, Y. (1998). *Öğrenme ve öğretme.* Ankara: Pegem Akademi Yayıncılık.

Özcan, S., & Akcan, K. (2010). Fen bilgisi öğretmen adaylarının hazırladığı soruların içerik ve Bloom taksonomisi'ne uygunluk yönünden incelenmesi. *Kastamonu Eğitim Dergisi*, *18*(1), 323–330.

Özüdoğru, G. (2021). Digital storytelling in education from teachers' perspectives. *Bartın University Journal of Faculty of Education, 10*(2), 445–454.

Paul, R. (1995). Critical thinking: Basic questions and answers. In J. Wilsen & A. J. A. Binker (Eds.), *Critical Thinking: How to Prepare Students for a Rapidly Changing World* (pp. 489-500). Santa Rosa, CA: Foundation for Critical Thinking.

Patton, M. Q. (2002). *Qualitative research and evaluation methods.* Thousand Oaks, CA: Sage.

Pesen, C. (2008). Kesirlerin sayı doğrusu üzerindeki gösteriminde öğrencilerin öğrenme güçlükleri ve kavram yanılgıları. *İnönü Üniversitesi Eğitim Fakültesi Dergisi, 9*(15), 157–168.

Ralph, E.G. (1999). Oral Questioning Skills of Novice Teachers: …Any Questions?. *Journal of Instructional Pyscology, 26*(4), 286-296.

Rosli, R., Han, S., Capraro, R., & Capraro, M. (2013). Exploring preservice teachers' computational and representational knowledge of content and teaching fractions. *Journal of Korean Society of Mathematics Education, 17*(4), 221–241.

OECD (2007). *Pisa 2006: Science competencies for tomorrow's World.* Paris: Organisation for Economic Cooperation and Development.

Soylu, Y., & Soylu, C. (2005). İlköğretim beşinci sınıf öğrencilerinin kesirler konusundaki öğrenme güçlükleri: kesirlerde sıralama, toplama, çıkarma, çarpma ve kesirlerle ilgili problemler. *Erzincan Eğitim Fakültesi Dergisi*, *7*(2), 101–117.

Soylu, Y. (2008). Öğrencilerin kesirler konusundaki hata ve yanlış anlamaları ve sınıf öğretmen adaylarının tahmin edebilme becerileri. *Çağdaş Eğitim Dergisi, 33*(356), 31–39.

Stafylidou, S., & Vosniadou, S. (2004). The development of students' understanding of the numerical value of fractions. *Learning and Instruction*, *14*(5), 503–518.

Tirosh, D. (2000). Enhancing prospective teachers' knowledge of children's conceptions: the case of division of fractions. *Journal for Research in Mathematics Education*, *31*(1), 5–25.

Umay, A. (1993). Matematiksel düşünmede süreci ve sonucu yoklayan testler arasında bir karşılaştırma. *Eğitim ve Bilim, 17*(90), 42–48.

Umay, A. (1996). Matematik öğretimi ve ölçülmesi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *12*(1996), 145–149.

Ünlü, M. & Ertekin, E. (2012). Why do pre-service teachers pose multiplication problems instead of division problems in fractions? *Procedia - Social and Behavioral Sciences, 46*(2012), 490–494.

Üredi, L., & Ulu, H. (2020). İlkokul matematik ders kitaplarında bulunan ünite değerlendirme sorularının yenilenmiş Bloom taksonomisine göre incelenmesi. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, *16*(2), 432–447.

Üstüner, A., & Şengül, M. (2004). Çoktan seçmeli test tekniğinin Türkçe öğretimine olumsuz etkileri. *Fırat Üniversitesi Sosyal Bilimler Dergisi, 14*(2), 197–208.

Yeşilyurt, E. (2012). Öğretmen adaylarının bilişsel alanla ilgili sınama durumu soruları yazma yeterliklerinin değerlendirilmesi. *Kastamonu Eğitim Dergisi*, *20*(2), 519–530.

Yılmaz, E., & Keray, B. (2012). Through the interwiev texts the analysis of the 8th grade students' skills of asking questions according to the revised Bloom's taxonomy. *Sakarya University Journal of Education*, *2*(2), 20–31.

Wood, J. M. (2007). Understanding and computing Cohen's kappa: A tutorial. *Web Psych Empiricist. Retrieved electronically from https://wpe.info/vault/wood07/Wood07.pdf on September, 26, 2020.*

Wu, H. (1999). Some remarks on the teaching of fractions in elementary school. *Retrieved electronically from* http://math.berkeley.edu/~wu/fractions2.pdf *on September, 26*, 2020.

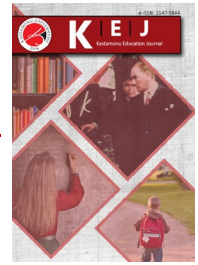Zembat, İ. Ö. (2007). Sorun aynı–kavramlar; Kitle aynı-öğretmen adayları. *İlköğretim Online, 6*(2), 305–312.

Appendix 1. Learning objective classification and problem posing test for fractions

Item 1) Below are the learning objectives on "Fractions" and "Operations with Fractions". Determine in which step these objectives are included in the revised Bloom taxonomy for the Cognitive Process and Knowledge dimensions. Prepare a question suitable for this objective and step.

a) Compares, orders and displays fractions on the number line.
Remember ( ) Understand (x) Apply (x) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge (x) Procedural Knowledge (x) Metacognitive Knowledge ( )
Problem:

b) Performs the division of two fractions and makes sense of them.
Remember ( ) Understand ( ) Apply (x) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge ( ) Procedural Knowledge (x) Metacognitive Knowledge ( )
Problem:

c) Predicts the result of operations with fractions.
Remember ( ) Understand (x) Apply (x) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge (x) Procedural Knowledge (x) Metacognitive Knowledge ( )
Problem:

d) Shows the concept of whole, half and quarter with suitable models; explains the relationship between the whole, half, and quarter
Remember ( ) Understand (x) Apply (x) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge (x) Procedural Knowledge ( ) Metacognitive Knowledge ( )
Problem:

e) Solves problems that require operations with fractions
Remember ( ) Understand ( ) Apply (x) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge (x) Procedural Knowledge (x) Metacognitive Knowledge ( )
Problem:

f) Compares and orders unit fractions
Remember ( ) Understand (x) Apply (x) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge (x) Procedural Knowledge (x) Metacognitive Knowledge ( )
Problem:

g) Divides a whole into equal parts and states that each of the equal parts is a unit fraction.
Remember ( ) Understand (x) Apply ( ) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge (x) Procedural Knowledge ( ) Metacognitive Knowledge ( )
Problem:

h) Determines a specified simple fraction of a multiplicity.
Remember ( ) Understand ( ) Apply (x) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge ( ) Procedural Knowledge (x) Metacognitive Knowledge ( )
Problem:

l) Solves and constructs problems that require addition and subtraction with fractions whose denominators are equal or whose denominator is a multiple of the other
Remember ( ) Understand ( ) Apply (x) Analyze (x) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge (x) Procedural Knowledge (x) Metacognitive Knowledge ( )
Problem:

Item 2) Below are sample questions on "Fractions" and "Operations with Fractions". Determine at which step these questions take place in the revised Bloom's taxonomy for the Cognitive Process and Knowledge dimensions (You do not need to write the answers to the sample questions).

a) Write the letter in the denominator of the fraction $\frac{a}{b}$.
Remember (x) Understand ( ) Apply ( ) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge (x) Conceptual Knowledge ( ) Procedural Knowledge ( ) Metacognitive Knowledge ( )

b) Write the relationship between the numerator and denominator in simple fractions.
Remember ( ) Understand (x) Apply ( ) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge (x) Procedural Knowledge ( ) Metacognitive Knowledge ( )

c) Show the fraction $\frac{3}{5}$ on the number line.
Remember ( ) Understand ( ) Apply (x) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge ( ) Procedural Knowledge (x) Metacognitive Knowledge ( )

d) Write the number that the denominator of the fraction $\frac{a}{b}$ cannot take.
Remember (x) Understand ( ) Apply ( ) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge (x) Conceptual Knowledge ( ) Procedural Knowledge ( ) Metacognitive Knowledge ( )

e) Determine the numbers that the denominator of a composite fraction $\frac{3}{a}$ cannot take.
Remember ( ) Understand (x) Apply ( ) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge (x) Procedural Knowledge ( ) Metacognitive Knowledge ( )

f) $\frac{3}{4}, \frac{1}{7}, \frac{6}{8}, \frac{2}{14},$? Which fraction should come in place of the question mark?
Remember ( ) Understand ( ) Apply ( ) Analyze (x) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge ( ) Procedural Knowledge (x) Metacognitive Knowledge ( )

g) $-\frac{9}{8}, -\frac{3}{2}, -2\frac{1}{2}, -\frac{3}{4}, -\frac{3}{2}$ Order the fractions from greatest to least.
Remember ( ) Understand (x) Apply ( ) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge (x) Procedural Knowledge ( ) Metacognitive Knowledge ( )

h) The smallest composite fraction with a denominator of 9 is how many times the largest simple fraction with a numerator of 2?
Remember ( ) Understand ( ) Apply (x) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge ( ) Procedural Knowledge (x) Metacognitive Knowledge ( )

i) Compare the result you found by multiplying the fractions $\frac{16}{5}$ and $\frac{4}{17}$ mentally with the result of the operation.
Remember ( ) Understand ( ) Apply (x) Analyze ( ) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge ( ) Procedural Knowledge (x) Metacognitive Knowledge ( )

j) $\frac{2}{3}, \frac{1}{7}, \frac{4}{4}, \frac{3}{3}, \frac{1}{4}, \frac{5}{5}, \frac{4}{...}$ ... Complete this pattern composed of simple fractions, compound fractions, and unit fractions.
Remember ( ) Understand ( ) Apply ( ) Analyze (x) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge (x) Procedural Knowledge ( ) Metacognitive Knowledge ( )

k) Develop a method for quick addition in compound fractions.
Remember ( ) Understand ( ) Apply ( ) Analyze ( ) Evaluate ( ) Create (x)
Factual Knowledge ( ) Conceptual Knowledge ( ) Procedural Knowledge ( ) Metacognitive Knowledge (x)

l) Which fraction is left out when the fractions $\frac{12}{3}, 2, \frac{2}{3}, 3\frac{1}{2}$ are grouped together?
Remember ( ) Understand ( ) Apply ( ) Analyze (x) Evaluate ( ) Create ( )
Factual Knowledge ( ) Conceptual Knowledge (x) Procedural Knowledge ( ) Metacognitive Knowledge ( )

m) Write a suitable activity for the educational objective "Shows the concept of whole, half and quarter with suitable models; explains the relationship between the whole, half, and quarter"
Remember ( ) Understand ( ) Apply ( ) Analyze ( ) Evaluate ( ) Create (x)
Factual Knowledge ( ) Conceptual Knowledge ( ) Procedural Knowledge ( ) Metacognitive Knowledge (x)

n) "Ali is 11 years old. Ali bought himself a pen with 3/5 of his money. He bought a notebook with 3/4 of his remaining money. He gave this notebook to Ayşe as a present. How much money did Ali have at first, since Ali has now 5 TL in his pocket?" Consider the question as a teacher candidate.
Remember ( ) Understand ( ) Apply ( ) Analyze ( ) Evaluate (x) Create ( )
Factual Knowledge ( ) Conceptual Knowledge ( ) Procedural Knowledge ( ) Metacognitive Knowledge (x)

| Research Article / Araştırma Makalesi|

Speech, Language and Communication Differences before Autism Diagnosis: The Perspectives of Parents

Ebeveynlerin Gözünden Otizmde Tanı Öncesi Dil, Konuşma ve İletişim Gelişimindeki Farklılıklar[1]

Özlem Oğuz[2], **Bengisu Çakır**[3], **Alperen Şentürk**[4]

Abstract

Purpose: Autism-specific behaviors begin with some preliminary symptoms and can be detected during the pre-verbal language stage or after diagnosis. Early diagnosis and early intervention can begin if caregivers or parents identify these precursors of behaviors during the pre-diagnostic period, and the person with autism can receive effective and timely training. The goal of this study was to find out what non-typical language and communication behavior parents or caregivers of children with autism might have noticed before they were diagnosed.

Design/Methodology/Approach: After applying exclusion criteria, fifty participants (47F, 3M) who are primary carers of 3-10-year-old children with autism were accepted into the study Data was gathered using a two-part interview form with 37 questions. Face-to-face interviews were held.

Findings: Descriptive and situational analysis methods were used to analyze the data. Following the analysis of the findings, behaviors such as not making eye contact, not responding when their name is called, and indifference toward their parents were observed in the children of the participants who were diagnosed with autism till the age of 18 months.

Highlights: When the findings were evaluated, it was discovered that the individuals' issues began at an early age. In terms of autism suspicion, family observations are crucial; early symptoms are predictors of various developmental stages. Accordingly, families should follow their children more closely and they should be informed more by experts so that families can notice the differences in developmental areas.

Öz

Çalışmanın amacı: Otizmli bireylerde gözlenebilen otizme özgü davranışlar söz öncesi dönemde ya da tanı öncesinde bazı ön belirtiler ile kendini ortaya koymaktadır. Bakım veren ya da ebeveynlerin bu davranış öncüllerini tanı öncesi dönemde fark etmeleri durumunda erken tanılama ile erken müdahale süreci başlayabilmekte ve kişiye etkili ve zamanında eğitim sunulabilmektedir. Bu araştırmada otizmli çocuğa sahip ebeveynlerin tanı öncesi dönemde gözlemiş olabilecekleri tipik olmayan dil ve iletişim davranışlarının belirlenmesi amaçlanmıştır.

Materyal ve Yöntem: Katılımcı grubunu 3-10 yaş arası otizmli çocukların birincil bakım veren durumundaki 50 (47K, 3E) ebeveyn oluşturmaktadır. Veri toplamak için 2 bölüm ve 37 adet sorudan oluşan bir görüşme formu hazırlanmıştır. Görüşmeler yüz yüze gerçekleştirilmiş. Veriler betimsel ve durum analiz yöntemleri kullanılarak analiz edilmiştir.

Bulgular: Bulguların analizi sonrasında katılımcıların otizm tanısı almış olan çocuklarında 18 aylık olana kadar geçen sürede gözlenen farklılıkların başında göz teması kurmama, ismi söylendiğinde tepki vermeme ve ebeveyne karşı ilgisizlik gibi davranışlar yer almaktadır. Bulgular incelendiğinde bireylerin yaşamış olduğu bu güçlüklerin yaşamın erken dönemlerinden itibaren kendini göstermekte olduğu saptanmıştır.

Önemli Vurgular: Erken dönemdeki göstergelerin çeşitli gelişim basamaklarının yordayıcıları olmaları sebebiyle ailelerin gözlemleri otizm şüphesi açısından önem arz etmektedir. Bu doğrultuda aileler çocuklarını daha yakından takip etmeli ve ailelerin gelişimsel alanlardaki farklılıkları görebilmeleri adına uzmanlar tarafından daha fazla bilgilendirilmelerinin önemli olduğu düşünülmektedir.

---

[1] The findings of the study were summarized in a poster presentation at the X. National Language and Speech Disorders Congress, which took place in Istanbul from April 28 to May 1, 2019.
[2]**Corresponding Author,** Üsküdar University, Faculty of Health Sciences, Department of Speech and Language Therapy, İstanbul, TÜRKİYE; ozlem.oguz@uskudar.edu.tr https://orcid.org/0000-0001-7590-0028
[3]Üsküdar University, Faculty of Health Sciences, Department of Speech and Language Therapy, İstanbul, TÜRKİYE; bengisucakir98@gmail.com https://orcid.org/0000-0003-3946-1210
[4]Üsküdar University, Faculty of Health Sciences, Department of Speech and Language Therapy, İstanbul, TÜRKİYE alperensenturk645@gmail.com https://orcid.org/0000-0002-7444-7281

INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by three core behaviors: inadequacy in social communication, inadequacy in social interaction, and finally limited/repetitive interest and behaviors, according to the Diagnostic and Statistical Manual of Mental Disorders-5 [DSM-5], published by the American Psychiatric Association in 2013. The presence of observable behavior and symptoms can help to diagnose ASD. Autism symptoms are said to appear over time, and some children's symptoms can be diagnosed as early as their first birthday (Ozonoff et al., 2009). Researchers who looked at video recordings of children before they were diagnosed (for example, movies taken on their first birthday) noticed that children tended to produce fewer sounds and they were limited in making eye contact, hugging adults, and smiling, all of which are crucial diagnostic criteria for autism (as cited in Aydın et al., 2017). Other studies (Gray and Tonge, 2001; Turan et al., 2020) state that most of the parents of children with autism notice problems with their children's development before the 24th month, while Servi and Baştuğ (2018) found that the difficulties related to ASD in the literature were noticed by the parents as early as the 24th month. According to studies, 31-55% of children with ASD exhibit symptoms in the first year of life, and 75-88 % of them display symptoms in the first two years of life (Volkmar et al., 1985; Loveland and Landry, 1986; Short and Schopler, 1988; Gray and Tonge, 2001). While Akkuş et al. (2020) reported that speech delay is the most common difference observed in children by 53% of parents, Crane et al. (2016) discovered that 82% of parents noticed a difference in the social development. According to the findings of the studies, these differences affect the communication abilities of children with autism and cause other issues in addition to communication challenges. These issues can also lead to behavioral problems like as tantrums, self-harm, and aggression. Studies by Webber and Scheuermann (2008), Hart and Banda (2009) and Ploog et al. (2013) revealed that inadequacy in functional communication skills causes individuals with autism to have difficulty expressing their preferences, wishes, and needs, as well as sharing their ideas. It is stated that these problems can also cause behavioral problems such as tantrums, self-harm and (as cited in Genç-Tosun and Kurt, 2017).

Typically developing children develop responsiveness to social interaction just a few hours after birth. Faces, rather than shapes, are preferred by typically developing children and they also prefer and show interest in their mother's face over strangers. Children follow the elements of attention with their gaze and gestures from the first years of life, but in varying degrees of quality and quantity. This tracking is done in a variety of ways by babies; babies as young as 6 months by scanning their visual fields with their gaze; 8 month-old babies by looking at auditory and visual objects and 20 months do it by turning their heads (Farroni et al., 2004; Brooks and Meltzoff, 2005; Mundy and Newell, 2007). Emotional reactions such as crying (from birth), social smiling (1-2 months), facial expressions also begin to demerge in the first months. Children with autism, on the other hand, do not complete these developmental phases in the same way. Comparative studies with children with typical development and children diagnosed with autism and/or not yet diagnosed with autism but in the risk group were conducted in order to study communicative intentions. Study findings reveal that during the 24-month developmental period, researchers noted poor coordination in pointing, restricted eye contact, and limited use of gestures in children with autism (Zwaigenbaum et al., 2005; Landa and Garrett-Mayer, 2006; Mitchell et al., 2006; Clifford and Dissanayake, 2008; Feldman et al., 2012). Children with autism have been seen to differ from typically developing children in areas such as interpersonal gaze shifting, eye contact to attract attention, and shared attention (Rozga et al. 2011). In their study, Ozonoff et al. (2011) investigated the social attention skills and found that there were significant limitations between groups of 12 month-old children (who were later diagnosed with ASD) with a sibling with autism (High-Risk Infant Siblings [HR-ASD]) and 12 month-old typically developing children with typically developing sibling (Low-Risk [LR Non-ASD]). Children who diagnosed with autism demonstrated less attention to faces, less directed vocalization, and limited social smiles at 36 months. Language development problems are also prevalent in children with autism, and there is a lot of heterogeneity in this instance. According to studies, some children with ASD acquire language in the same way as typically developing children do, while about a quarter of them never learn to communicate verbally and never acquire a functioning language ability (Tager-Flusberg, 2006; Luyster et al., 2007; as cited in Aydın et al., 2017). While some children with ASD are able to communicate verbally, others are unable to do so, according to Crais et al. (2009). While some children with ASD have completed their speech development, the reason why some of them lag behind in this development process is not yet known.

In children with ASD, problems with social communication and interaction skills also appear throughout the preverbal period of communication development (as cited in Akçamuş et al., 2019). Landa and Garrett-Mayer (2006) stated there are behaviors noticed in children with autism during the preverbal language period that are not seen in children with typical development. Atypical vocalization (including different vocalization limitations during crying), delaying or holding the parent's hand instead, not reacting to the name (appears 4-6 months in typical developing individuals), having problems with imaginary play, and less smile while interacting with the mother, limitation in intimacy, hugging, and imitation are examples of these behaviors. Smiles, limitations are examples of behaviors (Landa and Garrett-Mayer, 2006). Children with autism exhibit limited and decreased performance in imitating sounds and words at 12nd and 18th months. In studies comparing HR-ASD and LR-ASD children aged 12 and 24 months, functional and symbolic imitation skills were also found to be poorer in HR-ASD children. In a study by Loh et al. (2007), in terms of repeated activities, it has been suggested that *'arm waving'' (and its frequency)* is the behavior that distinguishes those with autism from those with typical development at 18-24 months. Ozonoff et al. (2008) also reported that children with autism exhibit shaking, rocking, hitting, rolling, and atypical visual field scanning behaviors. For these reasons and based on the findings, it is critical for families to evaluate and consider the indicators in the preverbal stage in order to make an

early diagnosis. However, it is also known that early signs are difficult to detect by observers who have little knowledge (Ozonoff et al., 2009).

Gaze, gesture, joint attention, and interaction skills, which are also represented as non-verbal communication, should be taken into account when predicting the language competency potential of children with ASD in the future (Crais et al., 2009). In a study by Shumway and Wetherby (2009), it was revealed that limitations in the use of gestures are one of the early nonverbal communication issues in children diagnosed with autism. It is known that children's language development can be influenced by gesture skills (e.g., pointing with fingers, moving hands to mimic wings, nodding) (as cited in Aydın et al., 2017). Knowing the characteristics of the development of gestures and different types of gestures in children with typical development is extremely important for early diagnosis in children who may have with a possible developmental-linguistic or communicative disability. Individuals with autism's language skills have been demonstrated to be a predictor of future language ability levels in studies. Wetherby et al. (2007) conducted a study to confirm the given information, with the goal of evaluating the social communication profiles of children with autism. The receptive language skills of children with autism aged 18-24 months were found to be the most important predictor of their predicted verbal and nonverbal developmental language performances at the age of 3 years in the aforementioned study. Anderson et al. (2007), on the other hand, did a study that found that the language abilities of children with autism at the age of 18-24 months could help professionals predict the functional language development of children at the age of 5. These findings once again highlight the need of early intervention, which begins with early diagnosis. Because of these findings, it is believed that future linguistic gains can be attained with early intervention.

In the sibling studies, it was seen that siblings in the high-risk group performed differently on language assessments than siblings in the low-risk group. receptive language subscales of the Mullen Scales of Early Learning (Mullen, 1995 [MSEL]) and MacArthur-Bates Communicative Development Inventory (Fenson et al., 2007 [CDI]- Turkish version: Aksu Koç et al., 2019; Türkçe İletişim Gelişimi Envanteri [TİGE]) were used in sibling studies which were carried out to establish the determinants for early autism diagnosis and HR-ASD and LR Non-ASD groups were compared. It was concluded that the children in the HR-ASD group had lower receptive language scores (Lazenby et al., 2016). In their own study, Landa and Garrett-Mayer (2006) found similar results to those found in this one. Accordingly, 24 children in the HR-ASD group scored lower on the MSEL battery's receptive and expressive language subtests than children in the comparison group (LR Non-ASD vs Non-ASD). Ozonoff et al. (2014) found that 12-month-old HR-ASD children had lower MSEL battery receptive language scores than LR-ASD children in a study involving 420 children within the HR-ASD and LR-ASD groups. The receptive and expressive language scores of children diagnosed with autism or in the risk group were found to be lower than those of the control groups in assessments (Mitchell et al., 2006; Ventola et al., 2007; Luyster et al., 2008; Chawarska et al., 2009; Weismer, Lord, and Esler, 2010).

In addition to assessing language development in the preverbal period, the assessment of other developmental areas in children with autism has become more important in terms of early identification and determining predicting indicators. Landa and Garrett-Mayer (2006) assessed 6-24-month-old children in the domains of fine-gross motor skills and visual perception, and found no significant differences in visual perception across a 14-24-month period, but the HR-ASD infants got lower scores in fine-gross motor skills. In addition, HR-ASD children were found to differ from typically developing children in the areas of muscle control, delayed walking, and atypical postural control (incontinence, sitting without support, etc.).

Motor development deficits (fine and gross motor skills deficits) in individuals with autism appear to be deficiencies in the field of non-linguistic development, based on the findings of studies in the literature. As, given that developmental areas (motor and linguistic) develop in lockstep and at the same time, it's reasonable to conclude that deficiencies in these two areas have an impact on one another. When compared to those with typical development, those with autism show different developmental traits in the pre-linguistic stage.

Individuals with autism do not use deictic (pointing) and symbolic (pretend play with objects) expressions and they also do not perform well in areas such as *'establishing eye-contact, making requests, rejecting, dissatisfaction, disapproval and responding (communicative intentions-acts*; Roth and Spekman, 1984) particularly in the pragmatic developmental period. Limitations in vocalizations, atypical vocalizations, and the fact that wishes and discontents are not conveyed by different vocalization patterns are among the conditions that may indicate autism in the phonological development following motor development from birth. The absence of features indicating typical development in the motor, phonological (vocalizations), and pragmatic (communicative intentions) areas, particularly in the first 18 months, can directly suggest language delay-disorder and may indirectly suggest autism. Even when verbal language competence is demonstrated in children with autism, issues in the pragmatic field are still seen; the basis of these problems leads us to the preverbal pragmatic development period. The delay in producing the first words expected at 18 months and the lack of receptive language abilities may also lead to a developmental issue in infancy and maybe autism suspicion.

When the literature is examined, it is seen that the qualitative studies conducted in the field of autism in Turkey mostly focus on the problems experienced by the families (Top, 2009; Töret et al., 2014; Akkuş et al., 2020; Turan et al., 2020). While various studies in the worldwide literature have been undertaken to determine the differences experienced by families with children with ASD in the pre-diagnosis phase (Gray and Tonge 2001; Young, 2003; Guinchat, 2012; Crane et al., 2016; Sicherman et al., 2019), the quantity of qualitative studies on this topic in Turkey appears to be limited (Servi and Baştuğ, 2018). As a result, it is expected that this study will make a substantial contribution to the Turkish literature, or at the very least will direct researchers interested in the subject to conduct research on the subject.

Language is a tool that people use to express their wants, needs, thoughts, and feelings. Language skills at a young age serve as the foundation for future language abilities. Lack of linguistic abilities, or failure to acquire them effectively, can cause difficulty in communication, as well as a slew of other issues. As a result, early detection and treatment of language and speech impairments is critical. Family observations are vital for the diagnosis and suspicion of autism since language, speech, and communication indicators in the early period are predictors of various developmental stages. Accordingly, in this study, answers were sought to the following questions in order to determine the behaviors that parents observed in the pre-verbal and pre-diagnosis period:

1. Is there a difference between children diagnosed with autism and children who develop typically in terms of general developmental stages?

2. In terms of general developmental stages, what is the difference between children diagnosed with autism and children who develop typically?

2. What differences did parents notice in the first 18 months of their child's life?

3. What differences did parents observe prior to diagnosis?

METHOD/MATERIALS

Study Design

The case study design, one of the qualitative research approaches, was used to conduct the descriptive research. In phenomenological research, the interview is the primary data collection tool. The phenomenology approach was used in this study, and semi-structured face-to-face individual interviews were used to try to determine the differences in language-speech-communication development noted by families prior to diagnosis.

Participants

The study included 50 (47F, 3M) parents who were primary caregivers of children with autism, aged 3-10 ($\bar{x}$=6.54, SD=1.99), who were enrolled in rehabilitation centers in Istanbul

The goals of the study were explained to the participants, and their consent was obtained after they were given general information about the study. The participants all agreed to take part in the study. Inclusion criteria for the study were determined as follows:

- Their children have only been diagnosed with autism and do not have any other disabilities.

- The age range of children diagnosed with autism is 3-10 years.

- Being the primary caregiver of the child with autism.

Material

Semi-structured interview technique was used in this qualitative study, which was conducted to determine the differences observed by families with children with ASD in the pre-diagnosis period. Interview questions were prepared based on the relevant study findings (Brewee, Pattison, and Young, 2003; Zwaigenbaum et al., 2005; Landa and Garrett-Mayer, 2006; Ozonoff et al., 2009; Chamak et al., 2011; Crane et al., 2016; Sicherman et al., 2019), collected as a result of the researchers' literature review and a semi-structured interview form was created for individual interviews with the participants. A pilot interview with a participant who met the inclusion criteria was done to assess the clarity and clarity of the questions in the interview form. Following the pilot interview, the participant was questioned on the questions' clarity, difficulty, and clarity, and feedbacks were collected. The interview form was revised in response to the feedback. Questions that were difficult to understand were simplified, and the usage of domain-specific words was minimized.

The interview form is divided into two sections, one for *'general information'* and the other for *'language and communication'*. 17 questions were created in the first half to acquire demographic information about the participant and the child, and 20 questions were created in the second part to determine the language, speech, and communication behaviors seen in the participants' children. These questions were formatted as 'yes/no' and 'open-ended' questions.

Data Collection

Face-to-face semi-structured interviews with the participant who provides primary care to the child with autism were undertaken in order to collect data. Participants were interviewed in a quiet room at three special education and rehabilitation centers that had previously been agreed upon. Participants were informed about the subject and purpose of the planned research, that the research results would not be used for anything other than scientific purposes, and that their personal information would be kept confidential prior to these face-to-face interviews, and voluntary consent was obtained. The interviews lasted about 15-20 minutes on average. The responses of the participants were noted during the interview in detail. Additional questions were asked and the answers were discussed in cases where the participants' answers were not clear and understandable.

Data Analysis

The data obtained from the participants were analyzed using descriptive and situation analysis methods. Descriptive analysis is a type of qualitative data analysis that entails summarizing and analyzing data based on pre-specified themes. The primary purpose of this type of analysis is to present the findings to the reader in a summarized and interpreted form. The researchers analyzed the interview data and identified common themes in order to compile the participants' responses on the differences they noticed prior to diagnosis. *'General Development'*, *'First 18 Months'*, *'Before Diagnosis'* and *'Problem Behaviors in* Communication' are the themes found. The researchers agreed to conduct descriptive analyses of the data based on the themes they had developed.

FINDINGS

The findings of the data analysis obtained by using the appropriate approach for the study's principal aims are presented in this section.

The demographic and other associated information regarding the study participants and their children diagnosed with autism spectrum disorder is provided in Tables 1 and 2.

Table 1. Demographic information about participants

Demographic information		%	N (50)
Gender	Female	94	47
	Male	6	3
Education	Primary School	16	8
	High School	32	16
	University (College)	50	25
	Postgraduate	2	1
Education (Spouse)	Primary School	14	7
	High School	34	17
	University (College)	52	26
Income (by month)	1000-2000 TL	14	7
	2000-3500 TL	30	15
	3500-5000 TL	32	16
	5000 TL and above	24	12
Number of children	1	24	12
	2	64	32
	3	12	6
History of speech and language disorders in family	Yes	18	9
	No	82	41

80% (n=40) of the participants participated from Istanbul and 20% (n=10) participated from Kocaeli. The participants in the study ranged in age from 27 to 53 (x=36.92, SD=5.10), while the age range of the spouses of the participants was 29-58 (x̄=40.62, SD=5.98).

A total of 9 (18%) participants answered *"Yes"* to the question *"Does anyone in your family have language and speech disorders?"* Statements like *'My brother had delayed speech,' 'My brother's son also has autism', 'There is stuttering on the father's side,'* and *'The mother has temporary stuttering,'* were given in response to comprehensive questions about these conditions.

Table 2. Demographic information about participants' children with ASD

	x̄	SD	Min	Max
Age	6,54	1,99	3	10
Age of 'difference' suspicion*	20,24	9,63	7	48
Age of 'ASD' diagnosis	2,86	1,05	1,5	6

* Indicated as month.

40% of the research participants' children are between the ages of 6-7. Of the children diagnosed with autism, 52% (n=26) were the second child, 44% (n=22) were the first child, and 4% (n=2) were the third child. The children were divided into two groups: boys (68%; n=34) and girls (32%; n=16). When asked when the differences in their children first became apparent, in response, 24% (n=12) of the participants said that their children were 1-year-old, 18% (n=9) said that they observed differences when their children were 1.5 years old, and 14% (n=7) said it was at 2 years old. The age at which children are diagnosed varies

significantly, as does the time it takes for individuals to notice differences. The vast majority of children are diagnosed between the ages of 2.6-3.0 (40%, n=20).

The table below shows the data of mean, minimum, maximum, and standard deviation (SD) derived from the language-speech-communication and general development questions (Table 3).

Table 3. Information about the development of children who have been diagnosed with autism

	x̄	SD	Min	Max
Unsupported Sitting	7,42	2,03	4	12
Sitting	7,93	2,38	3	12
Crawling*	9,63	3,05	6	18
Walking	14,24	3,93	8	27
Babbling*	7,64	2,92	3	18
First Words	16,33	10,92	6	60

* Indicated as month.

** The numerical findings were organized in order of most marked and the first two responses were given.

According to the participants' responses, the age of onset of sitting without support in children diagnosed with autism is x̄= 7.42 months; teething is x̄= 7.93 months; crawling is x̄= 9.63 months; walking is x̄= 14.24 months; babbling is x̄= 7.64 months; and the age of saying the first word is x̄= 16.33 months. While 34% (n=17) of the participants gave the information that their children diagnosed with autism begin to sit without support in the 6th month; 12% (n=6) of the participants stated that they started to sit without support at the 7th month and 10% (n=5) of them expressed that it was at the 12th month. When asked when their children were teething, 20% (n=10) stated they were teething in the seventh month, and 16% (n=8) said they were teething in the ninth month. 16% (n=8) of the participants said that their children began crawling at the age of eight months, and 12% (n=6) stated that it was at the age of twelve months. When asked when their children first started walking, 12% (n=6) said they didn't crawl but instead started walking right away, 34% (n=17) said they started walking at 12 months, and 14% (n=7) said they started walking at 18 months.

When participants were asked about the babbling period, which is an important period in children's language development, 12% (n=6) of the participants stated that their children's babbling started at the 10th month, 8% (n=4) said that it was at the 8th month, and 8% (n=4) expressed that it started in the 7th month. In addition to these responses, 6% (n=3) of respondents said *'I don't recall'* and 4% (n=2) said *'there was no babbling.'* When it came to first word production, 34% (n=17) of the participants said their children started saying their first words at the age of 12 months, and 12% (n=6) stated that it was at the age of 18 months. The most common responses when asked what these first words were *'mother, father, grandfather, mama.'* The amount of families who are unable to recall when their children first spoke is likewise extremely significant (54%, n=27).

The open-ended question *"Did you observe any differences till your child was 18 months old?"* received 66% (n=33) positive responses(yes) and 34% (n=17) negative responses(no). Participants who said *'yes'* were asked what kinds of differences they noticed, and the results are listed in Table 4.

Table 4. The differences till the child was 18 months' old

	%	n
No eye contact	47,1	16
Not responding to the name	32,4	11
Indifference to parents	20,6	7
Sensory sensitivity	17,6	6
Sleeping problems	17,6	6
Excessive interest in rotating objects	17,6	6
Not responding to sounds	11,8	4
Not playing with toys	11,8	4
Obsession	11,8	4
Desire to be alone	11,8	4

	%	n
Excessive crying and discomfort	8,8	3
Feeding problems	8,8	3
Being calm compared to other children	5,9	2
Selective perception	5,9	2
No babbling	2,9	1
Trembling (Shaking) behavior	2,9	1
Excessive interest in English words	2,9	1
Poor perception	2,9	1
Atypical behaviors	2,9	1

When looking at Table 4, the behavior of 'not making eye contact' comes out on top with a rate of 47.1 % (n=16) among the behaviors that parents see as a difference in their children before the age of 18 months. This behavior is followed by *'not responding when their name is called'* (32.4%; n=11) and *'indifference towards parents'* (20.6%; n=7). *"We experienced difficulty during the complementary meal time," " my child was picky about every food, my child did not take it into his mouth","* and "*My child was celiac"* were among the statements given by individuals who observed their children having feeding challenges in the first 18 months. *"My child was screaming and crying while washing hands with cold water,"* one participant responded, indicating that her child showed sensory sensitivity. Another participant said*, "my child would focus on the washing machine for a long time"* and *" my child would repeatedly rotate the objects that he could turn with his hands,"* referring to her child's extreme interest in rotating objects. In addition, some participants stated that "*my child would be more interested in the tiny features of toys than playing with them"* and *"my child would use toys out of the purpose."*

Table 5. Differences before the diagnosis

	YES		NO	
	%	n	%	n
Having problems in taking and trying foods after 6 months	40	20	60	30
Exhibiting differences in the first 18 months	66	33	34	17
Cooing in the first 2-3 months	74	37	26	13
Babbling similar to typically developing children*	78	39	12	6
Difference in vegetative sounds (crying, sneezing, coughing, laughing etc.)	18	9	82	41
Interest in other adults or other children	40	20	60	30
Making eye contact or pointing to initiate communication	66	33	34	17
Exhibiting stereotypical behaviors (shaking, etc.)	60	30	40	20
Showing intimacy (hugging, kissing, smiling) to family members	82	41	18	9
Enjoying hugs from family members	88	44	12	6
Being happy to be hugged by other people*	26	13	52	26
Reacting when name is called *	68	34	28	14
Imitating the sounds heard in the environment (animal, vehicle, etc.)*	26	13	72	36
Playing with toys (with family members)	62	31	36	18
Playing with toys (with other people)*	10	5	78	39

* *Items from the participants with the response "I don't remember"*

Each item in Table 5 about the behaviors noticed prior to the diagnosis was offered to the participants with a 'Yes' or 'No' choice, and the results are shown in the table as percentages and numbers. After the first six months, 40% of the participants (n=20) said they had difficulty taking and trying foods other than breast milk. Some of the participants answered this question with the *'' my child was vomiting frequently, then we discovered he had celiac'', 'Only breastfed until 2 years old', 'After 8 months, the issues began'',* They also gave the answers of "We were force-feeding" and "my child vomited often, my child always ate in the form of puree" *statements* as additional information.

The sounds described as cooing were heard by 74% (n=37) of those who took part in the interview. 78% (n=39) of participants said "Yes" to the question *"Was your child's babbling normal/typical?"* while 12% (n=6) said *"No."* 8% (n=4) of the participants stated that they had no idea and 2% (n=1) stated that their babbling stopped following the febrile convulsion. There is a difference in the natural sounds of their children such as crying, sneezing, coughing, and laughing, according to 18% (n=9) of the participants. When asked what these differences were, the participants gave the following responses: *'my child had strange and illogical laughter', 'my child had an uncontrollable cry', 'my child was sobbing all the time', 'my child didn't seem to be laughing, even though my child was smiling, 'my child didn't seem to be laughing at the proper thing', 'my child was crying for no apparent reason'.* 66 % (n=33) of the participants indicated their children communicate with them through making eye contact or pointing to items. When asked if their child reacts when their name is called, 68% (n=34) responded *'Yes'*, 28 % (n=14) said *'No'*, and 4% (n=2) said *'Sometimes'*. 72% of the participants (n=36) stated that their children could not imitate the sounds of cats, dogs and cars they heard in the surroundings. Only 2% (n=1) indicated her child could imitate on occasion.

The majority of the study group's participants (60%, n=30) reported seeing stereotyped behaviors in their children. *'Swinging, hand obsession, trembling, flapping their hands like butterflies, opening and closing their hands, waving rope, shaking hands'* were the most common responses when questioned about the observed behavior. 82% (n=41) of the participants said their children demonstrate affection for family members by smiling and hugging them. When the question *"Was your child happy to be hugged by family members?"*, 88% (n=44) answered "Yes"; when asked *"Was your child happy to be hugged by other people?"* This percentage dropped to 26% (n=13). Furthermore, 22% (n=11) of the participants said that their children were occasionally glad to be embraced/hugged by strangers. 62% of the participants (n=31) stated that they try to pick up their children's toys and play with them, however, when the participants were asked the question *'Did your child try to play with other people?',* this rate decreased to 10% (n=5). In addition, it was discovered that 12% (n=6) of the participants answered "Sometimes" to this question.

Table 6. Behaviors of the child when the child cannot explain himself

	%	n
Behavioral problems (crying, hitting to him/herself etc.)	64	32
Using gestures	30	15
Guidance by holding the parent's hand	14	7
Staying silent	6	3
Repeating what he/she says	2	1

'What was your child doing when he couldn't explain himself?' and *"How did he behave?"* questions were presented to the participant. They responded differently. *'Behavioral problems'* was the most commonly given response. One of the participants answered this question as "My child already explains him/herself very well and expresses his/her wishes". Table 6 contains detailed information about the responses.

DISCUSSION

In this study, data were collected to determine the atypical language and communication behaviors that parents of children with autism may have observed/noticed in the pre-diagnosis period.

According to the literature, people with language issues have a higher prevalence of language and speech disorders in their family history (Koyuncu and Mercan, 2019), the first child is more likely to be diagnosed with autism (Balkır, 2019; Ünver and Memik, 2019; Doğan, 2019), and boys have a higher risk of developing autism (Töret and Özkubat, 2013; Aslan, Cihan and Altın, 2014; Selimoğlu, Özdemir and Şekeroğlu, 2018). Unlike previous research findings, the majority of the participants in this study (n=41, 82%) did not have language or speech impairments in their families, and the children identified with autism were typically the second child (n=26, 52%). The fact that the majority of the children diagnosed in the present study are male (68%; n=34) is consistent with the findings of the literature. At 12 months, 24% (n=12) of participants noticed differences in their children's development for the first time, 18% (n=9) of them noticed at 18 months, and 14% (n=7) of them noticed them at 24 months, according to this study. Many other studies have also found that parents detect the first indicators of autism in their children before they reach the age of 24 months (Zwaigenbaum, 2001; Prater and Zylstra, 2002; Bıçak, 2009; Guinchat et al., 2012; Selimoğlu et al., 2013; Turan et al., 2020). The age of diagnosis of autism is found to be 2.6-3.0 in this study (40%). This conclusion is supported by numerous research in the literature (Brewee et al., 2003; Top, 2009; Selimoğlu et al., 2013; Aslan, Cihan and Altın, 2014; Servi and Baştuğ, 2018; Akkuş et al., 2020).

It is expected that a child with typical development begins to sit without support when he/she is 9-10 months old (Tekin, 2016), crawl in 8-10 months, and walk in 12-18 months (Kahriman, 2007). Individual variances, on the other hand, can cause variations in these stages. Some babies begin walking at the age of eight months, while others may not begin walking until they are eighteen months old (Ergin and Yıldız, 2017). In children with typical development, tooth eruption generally begins at 5-10 months (Arıkan and Bekar, 2020). The first words emerge between 8 and 18 months in children with typical development, and on average in the 12th month (Karacan, 2020). In our study, as a result of the analysis of the answers given to the general development questions asked to the participants about the children diagnosed with autism, the age of onset of sitting without support was found to be x̄

= 7.42 months; teething age was found to be x̄= 7.93 months; crawling age was found to be x̄= 9.63 months; walking age was found to be x̄= 14.24 months; the age of babbling was found to be x̄= 7.64 months and finally the age of saying the first word was found to be x̄= 16.33 months. 12 months for unsupported sitting, 12 months for teething, 18 months for crawling, 27 months for walking, 18 months for babbling, and 60 months for first words are the maximum values. The first words in the children of the study participants come on average at the age of 16 months, with a range of 6 to 60 months. The values in the literature regarding the months and the findings obtained in the research differ at some points. Individual differences can explain this condition, but according to the literature, it is assumed that it is primarily due to the fact that autism produces variances in general development.

According to published research, the time for parents to notice changes in their children varies greatly. According to Crane et al. (2016), 17% of parents noticed autism symptoms in their child's first year of life, 34% in the second year, and 33% of them noticed between the ages of 2 and 5, while in the study of Bonniau et al. (2011), 82% of parents noticed autism symptoms before their child turned two. According to another study conducted in Turkey, the age to observe these differences has been estimated to vary between 1.5 and 4 years old (Selimoğlu et al., 2013). The times of observing the differences in each participant's children differed in this study.

Single words such as "*mama," "dad," "grandfather," "bye bye"* and *"mama"* are among the child's first meaningful productions. (Baytar, 2014). This and other related information in the literature, as well as the results of our study, are all in agreement. Babbling appears about the middle of the sixth month, according to Charlier and Juhem (2007), although Alam Samsul (1998) claims that babies less than six months do not have substantial babbling and that the best babbling period is between 6 and 12 months (as cited in Tarcan, 2019). Based on the information gathered from the study's participants, it can be concluded that the onset of babbling in children with autism, which occurs at an average of 7 months, is relatively similar to typical development. Despite the fact that babbling occurs at a normal pace in this study, there is evidence in the literature that the development and patterns of babbling in children with autism differ from those in typically developing children (Landa and Garrett-Mayer, 2006; Ozonoff et al., 2011). However, just a few of the participants claimed that their children's babbling has various productions. The production of first words in children with autism was likewise observed to be considerably delayed (x= 16.33, SD= 10.92) in this study. The minimum and maximum values were found to be quite diverse according to the typical developmental stages, despite the mean values being similar to the literature findings. The minimum values, in particular, show exceptionally early onset values when compared to typical developmental phases. This has led to the conclusion that families are in a complex situation in terms of remembering or general development awareness. The age of the child with autism, as well as the child's birth order and the participant's emotional condition, are likely to have contributed to this conclusion.

Bonniau et al. (2011) reported that the majority of parents observed deficiencies in social and communication skills well as numerous behavioral issues in their children as the first differences. The most noticeable difference that parents noted was that their children did not make eye contact and did not react when their names were called. Parents began to observe some certain differences in their children at the age of 9 months in another study by Brewee, Pattison, and Young (2003). The first observed differences are avoidance of eye contact and indifference towards toys. Individuals diagnosed with autism have trouble making eye contact and display stereotypical behaviors, according to practically all autism studies. The primary difference noted by families in children with autism up to 18 months of age is not making eye contact, according to the associated replies in this study. Furthermore, in terms of language development, it was discovered that the production of first words was the most differentiated and delayed developmental stage before first 18 months. However, despite the fact that the production of first words was delayed, it was discovered that the first words were words like '*mother, father, grandfather*', and *'mama'* in this study, which was similar to the literature findings. Because habits like not establishing eye contact, acting stereotypically, and indifference are associated with autism and can be witnessed in a concrete sense, it's simpler to detect them. Information about autism on various platforms is also shaped within the framework of these behaviors. As indicated in the introduction, several studies have found that, in addition to behaviors like *'not making eye contact'* and *'indifference'*, there are other less concrete behaviors such *'unusual vocalizations'* and '*the lack of typical development of turn-taking abilities'*. The information given on various platforms should be integrated with given findings.

Various research has indicated that children with autism spectrum disorder experience dietary/feeding issues such as food selectivity and food rejection (Schreck, Smithin, and Williams, 2004; Sarı and Bahçeci, 2012). In this study, parents reported that their children had some feeding issues. This condition may have arisen as a result of sensory sensitivity or other factors in individual with autism. According to the responses, the families were aware of the condition but did not take any precautions or seek help from a professional until the diagnosis was made. Behaviors observed by parents such as disinterested behavior towards toys and the environment, improper use of toys, excessive attention to certain objects or toys (for example, high intensity or focus) are also consistent with the findings of the research (Gillberg et al., 1990; Guinchat et al., 2012; Selimoğlu et al., 2013; Sicherman et al., 2019).

Finally, a review of the literature reveals that the symptoms experienced by families in their children span a wide range of developmental areas. In some research, the first symptom noticed by parents in their children was about language and speech development (De Giacomo and Fombonne 1998; Selimoğlu et al., 2013), whereas Crane et al. (2016) discovered these variations

in the area of social interaction. The differences seen by the families were in the area of social contact, according to the findings of this study. Families noticed changes in language and speech development later in development, according to the findings.

The results of the open-ended questions and the results of the item-by-item yes-no questions differed. As a result, parents who indicated there was little difference before the diagnosis when asked an open-ended question said they noticed significant differences when answered yes-no questions. Both sorts of questions elicited contradictory responses. This is assumed to be owing to a lack of understanding of general developmental phases.

CONCLUSION AND RECOMMENDATIONS

With the discovery that the pre-verbal stage is actually extremely essential, the focus on exclusively verbal activities for autism diagnosis has shifted. According to the findings of this study, the majority of families did not notice any notable variations in their children's development throughout the preverbal stage, and reported that their children's development developed in a comparable manner to that of children with typical development. While they assumed their children were developing typically, their families were shocked and upset when they were diagnosed with autism.

The lack of observation of differences in elements such as gesture, joint attention, game ability, and social orientation during the preverbal period of language development is assumed to be attributable to a lack of awareness. Parents who know when their children crawled and walked are often unable to recall when they said their first words. This result could have been influenced by the fact that concrete behaviors are more persistent and observable. However, it may be important to bring attention to the lack of interest in language development as well as knowledge of the subject. As a result, it is suggested that language and related factors be studied more closely and that awareness-raising research be conducted to gather understanding.

Many projects to inform people have been launched as a result of today's technology advancements, and these activities are continuously growing. Informative sharing and online meetings are held by various professionals (doctors, speech and language therapists, teachers, special education specialists, psychologists, child development specialists, etc.) and organizations-communities (about general development: *Anne-Baba-Çocuk Eğitim Projesi, Kadın Emeğini Değerlendirme Vakfı (KEDV), Ana Baba Okulu, Benim Ailem Projesi, Mobil Anaokulu Projesi, Aile Mektupları Projesi, e-Bebek Uzman Bilgisi, KU Dil ve İletişim Gelişimi Laboratuvarı, BOUN Bebek ve Çocuk Gelişimi Laboratuvarı*; about autism: *Tohum Otizm, İstanbul Otizm Gönüllüleri Derneği, Otizm Vakfı* vb.) in different platforms and also training programs *(FLOORTIME, MEB Otistik Çocuklar Eğitim Programı, Otistik Çocuklar için Davranışsal Eğitimi Programı [OÇİDEP]* etc.) on the subject are also being offered at the same time. Guidance to these information events and activities is regarded to be effective in raising family awareness and knowledge about language development. Professionals who work with families bear a significant amount of responsibility in this regard. Professionals may inform families themselves about the developmental areas or inform them about the programs and social media profiles listed, as well as promote and propose activities that assist language development that parents can perform with their children at home. As understanding grows, early detection and intervention may become possible. In addition, efforts can be done to address future possible behavioral issues caused by the child's failure to meet his or her growing communication needs.

Acknowledgement

REFERENCES

Akçamuş, M. Ç., Acarlar, F., Alak, G., and Keçeli Kaysılı, B. (2019). Otizm spektrum bozukluğu olan çocuklar için erken sosyal iletişim ve etkileşim ölçeği (ESİE) geçerlik ve güvenirlik çalışması. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi,* 34(4), 1015-1036.

Akkuş, P. Z., Saygan, B. B., Bahadur, E. İ., Tuna, C. A. K., and Özmert, E. (2020). Otizm spektrum bozukluğu tanısı ile yaşamak: Ailelerin deneyimleri. *Türkiye Çocuk Hastalıkları Dergisi*, 1-8.

American Psychiatric Association. (2013). Diagnostic and Statistical Manual of Mental Disorders (5th ed.). Arlington, VA: American Psychiatric Publishing.

Anderson, D. K., Lord, C., Risi, S., DiLavore, P. S., Shulman, C., Thurm, A., & Pickles, A. (2007). Patterns of growth in verbal abilities among children with autism spectrum disorder. *Journal of Consulting and Clinical Psychology*, 75(4), 594.

Aydın, Ç., Aydin, C., Göksun, T., Goksun, T., Kuntay, A. C., Tahiroğlu, D., and Tahiroglu, D. (2016). *Aklın Çocuk Hali: Zihin Gelişimi Araştırmaları.* İstanbul: Koç Üniversitesi Yayınları.

Balkır, S. (2019). Otistik çocukların bakımının yapıldığı işletmelerde 24-36 aylık çocukların sosyal ve duygusal gelişim özelliklerinin incelenmesi. *R&S-Research Studies Anatolia Journal,* 2(5), 214-229.

Bekar, P., and Arıkan, D. (2020). Çocukların diş çıkarma ağrısında yapılan uygulamalar ve hemşirenin rolü. *Gümüşhane Üniversitesi Sağlık Bilimleri Dergisi,* 9(1), 44-47.

Bıçak, N. (2009). *Otizmli Çocukların Annelerinin Yaşadıklarının Belirlenmesi.* Yüksek Lisans Tezi, Abant İzzet Baysal Üniversitesi, Sosyal Bilimler Enstitüsü, Bolu.

Brooks, R., & Meltzoff, A. N. (2005). The development of gaze following and its relation to language. *Developmental Science,* 8(6), 535-543.

Chamak, B., Bonniau, B., Oudaya, L., & Ehrenberg, A. (2011). The autism diagnostic experiences of French parents. *Autism*, 15(1), 83-97.

Chawarska, K., Klin, A., Paul, R., Macari, S., & Volkmar, F. (2009). A prospective study of toddlers with ASD: Short-term diagnostic and cognitive outcomes. *Journal of Child Psychology and Psychiatry*, 50(10), 1235-1245.

Clifford, S. M., & Dissanayake, C. (2008). The early development of joint attention in infants with autistic disorder using home video observations and parental interview. *Journal of Autism and Developmental Disorders*, 38(5), 791-805.

Crais, E. R., Watson, L. R., & Baranek, G. T. (2009). Use of gesture development in profiling children's prelinguistic communication skills. *American Journal of Speech-Language Pathology*, 18(1), 95.

Crais, E., & Ogletree, B. T. (2016). *Prelinguistic Communication Development*. In D. Keen, H. Meadan, N. Brady & J. W. Halle (Eds.). *Prelinguistic Minimally Verbal Communicators on the Autism Spectrum Disorder* (pp. 9-33). Springer: Singapore.

Crane, L., Chester, J. W., Goddard, L., Henry, L. A., & Hill, E. (2016). Experiences of autism diagnosis: A survey of over 1000 parents in the United Kingdom. *Autism*, 20(2), 153-162.

De Giacomo, A., & Fombonne, E. (1998). Parental recognition of developmental abnormalities in autism*. European Child & Adolescent Psychiatry*, 7(3), 131–136.

Demirkan Baytar, B. (2014*). Dil Gelişimi Sorunlarının Ortaya Çıkışında Bakıcının Rolü*. Yayınlanmamış Yüksek Lisans Tezi. Marmara Üniversitesi, Sosyal Bilimler Enstitüsü, İstanbul.

Doğan, A. (2019). *Otizm Spektrum Bozukluğu Tanılı Çocukların ve Normal Gelişim Gösteren Çocukların Kardeşlerinde Aleksitimi, Ruminasyon Düzeyi ve Algılanan Ebeveyn Tutumunun Karşılaştırılması*. Yüksek Lisans Tezi, Maltepe Üniversitesi, Sosyal Bilimler Enstitüsü, İstanbul.

Ergin, H., and Yıldız, S. A. (2017). *Gelişim Psikolojisi.* Ankara: Nobel Akademik Yayıncılık.

Farroni, T., Massaccesi, S., Pividori, D., & Johnson, M. H. (2004). Gaze following in newborns. *Infancy*, 5(1), 39-60.

Feldman, M. A., Ward, R. A., Savona, D., Regehr, K., Parker, K., Hudson, M., & Holden, J. J. (2012). Development and initial validation of a parent report measure of the behavioral development of infants at risk for autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 42(1), 13-22.

Genç-Tosun, D., and Kurt, O. (2017). Otizmli bireylerin kullandığı yeni nesil konuşma üreten cihazlara ilişkin araştırmaların incelenmesi. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi*, 18(01), 125-147.

Gillberg, C., Ehlers, S., Schaumann, H., Jakobsson, G., Dahlgren, S. O., Lindblom, R., Bagenholm, A., Tjuus, T., Blidner, E. (1990). Autism under age 3 years: A clinical study of 28 cases referred for autistic symptoms in infancy. *Journal of Child Psychology and Psychiatry,* 31(6), 921-934.

Gray, K. M., & Tonge, B. J. (2001). Are there early features of autism in infants and preschool children*? Journal of Paediatrics and Child Health, 37(3)*, 221-226.

Guinchat, V., Chamak, B., Bonniau, B., Bodeau, N., Perisse, D., Cohen, D., & Danion, A. (2012). Very early signs of autism reported by parents include many concerns not specific to autism criteria. *Research in Autism Spectrum Disorders,* 6(2), 589-601.

Güleç-Aslan, Y., Cihan, H., and Altın, D. (2014). Otizm spektrum bozukluğu tanılı çocuk sahibi annelerin deneyimleri. *Electronic Journal of Social Sciences,* 13(50), 96-111.

Kahriman, İ., Topbaş, M., and Çan, G. (2011). Traditional baby care practices among mothers with children aged 6-12 months in the turkish province of Trabzon. *TAF Preventive Medicine Bulletin,* 10(1): 61-70.

Karacan, E. (2000). Bebeklerde ve çocuklarda dil gelişimi. *Klinik Psikiyatri,* 3(4), 263-268.

Koyuncu, Z., and Mercan, B. (2019). Konuşma ve dile özgü nörogelişimsel bozukluklar. *İKSSTD*, (11): 40-46. https://doi.org/10.5222/iksstd.2019.76598

Landa R., & Garrett-Mayer, E. (2006). Development in infants with autism spectrum disorders: A prospective study. *Journal of Child Psychology and Psychiatry,* 47. 629–638.

Lazenby, D., Sideridis, G., Huntington, N., Prante, M., Dale, P., Curtin, S., Henkel, S., Iverson, J., Carver, L., Dobkins, K., Akshoomoff, N., Tagavi, D., Nelson, C., & TagerFlusberg, H. (2016). Language differences at 12 months in ınfants who develop autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 46(3), 899-909.

Loh, A., Soman, T., Brian, J., Bryson, S. E., Roberts, W., Szatmari, P. (2007). Stereotyped motor behaviours associated with autism in high-risk infants: A pilot videotape analysis of a sibling sample. *Journal of Autism and Developmental Disorders,* 37(1), 25-36.

Lord, C. (1995). Follow-up of two-year-olds referred for possible autism. *Journal of Child Psychology and Psychiatry,* 36(8), 1365–1382.

Loveland, K. A., & Landry, S. H. (1986). Joint attention and language in autism and developmental language delay. *Journal of Autism and Developmental Disorders,* 16(3), 335-349.

Luyster, R. J., Kadlec, M. B., Carter, A., & Tager-Flusberg, H. (2008). Language assessment and development in toddlers with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 38(8), 1426-1438.

Mitchell, S., Brian, J., Zwaigenbaum, L., Roberts, W., Szatmari, P., Smith, I., & Bryson, S. (2006). Early language and communication development of ınfants later diagnosed with autism spectrum disorder. *Journal of Developmental and Behavioral Pediatrics,* 27(2), 69–78.

Mundy, P., & Newell, L. (2007). Attention, joint attention, and social cognition. *Current Directions in Psychological Science,* 16(5), 269-274.

Ozonoff S., Macari S., Young G.S., Goldring S., Thompson M., Rogers S.J. (2008). Atypical object exploration at 12 months of age is associated with autism in a prospective sample. *Autism*, 12. 457–472.

Ozonoff, S., Iosif, A. M., Baguio, F., Cook, I. C., Hill, M. M., Hutman, T. (2010). A prospective study of the emergence of early behavioral signs of autism. *Journal of the American Academy of Child and Adolescent Psychiatry,* 49, 256–266.

Ozonoff, S., Young, G. S., Steinfeld, M. B., Hill, M. M., Cook, I., Hutman, T., & Sigman, M. (2009). How early do parent concerns predict later autism diagnosis? *Journal of Developmental and Behavioral Pediatrics*, 30(5), 367–375.

Özen, F., and Hendekçi, E. A. (2016). Türkiye'de eğitim denetimi alanında 2005–2015 yılları arasında yayımlanan makale ve tezlerin betimsel analizi. *OPUS Uluslararası Toplum Araştırmaları Dergisi,* 6(11), 619-650.

Prater, C., & Zylstra, R. (2002). Autism: A medical primer. *American Family Physician,* 66, 1667–1674.

Roth, F. P., & Spekman, N. J. (1984). Assessing the pragmatic abilities of children: Part 1. Organizational framework and assessment parameters. *Journal of Speech and Hearing Disorders,* 49(1), 2-11.

Rozga, A., Hutman, T., Young, G. S., Rogers, S. J., Ozonoff, S., Dapretto, M., & Sigman, M. (2011). Behavioral profiles of affected and unaffected siblings of children with autism: Contribution of measures of mother–infant interaction and nonverbal communication. *Journal of Autism and Developmental Disorders,* 41(3), 287-301.

Sarı, H. Y., and Bahçeci, B. (2012). Nutritional status of children with an intellectual disability. *International Journal on Disability and Human Development*, 11(1), 17-21.

Schreck, K. A., Williams, K., & Smith, A. F. (2004). A comparison of eating behaviors between children with and without autism. *Journal of Autism and Developmental Disorders,* 34(4), 433-438.

Selimoğlu, Ö. G., Özdemir, S., Töret, G., and Özkubat, U. (2013). Otizmli çocuğa sahip ebeveynlerin otizm tanılama sürecinde ve tanı sonrasında yaşadıkları deneyimlerine ilişkin görüşlerinin incelenmesi. *International Journal of Early Childhood Special Education, 5(2), 129-161.*

Servi, C. and Baştuğ, Y. E. (2018). Otizm spektrum bozukluğunda erken dönem belirtileri: Annelerin görüşlerinin incelenmesi. M. A. Melekoğlu, (Ed.), 28. Ulusal Özel Eğitim Kongresi Tam Metin Bildiri Kitabı (s. 166-179) içinde. Eskişehir. ISBN: 978-605-80966-0-8.

Short, A. B., & Schopler, E. (1988). Factors relating to age of onset in autism. Journal of Autism and Developmental Disorders, 18(2), 207-216.

Shumway, S., & Wetherby, A. M. (2009). Communicative acts of children with autism spectrum disorders in the second year of life. *Journal of Speech, Language and Hearing Research,* 52(5), 1139-1156.

Sicherman, N., Charité, J., Eyal, G., Janecka, M., Loewenstein, G., Law, K., & Buxbaum, J. D. (2019). Symptoms leading to earlier diagnosis of children with autism spectrum disorder.

Şekeroğlu, Z. O. (2018). *Otizm Spektrum Bozukluğu Olan Bireylere Bakım Veren Kişilerin Bakım Yükü İle Yaşam Kalitesinin İncelenmesi.* Yüksek Lisans Tezi. Çağ Üniversitesi Sosyal Bilimler Enstitüsü, Mersin.

Tarcan, A. (2019). Babıldama döneminde okuma taklidi. *Elektronik Sosyal Bilimler Dergisi,* 18(69), 373-384.

Tekin, F. (2016). *Serebral Palsili Çocuklarda Nörogelişimsel Tedavi (BOBATH Tedavisi) Yaklaşımı'nın Postüral Kontrol ve Denge Üzerine Etkisi.* Yayınlanmamış Yüksek Lisans Tezi. Pamukkale Üniversitesi, Sağlık Bilimleri Enstitüsü, Denizli.

Top, F. Ü. (2009). Otistik çocuğa sahip ailelerin yaşadıkları sorunlar ile ruhsal durumlarının değerlendirilmesi: Niteliksel araştırma. *Çocuk Dergisi*, 9(1), 34-42.

Töret, G., Özdemir, S., Gürel Selimoğlu, Ö., and Özkubat, U. (2014). Otizmli çocuğa sahip olan ebeveynlerin görüşleri: Otizm tanımlamaları ve otizmin nedenleri. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi*, 15 (01), 1-17.

Töret, G., and Özmen, E. R. (2014). Erken çocukluk döneminde otizm spektrum bozukluğu olan çocuklarda taklit becerileri. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi*, 15(03), 51-68.

Turan, B., Esin, İ.S., Abanoz, E. and Dursun, O. B. (2020). Şüpheden tedaviye otizm spektrum bozukluğunda ailelerin gözünden yaşanan sorunlar. *Tıbbi Sosyal Hizmet Dergisi,* 15, 35-49.

Ünver, H., and Memik, N. Ç. (2019). Otizmli hastaların kardeşlerinin değerlendirilmesi ve kardeş sayı/sırasının hastalık şiddetine etkisi. *Cukurova Medical Journal,* 44(4), 1339-1346.

Ventola, P., Kleinman, J., Pandey, J., Wilson, L., Esser, E., Boorstein, H., & Green, J. (2007). Differentiating between autism spectrum disorders and other developmental disabilities in children who failed a screening instrument for ASD. *Journal of Autism and Developmental Disorders,* 37(3), 425-436.

Volkmar, F. R., Stier, D. M., & Cohen, D. J. (1985). Age of recognition of pervasive developmental disorder. *The American Journal of Psychiatry*, 142, 1450-1452.

Weismer, S. E., Lord, C., & Esler, A. (2010). Early language patterns of toddlers on the autism spectrum compared to toddlers with developmental delay. *Journal of Autism and Developmental Disorders,* 40(10), 1259-1273.

Wetherby, A. M., Watt, N., Morgan, L., & Shumway, S. (2007). Social communication profiles of children with autism spectrum disorders late in the second year of life. *Journal of Autism and Developmental Disorders*, 37(5), 960-975.

Wetherston, V., Gangat, S., Shange, N., Wheeler, K., Karrim, S. S., & Pahl, J. (2017). The views and knowledge of parents of children with autism spectrum disorder on a range of treatments. *South African Journal of Child Health,* 11(3), 117-121.

Young, R. L., Brewer, N., & Pattison, C. (2003). Parental identification of early behavioural abnormalities in children with autistic disorder. *Autism*, 7(2), 125-143.

Zwaigenbaum, L. (2001). Autistic spectrum disorders in preschool children. *Canadian Family Physician*, 47, 2037-2042

Zwaigenbaum, L., Bryson, S., Rogers, T., Roberts, W., Brian, J., & Szatmari, P. (2005). Behavioral manifestations of autism in the first year of life. *International Journal of Developmental Neuroscience*, 23(2-3), 143-152.

Effect of European Union Education Policy on Turkish Education System in Scope of European Union-Turkey Relations

Avrupa Birliği-Türkiye İlişkileri Bağlamında Avrupa Birliği Eğitim Politikasının Türk Eğitim Sistemi Üzerindeki Etkisi

Omca ALTIN[1]

Abstract

By unifying on the basis of common culture and values, the European Union (EU) is aiming to develop cooperation and deepen integration between 27 member countries. Education issue which holds great importance at the point of reaching these targets also plays a great role at the success of Union's policies. Turkey, who wants to partake in such a Community, concurrently realized various regulations in the education field in the scope of the EU harmonization process as well as the other political fields during the full membership process. In this study; EU education policy was handled within the course of history in the context of EU-Turkey relations and the effect of EU education policy on the Turkish education system is going to be evaluated. This is a literature review study conducted on written sources, and it was based on the scanning model of the qualitative research method. At the result of the study; it was seen that EU education policy is very effective over the Turkish education system which on its course to the EU full membership process. In this context, Turkey realized significant regulations in the education field within the frame of criteria designated for candidate countries by the EU. However, it has been observed that there are deficiencies in the regulations. Thus, Turkey should properly designate the root causes of problems regarding the education field and strictly accelerate the realization of studies in terms of criteria designated by the EU in this field in order to be a society with a higher level of development.

Öz

Avrupa Birliği (AB), ortak kültür ve değerler temelinde bütünleşerek 27 üye ülke arasında işbirliğini geliştirmeyi ve aynı zamanda entegrasyonu derinleştirmeyi hedeflemektedir. Bu hedeflere ulaşma noktasında büyük bir öneme sahip olan eğitim konusu, Birlik politikalarının başarısında da oldukça etkin bir rol oynamaktadır. Bu Topluluk içerisinde yer almak isteyen Türkiye, tam üyelik sürecinde diğer politika alanlarında olduğu gibi eğitim alanında da AB'ye uyum kapsamında çeşitli düzenlemeler gerçekleştirmiştir. Bu çalışmada; AB-Türkiye ilişkileri bağlamında AB eğitim politikası tarihsel süreç içerisinde ele alınarak, AB eğitim politikasının Türk eğitim sistemi üzerindeki etkisi değerlendirilmeye çalışılmıştır. Çalışma, yazılı kaynaklar üzerinde yürütülmüş bir literatür tarama çalışması olup, nitel araştırma yönteminin tarama modeli temel alınarak gerçekleştirilmiştir. Verilerin toplanmasında ise belge tarama yöntemi kullanılmıştır. Çalışmanın sonucunda; AB eğitim politikasının AB tam üyelik sürecinde olan Türk eğitim sistemi üzerinde oldukça etkili olduğu görülmüştür. Bu kapsamda Türkiye, AB tarafından aday ülkeler için belirlenen kriterler çerçevesinde eğitim alanında önemli düzenlemeler gerçekleştirmiştir. Ancak bu düzenlemelerde eksiklikler olduğu görülmüştür. Dolayısıyla Türkiye, bu düzenlemeleri geliştirmeli, özellikle eğitim alanına ilişkin sorunların temel nedenlerini doğru bir şekilde saptayarak, gelişmişlik düzeyi yüksek bir toplum olabilmek adına bu alanda AB tarafından belirlenen kriterleri tam anlamıyla gerçekleştirme çalışmalarını hızlandırmalıdır.

---

[1] **Asst. Prof. Omca ALTIN,** Kastamonu University, Faculty of Economics and Administrative Sciences, Department of International Relations, Kastamonu, TURKEY; oaltin@kastamonu.edu.tr, https://orcid.org/0000-0002-2529-4979

INTRODUCTION

Education is the main way to achieve quality living standards and to become a society with a high level of development. It is also a fundamental element of creating and developing a political and social system that respects both democratic and human rights (Özyılmaz, 2013). The globalization process has made a difference in the needs of societies, and the needs for information societies that constantly renew themselves and aim to reach different information have increased, especially within the framework of the developments in the fields of science and technology in the world (Turan, 2005). Training the people needed for the information society, and accordingly, producing information, accessing information, being able to use the information and transforming it into technology come to the forefront in the focus of innovation movements in education. Therefore, education plays a very important role in this process of change of societies (Göksoy, 2013).

The EU is developing cooperation between the Member States in many areas, from economy to politics. Common policies are also the most important elements in developing these collaborations. The EU aims to create a high awareness of Europeanness by mutual interaction between different languages, cultures and understandings of the citizens of the Member States. One of the policies created to achieve these goals is the education policy (Çelebi, 2007). The EU first considered education a tool contributing to the development of economic integration, and vocational education was focused on within the framework of the economic objectives of the European Union. However, especially science and technology-based developments led the EU to develop common policies in the field of education in the following period. It has been tried to establish partnerships covering the Member States by respecting the content and implementation methods of the national education systems of the Member States in the EU in this context. Therefore, the EU wants to create a European dimension in this area by strengthening cooperation between the Member States in the field of education policies.

Turkey's efforts to join the EU, which started in the 1960s, accelerated even more during the 2000s. Therefore, Turkey is obliged to fully meet the criteria set by the EU for candidate states in the process of full EU membership. Therefore, Turkey makes many regulations in the field of education as in other policy areas and tries to adapt to EU standards in this field within the framework of these criteria.

The development of the EU education policy in the context of EU-Turkey relations was examined within the historical process, and the impact of the EU education policy on Turkey's education system in the EU full membership process and how successful Turkey was in meeting the EU criteria in the field of education were tried to be evaluated in this study.

METHOD

The study is a literature review study and aims to integrate existing information on the historical development of EU education policy on the basis of EU-Turkey relations and the impact of EU education policy on the Turkish education system. A literature review is a research method that allows the systematic, understandable and repeatable synthesis and evaluation of information obtained by researchers, academicians or practitioners on a subject. This study was conducted on written resources (Göksoy, 2013).

The screening model of the qualitative research method was used in the study. Screening models are research approaches aiming to describe a past or still present situation as it is or as it was. In other words, the event, individual or object, which forms the basis of the research and is the subject of the research, is tried to be defined in the current conditions without any effort to change or influence it (Karasar, 2005).

The document screening method was used in the collection of the data in this study. Collecting data by examining existing records and documents is described as document screening. Document screening involves screening, reviewing, taking notes and evaluating resources for a specific goal (Karasar, 2005). The current research has been examined based on related articles, books, legislation and reports.

European Union-Turkey Relations

Turkey has been involved in very important international formations such as OECD, Council of Europe and NATO in the historical process. Therefore, Turkey did not remain indifferent to European integration, which is defined as the most important peace project in history, and applied for membership in the European Economic Community in 1959. This application for membership made by Turkey was stated by the Community Council that the level of development of Turkey would be insufficient to fulfill the obligations required by the full membership, and it was suggested that relations would progress within the framework of the partnership until the conditions required for full membership are fulfilled on the basis of Article 238 of the Treaty establishing the European Economic Community. The Ankara Agreement, also known as the Agreement Establishing a Partnership between Turkey and the European Economic Community, was signed in 1963 upon the adoption of the Community Council proposal by Turkey (Can, Balkır, Tonus et al., 2013). Thus, Turkey has a joint member status with the Ankara Agreement (Sözen and Shaw, 2003).

It is envisaged that this partnership, which was established between Turkey and the European Economic Community in the Ankara Treaty and whose main objective is Turkey's full membership of the European Community, be realized with the completion of three sections consisting of preparation, transition and the last period. Therefore, this Agreement has been an important step

for Turkey's full membership in the European Community in the future (Tekeli and İlkin, 2000). However, Turkey applied for full membership in the European Economic Community in 1987 without completing the gradual integration process stipulated in the Ankara Agreement. It has been reported by the Commission that a new member cannot be included in the Community without fully realizing the Community's own integration, and it has been recommended that Turkey first continue its development in the social, economic, and political fields and that the relations be maintained within the scope of the partnership agreement (Can, Balkır, Tonus, et al., 2013).

The Customs Union Treaty was signed between Turkey and the EU Association Council in 1995 and entered into force in 1996 after its ratification by the European Parliament (Klauss, 2000). The Customs Union Agreement has been seen as an important step for Turkey's full membership (Özkılıç and Haspolatlı, 2008), but Turkey achieved its candidate state status with the European Union Summit of Heads of State and Government in Helsinki in 1999 (Duman, 1991).

It was unanimously decided that Turkey would be elected as a candidate state, and it was clearly stated that it would have an equal position with other candidate states at the Summit of Heads of State and Government of the European Union in Helsinki (Tuzcu, 2002). The Council of the European Union adopted the Accession Partnership Document on 8 March 2001, which clearly sets out the objectives that Turkey should achieve in the field of human rights and within the scope of its compliance with the Copenhagen Criteria following the Summit of Heads of State and Government of the European Union. Subsequently, a national program was announced by Turkey on March 19, 2001, which included a calendar for the achievement of the objectives set out in the Accession Partnership Document. Important regulations have been made in this field in Turkey in this context (Can, Balkır, Tonus, et al., 2013).

It was stated that accession negotiations with Turkey would be initiated from 2005 if the Copenhagen political criteria were met by Turkey until December 2004 at the Summit held in Copenhagen in December 2002 (Can, Balkır, Tonus et al., 2013).

The Commission stated that the Copenhagen political criteria were met by Turkey and made some recommendations to the Member States regarding the opening of negotiations with Turkey before the December 2004 Summit (Aygül and Güvemli, 2005). It was stated that Turkey's steps in this process were welcomed at the Summit of Heads of State and Government of the European Union in Brussels on 16-17 December 2004 (Özkılıç and Haspolatlı, 2008). Therefore, it was decided to initiate the negotiation process with Turkey on October 3, 2005, in accordance with the framework stated in Article 23 of the Summit final text. It was stated in the Recommendation Document published by the Commission in October 2004 that Turkey would be deemed to have fulfilled the Copenhagen criteria when it put 6 regulations into effect. The Commission was given two main tasks as the revision of the Framework Document and the 2001 Accession Partnership Document, in other words, the preparation of a new Accession Partnership Document at the Summit. The Commission was requested to conduct a Civil Society Dialog involving activities to be carried out with the help of non-governmental organizations in order to ensure the promotion of both Turkey in the Member States and the EU in Turkey at the same time. The Commission adopted a framework that set the path for the EU in the negotiation processes in June 2005 (Can, Balkır, Tonus et al., 2013). Therefore, the EU decided to open negotiations with Turkey in Luxembourg on October 3, 2005 (Özkılıç and Haspolatlı, 2008). Turkey has entered the process of restructuring in many areas such as education, environment, health and social security for full membership in the EU since then (Bağcı, 2011).

Formation of the Education Policy of the European Union and Historical Development Process

The legal infrastructure of the European Community is based on the 1951 Treaty of Paris and the 1957 Treaty of Rome (Phillips and Ertl, 2003), and the main objective of the treaties was cooperation in the economic field (Hoggart and Johnson, 1987). The countries that established the European Coal and Steel Community Treaty associated education with national identities and opposed the development of education policy by the Community (Mikl, 2003). Therefore, neither treaty included specific provisions for general education. However, vocational education, which is thought to be directly related to the economic field, is mentioned in the treaties in addition to this (Ertl, 2003).

Article 128 of the EEC Treaty laid the foundations for the creation of a common policy for vocational education within the Community in particular (Ertl, 2003). Therefore, principles related to the creation of a common policy on vocational education were determined based on Article 128 with the General Principles Decision on the Establishment of Common Policies in Vocational Education dated 2 April 1963 and numbered 63/226 adopted by the Council of Europe (Denac, Cagran, Denac, and Sicherl Kafold, 2011). These principles in particular focused on the education required for all individuals to choose the profession they want, the adaptation of individuals working in the Member States to the changes in general economic conditions and production technologies, the increase of employment and the circulation of workers (Tuzcu, 2006). However, these principles are not considered legally binding by the Member States. In other words, all of the activities carried out in this field were conducted with the interstate cooperation method, not within the scope of the Community. Therefore, limited activities have been carried out for vocational education as well since these principles are not legally binding on the Member States (Ertl, 2003).

Approaches to vocational education mentioned in the founding treaties are an indicator of states' commitment to economic integration. Established to ensure economic integration, the Community primarily aimed to create a common market and the cooperating Member States based on the free movement of goods, capital, services and persons. It was thought for this reason that the creation of a common vocational education policy would both be extremely important for the free movement of these four fundamental factors of the common market and would increase the likelihood of finding a job outside the free movement of

people receiving vocational education. Therefore, a common vocational education policy would be created and contribute to the development of the common market (Denac, Cagran, Denac, and Sicherl Kafold, 2011). Vocational education has been considered a tool contributing to the development of economic integration as can be understood from all of these (Ertl, 2003), in other words, EU initiatives on vocational education have been carried out in line with the economic objectives of the European Union (Cankaya, Kutlu and Cebeci, 2015).

However, it is seen that the obligations regarding the Community institutions are not clearly stated in Article 128. In other words, the job descriptions for the Community institutions are not fully clarified. There are inconsistencies between the objectives and general principles of common vocational education policies. Article 128 contradicts the way in which decisions are taken and the policy instruments throughout the treaty. Therefore, this situation made it difficult to interpret Article 128 in European law. For this reason, the Member States interpreted Article 128 in a more limited way and claimed that the Community was given more limited powers in this field while the European Commission interpreted Article 128 widely (Ertl, 2003).

It was seen in the 1970s that the perspectives of European politicians towards education policies started to change, and the interest in education increased even more during this period. Political education was seen as an important element of creating European citizenship in the following periods, especially in these years. A European University Institute was established with an interstate agreement in Florence as a reflection of this idea (Özkılıç and Haspolatlı, 2008). This situation has been an indication that cooperation and activities for education have an inter-state nature, not a supra-state nature (Ertl, 2003).

An education committee consisting of the education ministers of the Member States was established, and a meeting was held by this committee to ensure future cooperation in the field of education in 1971. It was decided to make the cooperation on education more comprehensive not only to include vocational education after the meeting (Köksal, Yıldırım and Özdemir, 2013). Therefore, cooperation and permanent programs for general education were initiated by the education committee. However, all these activities have not been very comprehensive due to the lack of financial and personnel support by the European Commission. Economic factors such as young unemployment caused by the economic depression brought about by the oil crisis in 1973 and especially young individuals aged 16 and under taking part in the labor market without any qualifications after leaving school have also played a role in increasing interest in education in the 1970s at the same time (Ertl, 2003). The globalization of the economy in particular and, therefore the increasing need for a high-quality labor force (Brine, 1995) necessitated a reconsideration of the issue of education at the national and also Community level. The Community reached a consensus on the establishment of a social action program with full employment as a priority with the decision taken by the Council in 1974 (Ertl, 2003).

Vocational education has been seen as an essential element for economic recovery in this context. It has been accepted as a result of the economic problems experienced in these years that general education and vocational education are directly related and inseparable whole at the same time (Ertl, 2003).

General education and vocational training were included together in the report titled "Community Policies in Education" prepared by Belgian Minister of Education Henri Janne in 1973 and also defined as "Janne Report". The fact that vocational education and general education are not considered as a whole is an important obstacle to the establishment of a Community common education policy according to the report. On the other hand, it was stated considering the link between economy and education that education should be included in EC policies in the following periods, and the importance of creating a European dimension in education was emphasized (Ertl, 2003). It was also stated that education policies should take into account the national education systems of the Member States and that national education systems and teaching methods should not be standardized (Sevinç, 1996).

The Education Ministers' Decision to establish cooperation in education in 1974 is one of the most important decisions of the EU on education. European cooperation in education is based on three fundamental principles. Social and economic policies in the EC should be harmonized, education should not only be seen as an element of economic improvement, but the traditions of each country should be taken into consideration in the field of education in this context. It was decided to create a joint action in areas such as providing efficiency in both cultural and vocational education, taking into account the issue of transparency in education systems in Europe, obtaining documentation and statistical data, increasing cooperation between higher education institutions, mutual recognition of diplomas by countries, allowing teachers, students and researchers to learn the language better by encouraging the circulation and creating equal opportunities for full access to various types of education at the same time (Ertl, 2003).

The Ministerial Decree of 1974 had been further expanded by 1976. The Community Education Action Program was adopted as a result of the studies carried out (Brock and Tulasiewicz, 2000). It was decided to establish an education committee by the education ministers in order to increase coordination in the field of education at the same time (Ertl, 2003). It is aimed to develop cooperation in the field of education between the Community Education Action Program and the education committee, and the Member States (Commission of the European Communities, 1993; Brock and Tulasiewicz, 2000). The Commission is empowered to explore options to facilitate the exchange of education experts and the transition from schools to labor markets with the 1976 Community Education Action Program. It is the first time that the Council of Ministers has taken a decision on education policy in the legal regulations that make the Community Education Action Program important. This action program has played an important role in the realization of many projects for education (Ertl, 2003).

However, it appears that the Community has limited authority in all educational activities despite all this. In particular, the legal infrastructure of educational activities was formed within the scope of the decisions interpreted by the European Court of Justice due to the unclear provisions of Article 128 of the Treaty of Rome. It has been stated in the decisions made by the European Court of Justice that the Community may adopt regulations binding Member States and that vocational education is very important for higher education. The Community has further increased its activities based on these decisions. The Council and Commission developed various programs and projects on education as a result of these decisions made by the Court of Justice in the 1980s. Especially the COMMENT program, which facilitates cooperation between universities and research institutions and then Erasmus, which was created to establish cooperation in the field of higher education, are some of these activities. PETRA, which also plays an important role in providing vocational training opportunities to young people by the Member States, is one of these programs. Programs, which were initiated especially in the mid-1980s, played an important role in recognizing professional qualifications as well as competencies. More than two hundred professions were recorded, and the characteristics of the professions and the professional conditions required for the award of diplomas were determined (Ertl, 2003).

Some revisions were carried out on the aforementioned programs within the scope of preliminary preparation for the Single European Market, which was introduced with the Single European Act in 1986 and then entered into force on 1 January 1993. There is a consensus that it is very important to focus on the issue of education among the Member States even though the issue of education is not directly mentioned in the Single European Charter (Ertl, 2003; Brock and Tulasiewicz, 2000). The duration of the programs was extended, the Comment and Erasmus programs started their second term in 1990, and the PETRA program started its second term in 1992 following the signing of the Single European Charter. At the same time, the FORCE program was prepared in the field of vocational education, and the implementation phase was started in 1990 (Funell and Müller, 1991). It was aimed to promote the circulation of labor, increase competition and create European citizenship with the revisions carried out on the programs (Özkılıç and Haspolatlı, 2008).

Some regulations were made in the field of education, and the unclear legal infrastructure in Community law was clarified in the 1970s and 1980s with the Maastricht Treaty. Vocational education and general education are clearly separated in Articles 126 and 127 of the Maastricht Treaty (Blitz, 2003).

Articles 126 and 127 are included under the titles of "Education, Vocational Education and Youth" of the Maastricht Treaty. The European Union has been limited to promoting cooperation between the Member States in general education, while it has gained more powers in vocational education in the Maastricht Treaty (Ertl, 2003).

Article 126 of the Maastricht Treaty states that the Community will support the work of the countries by respecting the language, culture, and education system differences of the Member States and contribute to the development of cooperation between the Member States. It is seen that the Community aims to implement a vocational education policy that supports the activities carried out by the Member States by taking into account the obligations of the Member States regarding the content and implementation methods of vocational education when Article 127 is examined (Karluk, 2005).

The EU is obliged to implement a vocational education policy that supports the activities of the Member States with the Maastricht Treaty, but the Member States' own laws and regulations are not obliged to directly comply with the decisions of the EU Council on the subject, and the implementation of education policies is left to the responsibility of the Member States (Tuzcu, 2006). However, it has been claimed that leaving the implementation of education policies to the responsibility of the Member States also constitutes an obstacle to the possibility of creating a European dimension in education and vocational education (Ertl, 2003).

The European Commission published the White Paper on "Growth, Competitiveness, and Employment" and the subject of education was at the heart of the Community's social, economic, and employment policies at the 1993 Brussels Summit, following the Maastricht Treaty. Meanwhile, it is clearly emphasized that general and vocational education is necessary to accelerate growth and transform it into employment (Charlier and Croche, 2005).

The European Union focused on programs such as Socrates, Leonardo Da Vinci and Youth for Europe in the post-Maastricht period (Economou, 2003). These programs included the objectives of creating collaborations between countries in the fields of education, vocational education, and youth, providing the opportunity to receive education in a different country, presenting and implementing education and training projects focusing on new approaches, and ensuring the recognition of professional qualifications between countries (Ertl, 2003). These programs also try to highlight the European dimension in education and vocational education. These programs, therefore, highlight the European dimension expressed in the Maastricht Treaty. However, the fact that the European dimension was not clearly defined in the Maastricht Treaty was seen as one of the biggest shortcomings. The concept of the European dimension has failed to affect the education systems of the Member States due to this deficiency (Ryba, 2000). The fact that education policies are seen as an important element in achieving economic objectives, in particular, has not changed with the Maastricht Treaty (Ertl, 2003).

The European Commission set two main objectives of its own working group in 1995. One of these goals is to work in accordance with the White Paper and to celebrate the European Year of Lifelong Learning, and the other is to produce ideas and work on the subject on its own initiative. It is aimed to protect employment by promoting European citizenship, competitiveness, to ensure social cohesion, to interact education and training in the information society, and to support education systems for individuals with these studies (Tuzcu, 2006).

The ministers responsible for the field of employment launched the European Employment Strategy at the Council meeting held in Luxembourg in 1997. Employment, entrepreneurship and equal opportunities were focused on with the European Employment Strategy and education were included in the employment policies of the Member States (Toprakçı, 2004).

The Bologna process was introduced in higher education with the 1998 Sorbonne Declaration and the 1999 Bologna Declaration. The Sorbonne Declaration focused on creating a common system for undergraduate and graduate students and increasing student and academic mobility (Fredriksson, 2003). Meanwhile, it was stated in the Sorbonne Declaration that universities are extremely important in the creation of the European higher education field and the cultural development of Europe, and therefore universities should act together in this regard (Tuzcu, 2006). It has also been emphasized that the creation of the European higher education field is very important in the mobility of individuals, employment and all developments. The Bologna Declaration was signed within the framework of the Sorbonne Declaration on June 19, 1999. European Education Ministers aimed to create a European higher education area by 2010 and to spread the European higher education system internationally with the Bologna Declaration (Charlier and Croche, 2005). Therefore, five main targets have been identified to be achieved by 2010. These include;

- Promoting the employment of European citizens and the global competitiveness of the European higher education system by creating an easily readable and comparable degree system with the application of the diploma supplement,
- Implementing a two-degree system that covers both undergraduate and graduate degrees and where the transition to the second degree will be possible after the successful completion of the three-year first-degree studies,
- Promoting student mobility by establishing the European Credit Transfer and Accumulation System (ECTS),
- Ensuring the mobility of students, teachers, researchers and also administrative personnel by eliminating obstacles to free movement,
- Encouraging the development of the European dimension in the field of higher education (Fredriksson, 2003).

Thus, it has been tried to create regional cooperation in which countries share their experiences by comparing higher education systems with other countries with the Bologna process and thus develop solutions to similar problems they have collectively experienced (Cankaya, Kutlu, and Cebeci, 2015). The most important feature of the Bologna process is that the country to be a member of the process does not have to be an EU Member State. Therefore, this feature of the Bologna process distinguishes it from other EU policies (Charlier and Croche, 2005).

The Lisbon Strategy presented to the Council of Europe aims to make the EU economy the most competitive, knowledge-oriented economy in the world with a sustainable growth capacity by 2010 at the Lisbon Summit held in March 2000. It was emphasized that there is a need for a knowledge-based society first (Köksal, Yıldırım and Özdemir, 2013), and education was seen as an integral element of economic and social policies in order to achieve these goals (Tuzcu, 2006). Therefore, the field of education has been included in the objectives set to revise EU policies with this strategy. The European Union has decided to make some transformations to become a pioneering economy in the global arena. It was aimed to place the economy on a knowledge-based basis in order to solve some problems in the economic field, to review macroeconomic policies to achieve the desired economic growth, to build a European Social Model in which people are at the center and to increase investments related to education in this context (Köksal, Yıldırım and Özdemir, 2013). Meanwhile, the Education Council was asked to determine its goals for the education system in parallel with the international competitive environment and developments in information technology (Mikl, 2003).

On March 3, 2010, the Europe 2020: A Strategy for Smart, Sustainable and Inclusive Growth report was published. The report aims to improve the quality of education and vocational education by emphasizing that initiatives in the field of education, vocational education and lifelong learning and employment opportunities of the young population should be increased within the scope of smart growth (Akbas and Apar, 2010).

In short, economic priorities have directed the EU towards education as previously stated, and education has been seen by the EU as an important tool for economic development. Thus, collaboration in the field of education has become a requirement (Tuzcu, 2006). However, the EU, which has the feature of being a supranational union, has not gone beyond showing a cooperative approach in the field of education even though it has binding regulations in many areas. The biggest reason for this is that it is very difficult for states with different education policies to bring their current education policies under a single policy with the law (Kısakürek, 2013). Therefore, the main objective of EU education policy is to promote a common understanding by providing cooperation and solidarity between the Member States and to develop a sense of Europeanness (Tuzcu, 2002).

Effect of Education Policy of the European Union on the Turkish Education System

It was observed that education was not included in the treaties and protocols, which are the legal basis of EU-Turkey relations, until Turkey achieved candidate state status (10-11 December 1999 Summit of Heads of State and Government of the European Union). The process of cooperation and harmonization with the EU in the field of education gained momentum on March 19, 2001, within the scope of the calendars and priorities set out in the National Program prepared by Turkey for the achievement of the objectives set out in the Accession Partnership Document dated March 8, 2001 (Köksal, Yıldırım, and Özdemir, 2013). Therefore, education has become a very important issue in terms of the progress of Turkey's EU full membership process and

increasing its competitiveness in the global field, and Turkey's EU full membership process has been an important opportunity and a driving force for education reform (Köksal, Yıldırım, and Özdemir, 2013). Turkey made serious revisions in this field to align its education system with the European Union education policies especially after 3 October 2005, when it was decided to start full membership negotiations with Turkey (Bağcı, 2011). All studies carried out by Turkey in different fields of education such as primary, secondary, higher education and lifelong learning within the scope of compliance with EU education policy in the process of full EU membership are also evaluated in the annual progress reports prepared by the EU to determine the developments of candidate states in fields such as education, energy and environment (Fredriksson, 2003). Below, it has been tried to evaluate how much progress Turkey has made in the studies it has carried out in the field of primary, secondary, higher education and lifelong learning within the scope of compliance with the EU education policy and in its annual progress reports.

Turkey's Primary Education Policies

The fact that the knowledge and skills acquired by the students in primary education constitute an infrastructure for the knowledge and skills to be acquired at other stages of the teaching process makes primary education one of the most important steps of the education process. Turkey, which is aware of this situation, carries out various studies in the field of primary education as well as in other educational processes, especially within the scope of compliance with EU education policy (Sağlam, Özüdoğru and Çıray, 2011a).

Compulsory education practice in the field of primary education, the history of which dates back many years, is an important issue that Turkey has focused on since the 1970s in many European countries. Making 8-year education compulsory in 1997 is an important step taken to close the education gap with developed countries, even though it is a very late decision, especially in Turkey, which is in the process of full EU membership (Şadioğlu, 2013; Gedikoğlu, 2005). However, it is seen that the compulsory education period extends to 9 years in these countries in EU Member States such as Greece, Denmark and France in 1998 and up to 12 years in EU countries such as Belgium, Germany and the Netherlands. Therefore, Turkey was still lagging behind the EU Member States even though it took an important step with its 8-year compulsory education decision (Gedikoğlu, 2005). The 4+4+4 system, which increases the compulsory education period from 8 years to 12 years and is a new approach for schools, entered into force in 2012 with a change made in the Turkish Education Law in the following processes, and some changes were introduced to the existing education system to include the right to choose between secondary schools, primary and vocational schools with this system, which entered into force in 2012 (European Commission, 2012). Meanwhile, the age of starting compulsory education was reduced from 84 months to 66 months with this system. However, the progress report published in 2013 revealed that the direct implementation of the system without reviewing the curriculum in this direction posed serious problems for beginners (European Commission, 2013). Therefore, the transition to this system without creating the necessary infrastructure has brought serious discussions (Şadioğlu, 2013; Gedikoğlu, 2005). In addition, it was stated in the 2013 progress report that the primary school (first four years) enrollment rate was 98.9%, and the secondary school (second four years) enrollment rate was 93.1% (European Commission, 2013). The schooling rate of primary school children increased to 99.6% and this rate to 94.5% for primary education according to the 2014 progress report (European Commission, 2014). Therefore, the transition to the 12-year compulsory education system played an important role in making progress in schooling rates.

It is seen that in the 2019 progress report, there was an improvement in the school enrollment rates of children in Turkey. The primary school enrollment rate increased from 91.2% in 2017 to 91.7% in 2018, but the secondary school enrollment rate decreased from 95.7% to 94.5% in the same period when primary school enrollment rates were examined (European Commission, 2019). It was observed in the 2020 progress report that net enrollment rates in primary education increased from 91.7% to 92.1% for girls and from 91.4% to 91.8% for boys in the 2018-2019 period compared to the 2017-2018 period. It is seen that the rate of secondary school enrollment for girls decreased from 94.7% to 93.6%, and this rate decreased from 94.3% to 92.9% for boys in the 2018-2019 education period when the rates of secondary school enrollment for girls and boys are examined compared to the 2017-2018 education period (European Commission, 2020).

In addition, Turkey has developed projects called 100% Support to Education and Hey Girls, Let's Go to School in order to mobilize the community's investment support in education and at the same time to encourage girls' participation in education during the process of full EU membership. There has been an increase in the number of schools and also in the rate of girls going to school with these projects (European Commission, 2009-2010).

Socrates Program, which aims to contribute to the development of quality in education by increasing cooperation between European countries in fields such as formal education, non-formal education, distance education and education of European languages and to strengthen the European dimension in education, has had a significant impact on primary education programs in Turkey (Duman, 2001; Kihtir, 2004). Some skills and abilities were given importance in education programs, especially in primary education programs, in order to ensure the adaptation of the new generation in Turkey to the information society (Sağlam, Özüdoğru and Çıray, 2011a). These skills, which are called verbal and mathematical skills such as basic competencies of science and technology, a different language learning, use of technology, creativity, entrepreneurship, research, critical thinking, social skills and which are included in education programs, are considered as the basic elements of the Turkish education system in this context and the system is exactly the same with EU countries (Kırkgöz, 2009).

Meanwhile, foreign language courses were given more place in education programs within the scope of EU foreign language education policies in Turkey, and it was decided to start foreign language education, which became a compulsory course in order

to realize effective foreign language learning in schools, from smaller classes (Sağlam, Özüdoğru and Çıray, 2011a). In addition, foreign language education programs in Turkey were revised in 2005, so regulations were made in terms of objectives, content, teaching, learning process and evaluation. Subject-based language learning such as geography, mathematics and music was tried to be provided, and foreign language lesson hours were increased in order to make foreign language education much more effective in the programs. A communicative approach was adopted in foreign language education, and teacher-oriented education in the old system was replaced by student-oriented education during the process of full EU membership. The role of teachers in the new system changed as a guide to the learning process, in other words, as a facilitator (Kırkgöz, 2009).

Turkey has made some initiatives to equip its schools with computer technologies in accordance with the information technology policies contained in the Lisbon Strategy, which aims to make the EU the most competitive, sustainable growth capacity in the world and knowledge-based economy by 2010. Accordingly, computer laboratories were established in primary and secondary schools in pilot provinces and teachers were trained in this regard (Bayrakçı, 2005).

Turkey's Secondary Education Policies

The main purpose of secondary education is to prepare students for the profession, business life and higher education in the process in line with their interests and abilities (Gediklioğlu, 2005). Turkey has made various arrangements in the field of secondary education with the projects it has carried out within the scope of compliance with EU education policy during the process of full EU membership. Turkey focused on activities such as increasing the rate of vocational and technical education, further developing general, vocational, and technical secondary education programs, restructuring vocational and technical secondary education programs in accordance with vocational standards and raising them to the standards of EU countries, creating a secondary education system where the vocational and technical secondary education process will be predominant, restructuring the existing general, the vocational and technical secondary education system in order to completely eliminate the obstacles to the information economy, which is among the objectives of Turkey in the EU full membership process, and attaching importance to the use of technology in education especially within the scope of the Secondary Education Project in 2001. The restructuring process in the field of secondary education was initiated in 2005, especially foreign language education was emphasized, and the EU Foreign Language Level system was adopted starting from primary education until the end of secondary education in this context. Thus, curricula and hours of the courses were arranged accordingly based on an interactive approach to make the foreign language available in daily life as in the EU Member States. In addition, increasing the education and training periods of general, vocational, and technical high schools, whose education and training periods are 3 years, to 4 years, and starting to teach common skills, computer promotion and guidance courses in general, vocational and technical secondary education institutions have also been among the important activities carried out in the restructuring process in the field of secondary education (Yıldırım, 2007).

It was mentioned in the 2007 progress report that Turkey actively participated in the vocational education field Leonardo da Vinci, Socrates, and youth programs in the field of general education, which the EU implemented to increase cooperation in the field of education between its own members and also the candidate states for the European Union (European Commission, 2008). The enrollment rate of male students in secondary education increased from 67.55% to 72.35% and this rate increased from 62.21% to 66.14% for female students, especially in secondary education compared to the previous year when the 2011 progress report is examined (European Commission, 2011). It was observed in the 2012 progress report that there was a 2.5% contraction in the gender imbalance in registration rates, especially in secondary education. However, the continued efforts to increase enrollment rates at all levels, especially for female students, indicate that effective intervention strategies used to reduce school dropouts are insufficient (European Commission, 2012). The fact that Turkey ranked at the end of the PISA test results, which are considered as Student Evaluation Program and attended by children aged 15 years, indicates that there is a serious problem in education quality in the 2019 progress report, while the secondary education enrollment rate increased from 82.5% in 2017 to 83.6% in 2018 (European Commission, 2019). The resources distributed irregularly among schools and inequalities in education opportunity continue to be a problem in Turkey in the field of education even though there was an increase in the 2018 PISA test results in the 2020 progress report compared to 2015 and 15.2 students per teacher in 2018, this rate slightly exceeded the average of the Organization for Economic Development and Cooperation, which was 13.1 in 2018 (European Commission, 2020).

Turkey's Higher Education Policies

Higher education institutions are institutions where the necessary information emerges in the development and progression of countries and at the same time human resources are trained. Universities play an important role in determining the future of nations for this reason. Meanwhile, higher education institutions have serious obligations in discussing various social and economic development, providing new information to individuals, and protecting them (Blacburn and Lawrence, 1995). It is also an undeniable fact that higher education institutions contribute to issues such as increasing social welfare and improving living conditions (Gedikoğlu, 2005).

Turkey's efforts to integrate with the European Higher Education Area started with its involvement in the Bologna process in 2001. Turkey has made important arrangements in the field of compulsory ECTS implementation in higher education institutions, making diplomas understandable (diploma appendix), quality in higher education, mobility of students as well as academics considering the implementation of the Bologna Process. Actions were taken as of the end of the 2005-2006 academic year in the applications for the diploma appendix. Meanwhile, studies such as internal quality assessment and strategic planning were carried

out for existing higher education institutions in Turkey. Erasmus program, which provides both student and academic mobility, was started in 2004 apart from these (European Commission, 2009-2010). The mobility under the Erasmus+ program increased from 9,391 in 2017 to 10,578 in 2018, especially according to the 2019 progress report (European Commission, 2019). This figure reached 12.816 in 2019 (European Commission, 2020).

It was also stated in the 2019 progress report that there are significant differences in quality among the 206 existing universities in Turkey, but significant progress has been made in the Bologna process (European Commission, 2019). It was also stated in the 2020 progress report that there are serious differences in quality between 209 universities as stated in the 2019 progress report, but Turkey is at an advanced level in implementing the Bologna process (European Commission, 2020). Meanwhile, the Quality Board for Higher Education, which was established to deal with Turkey's quality evaluation and assurance in the 2019 progress report, and an arrangement containing the procedures and principles for quality assurance management in Turkey's higher education system, which was published in addition to the management of the Quality Council in Higher Education in November 2018, were mentioned, but it was stated that this board still did not become a member of the European Union for Quality Assurance in Higher Education (European Commission, 2019). It was emphasized in the 2020 progress report that the reorganization of the Higher Education Quality Council increased its administrative and financial independence and that the Higher Education Quality Council became a national authority with the authority to supervise higher education institutions in Turkey independently. The Quality Council for Higher Education also became a member of the European Union for Quality Assurance in Higher Education in April 2020 (European Commission, 2020).

Turkey has also made some changes regarding foreign language learning at the higher education level within the scope of compliance with EU education policies during the process of full EU membership. A system called "Teaching English to Young Students" aimed at introducing foreign language learning characteristics of young students to new teacher candidates has been included in the program of the English Teaching Department in Education Faculties (Kırkgöz, 2009).

It is also emphasized in the 2019-2020 progress reports that Turkey's Professional Qualifications Institution continues to implement the national professional qualifications system and that the Professional Qualifications Institution, which is responsible for preparing national professional standards as well as national qualifications and authorizing certification bodies, has an obligation to implement the Turkish Qualifications Framework (European Commission, 2019).

The number of occupational standards published in the Official Gazette has reached 855, and 498 qualifications have been approved as of June 2020, according to the 2020 progress report. Meanwhile, it was observed that the number of certification bodies authorized in the reporting period reached 217, and the number of professional qualification certificates of the Professional Competence Authority reached 1,047,044. On the other hand, professional documents were made mandatory for those working in heavy and dangerous jobs, and the number of these documents was recorded as 143 in October 2019. Implementation of the Turkish Qualifications Framework is ongoing under the coordination of the Professional Qualifications Authority (European Commission, 2020).

It should be ensured that the principles and procedures related to quality assurance, compliance of qualifications, credit systems, the validity of non-formal, and free learning are fully implemented by Turkey even though the Turkish Qualifications Framework has been established in accordance with the scope of European qualifications. The implementation of the modular curriculum and credit module method, not the current class transition method, poses an important problem in the implementation of the Turkish Qualifications Framework in the field of formal vocational education and training. The amendment to the Law on Special Education, approved in May 2018, shows that the holders of certificates and holders of completed training certificates issued by special education institutions are on equal terms after the examination held in an accredited vocational qualification institution. Therefore, this negatively affects efforts to establish a professional qualifications system with quality assurance in Turkey (European Commission, 2020).

Turkey's Lifelong Learning Policies

It is aimed with lifelong learning to provide individuals with the opportunity to learn, to support their personal development, to strengthen their active citizenship with the aim of social integration, and to expand their fields of employment by improving their skills and capacities (Turan, 2005; Cansever, 2009). The EU has revealed smart, sustainable, inclusive growth targets based on employability and social solidarity especially considering the impact of globalization on economic and also social developments. For this reason, it has turned to lifelong learning policies covering all formal, free, and also, widespread learning styles (Urhan, 2020). Turkey has also started to attach more importance to lifelong learning and adult education issues within the scope of EU lifelong learning policies and has included practices for adult learning (Grundtvig) program, especially within the framework of Socrates (Lifelong Learning) program (Atik and Kürüm, 2007). Meanwhile, studies within the scope of lifelong learning in universities in Turkey have gained momentum, and these units with different names such as continuous education center, lifelong learning center, personal development center offer lifelong learning opportunities for employees within their own body and other people in the society (Sağlam, Çıray and Özüdoğru, 2011b).

It was emphasized considering the Articles 38, 537, 547, 555, and 657 of the Eleventh Development Plan that various, inclusive, and also qualified lifelong learning opportunities should be accessed in order to gain the skills needed due to technological developments and to further strengthen the human structure by increasing the competencies. Therefore, all of this has been an

indication that lifelong learning plays an important role in the economic, social, and individual development of individuals and is accepted by Turkey. Turkey's needs in this field and the measures to be taken are mentioned especially in the Lifelong Learning Strategy Document prepared by the Ministry of National Education. 2009-2013 Lifelong Learning Strategy and Action Plan Document aim to make access to quality learning that will strengthen the lifelong learning infrastructure easier whereas 2014-2018 Turkey Lifelong Learning Strategy includes six priorities: raising the culture of lifelong learning strategy and also awareness in society, providing access to lifelong learning opportunities, increasing lifelong learning opportunities and presentation, developing lifelong guidance and counseling service, developing the system of recognition of previous learning, and developing the lifelong learning monitoring and evaluation system (Urhan, 2020).

However, it was seen in the 2018 progress report that the participation rate of adults in lifelong learning in Turkey was 6% despite all the studies carried out by Turkey within the scope of lifelong learning and developments in this field (European Commission, 2018). Meanwhile, it is seen that the basic and intermediate level digital skills are 65% in the EU between the ages of 25 and 54, while this rate is 35% in Turkey when the basic and intermediate level digital skills data of 2017 are examined. Similarly, the digital skill rate in adults between 55-74 is 34% in the EU and 5% in Turkey. It is seen that Turkey lags behind the EU in terms of digital skills. Therefore, the concept and importance of lifelong learning are still not fully known in Turkey, and at the same time, the fact that these education and training activities are not mandatory causes the participation to be low even though emphasizing the importance of individuals' participation in learning activities throughout their lives, the gains to be achieved through non-formal and free education, the skills to be provided within the scope of vocational education and the education of adults in order to create mobility in the employment market, especially the services provided both in classrooms and digitally with e-learning resources through centers within the scope of lifelong learning institutions are gradually increasing. This shows that there is still no awareness in Turkish society that learning must continue throughout life for continuous development. Therefore, studies aimed at raising awareness on this issue should be further increased in order to establish continuous learning awareness in society. The establishment of this consciousness will cause more people to demand access to education and training activities. This will require more people to be offered much more qualified opportunities. The opportunities offered to more people, including disadvantaged people, depending on the dissemination and quality of educational activities to meet current requirements. Therefore, lifelong education activities should be successfully coordinated by covering local levels (Urhan, 2020).

CONCLUSION AND RECOMMENDATIONS

Education was seen as an important tool that would contribute to the development of economic integration and vocational education was focused on in line with the economic objectives in the EU, which was initially a Union established in line with economic objectives. EU, which is a supranational union, has shown a cooperative approach in the field of education even though it has binding regulations in many areas. In other words, all of the activities related to education were conducted with the interstate cooperation method. Developments in the international field led the EU to take further steps in the field of education in the following period. In particular, the EU is trying to establish partnerships in the field of education by taking into account the national education systems and implementation methods of the Member States. Therefore, it is aimed to ensure the adoption of a Europeanness consciousness by developing cooperation between EU education policy and the Member States.

It has been seen that the EU education policy is also very effective on the education system of Turkey, which is in the process of full EU membership. Turkey has to comply with EU education policy in the field of education within the framework of the criteria set by the EU for candidate countries and to develop education policies on the basis of EU education policy in this process. Turkey has made and continues to make important arrangements, especially at different levels of education such as primary, secondary, higher education, and lifelong learning in this context. Therefore, the EU full membership process has been an important opportunity and a driving force for Turkey's education reform.

Turkey has increased the number of schools and girls' school attendance rates with various projects it has developed within the scope of compliance with EU education policy, has placed more emphasis on foreign language courses in education programs, and has ensured that schools are equipped with technological tools and equipment in accordance with information technology policies in the Lisbon Strategy. Socrates Program, which aims to strengthen the European dimension, in particular, has had a significant impact on Turkey's primary education programs, and it has been prioritized to provide students with skills such as critical thinking and entrepreneurship in primary education programs in order for the new generation in Turkey to adapt to the information society. Meanwhile, Turkey took an important step in the field of primary education by putting the 4+4+4 system, which increases the compulsory education period from 8 years to 12 years, into force in 2012, and it was seen that there was an increase in primary education enrollment rates in 2019 and 2020. However, the direct implementation of the 4+4+4 system without creating the necessary infrastructure has brought some problems and discussions.

Turkey entered into a structuring process in the field of secondary education in 2005 within the scope of compliance with EU education policy. The EU Foreign Language Level system was taken as the basis starting from primary education until the end of secondary education and the course hours were arranged accordingly in this context. In addition, the education periods of general, vocational and technical high schools have been increased from 3 to 4 years. Leonardo da Vinci program in the field of vocational education in Turkey, Socrates program in the field of general education and youth programs have also received intensive participation. However, the fact that Turkey ranked at the end of the PISA test results attended by children aged 15 years despite

all these regulations in secondary education areas indicates that there is a serious problem in education quality. In addition, resources distributed irregularly among schools in Turkey and inequalities in education opportunities continue to be the main problems in the field of education.

It is seen that Turkey has also made important arrangements in the fields of higher education and lifelong learning within the scope of compliance with EU education policy. Turkey's education system has been influenced by EU programs such as Bologna, Erasmus, Grundtvig, and important studies have been carried out to implement these programs. It was observed that Turkey made significant progress in Bologna and Erasmus fields, carried out important studies on lifelong learning and adult education, while there were still significant differences in quality between universities in Turkey and the participation rate of adults in lifelong learning was fairly low, especially in the progress reports. The concept and importance of lifelong learning are still not fully known, especially in Turkey.

Turkey has made important arrangements at different levels of education such as primary, secondary, higher education, and lifelong learning within the scope of compliance with the EU, as can be seen. However, it seems that there are deficiencies in regulations even though some progress has been made in the field of education. Turkey is partially prepared within the scope of compliance with EU education policies, even though it has made progress in the field of education, especially in the 2020 progress report. Turkey must accurately identify the root causes of its problems in the field of education in order to achieve EU standards in the field of education fully. In particular, it should solve the main problems in the field of education, such as inequality of opportunity in education and resources distributed irregularly among schools by using its economic resources correctly. In addition, research and development studies should be implemented rapidly at all levels of education in order to educate individuals who can use today's technology, and EU policies on vocational and technical education should be taken into consideration more in order to adapt to EU education policies in the field of secondary education. Vocational and technical education systems of developed EU member states may be an important guide in this regard. Elimination of quality differences between universities in the field of higher education is another important issue that needs to be solved. Meanwhile, Turkey's efforts to raise awareness in this field should be further focused on in order to develop continuous education awareness in society.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author received no financial support for the research, author-ship, and/or publication of this article.

Statements of publication ethics

I hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

There is only one author of this article. Asst. Prof. Omca ALTIN is responsible for all of the work done for this article.

Ethics Committee Approval Information

The research is not an experimental study. The study is a literature review study. Therefore, ethics committee approval was not required.

REFERENCES

Akbas, G. ve Apar, A. (2010). *Avrupa 2020 stratejisi: Akıllı, sürdürülebilir ve kapsayıcı büyüme için Avrupa stratejisi.* https://www.ab.gov.tr/files/SBYPB/Sosyal%20Politika%20ve%20%C4%B0stihdam/avrupa_2020_stratejisi.pdf (2020, Şubat 3).

Atik, K., D. ve Kürüm, D. (2007). Sınıf öğretmeni adaylarının "yaşam boyu öğrenme" kavramına yükledikleri anlam (Anadolu Üniversitesi eğitim fakültesi örneği). 16. Ulusal Eğitim Bilimleri Kongresi'nde sunulan bildiri. Gaziosmanpaşa Üniversitesi, Tokat.

Avrupa Komisyonu (2008). *Türkiye 2008 ilerleme raporu*. https://www.ab.gov.tr/ilerleme-raporlari_46224.html (2020, Şubat 3).

Avrupa Komisyonu (2011). Komisyon tarafından Avrupa Parlamentosu'na ve Konsey'e sunulan bildirim. *2011 Yılı İlerleme Raporu.* https://www.ab.gov.tr/ilerleme-raporlari_46224.html, 3 Şubat 2020.

Avrupa Komisyonu (2012). Komisyon tarafından Avrupa Parlamentosu'na ve Konsey'e sunulan bildirim. *2012 Yılı İlerleme Raporu*. https://www.ab.gov.tr/files/AB_Iliskileri/AdaylikSureci/IlerlemeRaporlari/2012_ilerleme_raporu_tr.pdf (2020, Şubat 4).

Avrupa Komisyonu (2013). Komisyon tarafından Avrupa Parlamentosu'na ve Konsey'e sunulan bildirim. *2013 Yılı İlerleme Raporu*. https://www.ab.gov.tr/ilerleme-raporlari_46224.html, 4 Şubat 2020.

Avrupa Komisyonu (2014). *Komisyon tarafından Avrupa Parlamentosuna, Konseye, Avrupa Ekonomik ve Sosyal Komitesine ve Bölgeler Komitesine sunulan bildirim*. https://www.ab.gov.tr/ilerleme-raporlari_46224.html (2020, Şubat 4).

Avrupa Komisyonu (2019). Komisyon tarafından Avrupa Parlamentosuna, Konseye, Avrupa Ekonomik ve Sosyal Komitesine ve Bölgeler Komitesine sunulan bilgilendirme. AB genişleme politikasına ilişkin 2019 bilgilendirmesi. *2019 Türkiye Raporu.* https://www.ab.gov.tr/ilerleme-raporlari_46224.html (2020, Eylül 9).

Avrupa Komisyonu (2020). Komisyon tarafından Avrupa Parlamentosuna, Konseye, Avrupa Ekonomik ve Sosyal Komitesine ve Bölgeler Komitesine sunulan Komisyon bilgilendirmesi. *2020 Türkiye Raporu.* https://www.ab.gov.tr/ilerleme-raporlari_46224.html (2020, Şubat 1)

Aygül, E. ve Güvemli, B. (2005). AB-Türkiye ilişkisinde gelinen nokta: Müzakere tarihinin verilmesi ve müzakere konuları. *Muhasebe ve Finansman Dergisi*, 25, 207-211.

Bağcı, E. (2011). Avrupa Birliği'ne üyelik sürecinde Türkiye'de yaşam boyu eğitim politikaları. *Ondokuz Mayıs Üniversitesi Eğitim Fakültesi Dergisi*, 30(2), 139-173.

Bayrakcı, M. (2005). *Avrupa Birliği ve Türkiye eğitim politikalarında bilgi ve iletişim teknolojileri ve mevcut uygulamalar*. http://dhgm.meb.gov.tr/yayimlar/dergiler/Milli_Egitim_Dergisi/167/index3-bayrakci.htm (2020, Eylül 9).

Blackburn, R. T. ve Lawrence J. H. (1995). *Faculty at work*. Baltimore and London: The Johns Hopkins University Press.

Blitz, K., B. (2003). From Monnet to Delors: Educational cooperation in the European Union. *Contemporary European History*,197-212.

Brine, J. (1995). Educational and vocational policy and construction of The European Union. *International Studies in the Sociology of Education*, 5(2), 145-163.

Brock, C. and Tulasiewicz, W. (2000). *Education in a single Europe (2nd Ed.).* London: Routledge.

Can, H., Balkır, C., Tonus, Ö. vd. (2013). *Avrupa Birliği ve Türkiye ilişkileri.* Eskişehir: T.C. Anadolu Üniversitesi Yayını.

Cansever, A. B. (2009). Avrupa Birliği eğitim politikaları ve Türkiye'nin bu politikalara uyum sürecinin değerlendirilmesi. *International Online Journal of Educational Sciences*, 1(1), 222-232.

Charlier, J., E. and Croche, S. (2005). How European integration is eroding national control ver education planning and policy. *European Education*, 37(4), 7-21.

Cankaya, S., Kutlu, Ö. ve Cebeci, E. (2015). The educational policy of European Union. *Social and Behavioral Sciences*, 174, 886-893.

Commission of the European Communities. (1993). *Green paper on the European dimension of education*. https://op.europa.eu/en/publication-detail/-/publication/ca1f0e1a-7e3c-4093-ac92-b5ffd0c38082 (2020, Eylül 9).

Çelebi, N. (2007). Avrupa Birliği eğitim politikalarının tarihçesi. *Avrupa Araştırmaları Dergisi*, 15(2), 59-89.

Denac, O., Cagran,B., Denac, J. and Sicherl, Kafol, B. (2011). Arts and cultural education in Slovenian primary schools. *The New Educational Review*, 24, 121-132.

Duman, A. (1991). Avrupa Birliği, Türkiye ve eğitim. *Mülkiye Dergisi*, 26(223), 191-207.

Duman, T. (2001). *Avrupa Birliği programları "Sokrates programı".* https://dhgm.meb.gov.tr/yayimlar/dergiler/Milli_Egitim_Dergisi/149/duman.htm (2020, Eylül 9).

Economou, A. (2003). Comparative study of the European dimension in education in England, Scotland and Wales. In Phillips, D. and Ertl, H., (Eds.), *Implementing European Union Education and Training Policy : A Comparative Study of Issues in Four Member States* (pp.117-126). Netherlands: Springer.

European Commission.(2009-2010). *Türk eğitim sisteminin örgütlenmesi*. http://www.edchreturkey-eu.coe.int/Source/Resources/ORGANISATION_OF_THE_EDUCATION_SYSTEM_IN_TURKEY_TU.pdf (2020, Eylül 9).

Ertl, H. (2003). The European Union and education and training: An overview of policies and initiatives. In Phillips, D. and Ertl, H., (Eds.), *Implementing European Union Education and Training Policy : A Comparative Study of Issues in Four Member States (pp.13-39).* Netherlands: Springer.

Fredriksson, U. (2003). Changes of education policies within the European Union in the light of globalization. *European Educational Research Journal*, 2(4), 522-546.

Funell, P. and Müller, J.,D. (1991). *Vocational education and the challenge of Europe: New developments in vocational education*. London: Kogan Page.

Gedikoğu, T. (2005). Avrupa Birliği sürecinde Türk eğitim sistemi: Sorunlar ve çözüm önerileri. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, 1(1), 66-80.

Göksoy, S. (2013). Türkiye ve Avrupa Birliği ülkelerinde zorunlu eğitim uygulamaları. *Asya Öğretim Dergisi*, 1(1), 30-41.

Hoggart, R.and Johnson, D. (1987). *An idea of Europe*. London: Chatto&Windus.

Karasar, N. (2005). *Bilimsel Araştırma Yöntemi*. Ankara: Nobel Yayın Dağıtım.

Karluk, R. (2005). *Avrupa Birliği ve Türkiye*. İstanbul: Beta Basım Yayım.

Kırkgöz, Y. (2009). Globalization and english language policy at primary education in Turkey. *English as an International Language Journal*, 5, 176-181.

Kısakürek, M., A. (2003). Avrupa Birliği ve eğitim. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Yayınları*, 129, 9-29.

Kihtir, A. (2004). *Avrupa Birliği'nin eğitim politikası*. İstanbul: İstanbul Üniversitesi İletişim Fakültesi Yayınları.

Klauss, S. (2000). European Parliament in the EU external relations: The customs union with Turkey. *European Foreign Affairs Review*, 5(2), 215–237.

Köksal, O., Yıldırım, T. ve Özdemir, O. (2013). The reflection of the educational policies of the European Union to Turkish education system in terms of Turkey- European Union integration. *Middle-East Journal of Scientific Research*,18(6), 803-809.

Mikl J. (2003). The Education Council report 2001—an evaluation based on the ATEE-RDC19 scenarios. *European Journal of Teacher Education*, 26(1), 47-61.

Özkılıç, R. ve Haspolatlı, E. (2008). Türkiye'nin Avrupa Birliği eğitim programlarına katılım süreci. *Eğitim Fakültesi Dergisi*, XXI(1), 151-172.

Özyılmaz, Ö. (2013). *Türk Milli Eğitim Sisteminin Sorunları ve Çözüm Arayışları. (4.baskı).* Ankara: Pegem Akademi.

Phillips, D. and Ertl, H. (2003). *Implementing European Union education and training policy: A comparative study of issues in four member states (2nd Ed.).* Netherlands: Springer.

Ryba, R. (1992). Toward a European dimension in education. Intention and Reality in European community policy and practice. *Comperative Education Review,* 36(1), 10-24.

Sağlam, M., Çıray, F. ve Özüdoğru, F. (2011a). Avrupa Birliği eğitim politikaları ve Türk eğitim sistemine etkileri. *Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi*, 8(1), 87-109.

Sağlam, M., Çıray, F. ve Özüdoğru, F. (2011b). Türkiye'deki üniversitelerin sundukları yaşam boyu öğrenme uygulamaları ve olanaklarının incelenmesi. 3. Uluslararası Eğitim Bilimleri Kongresi'nde sunulan bildiri. Doğu Akdeniz Üniversitesi, Gazimağusa.

Sevinç, D. (1996). *Avrupa Birliğinde eğitim politikaları ve eğitim politikaları açısından Türkiye-Avrupa Birliği ilişkileri.* Ankara: Eğitim Ana Planı Destek Raporu.

Sözen S. and Shaw I. (2003). Turkey and the European Union: Modernizing a traditional state. *Social Policy and Administration*, 37(2), 108-120.

Şadioğlu, Ç., N. (2013). Avrupa Birliği müzakere sürecinde Türk eğitim ve kültür siteminin literatür açısından değerlendirilmesi. *Akademik Bakış Dergisi*, 37, 1-20.

Tekeli, İ ve İlkin, S. (2000). *Türkiye ve Avrupa Birliği III.* İstanbul: Ümit Yayıncılık.

Toprakçı, E. (2004). The European Union action programme in the area of education: A comparative analysis. *Eğitim ve Bilim*, 29(131), 83-92.

Turan, S. (2005). Öğrenen toplumlara doğru Avrupa Birliği eğitim politikalarında yaşam boyu öğrenme. *Ankara Avrupa Çalışmaları Dergisi*, 5(1), 87-98.

Tuzcu, G. (2002). *Avrupa Birliği'ne giriş sürecinde Türk eğitiminin planlanması.* https://dhgm.meb.gov.tr/yayimlar/dergiler/Milli_Egitim_Dergisi/155-156/tuzcu.htm (2020, Eylül 9).

Tuzcu, G. (2006). *Eğitimde vizyon 2023 ve Avrupa Birliği'ne giriş süreci.* http://portal.ted.org.tr/yayinlar/EgitimdeVizyon2023veAvrupaBirligineGirisSureci.PDF (2020, Eylül 9).

Urhan, N. (2020). Hayat boyu öğrenme: Avrupa Birliği ve Türkiye karşılaştırması. *Çalışma İlişkileri Dergisi*, 1, 18-45.

Yıldırım, Y. (2007). Türk eğitim siteminin Avrupa Birliği eğitim politikalarına uyumu (Yayımlanmamış yüksek lisans tezi). Fırat Üniversitesi, Elazığ.
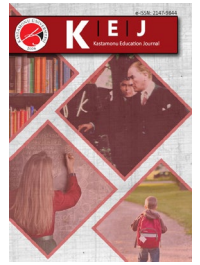
The Prevalence of Problematic Mobile Phone Use amongst EFL Learners in Turkey

İngilizce'yi Yabancı Dil Olarak Öğrenenler Arasında Problemli Cep Telefonu Kullanımının Yaygınlığı[1]

Omer Ozer[2]

Abstract

Purpose: Despite the many benefits attributed to mobile phones in nearly all aspects of everyday life, concern over the problematic use of these smart devices has grown. This study investigates the prevalence of problematic mobile phone use in a sample of Turkish undergraduate EFL learners. Additionally, it verifies whether this particular assessment was equally applicable to male and female students in different age groups.

Design/Methodology/Approach: Problematic mobile phone use was assessed using a mobile phone addiction scale. After employing non-random convenience sampling, 267 students responded to the survey.

Findings: The results showed that neither age nor gender had a significant effect on mobile phone addiction levels. In this study, the prevalence of problematic mobile phone use was 5.2 per cent.

Highlights: Furthermore, the prevalence of problematic and at-risk mobile phone users constituted 19.8% of the study population and an overwhelming majority of the problematic mobile phone users were females, which indicated that they could potentially be considered as addicted to mobile phones. The implications of these findings for classroom practices and for the more inclusive language-learning environment are discussed.

Öz

Çalışmanın amacı: Cep telefonlarının yaşamın hemen hemen her alanındaki atfedilen yararlarına karşın, bu akıllı cihazların sorunlu kullanımlarına ilişkin kaygılar giderek artmaktadır. Bu çalışma sorunlu cep telefonu kullanımının yaygınlığını, İngilizce'yi yabancı dil olarak öğrenen Türk üniversite öğrencileri üzerinde incelemektedir. Buna ek olarak, bu çalışma sonucunda tespit edilen sorunlu cep telefonu kullanımının öğrencilerin yaş ve cinsiyetlerine göre farklılık gösterip göstermediği araştırılmaktadır.

Materyal ve Yöntem: Sorunlu cep telefonu kullanımı, cep telefonu bağımlılığı ölçeği aracılığıyla ölçülmüştür. Tesadüfi olmayan, kolayda örnekleme yöntemiyle çalışmaya 267 öğrenci dahil olmuştur.

Bulgular: Çalışmanın sonuçları cinsiyet ve yaş değişkenlerine göre cep telefonu bağımlılığının anlamlı bir farklılık göstermediğini ortaya koymuştur. Çalışmada, sadece problemli kullanıcı olarak sınıflandırılan öğrencilerin yaygınlığı %5,2 olarak hesaplanmıştır.

Önemli Vurgular: Sorunlu cep telefonu kullanma davranışları gözlenen öğrencilerin örneklemin %19,8'ine denk geldiği, büyük bir çoğunluğunu kadınların oluşturduğu ve bu kullanıcıların potansiyel cep telefonu bağımlısı olarak değerlendirilebilecekleri sonucuna ulaşılmıştır. Araştırmanın bulguları ışığında sınıf ortamı için bazı çıkarımlarda bulunulmuş ve yabancı dil öğrenme çevresinin herkes için kapsayıcı olması için öneriler geliştirilmiştir.

INTRODUCTION

In the information age in which we live, mobile phones are an integral part of our daily life. In recent years, the world has witnessed a dramatic rise in the ownership and use of smartphones and this reality has clearly brought as many challenges as opportunities for users of all ages. There are many benefits which mobile phone users get from the built-in capabilities of the phones and from the many applications which these smart devices can support (Winskel et al., 2019). The reported benefits which users receive, when taken to excess, might lead to problematic behaviour or even to behavioural addiction (Griffiths, 2008). Doing something excessively for a long period of time does not necessarily equate to addictive activity; some activities lead to healthy outcomes and do not cause health problems whereas others can impair the quality of life (Griffiths, 2005). Even though scholars accept that excessive behaviour and addiction are two different things, caution might be necessary when the behaviours are related to video games (Griffiths & Meredith, 2009), internet use (Griffiths, 2018) or mobile phones in general (Chen, 2020; Laurence et al., 2020). There is an ongoing discussion about whether internet addiction in a general sense and mobile phone addiction in particular are really addictions or whether this is simply a misnomer (Csibi et al., 2109; Griffiths, 2019; Panova & Carbonell, 2018). When the Diagnostic and Statistical Manual of Mental Disorders was published in 2013, it was quickly noticed that one of the categories had been renamed 'Substance-Related and Addictive Disorders'. This category included two sub-divisions, one of which was non-substance-related disorders, which is commonly associated with behavioural addiction (Kardefelt-Winther et al., 2017). However, as Potenza (2014) put it, "Debate on how best to define which disorders constitute addictions remains" (p. 2). The previous literature suggests that any new behavioural addiction is expected to compare with substance-related addictions in terms of symptoms. That is, criteria such as psychological distress and a departure from normative behaviour are indicators of a new addiction. Similarly, changes in mood, anxiety and craving might also be expected to be observed when people experience smartphone abstinence (Kardefelt-Winther et al., 2017). If it is the case that smartphone abstinence causes all three of these symptoms, then there might be a need for further discussion about whether to consider it as a separate behavioural addiction (Wilcockson et al., 2019). Marlatt (1987) defined craving as a subjective experience which causes an individual to "anticipate, expect and desire the effects of a given activity that has yet to occur" (p. 43). According to Skinner and Aubin (2010), craving typically prompts a strong motivation in the individual, similar to an obsession, to do what is believed to be necessary to relieve it. The issue of how similar behavioural and substance addictions are will clearly be a matter for debate for a considerable time (Kardefelt-Winther et al., 2017).

Literature Review

Mobile phones have not only dramatically changed the way we interact but also the way we learn and our habits because these devices are not simple telecommunications devices anymore but handheld computers. Users can now access the information which they are looking for anytime and anywhere (Chen, 2020; Seemiller & Stover, 2017). This has led researchers from various fields to look into the effect of mobile phones on improving learners' productivity and learning performance. Foreign-language learning is one of the contexts in which scholars have been seeking evidence that mobile phones in general or specific mobile apps lead to an increase or a decrease in student learning (Chen, 2020; Klimova, 2018; Ozer & Kılıç, 2018; Seemiller & Stover, 2017). Even though, mobile phones can be actively used to support foreign language learning inside and outside the classroom, studies also report problematic use of mobile phones based on adverse consequences experienced by individuals. Problematic mobile phone use is an emerging problem for many users and a new term that is defined as the inability to keep mobile phone use time under control despite negative consequences on the users (Billieux et al., 2015; Cha & Seo, 2018). Even though excessive use of smartphone might be an indicator of problematic mobile phone use, not all excessive mobile phone users are problematic users (Billieux et al., 2015). A considerable number of people use their phones to connect to internet and run apps in order to increase their productivity. Problematic mobile phone use, on the other hand, is associated with a number of serious issues from mental distraction (Divan et al., 2012) to depression (Xie et al., 2019). Studies exploring the prevalence of problematic mobile phone use by user categories are limited (De-Sola et al., 2017a; Nahas et al., 2018; Sohn et al., 2019; Yang et al., 2019), and almost non-existent particularly amongst EFL learners at the tertiary level (Sanal & Ozer, 2017). Despite the many benefits attributed to mobile phones in nearly all aspects of everyday life, concern over the problematic use of these smart devices has grown.

Problematic Mobile Phone Use in Relation to Age and Gender

Before problematic behaviours form into behavioural addictions, they are typically signalled by an urge or craving (Grant et al., 2010). A small but growing body of research is focusing on cravings related to problematic mobile phone use. De-Sola et al. (2017a) found higher levels of craving in participants up to 35 years of age and that the level of craving decreased in individuals after that age. Ozer and Ozer (2018) investigated craving in a sample of 680 people between 18 and 65 years of age and found that the 18-to-25-year-olds were the group with the highest levels of craving. Savci and Griffiths (2019) developed a unidimensional Social Media Craving Scale by sampling 423 university students in Turkey. Wilcockson et al. (2019) found that smartphone abstinence could lead to craving. A vast amount of research across the globe has focused on populations of adolescents and university students and the researchers have consistently found that adolescents, in comparison with adults, are reportedly more vulnerable to problematic mobile phone use (Billieux et al., 2015; De-Sola et al., 2019; Fischer-Grote et al., 2019; Kim et al., 2012; Kuss et al., 2018; Sanal & Ozer, 2017; Savci & Griffiths, 2019; Smetaniuk, 2014). De-Sola et al. (2019) examined

the patterns and differences of mobile phone use based on habitual use, abuse and problematic use in a Spanish population and found that age was a vulnerability factor especially among young people aged between 16 and 25. It has recently been accepted that problematic mobile phone use affects a wider proportion of the adult population than was previously thought (De-Sola et al., 2017a; De-Sola et al., 2017b).

The previous literature has reported that, generally, females tended to report higher scores on the scales of smartphone addiction or problematic mobile phone use (Choi, et al., 2015; Khoury et al., 2019; Nahas et al., 2018; Vally & El Hichami, 2019). Fischer-Grote et al. (2019) carried out an overview of studies focusing on risk factors predicting problematic smartphone use and concluded that female adolescents appeared to be prone to a higher smartphone addiction risk than male adolescents. In another study, Jeong et al. (2019) found that the number of females who were addicted to smartphones was twice that of males in a sample of 768 Korean adolescents.

Problematic Mobile Phone use in Foreign-language Learning Contexts

Despite accumulating evidence that smartphone use could become problematic and could lead to negative consequences among university students and in particular students learning English as a foreign language, its prevalence remains a matter of much debate (Billieux et al., 2015). There is a large body of research addressing the question of how to improve EFL learners' academic performance. In particular, EFL learners' academic performance in preparatory-year English language programmes (PYP) in Turkish universities has been extensively examined (Adıgüzel & Özdoğru, 2017; Cakıcı, 2016; Ozer & Kılıç, 2018) but still remains a subject of study by different variables and in terms of the counterparts' perspectives. A wide variety of learning-related variables such as foreign-language classroom anxiety (Akpur, 2017), self-efficacy (Kesen et al., 2019), cognitive load (Ozer & Kılıç, 2018) and learning strategies (Sahin-Kızıl & Savran, 2016) have been associated with an increase or a decline in the academic performance of PYP students in Turkey. Although a plethora of studies has examined the many effects of these variables on foreign-language learning, there has been a growing body of literature regarding smartphone addiction, problematic mobile phone use and their impact on student learning over the last two decades (Laurence et al., 2020; Vally & El Hichami, 2019; Yang et al., 2019). Even though there are three recent studies investigating smartphone addiction in the Turkish educational contexts, their participants were secondary or high school students (Gezgin et al., 2018; Kara et al., 2019; Yildiz Durak, 2019). It is worth noting that smartphones together with other mobile devices and the use of these devices for school-related purposes have been of vital importance on account of the increased need for distance learning required for the purposes of social isolation during the COVID-19 pandemic (Ng et al., 2020).

Whereas the recent literature indicates both positive and negative effects of smartphones, the present study focuses on problematic mobile phone use in order to be able to determine and interpret smartphone use as a risk factor among a sample of PYP students. Several studies have shown that problematic mobile phone use can lead to addiction and, in some cases, could lead some people to lose their self-direction. Despite accumulating evidence that some behaviours can pose some threats to mobile phone users, there is still a need for research which investigate which behaviours lead to negative consequences (Billieux et al., 2015; De-Sola et al., 2017a; Grant et al., 2010). Interestingly, prevalence studies carried out in the Turkish context are still rare and have produced heterogeneous results of problematic mobile phone use in different age groups (Durak & Seferoğlu, 2018; Gül et al., 2019; Yildirim *et al*., 2016). This heterogeneity results partly from the employed scales and the lack of a firm theoretical background. As reported in the literature, problematic mobile phone use can lead to some situations in which the individuals engage in some behaviours, such as losing control and an intense desire for mobile phone (De-Sola et al., 2017a; Wilcockson et al., 2019), and this sorts of behaviours can be very similar to those observed in other cases of addiction. The concept of craving has turned out to be crucial as a diagnostic criterion in the explanation of a potential addiction (American Psychiatric Association, 2013; De-Sola et al., 2017a). This is the main reason why the current study was conducted using the Mobile Phone Addiction Craving Scale (MPACS). If the occurrence of problematic mobile phone use is frequent, there might be a negative association between problematic mobile phone use and academic performance. This study was therefore designed to investigate the prevalence of problematic mobile phone use in a sample of Turkish undergraduate EFL learners; specifically, to assess problematic mobile phone addiction among EFL learners in a state university in Turkey. Additionally, it sought to verify whether this assessment was equally applicable to the students in relation to gender and age. Given the conceptual understandings of the role which problematic mobile phone use plays in academic settings as reported in various studies using samples of undergraduate students from various academic majors (Calderwood et al., 2014; Sanal & Ozer, 2017; Vally & El Hichami, 2019; Winskel et al., 2019), this study using a comparative, quantitative research design was guided by the following research questions:

RQ_1: Are there significant differences among EFL learners' scores on the Mobile Phone Addiction Craving Scale in relation to gender and age?

RQ_2: How are students categorised in relation to the risk of problematic mobile phone use using the cut-off scores?

METHODS

This study was conducted at a medium-size state university in the south of Turkey and employed a quantitative-based cross-sectional design. The data to assess the prevalence and categorisation of mobile phone addiction were collected through self-report.

Participants

Even though previous research shows that younger people are more often associated with excessive mobile phone usage (Lopez-Fernandez *et al.*, 2014; Sohn et al., 2019), the need for investigating further to determine which usage is excessive and which one is problematic has grown in importance. A review of the literature demonstrates that problematic mobile phone use is related with academic performance, but the prevalence of problematic mobile phone use among foreign language learners is still under-researched. Therefore, to investigate this matter further a large number of EFL students were invited to fill out the survey. A total of 270 students responded to the survey. The data belonging to one respondent aged 37 and to two more respondents were excluded due to incomplete information. Therefore, complete data were available for 267 post-secondary students (121 females and 146 males) who were enrolled in PYP classes at a state university in the south of Turkey. The majority of the sample were male (54.7%) with an overall age range between 18 and 35 years. The 18-25-year-olds were 218 respondents (81.6%), whereas there were 49 respondents in the 26-35 age group (18.4%). A non-random method of convenience sampling was used to recruit the participants in an attempt to ensure greater representativeness of the population by reaching a larger sample. The only inclusion criterion for the study was ownership of a smartphone, but students who were younger than 18 years of age were also excluded.

Materials

The survey tool used in this study was the Turkish version of MPACS (hereafter the MPACS-TR) which had been developed to be used to assess problematic mobile phone use by measuring craving (De-Sola et al., 2017a). The MPACS is a unidimensional scale with eight Likert-type items; respondents rate their degree of restlessness on a response range from 1 ('not at all') to 10 ('too much') which they would feel in situations in which their mobile phones were not immediately available. Ozer and Ozer (2018) had previously adapted the MPACS for use with Turkish samples. Internal consistency for the MPACS-TR was high (α = 0.88) in the original study. In the present study, internal consistency reliability was assessed and the Cronbach's alpha results indicated good internal consistency (0.869) for the scale (George & Mallery, 2011). The scale used in the current study was chosen because it contributes to the quality of answers as it includes only eight items to assess mobile phone addiction based on craving as a key aspect of potential behavioural addictions.

Data Collection

Participation was voluntary and the study took place at the beginning of the spring term in 2019. The respondents took approximately two minutes to complete the questionnaire. The researcher visited the classrooms to deliver the questionnaires, but since some of the respondents preferred to complete the questionnaire online, they were sent an e-mail including the link to access the survey. The informed consent form was either read by the researcher in each classroom environment for the participating students or was provided online to the students who participated in the study via GoogleDocs. The survey was administered in Turkish. All of the procedures carried out in this study which involved human participants were performed in accordance with the ethical standards of the selected university's Research Ethics Board (Reference number: E.6260).

Statistical Analyses

First, the normality distribution of the MPACS-TR scores was tested using Kolmogorov-Smirnov and analysing skewness and kurtosis. Respondents' characteristics were presented using means and standard deviations, percentages, medians, and minimum and maximum values. Gender comparisons were performed using t-tests. Statistical significance was assumed at $p < 0.05$. The data were then entered into IBM SPSS Statistics 20 and analysed.

FINDINGS

The principal aim of this study was to investigate the prevalence of problematic mobile phone use in a sample of EFL learners in a university setting in Turkey. Descriptive data for the MPACS-TR are presented in Table 1.

Table 1. Mean scores for mobile phone addiction craving (*n* = 267)

Item	*M*	*SD*
1. If I wanted to turn it on right now and could not or would not be allowed to	4.75	2.53
2. If, at this very moment, I found myself out of battery or without coverage	5.49	2.77
3. If, at this very moment, I should be forced to turn it off because I was at the movies or at work	2.90	2.15
4. If, at this very moment, I realized that I left it at home	7.15	2.58
5. If, at this very moment, I could not or if they did not let me reply to a message	4.56	2.64
6. If I was with people at the moment I was using it and it did not work for me	4.88	2.87
7. If I was in a place or a situation in which I always used it and no longer could	5.40	2.58
8. If, at this very moment, I was restless and needed to relax and did not have it available	5.52	2.76

The means of individual items ranged from 2.90 to 7.15, with an overall mean of 5.16 in the study sample. A reliability test of the MPACS yielded a Cronbach's alpha of 0.87. The items presented the respondents with some hypothetical situations in which their mobile phones were not immediately available. Among the items measuring the respondents' degree of restlessness in the given situations, the item with the highest mean score referred to the statement 'If, at this very moment, I realized that I left it at home'.

In an attempt to answer the first research question, the means of students obtained from the MPACS-TR were measured to determine whether there was a difference in their problematic mobile phone use in relation to gender and age.

Table 2. Means, standard deviations and gender/age comparisons (t-tests)

Gender Comparisons					
Female (*n* = 121)		Male (*n* = 146)			
M	*SD*	*M*	*SD*	*T*	*p*
5.29	2.01	5.05	1.82	.989	.279
Age Comparisons					
18-25 years (*n* = 218)		26-35 years (*n* = 49)			
M	*SD*	*M*	*SD*	*T*	*p*
5.26	1.90	4.72	1.87	1.803	.887

An independent samples t-test showed that the MPACS-TR scores were not significantly different with regard to gender; t(265)=.989, *p* = .279). Levene's test showed equal variances (*F* = 1.178, *p* = .279). For the age comparisons, an independent samples t-test showed that the MPACS-TR scores were not significantly different with regard to age group; t(265) = 1.803, *p* = .887). Levene's test showed equal variances (*F* = .020, *p* = .887).

In the original study of De-Sola et al. (2017a), they followed the criteria based on the percentiles which had been developed by Chow et al. (2008) and categorised users under four categories, namely casual, habitual or regular, at-risk and problematic. The MPACS-TR user categories cut-off scores for the Turkish context was calculated by Ozer and Ozer (2018). A total of 21 or a lower score corresponds to the cut-off of casual users; a score from 22 to 54 is the range of regular users; 55-66 corresponds to the cut-off of at-risk users, whereas a score of 67 and above indicates problematic cell phone use and possible addiction.

Table 3. Prevalence by user categories

User categories	N	M	SD	Median	Minimum	Maximum	%
Casual	28	15.86	4.21	16.50	8	21	10.5
Habitual or regular	186	38.25	9.22	39.00	22	54	69.7
At-risk	39	59.64	3.53	59.00	55	66	14.6
Problematic	14	69.64	1.69	69.50	67	72	5.2

Mobile phone users were categorised based on the criteria originally developed by Chow *et al.* (2009) and later adapted by De-Sola *et al.* (2017a) and Ozer and Ozer (2018) and the total of four categories were thus identified. The prevalence of problematic and at-risk mobile phone users made up 19.8% of the study population, of whom 14.6% were at-risk users and 5.2% were problematic users who could be considered as having a mobile phone addiction. The distribution of gender across the user categories showed that 78.6% (*n* = 11) of the users were female as opposed to three males (21.4%) out of fourteen problematic mobile phone users in total.

DISCUSSION

The results of this study add to the existing literature on mobile phone addictions by reporting and discussing the prevalence of at-risk and problematic mobile phone users among post-secondary students in Turkey as well as making gender and age comparisons within the sample. With regard to the examination of the effect of independent variables on the dependent variables, some findings should be noted.

Even though the female respondents scored higher than the males on the means of the MPACS-TR, the difference was not statistically significant. Therefore, the finding on gender does not concur with those of De-Sola *et al.* (2019), Fischer-Grote *et al.* (2019), Khoury *et al.* (2019), Kim *et al.* (2016), Laurence *et al.* (2020) or Oviedo-Trespalacios *et al.* (2019) in all of which female users had significantly higher smartphone addiction scores. In the Turkish context, Ozer (2020) found that a female undergraduate-students group had statistically higher means on the smartphone addiction scale.

The findings did not show any significant differences among the respondents in the 18-25 and 26-35 age groups. Although the youngest age group reported higher levels of problematic mobile phone use, this difference was also not statistically significant, so this finding is incongruent with those of previous studies which reported an increasing trend for problematic mobile phone use as age increases (De-Sola *et al.*, 2019; Oviedo-Trespalacios *et al.*, 2019). Similarly, Khoury *et al.* (2019) found that the 18-25 age group was a predictor of smartphone addiction in a sample of undergraduate students in Brazil. In a study in Spain conducted by

de-Sola *et al.* (2017a), the 16-25 age group was found to have the highest mean scores, followed by the 26-35, 36-45 and 46-55 age groups respectively. That finding indicated a potential vulnerability of those with the highest means to mobile phone addiction.

In addition, the sum of all eight items was used to calculate an MPACS-TR for each participant and thus to determine the user categories as 'casual', 'habitual', 'at-risk' and 'problematic'. In this study, the prevalence of problematic mobile phone use was 5.2 per cent. De Sola et al. (2019) merged at-risk and problematic user categories and call it 'users with difficulties' and in the present study, the prevalence of users with difficulties was 19.8 per cent, which was lower than that reported in the study of De Sola et al. (2018) involving 1126 Spanish respondents. The distribution of gender across the user categories revealed that an overwhelming majority of problematic mobile phone users were females and they can therefore potentially be considered as addicted to their mobile phones. This finding mirrors that of Ozer and Ozer (2018) who found almost the same distribution by user categories in the Turkish context. In the study conducted by de-Sola *et al.* (2017a) in Spain, the prevalence of problematic and at-risk mobile phone users made up 20.5% of the study population, of whom 15.4% were at-risk users and 5.1% were problematic users who could be considered as having a mobile phone addiction. A different study by de-Sola *et al.* (2017b) using a different scale to measure smartphone addiction yielded similar results, that is, at-risk users comprised 15.4% and problematic users made up 5.1% of the respondents. In the meta-analysis study by Sohn *et al.* (2019), they found that one in four young users demonstrated problematic smartphone use.

LIMITATIONS AND FUTURE DIRECTIONS

Two major limitations are present in this study. First, the findings are based on the use of self-reported data. The other limitation is that there was a disproportionate distribution of the participants by age group. In particular, the 26-35-year-old group was under-represented due to the fact that most students at PYPs are about nineteen years old.

Several implications stem from the present work. Language teachers working in PYPs should be aware of the prevalence of mobile phone addiction among EFL learners given emerging evidence on a global scale. Given that many schools worldwide have moved their classes online due to the ongoing pandemic, teachers' guidance and careful observation could be even more important these days in terms of the detrimental effects of problematic mobile phone use on student learning. Given that smartphone addiction has been demonstrated to be associated with academic performance, language teachers should be on the alert for students suffering from problematic mobile phone use. Learning English as a foreign language is a complex interactive process and requires learners' self-direction and autonomy. Therefore, it seems highly likely that at-risk and problematic users in the language classroom will fall behind their peers. In this respect, it is important for teachers to manage the phone use through learner-centred division of labour and some common classroom rules against disruptive use of mobile phones in class.

The MPACS-TR, as a reliable tool for assessing problematic mobile phone use addiction, is believed to be utilised by researchers to complement their studies investigating the academic performance of EFL learners. Future studies should consider investigating whether smartphone addiction is a predictor of academic success and academic self-efficacy in foreign language learning contexts at varying education levels.

Undoubtedly, the functions of a mobile phone to connect and to access information will not slow down its pace. Therefore, there is a need to make better use of this smart technology with the aim of making a strong contribution to student learning. Future studies could explore the factors which facilitate learning based on conditions in which students keep their smartphones on or off. In addition, future studies could also add a question designed to find how much time EFL learners spend on their phones and how much of that time is spent on language learning.

CONCLUSION

Despite the large variety of applications with which smartphone users are provided, some of these applications might reportedly have more negative consequences for students' academic performance. Texting, instant messaging and social media applications are both potentially useful and potentially able to put student learning at risk, and that risk is associated with an all-inclusive term, namely, problematic mobile phone use. This current study has investigated the prevalence of smartphone addiction in a sample of university students.

Overall, this study has produced interesting findings for smartphone addiction and problematic mobile phone use. First, neither gender nor age had a significant effect on the MPACS-TR scores, although the younger age group reported higher levels of problematic mobile phone use. Second, the overall mean was found to be 5.16 in the study sample. Third, the distribution of gender across user categories showed that an overwhelming majority of problematic mobile phone users were female. Finally, the findings of the study show that problematic mobile phone use is more prevalent among females, but even so, the means of female users were not significantly higher than those of male users.

Modern society is in a state of constant change and language learning does likewise. As we become increasingly more reliant on mobile phones, it is a requirement of the digital era to determine the technology-related needs of foreign-language learners, so learners' needs and the concerns of educators in mobile-assisted language learning environments should be addressed in future research. Given that the integration of technology in our everyday life and in educational settings will continue to play an important role, researchers and teachers should devote their efforts to dealing with the concerns about the successful integration of mobile phones and other portable smart devices into language-learning environments.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author received no financial support for the research, authorship, and/or publication of this article.

Statements of publication ethics

I hereby declare that the study does not have unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

Ethics Committee Approval Information

Ethical approval was successfully obtained from the Research and Publication Committee on Ethics at Adana Alparslan Türkeş Science and Technology University (Reference number: E.6220; 18/05/2018).

REFERENCES

Adıgüzel, O. C., & Özdoğru, F. (2017). Anadili İngilizce olan ve olmayan İngilizce öğretmenlerinin öğrencilerin yabancı dil becerilerine etkileri [Effects of Turkish and English speaking teachers on students' foreign language skills]. *Kastamonu Eğitim Dergisi*, *25*(1), 171-186. https://dergipark.org.tr/en/pub/kefdergi/issue/27737/308320

Akpur, U. (2017). Predictive and explanatory relationship model between procrastination, motivation, anxiety and academic achievement. *Eurasian Journal of Educational Research*, *69*, 221-240. http://dx.doi.org/10.14689/ejer.2017.69.12

American Psychiatric Association, DSM-5 Task Force. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5™* (5th ed.). American Psychiatric Publishing. http://doi.org/10.1176/appi.books.9780890425596

Billieux, J., Maurage, P., López-Fernández, O., Kuss, D. J., & Griffiths, M. D. (2015). Can disordered mobile phone use be considered a behavioral addiction? An update on current evidence and a comprehensive model for future research. *Current Addiction Reports*, *2*, 156-162. http://doi.org/10.1007/s40429-015-0054-y

Cakıcı, D. (2016). The correlation among EFL learners' test anxiety, foreign language anxiety and language achievement. *English Language Teaching*, *9*(8), 190-203. http://dx.doi.org/10.5539/elt.v9n8p190

Calderwood, C., Ackerman, P. L., & Conklin, E. M. (2014). What else do college students "do" while studying? An investigation of multitasking. *Computers & Education*, *75*, 19-29. http://dx.doi.org/10.1016/j.compedu.2014.02.004

Cha, S. S., & Seo, B. K. (2018). Smartphone use and smartphone addiction in middle school students in Korea: Prevalence, social networking service, and game use. *Health Psychology Open*, *5*(1). https://doi.org/10.1177/2055102918755046

Chen, C-Y. (2020). Smartphone addiction: Psychological and social factors predict the use and abuse of a social mobile application. *Information, Communication & Society*, *23*(3), 454-467. https://doi.org/10.1080/1369118X.2018.1518469

Choi, S. W., Kim, D. J., Choi, J. S., Ahn, H., Choi, E. J., Song, W. Y., Kim, S., & Youn, H. (2015). Comparison of risk and protective factors associated with smartphone addiction and internet addiction. *Journal of Behavioral Addictions*, *4*(4), 308–314. http://doi.org/10.1556/2006.4.2015.043

Chow, S. L., Leung, G. M., Ng, C., & Yu, E. (2009). A screen for identifying maladaptive internet use. *International Journal of Mental Health and Addiction*, *7*, 324-332. https://doi.org/10.1007/s11469-008-9170-4

Csibi, S., Griffiths, M. D., Demetrovics, Z., & Szabo, A. (2019). Analysis of problematic smartphone use across different age groups within the 'Components Model of Addiction'. *International Journal of Mental Health Addiction*. https://doi.org/10.1007/s11469-019-00095-0

De-Sola, J., Talledo, H., Rubio, G., & de Fonseca, F. R. (2017a). Development of a Mobile Phone Addiction Craving Scale and its validation in a Spanish adult population. *Frontiers in Psychiatry*, *8*, 1-9. http://doi.org/10.3389/fpsyt.2017.00090

De-Sola, J., Talledo, H., de Fonseca, F. R., & Rubio, G. (2017b). Prevalence of problematic cell phone use in an adult population in Spain as assessed by the Mobile Phone Problem Use Scale (MPPUS). *PLoS ONE*, *12*(8), 1-17. http://doi.org/10.1371/journal.pone.0181184

De-Sola, J., Rubio, G., Talledo, H., Pistoni, L., Van Riesen, H., & Rodríguez de Fonseca, F. (2019). Cell phone use habits among the Spanish population: Contribution of applications to problematic use. *Frontiers in Psychiatry*, *10*, 1-13. http://doi.org/10.3389/fpsyt.2019.00883

Divan, H. A., Kheifets, L., Obel, C., & Olsen, J. (2012). Cell phone use and behavioural problems in young children. *Journal of Epidemiology and Community Health*, *66*(6), 524–529. https://doi.org/10.1136/jech.2010.115402

Durak, H., & Seferoğlu, S. S. (2018). Ortaokul öğrencilerinin akıllı telefon kullanımları ve bağımlılık düzeyleriyle ilgili bir inceleme [An examination of smartphone use and addiction among middle school students]. *Educational Technology: Theory and Practice*, *8*(1), 1-23.

Fischer-Grote, L., Kothgassner, O. D., & Felnhofer, A. (2019). Risk factors for problematic smartphone use in children and adolescents: a review of existing literature. *Neuropsychiatr*, *33*, 179–190. https://doi.org/10.1007/s40211-019-00319-8

George, D., & Mallery, P. (2011*). SPSS for Windows step by step: A simple guide and reference,18.0 update* (11th ed.). Boston, MA: Allyn and Bacon.

Gezgin, D. M., Cakir, O., & Yildirim, S. (2018). The relationship between levels of nomophobia prevalence and internet addiction among high school students: The factors influencing Nomophobia. *International Journal of Research in Education and Science*, *4*(1), 215-225. https://www.ijres.net/index.php/ijres/article/view/185

Grant, J. E., Potenza, M. N., Weinstein, A., & Gorelick, D. A. (2010). Introduction to behavioral addictions. *American Journal of Drug and Alcohol Abuse*, *36*(5), 233–241. https://doi.org/10.3109/00952990.2010.491884

Griffiths, M. D. (2005). Online therapy for addictive behaviors. *CyberPsychology & Behavior*, *8*(6), 555–561. http://doi.org/10.1089/cpb.2005.8.555

Griffiths, M. D. (2008). Internet and video-game addiction. In C. Essau (Ed.), *Adolescent addiction: Epidemiology, assessment and treatment* (pp. 231–267). San Diego: Elselvier. http://doi.org/10.1016/B978-012373625-3.50010-3

Griffiths, M. D., & Meredith, A. (2009). Videogame addiction and its treatment. *Journal of Contemporary Psychotherapy*, *39*, 247-253. https://doi.org/10.1007/s10879-009-9118-4

Griffiths M. D. (2018). Conceptual issues concerning internet addiction and internet gaming disorder: Further critique on Ryding and Kaye (2017). *International Journal of Mental Health and Addiction*, *16*(1), 233-239. http://doi.org/10.1007/s11469-017-9818-z

Griffiths, M. D. (2019). Conceptual issues concerning internet addiction and internet gaming disorder: Further critique on Ryding and Kaye (2017). *International Journal of Mental Health and Addiction*, *16*, 233–239. http://doi.org/10.1007/s11469-017-9818-z

Gül, H., Fırat, S., Sertçelik, M., Gül, A., Gürel, Y., & Günay Kılıç, B. (2019). Cyberbullying among a clinical adolescent sample in Turkey: Effects of problematic smartphone use, psychiatric symptoms, and emotion regulation difficulties. *Psychiatry and Clinical Psychopharmacology*, *29*(4), 547-557.

Kara, M., Baytemir, K., & Inceman-Kara, F. (2019). Duration of daily smartphone usage as an antecedent of nomophobia: Exploring multiple mediation of loneliness and anxiety. *Behaviour & Information Technology*. https://doi.org/10.1080/0144929X.2019.1673485

Kardefelt-Winther, D., Heeren, A., Schimmenti, A., van Rooij, A., Maurage, P., Carras, M., Edman, J. Blaszczynski, A., Khazaal, Y., & Billieux, J. (2017). How can we conceptualize behavioural addiction without pathologizing common behaviours? *Addiction*, *112*(10), 1709-1715. http://doi.org/10.1111/add.13763

Kesen Mutlu, A., Andarab, M. S., & Karacan, C. G. (2019). Self-efficacy and the use of compensatory strategies: a study on EFL learners. *European Journal of Educational Research*, *8*(1), 249-255. http://doi.org/10.12973/eu-jer.8.1.249

Khoury, J. M., Neves, M. C. L., Roque, M. A. V., Freitas, A. A. C., da Costa, M. R., & Garcia, F. D. (2019). Smartphone and Facebook addictions share common risk and prognostic factors in a sample of undergraduate students. *Trends Psychiatry Psychother*, *41*(4), 358-368. http://dx.doi.org/10.1590/2237-6089-2018-0069

Kim, D. I., Lee, Y. H., Lee, J. Y., Kim, M. C, Keum, C. M, Nam, J. K., & Kang, E. (2012). New patterns in media addiction: Is smartphone a substitute or a complement to the Internet? *The Korea Journal of Youth Counseling*, *20*(1), 71–88. http://doi.org/10.35151/kyci.2012.20.1.005

Kim, Y., Jeong, J. E., Cho, H., Jung, D. J., Kwak, M., Rho, M. J., Yu, H., Kim, D-J., & Choi, I. Y. (2016). Personality factors predicting smartphone addiction predisposition: Behavioral inhibition and activation systems, impulsivity, and self-control. *PLoS One*, *11*(8). https://doi.org/10.1371/journal.pone.0159788

Kuss, D. J., Knjo, E., Crook-Rumsey, M., Kibowski, F., Wang, G. Y., & Sumich, A. (2018). Problematic mobile phone use and addiction across generations: the roles of psychopathological symptoms and smartphone use. *Journal of Technology in Behavioral Science*, *3*, 141-149. http://doi.org/10.1007/s41347-017-0041-3

Laurence, P. G., Busin, Y., da Cunha Lima, H. S., & Macedo, E. C. (2020). Predictors of problematic smartphone use among university students. *Psicologia: Reflexao e Critica*, *33*(8), 1-13. https://doi.org/10.1186/s41155-020-00147-8

Lopez-Fernandez, O., Honrubia-Serrano, L., Freixa-Blanxart, M., & Gibson, W. (2014). Prevalence of problematic mobile phone use in British adolescents. *Cyberpsychology, Behavior and Social Networking*, *17*(2), 91–98. https://doi.org/10.1089/cyber.2012.0260

Marlatt, G. A. (1987). Craving notes. *British Journal of Addiction*, *82*(1), 42–44. https://doi.org/10.1111/j.1360-0443.1987.tb01434.x

Nahas, M., Hlais, S., Saberian, C., & Antoun, J. (2018). Problematic smartphone use among Lebanese adults aged 18–65 years using MPPUS-10. *Computers in Human Behavior*, *87*, 348-353. https://doi.org/10.1016/j.chb.2018.06.009

Ng, S. F., Azlan, M. A. K., Kamal, A. N. A., & Manionet, A. (2020). A quasi-experiment on using guided mobile learning interventions in ESL classrooms: Time use and academic performance. *Education and Information Technologies*. https://doi.org/10.1007/s10639-020-10191-7

Oviedo-Trespalacios, O., Nandavar, S., Newton, J. D. A., Demant, D., & Phillips, J. G. (2019). Problematic use of mobile phones in Australia…Is it getting worse? *Frontiers in Psychiatry*, *10*, 1-15. http://doi.org/10.3389/fpsyt.2019.00105

Ozer, O., & Kılıç, F. (2018). The effect of mobile-assisted language learning environment on EFL students' academic achievement, cognitive load and acceptance of mobile learning tools. *EURASIA Journal of Mathematics, Science and Technology Education,* 14(7), 2915-2928. http://doi.org/10.29333/ejmste/90992

Ozer, O., & Ozer, E. (2018). Cep Telefonu Bağımlılığında Aşerme Ölçeği'nin Türkçe uyarlaması: geçerlik ve güvenirlik çalışması [Adaptation of mobile phone addiction craving scale to Turkish: Further evidence of reliability and validity]. *Turkish Studies*, *13*(26), 953-970. http://dx.doi.org/10.7827/TurkishStudies.14285

Ozer, O. (2020). Smartphone addiction and fear of missing out: Does smartphone use matter for students' academic performance? *Journal of Computer and Education Research*, *8*(15), 344-355. http://doi.org/10.18009/jcer.696481

Panova, T., & Carbonell, X. (2018). Is smartphone addiction really an addiction? *Journal of Behavioral Addictions*, *7*(2), 252-259. http://doi.org/10.1556/2006.7.2018.49

Potenza, M. N. (2014). Non-substance addictive behaviors in the context of DSM-5. *Addictive Behaviors*, *39*(1). http://doi.org/10.1016/j.addbeh.2013.09.004

Sahin-Kızıl, A., & Savran, Z. (2016). Self-regulated learning in the digital age: an EFL perspective. *Novitas-ROYAL*, *10*(2), 147-158. http://www.novitasroyal.org/Vol_10_2/4.Sahin%20&%20Savran.pdf

Sanal, Y., & Ozer, O. (2017). Smartphone addiction and the use of social media among university students. *Mediterranean Journal of Humanities*, *7*(2), 367-377. http://doi.org/10.13114/MJH.2017.370

Savci, M., & Griffiths, M. D. (2019). The development of the Turkish Social Media Craving Scale (SMCS): a validation study. *International Journal of Mental Health and Addiction*. http://doi.org/10.1007/s11469-019-00062-9

Seemiller, C., & Stover, S. (2017). Curbing digital distractions in the classroom. *Contemporary Educational Technology*, *8*(3), 214-231. https://doi.org/10.30935/cedtech/6197

Skinner, M. D., & Aubin, H-J. (2010). Craving's place in addiction theory: Contributions of the major models. *Neuroscience & Biobehavioral Reviews*, *34*(4), 606-623. https://doi.org/10.1016/j.neubiorev.2009.11.024

Smetaniuk, P. (2014). A preliminary investigation into the prevalence and prediction of problematic cell phone use. *Journal of Behavioral Addictions*, *3*(1), 41–53. http://doi.org/10.1556/JBA.3.2014.004

Sohn, S., Rees, P., Wildridge, B., Kalk, N. J., & Carter, B. (2019). Prevalence of problematic smartphone usage and associated mental health outcomes amongst children and young people: a systematic review, meta-analysis and GRADE of the evidence. *BMC Psychiatry*, *19*, 1-10. https://doi.org/10.1186/s12888-019-2350-x

Vally, Z., & El Hichami, F. (2019). An examination of problematic mobile phone use in the United Arab Emirates: Prevalence, correlates, and predictors in a college-aged sample of young adults. *Addictive Behaviors Reports*, *9*. https://doi.org/10.1016/j.abrep.2019.100185

Wilcockson, T. D. W., Osborne, A. M., & Ellis, D. A. (2019). Digital detox: The effect of smartphone abstinence on mood, anxiety, and craving. *Addictive Behavior*, *99*. https://doi.org/10.1016/j.addbeh.2019.06.002

Winskel, H., Kim, T-H., Kardash, L., & Belic, I. (2019). Smartphone use and study behavior: A Korean and Australian comparison. *Heliyon*, *5*(7). https://doi.org/10.1016/j.heliyon.2019.e02158

Xie, H., Tao, S., Zhang, Y., Tao, F., & Wu, X. (2019). Impact of problematic mobile phone use and insufficient physical activity on depression symptoms: A college-based follow-up study. *BMC Public Health*, *19*. https://doi.org/10.1186/s12889-019-7873-z

Yang, Z., Asbury, K., & Griffiths, M. D. (2019). An exploration of problematic smartphone use among Chinese university students: Associations with academic anxiety, academic procrastination, self-regulation and subjective wellbeing. *International Journal of Mental Health and Addiction*, *17*, 596–614. https://doi.org/10.1007/s11469-018-9961-1

Yildirim C., Sumuer E., Adnan M., & Yildirim S. (2016). A growing fear: Prevalence of nomophobia among Turkish college students. *Information Development*, *32*(5), 1322-1331. https://doi.org/10.1177/0266666915599025

Yildiz Durak, H. (2019). Investigation of nomophobia and smartphone addiction predictors among adolescents in Turkey: Demographic variables and academic performance. *The Social Science Journal*, *56*, 492-517. http://doi.org/10.1016/j.soscij.2018.09.003
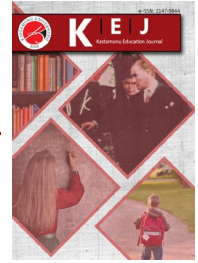
Opinions of Classroom Teacher Candidates on STEM Education

STEM Eğitimine Yönelik Sınıf Öğretmeni Adaylarının Görüşleri

Ayten Pınar Bal[1]

Abstract

Purpose: Scientific and technological developments in the last century have undoubtedly been realized in the light of new paradigms that have taken place in education programs. Especially advances in science, technology, engineering and mathematics have been transformed into new inventions and products. From this point of view, STEM, which has become an important education discipline by combining the fields of science, technology, engineering and mathematics, has enabled learners to absorb, synthesize and apply the information they have acquired with an interdisciplinary perspective. It is considered important and necessary to learn. Based on this idea, this study was conducted in order to examine the opinions of teacher candidates studying in the primary school teaching department about STEM education after STEM education.

Design/Methodology/Approach: This research is a qualitative study aimed at determining the opinions of teacher candidates on STEM education. The study was conducted based on a case study, one of the qualitative research methods. Working group of the study consisted of 57 teacher candidates educating at a state university in southern Turkey. The sample of the study was determined by the criterion sampling method, one of the purposeful sampling methods.

Findings: It was concluded that the classroom teacher candidates generally thought that STEM education was related to science, technology, engineering and mathematics fields, that it included daily life lesson problems, that it gave teacher skills, provided permanent learning and gained perspectives. In addition, it was concluded that in the case of applying STEM activities in mathematic lessons, both teachers and teaching time management may have problems in the context of preparing headings individually.

Highlights: According to these results, applied trainings can be given to both in-service processes and teacher candidates and teachers to solve such problems. In addition, this study turned out to be about the participants following education in the classroom teaching department. In cooperation with students studying in mathematics, science and engineering departments on STEM education, new studies can also be conducted to examine their thoughts on STEM education and applications.

Öz

Çalışmanın amacı: Son yüzyılda yaşanan bilimsel ve teknolojik gelişmeler şüphesiz eğitim programlarında yerini alan yeni paradigmalar ışığında gerçekleşmiştir. Özellikle fen, teknoloji, mühendislik ve matematik alanlarında gerçekleşen ilerlemeler yeni buluş ve ürünlere dönüştürülmüştür. Bu açıdan bakıldığında, kısaca fen, teknoloji, mühendislik ve matematik alanlarının birleştirilmesiyle önemli bir eğitim disiplini halini alan STEM, öğrenenlerin disiplinler arası bakış açısıyla edindiği bilgileri özümsemesini, sentezlemesini ve uygulamasını sağlamıştır Özellikle ilköğretim öğrencileri için en önemli etmenlerden biri olan sınıf öğretmeni adaylarına STEM konusundaki düşüncelerinin öğrenilmesinin önemli ve gerekli olduğu düşünülmektedir. Bu düşünceden yola çıkarak bu araştırma STEM eğitimi uygulamaları sonrası, sınıf öğretmenliği bölümünde öğrenim gören öğretmen adaylarının STEM eğitimine yönelik görüşlerinin neler olduğunu incelemek amacıyla yapılmıştır.

Materyal ve Yöntem: Bu araştırma, STEM eğitimi konusunda öğretmen adaylarının düşüncelerini belirlemeye yönelik nitel bir çalışmadır. Çalışma nitel araştırma yöntemlerinden durum çalışmasına dayalı olarak yürütülmüştür. Araştırmanın çalışma grubunu Türkiye'nin güneyinde bir devlet üniversitesinin sınıf öğretmenliği ana bilim dalında öğrenimlerine devam eden 57 öğretmen adayı oluşturmaktadır. Araştırmanın örneklemi amaçlı örneklem yöntemlerinden ölçüt örnekleme yöntemi ile belirlenmiştir.

Bulgular: Sınıf öğretmeni adaylarının genel olarak STEM eğitiminin fen, teknoloji, mühendislik ve matematik alanları ile ilgili olduğunu, günlük hayatla ilişkili problemleri kapsadığını, öğrencilere çeşitli beceriler kazandırdığını, kalıcı öğrenme sağladığını ve farklı bakış açıları kazandırdığını düşündükleri sonucuna ulaşılmıştır. Ayrıca, STEM etkinliklerinin matematik derslerinde uygulanabilme durumunda hem öğretmenlerin hem de öğrencilerin zaman yönetimi, bireysel farklılıklarla başa çıkma, etkinlik hazırlama bağlamında sorunlar yaşayabilecekleri sonucuna ulaşılmıştır.

Önemli Vurgular: Bu araştırma sonuçlarına göre öğretmen adayları ve öğretmenlere STEM etkinliklerinin hazırlanmasına yönelik eğitimler verilebilir. Ayrıca, bu çalışma sınıf öğretmenliği bölümünde öğrenim gören katılımcılar ile yürütülmüştür. STEM eğitimi konusunda matematik, fen bilgisi, mühendislik bölümlerinde öğrenim gören öğrencilerle işbirliği yapılarak onların STEM eğitimi ve uygulamaları hakkındaki düşüncelerini irdeleyen yeni araştırmalar yapılabilir.

[1] **Corresponded Author,** Assoc. Prof. Dr., Cukurova University, Faculty of Educational, Department of Mathematics and Science Education, Adana, TÜRKİYE;
https://orcid.org/0000-0003-1695-9876

INTRODUCTION

Scientific and technological developments in the last century have undoubtedly been realized in the light of new paradigms that have taken place in education programs. Advances in science, technology, engineering and mathematics have been transformed into new inventions and products. From this point of view, STEM, which has become an important education discipline by combining the fields of science, technology, engineering and mathematics, has enabled learners to absorb, synthesize and apply the information they have acquired from an interdisciplinary perspective (MEB, 2016).

By bringing together different scientific disciplines, STEM education aims to enable students to solve practical skills that they can use in real life and to solve theoretical problems they may encounter in the future and to prepare new technological inventions (Bybee, 2010; Capraro & Slough, 2008; Sanders, 2008; Stolhmann, Moore & Roehrig, 2012; Şahin, Ayar and Adıgüzel, 2014). In this context, STEM education enables students to have multiple perspectives and to use the information obtained from different disciplines in the problem solving process (Lacey & Wright, 2009; Wang, 2012). In addition, based on a student-centered educational approach, STEM education is seen as an important tool for economic development and scientific leadership as well as providing individuals with knowledge and skills from an interdisciplinary perspective (Brophy, Klein, Portsmore & Rogers, 2008; Wang, 2012). In this context, it is clearly seen that many countries that integrate STEM education into their educational policies (such as Europe, America, England, Japan) have made progress in the economic field, and that there are significant increases in the favor of their students in PISA and TIMSS exam results, which measure students' competencies in mathematics and science (Kennedy & Odell, 2014; Wang, Guo & Jou, 2015).

In the context of our country, STEM education is given great importance both in universities and in in-service training, as in many countries. (Akaygün & Aslan Tutak, 2016; Özbilen, 2018). In order for this process to function effectively, STEM must be integrated into curriculum and students must have the necessary competencies for the process (Çepni, 2017; Stolhmann, Moore & Roehrig, 2012; Zarske, Sullivan, Carlson, & Yowell, 2004). In this context, the use of STEM education and applications in mathematic lessons from pre-school to higher education levels is becoming increasingly common in our country (Akgündüz & Ertepınar, 2015; Gonzalez & Kuenzi, 2012; Kennedy & Odell, 2014). However, Rockland et al. (2010) state that teachers do not receive sufficient training on how to apply STEM education in the classroom. Today, there is a need for teachers who are open to learning and innovations, who have scientific process skills, problem solving skills, and ability to work collaboratively. From this point of view, it is important for teachers to gain the knowledge and skills of their own branches to students in collaboration with experts from other disciplines (Becker & Park, 2011; Stohlman, Moore & Roehrig, 2012). The most critical period in the development of students' attitudes and interests towards STEM is the primary school period (Geiger, 2019; Miller, 2019; Moore, Johnston, & Glancy, 2020). Therefore, primary school teachers' interests and perceptions about STEM are correct; It is thought that it is important to eliminate the deficiencies, if any.

When the literature on STEM approach is examined; most of the national and international studies conducted are students (Cho & Lee 2013; Cotabish, Dailey, Robinson & Hunghes, 2013; Gümüş, 2019; Miller, 2019; Priatna, Lorenzia & Widodo, 2020; Yılmaz, Gülgün & Çağlar, 2017) and teachers (Bakırcı & Kutlu, 2018; Du Plessis, 2018; Geiger, 2019; Köse & Ataş, 2020; Nguyen, Nguyen & Tran, 2020; Park, Byun, Sim, Han & Baek, 2016; Siew, Amir & Chong, 2015; Yıldırım, 2017; Stohlmann, 2018; Stohlmann, Moore & Roehrig, 2012; Wang, 2012; Weber, 2015). However, it is seen that studies on teacher candidates (Akaygün & Aslan Tutak, 2016; Bergsten & Frejd, 2019; Buyruk & Korkmaz, 2018; Yıldırım, 2017) are quite limited. For example; Bergsten and Frejd (2019), as a result of their research with mathematics teacher candidates in Sweden, concluded that teacher candidates were successful in designing STEM activities by integrating their twenty-first century skills with mathematics. Similarly, Evans (2005), as a result of his research conducted with classroom teacher candidates, concluded that teacher candidates' perceptions, attitudes and abilities about education with STEM are positive.

As can be seen from the studies mentioned above, it is thought that it is important and necessary to learn the opinions of classroom teacher candidates on STEM, which is one of the most important factors especially for primary school students. Based on this idea, this study was conducted in order to examine the opinions of teacher candidates studying in the primary school teaching department about STEM education after STEM education applications. Sub-problems of the research;

1) What are the opinions of teacher candidates about STEM education in general?

2) What are the opinions of the teacher candidates about the adequacy of mathematical knowledge in the preparation process of STEM activities?

3) What are the opinions of the teacher candidates regarding the applicability of STEM activities in mathematic lessons?

4) What are the opinions of teacher candidates regarding the applicability of STEM activities in mathematic lessons in terms of teachers?

5) What are the opinions of teacher candidates about the state of using STEM activities in the context of mathematic lessons in their professional lives?

METHOD/MATERIALS

This research is a qualitative study aimed at determining the opinions of teacher candidates on STEM education. The study was conducted based on a case study, one of the qualitative research methods. Case study is applied in order to examine the reasons of an event, situation or problem in depth (Merriam, 2013). In this study, primary school teacher candidates' views on STEM education and applications were applied in depth.

Working Group

The study was conducted based on a case study, one of the qualitative research methods. Working group of the study consisted of 57 teacher candidates educating at a state university in southern Turkey. The sample of the study was determined by criterion sampling method, one of the purposeful sampling methods. The purpose of the purposeful sampling is to collect the most accurate information about the individual, phenomenon or situation directly related to the subject of the study (Maxwell, 1996). As a criterion, having not attended STEM education before, information technologies, basic mathematics in primary school, science teaching and mathematics teaching I courses and being successful were taken into account. 46 of these participants are women and 11 of them are men and their ages vary between 17 and 23. Participants' GPA (Grade Point Average) ranges between 2.72 and 3.39.

Data Collection and Application

In this study, a six-hour program on STEM education was prepared. The activities in this program were prepared to include geometry teaching and measurement teaching subjects within the scope of mathematics teaching course to teacher candidates. In the program prepared, general information about STEM education, how the STEM learning teaching process is and how the lesson plans should be prepared were given to the students in the first three hours. In the other three hours, the sample applications within the scope of STEM education were examined and discussed in the classroom after evaluating the subject. At the last stage, sample STEM applications were made to teacher candidates using their knowledge on geometry and dimensions.

Data Collection Tool and Analysis

Within the scope of the study, a semi-structured interview form on STEM developed by the researcher was used as a data collection tool. While creating this form, the literature was first reviewed. After the literature review, the first trial form was created. The trial form was asked to two experts working in the field of STEM education. Experts evaluated the appropriateness, clarity, comprehensibility and content validity of the questions. In this context, the form was finalized in line with the feedback from the experts. This final form was applied to two teacher candidates as a pilot study. As a result of the application, a few corrections were made and the interview form was finalized. The questions in the interview form; the general views of the participants on STEM education are related to the adequacy of mathematical knowledge in the case of preparing such activities and the situation of the participants to include such activities in their professional lives.

Participants were asked to state their opinions in writing about the questions in the semi-structured interview form on STEM. Descriptive analysis was used to analyze the data obtained. Descriptive analysis is the process of summarizing and interpreting data based on predetermined themes that can be obtained with many data collection tools such as interview, observation and document analysis (Yıldırım & Şimşek, 2003). Within the scope of this study, first of all, a general framework has been created based on research questions. It has been determined in which categories the data obtained within the scope of this framework can be.

In the next stage, meaningful and logical codes were arranged in accordance with the categories prepared using the relevant literature. In order to allow comparison of the categories arranged, the data were arranged in tables and the opinions of the students were stated in the context of the frequency level under each code. Then, where necessary, the findings were presented by placing students' explanations through direct quotations (Yıldırım & Şimşek, 2003). The form number and gender of the relevant participant were coded in the Semi-Structured Interview Form on STEM. For example, E1 male participant first form was coded as K1 female participant first form.

Expert control is important in ensuring the reliability of data analysis (Creswell, 2013). In this direction, a mathematics educator experienced in qualitative research worked as the second coder and analyzed all data separately. For the agreement rate between the two coders, the agreement was calculated with the formula of Agreement Percentage=Agreement/(Agreement+Disagreement)*100 stated by Miles and Huberman (1996) and this value was found as .92. The fact that this value is at least .70 is an indication that the encoding is reliable. In addition, in cases where there was a difference of opinion, it was agreed by making a joint decision on what the code would be.

Within the scope of the ethical measures taken during the research process, the necessary official permissions were obtained from the ethics committee. In addition, at the beginning of the study, all participants were informed about the purpose of the study, the implementation process and how to collect data. Volunteerism was taken into consideration for participation in the study. On the other hand, codes were used to keep the identities of the teacher candidates participating in the study secret. It has been stated that all the data obtained will be used only within the scope of this research.

FINDINGS

The data obtained from the opinions of the participants in line with the sub-objectives of the research are given below. In this regard, first of all, the participants were asked what they think about STEM education in general. The opinions of the participants on this issue are presented in Table 1.

Table 1. Participants' General Views on STEM Education

Category	Codes	f
STEM Education	A teaching model that can solve problems related to daily life with a scientific perspective	21
	An understanding that includes the fields of Science, Technology, Engineering and Mathematics	20
	All of the sciences related to numerical fields	18
	An approach to the fields of Science, Technology, Engineering and Mathematics	10
	An understanding that different disciplines are used together and that gives students skills	8
	An education system	5

According to Table 1, with regard to STEM education, the participants mostly stated that "the teaching model that can solve problems related to daily life from a scientific point of view" (f=21), "science, technology, engineering and mathematics fields" (f=20) and stated that "the whole of the sciences related to numerical fields" (f=18). For this, the view of the participant K19 is as follows: "*It is a system that aims to remove the fields of science, mathematics, engineering and technology from the memorization system, to improve the applicability of information in real life and to develop problem solving techniques, and to highlight the features of curiosity, research and creativity*". On the other hand, five of the participants stated that STEM education is "an education system" (f=5). In this regard, the participant E3 coded "*It is an education system formed by the combination of fields such as science, technology, and mathematics*" expressed his opinion in the form.

As the second sub-aim of the research, the opinions of the participants about the adequacy of mathematical knowledge in the process of preparing activities for STEM education are included in Table 2.

Table 2. Participant Views on the Adequacy of Mathematical Knowledge in STEM Activities

Category	Codes	f
Insufficient Mathematical Knowledge	Knowledge of other disciplines required (such as science, technology, engineering and arts)	43
	Skill required (problem solving, manual dexterity, creativity, visualization)	8
	Necessary to associate with everyday life	4
Sufficient Mathematical Knowledge	Mathematics field knowledge must be sufficient	3

According to Table 2, the participants who stated that mathematical knowledge was not sufficient in the process of preparing STEM activities, in addition to mathematical knowledge, mostly pointed "knowledge about other disciplines" (f=43), "skill required" (f=8) and "necessary to associate with daily life" (f=4) codes. The opinion of the participant K4 on this subject is as follows: "*Mathematical knowledge alone will not be sufficient. For example, in the construction process of an activity such as bridge construction, science will also help in points such as gravity, effect of objects on each other and weight. In addition, the properties of the materials used will also have an effect. Visual arts should be used in terms of the appearance of the bridge. Engineering and architectural knowledge will also be useful in bridges that are larger and aesthetically beautiful*". On the other hand, three participants who participated in the study emphasized that mathematical knowledge is sufficient in the process of preparing activities in the context of STEM education. In this context, for example, the participant K7 coded "*Mathematics and geometry knowledge will be sufficient. For example, the information we will use when making the bridge activity includes mathematical knowledge in terms of geometric shapes and equality in the formation of shapes in bridges*" stated her opinion in the form.

Within the scope of the third sub-purpose of the research, the participants' views on the application of STEM activities in mathematic lessons in terms of students are presented in Table 3.

Table 3. Participants' Views Regarding the Applicability of STEM Activities in Mathematic Lessons from the Perspective of Students

Categories	Codes	f
Student Dimension	Students' ability to gain skills (such as problem solving, thinking skills, communication, creative thinking, leadership, creativity, manual skills)	13
	Recognizing the importance of interdisciplinary interaction	12
	Gaining a different perspective and experience	9
	Students collaborating	3
Learning-Teaching Process	Relating lessons to daily life	17
	Permanent learning	10
Experienced Difficulties	Takes Time	7
	Difficulty reaching the material	2
	High cost	1

When Table 3 is examined, the views of the participants about the applicability of STEM activities in mathematic lessons in terms of students are discussed in three categories. In this context, when the first category is examined; Participants STEM education "students gain skills" (f=13) and "realizing the importance of interdisciplinary interaction" (f=12), "gaining different perspectives and experiences" (f=9) and "students' cooperation" (f=3) stated that it was beneficial for students in their subjects. For example, the K8 coded participant's opinion on this subject states that "*With the help of such activities, the student begins to*

think more critically, more problem-solving, more assertive and versatile. He also realizes that they need to use their knowledge of mathematics, science, engineering, and arts that make everyday life easier. In addition, the student's science, mathematics and technology literacy levels also increase" expressed in the form.

Secondly, in the category of learning-teaching process, the participants mostly drew attention to the codes "lessons are associated with daily life" (f=17) and "provide permanent learning" (f=10). In this regard, for example, the participant's opinion coded K18 "*Such activities can actually bring many things to the student at the same time. One of them can learn by observing the functioning of the mathematics and geometry lesson that comes across in school life in daily life. Besides, it can add many things to the imagination in terms of geometry*" expressed in the form.

Finally, in the category of difficulties, the participants stated that they mostly experienced problems with "taking time" (f=7), "difficulty in accessing the material" (f=2) and "high cost" (f=1). In this regard, the participant E6 expressed his opinion as "The activities are very challenging and take time compared to the traditional method", while the participant K5 stated that "*For the student, it is an important problem that these activities require effort and the cost of tools to be used in the activities is high*". She expressed her opinion in the form.

Within the scope of the fourth sub-aim of the research, the views of the participants about the application of STEM activities in mathematic lessons in terms of teachers are presented in Table 4.

Table 4. Participant Views Regarding the Applicability of STEM Activities in Mathematic Lessons from the Perspective of Teacher

Categories	Codes	f
Student Dimension	Knowing about students	11
	Providing students with skills	5
Learning-Teaching Process	Relating to daily life	8
	Being able to be taught by concretizing	7
	Being permanent	6
	Have fun	2
	Decreased prejudices against mathematics	1
Teacher Dimension	Improving perspective	5
	Encountering creative and different ideas	3
Experienced Difficulties	Difficulty in Time Management	6
	Not enough hardware (Such as computer, material)	3
	Encountering individual difference	2
	Activity preparation process	1

When Table 4 is examined, the views of the teachers about the applicability of STEM activities in mathematic lessons are collected in four categories. Accordingly, the participants drew attention to the codes of "having information about students" (f=11) and "ability to gain skills for students" (f=5) in the student category. In this context, for example, the participant K2 stated that "*we can have an idea about how students use their minds*". Secondly, in the learning-teaching category, the participants were mostly "associating lessons with daily life" (f=8), "being able to be taught by concretizing" (f=7), "being permanent" (f=6), "having fun" (f=2) and "decreasing prejudices against mathematics" (f=2). In this context, for example, the participant K25 coded "*It provides the teacher with the opportunity to teach more easily since it will cause students to learn by experiencing. Thus, the subject is concretized and taught permanently*". She expressed her opinion in the form. Thirdly, in the teacher theme, the participants mostly focused on the codes of "improving perspective" (f=5) and "encountering creative and different ideas" (f=3). In this context, for example, the participant E3 coded "*With this kind of studies, teachers can have an idea about how their students use their minds. At the same time, it can gain a versatile perspective on students*" expressed his opinion in the form. Lastly, in the category of difficulties, the participants mostly stated that "difficulty in time management" (f=6), "not enough hardware" (f=3), "encountering individual differences" (f=2) and "activity preparation process" (f=1) pointed out the codes. In this regard, for example, participant K6 "*also provides teachers with a versatile perspective. However, if the teacher does not have enough equipment in such activities and cannot cooperate with experts in other disciplines, he/she will have a hard time preparing these activities*" stated her opinion in the form.

Within the scope of the last sub-purpose of the research, the opinions of the participants about the situation of using STEM activities in mathematic lessons in their professional lives are given in Table 5.

Table 5.Participant Views Regarding the Use of STEM Activities in Their Professional Life

Category	Codes	f
Usable	Gaining skills	13
	Permanent learning	10
	Associating with daily life	9
	Increasing motivation	6
	Getting to know students closely	3
	Being a measurement and evaluation tool	2
Depends on Conditions	Takes time	6
	Equipped	3
	Lack of material	2

As seen in Table 5, the majority of the participants (f=43) stated that they could use STEM activities in their professional lives. Accordingly, the participants mostly emphasized the importance of effects such as "gaining skills" (f=13), "permanent learning" (f=10), "associating with daily life" (f=9) and "increasing motivation" (f=6). In this direction, the participant K3 coded *"Of course I can use it. Because such projects are great opportunities to create significant changes in both teachers 'and students' perspective on mathematics. I also show that mathematics actually exists in nature. I will improve my students' manual skills. I will show that we can do different things as we want with the materials we have. I let them use their imagination. I would show that mathematics is used in different professions"* stated her opinion in the form. On the other hand, six of the participants stated that they can use STEM-based activities depending on the conditions, it may take time, three of them stated that they should be equipped and both of them stated that there might be a lack of material. For example, the participant with the code K17 said, *"If the event we will do will have a problem in terms of time, I may not use it"* expressed her opinion in the form.

DISCUSSION

This research was conducted to examine the opinions of classroom teacher candidates on STEM education and applications. As a result of the research, the participants generally; they stated that STEM education is related to the fields of science, technology, engineering and mathematics; it covers problems related to daily life and gives students various skills. These results are also similar to the relevant literature (Hacıoğlu & Başpınar, 2020; Karademir Coşkun, Alakurt & Yılmaz, 2020; Köse & Ataş, 2020; Nguyen, Nguyen & Tran, 2020; Park et al., 2016; Siew et al., 2015; Yıldırım, 2017; Yılmaz et al., 2017; Wang, 2012). In this regard, for example, Yıldırım (2017) reached the conclusion that students will provide permanent learning and actively participate in classes as a result of his study examining the opinions of teacher candidates on STEM education. Similarly, Karademir Coşkun et al. (2020), in their studies on STEM applications, concluded that students can learn permanently, improve their problem-solving skills and their academic skills with the help of STEM education.

According to the second sub-aim of the study, most of the participants clearly stated that their mathematics knowledge was not sufficient and they needed knowledge and skills related to many disciplines such as science, technology and engineering during the preparation process of STEM activities. This result is similar to the studies conducted in the literature (Bakırcı & Kutlu, 2018; Köse & Ataş, 2020; Kızılay, 2018; Stohlmann, 2018; Özbilen, 2018). In this context, for example, Özbilen (2018) stated in his study that the theoretical knowledge learned only in mathematics and science fields is not enough for those who learn in the process of STEM applications; He concluded that engineering applications are also indispensable in practice in order to associate the acquired knowledge with daily life. In addition, Stohlmann (2018) emphasized the importance of associating mathematics with other disciplines in STEM education and proposes different models on this issue.

On the other hand, regarding the applicability of STEM activities in mathematic lessons in terms of students, it was concluded that it is very useful for students to gain skills, to realize the importance of interdisciplinary interaction, to gain different perspectives, to gain experience and to cooperate in this process. This result is also similar to the results of the studies in the literature (Bakırcı & Kutlu, 2018; Cotabish et al., 2013; Hacıoğlu & Başpınar, 2020; Kim & Choi, 2012; Park et al., 2016; Siew et al., 2015; Yıldırım and Türk , 2018; Wang, 2012). In this regard, for example, Cotabish et al. (2013) STEM education in increasing the academic success of students. They concluded that it is an important factor in developing process and inquiry skills. Similarly, Wang (2012) concluded in his study that teachers could conduct their lessons more effectively by associating STEM activities with daily life and students acquired meaningful learning. Again, Yıldırım and Türk (2018) stated that STEM education is an important factor for students to acquire many skills such as thinking and problem solving; they also found that STEM activities increased the motivation of students and also improved their cooperation skills.

Another important result obtained from the study is that STEM activities can combine mathematic lesson with daily life and thus provide permanent learning. This result is similar to the studies conducted in the literature (Özbilen, 2018; Yıldırım, 2017; Yıldırım & Altun, 2015; Wang, 2012). In this context, for example, Wang (2012) found in his study that teachers made the lessons more meaningful for students by associating STEM activities with daily life. Similarly, Yıldırım and Altun (2015) concluded in their study that STEM education increased students' success in the classroom.

On the other hand, during the implementation of STEM activities, the participants pointed to similar problems in both student and teacher dimensions. Accordingly, the participants pointed out that STEM application may take time for the students or there may be problems in accessing the necessary materials in the preparation of such activities. Similarly, the participants emphasized that teachers may have problems in time management, in having sufficient equipment, in preparing activities, in organizing activities suitable for students' individual differences. This result is similar to the studies in the literature (Hacıoğlu & Başpınar, 2020; Karademir Coşkun et al., 2020; Köse & Ataş, 2020; Özbilen, 2018; Park et al., 2016; Siew et al., 2015; Yıldırım, 2017). In this context, for example, Park et al. (2016) concluded in their study that Korean teachers had problems in finding time and accessing necessary materials during the implementation of STEM education.

According to the last sub-purpose of the study, most of the participants emphasized that they can use STEM activities in their professional lives. However, a few participants stated that they could carry out STEM activities in their professional lives due to the lack of time, equipment and materials. This result is similar to the studies in the literature (Özbilen, 2018; Park et al., 2016; Yıldırım, 2018; Yıldırım & Türk, 2018; Stolhmann et al., 2012). In this context, for example, Yıldırım (2018) revealed that during the implementation of STEM activities, teachers experienced problems due to the physical structure of the classroom, class size and time. Again, Yıldırım and Türk (2018) stated that the majority of teacher candidates want to include STEM-related studies in their

professional lives; however, some of them found out that they thought they did not have enough knowledge on this subject and could not use them in their lessons.

CONCLUSION AND RECOMMENDATIONS

In summary, in the study, it was concluded that the classroom teacher candidates generally thought that STEM education is related to science, technology, engineering and mathematics fields, it covers problems related to daily life, provides students with various skills, provides permanent learning and gives them a different perspective. In addition, it was concluded that if STEM activities can be applied in mathematic lessons, both teachers and students may experience problems in terms of time management, coping with individual differences, and activity preparation. For this reason, both teacher candidates and teachers can be given practical training to eliminate such problems. Finally, this study was carried out with the participants studying in the classroom teaching department. In cooperation with students studying in mathematics, science and engineering departments on STEM education, new studies can also be conducted to examine their views on STEM education and applications.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

Statements of publication ethics

I hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Author's Contributions

There is only one author of this article. Ayten Pınar BAL is responsible for all of the work done for this article.

Ethics Committee Approval Information

Name of ethical reviewer: Cukurova University Scientific Research and Editorial Board in the Field of Social Sciences And Humanities
Decision date: 02.06.2020
Ethics evaluation document issue number: E.65163

REFERENCES

Akaygün, S., & Aslan Tutak, F. (2016). STEM images revealing STEM conceptions of pre-service chemistry and mathematics teachers. *International Journal of Education in Mathematics, 4*(1), 56-71. doi: 10.18404/ijemst.44833.

Akgündüz, D., & Ertepınar, H. (2015). *STEM eğitimi Türkiye raporu: "günün modası mı? Yoksa gereksinim mi?.* İstanbul: STEM Merkezi ve Eğitim Fakültesi, İstanbul Aydın Üniversitesi.

Bakırcı, H., & Kutlu, E. (2018). Fen bilimleri öğretmenlerinin FeTeMM yaklaşımı hakkındaki görüşlerinin belirlenmesi. *Turkish Journal of Computer and Mathematics Education, 9*(2), 367-389. doi: 10.16949/turkbilmat.417939.

Becker, K., & Park, K. (2011). Effects of integrative approaches among science, technology, engineering, and mathematics (STEM) subjects on students' learning: A preliminary meta-analysis. *Journal of STEM Education, 12*(5&6), 23-37.

Bergsten, C., & Frejd, P. (2019). Preparing pre-service mathematics teachers for STEM education: an analysis of lesson proposals. *ZDM Mathematics Education*, *51*, 941-953. doi: 10.1007/s11858-019-01071-7.

Brophy, S., Klein, S., Portsmore, M., & Rogers, C. (2008). Advancing engineering education in p-12 classrooms. *Journal of Engineering Education, 97*(3), 369-387.

Buyruk, B., & Korkmaz, Ö. (2018). Teacher candidates' STEM awareness levels. *Participatory Educational Research, 2016*(III), 272-279. http://www.partedres.com.

Bybee, R. W. (2010). Advancing STEM Education: A 2020 Vision. *Technology and Engineering Teacher, 70* (1), 30-35.

Capraro, R. M., & Slough, S. W. (2008). *Project-based learning: an integrated science, technology, engineering, and mathematics (STEM) Approach*. Rotterdam, The Netherlands: Sense Publishers.

Cho, B., & Lee, J. (2013). The effects of creativity and flow on learning through the STEAM education on elementary school contexts. Paper presented at the International Conference of Educational Technology, Sejong University, South Korea.

Cotabish, A., Dailey, D. Robinson, A., & Hunghes, G. (2013). The effects of a STEM intervention on elementary students' science knowledge and skills. *School Science and Mathematics, 113*(5), 215-226. doi: 10.1111/ssm.12023.

Creswell, J. W. (2013). *Qualitative Inquiry &Research Design*. London, UK: SAGE.

Çepni, S. (2017). *Kuramdan uygulamaya STEM eğitimi* (Editör: S. Çepni). Ankara: Pegem Akademi.

Du Plessis, A. E. (2018). The lived experience of out-of-field STEM teachers: A quandary for strategising quality teaching in STEM?. *Research in Science Education, 50,* 1465-1499. doi: 10.1007%2Fs11165-018-9740-9.

Evans, E. M. (2015). *Preparing elementary pre-service teachers to integrate STEM: A mixed-methods study.* Unpublished doctor of education. Northern Illinois University, Illinois.

Geiger, V. (2019). Using mathematics as evidence supporting critical reasoning and enquiry in primary science classrooms. *ZDM: The International Journal on Mathematics Education, 51*(1), 929-940. doi: 10.1007/s11858-019-01068-2.

Gonzalez, H. B., & Kuenzi J. (2012). Science, Technology, Engineering, and Mathematics (STEM) Education: A Primer. Congressional Research Service. http://www.stemedcoalition.org/wp-content/uploads/2010/05/STEM-Education-Primer.pdf.

Gümüş, E. B. (2019). Ortaokul öğrencilerinin STEM eğitimine yönelik ilgi ve görüşlerinin belirlenmesi. *Yayınlanmamış Yüksek Lisans Tezi, Gazi Üniversitesi Eğitim Bilimleri Enstitüsü,* Ankara.

Hacıoğlu, Y., & Başpınar, A. (2020). Bir sınıf öğretmeni ve öğrencilerinin ilk STEM eğitimi deneyimleri. *Karadeniz Sosyal Bilimler Dergisi, 12*(22), 1-23. DOI: 10.38155/ksbd.690919.

Karademir Coşkun, T., Alakurt, T., & Yılmaz, B. (2020). Bilişim teknolojileri öğretmenlerinin perspektifinden STEM eğitimi. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 20* (2), 820-836. doi: 10.17240/aibuefd.2020..-536856

Kennedy, T.J., & Odell, M. R. L. (2014). Engaging students in STEM education. *Science Education International, 25*(3). 246-258. https://files.eric.ed.gov/fulltext/EJ1044508.pdf.

Kızılay, E. (2018). Pre-service science teachers' opinions about the relationship of STEM fields. *Journal of Research in Education and Society, 5*(2), 174-186. https://dergipark.org.tr/tr/download/article-file/612427.

Kim, G., & Choi, S. Y. (2012). The effect of creative problem solving ability and scientific attitude through the science-based STEAM program in the elementary gifted students. *Journal of Korean Elementary Science Education, 31*(2), 216-226. doi: 10.15267/keses.2012.31.2.216.

Köse, M., & Ataş, R. (2020). Sınıf öğretmenlerinin STEM eğitimine yönelik görüşlerinin değerlendirilmesi. A*cademy Journal of Educational Sciences,* 4(2), 103-110. http://dx.doi.org/10.31805/acjes.828442

Lacey, T. A., & Wright, B. (2009). Occupational employment projections to 2018. *Monthly Labor Review,* 82-109.

Maxwell, J. A. (1996). *Qualitative research design: An interactive approach*. California: SAGE Publications.

MEB, (2016). *STEM Eğitimi Raporu.* Ankara: SESAM Grup.

Merriam, S. B. (2013). *Nitel araştırma desen ve uygulama için bir rehber.* Selahattin Turan (Çeviri Editörü). Ankara: Nobel Akademik Yayıncılık.

Miles, M. B., & Huberman, A. M. (1996). *Qualitative Data Analysis: An Expanded Sourcebook.* London, UK: SAGE.

Miller, J. (2019). STEM education in the primary years to support mathematical thinking: using coding to identify mathematical structures and patterns. *ZDM, 51*, 915–927. doi: /10.1007/s11858-019-01096-y.

Moore, T. J., Johnston, A. C., & Glancy, A. W. (2020). STEM integration: A synthesis of conceptual frameworks and definitions. In C. C. Johnson, M. J. Mohr-Schroeder, T. J. Moore, L. D. English (Eds.). *Handbook of Research on STEM Education* (3-16). New York, NY: Routledge.

Nguyen, T. P. L., Nguyen, T. H. & Tran, T. K. (2020). STEM education in secondary schools: Teachers' perspective towards sustainable development. *Sustainability,* 12, 2-16. doi:10.3390/su12218865

Özbilen, A. (2018). STEM eğitimine yönelik öğretmen görüşleri ve farkındalıkları. *Scientific Educational Studies, 2*(1), 1-21.

Park, H., Byun, S.,Sim, J., Han, H., & Baek, Y. S. (2016). Teachers' Perceptions and Practices of STEAM Education in South Korea. *Eurasia Journal of Mathematics, Science & Technology Education, 12*(7), 1739-1753. doi: 10.12973/eurasia.2016.1531a

Priatna, N., Lorenzia, S. A. & Widodo, S. A. (2020). STEM education at junior high school mathematics course for improving the mathematical critical thinking skills. *Journal for the Education of Gifted Young Scientists, 8*(3), 1173-1184. DOI: 10.17478/jegys.728209.

Rockland, R., Bloom, D. S., Carpinelli, J., Burr-Alexander, L., Hirsch, L. S., & Kimmel, H. (2010). Advancing the "E" in K-12 STEM education. *Journal of Technology Studies, 36*(1), 53-64. https://www.learntechlib.org/p/55436/.

Sanders, M. E. (2008). STEM, STEM education, STEMmania, *The Technology Teacher*, December/January 2009,20-29. https://www.teachmeteamwork.com/files/sanders.istem.ed.ttt.istem.ed.def.pdf

Siew, N., Amir, N. & Chong, C. (2015). The perceptions of pre-service and in-service teachers regarding a project-based stem approach to teaching science. *Springerplus,* 4(1), 8, doi: 10.1186/2193-1801-4-8

Stolhmann, M., Moore, T. J., & Roehrig, G. H. (2012). Considerations for teaching integrated STEM education. *Journal of Pre-college Engineering Education Research, 2*(1), 28-34. https://docs.lib.purdue.edu/jpeer/vol2/iss1/4/

Stohlmann, M. (2018). Three modes of STEM integration for middle school mathematics teachers. *School Science and Mathematics, 119*:287–296. DOI: 10.1111/ssm.12339

Şahin, A., Ayar, M. C., ve Adıgüzel, T. (2014). Fen, teknoloji, mühendislik ve matematik içerikli okul sonrası etkinlikler ve öğrenciler üzerindeki etkileri. *Educational Sciences: Theory & Practice, 14*(1), 297-322.

Wang, H. H. (2012*). A new era of science education: science teachers' perceptions and classroom practices of science, technology, engineering, and mathematics (STEM) integration*. Unpublished doctoral dissertation, Minnesota University, Minnesota.

Wang, J., Guo, D., & Jou, M. (2015). A study on the effects of model-based inquiry pedagogy on students' inquiry skills in a virtual physics lab. *Computers in Human Behavior, 49*, 658-669. doi.org/10.1016/j.chb.2015.01.043

Weber, M. L. (2015). *The Role of Globalization, Science, Technology, Engineering, and Mathematics Project-Based Learning, and The National Science and Technology Fair Mandate in Creating 21st-Century-Ready Students in Schools in Costa Rica*. Unpublished dissertation, University of Southern California, UMI No.3704262.

Yıldırım, A., & Şimşek, H. (2003). *Sosyal bilimlerde nitel araştırma yöntemleri*. Ankara: Seçkin Yayınları.

Yıldırım, B. (2018). STEM Uygulamalarına Yönelik Öğretmen Görüşlerinin İncelenmesi. *Eğitim Kuram ve Uygulama Araştırmaları Dergisi*, 4(1), 42-53. http://ekuad.com/articles/stem-uygulamalarina-yonelik-ogretmen-goruslerinin-incelenmesi.pdf.

Yıldırım, B., & Altun, Y. (2015). STEM eğitim ve mühendislik uygulamalarının fen bilgisi laboratuvar dersindeki etkilerinin incelenmesi. *El-Jezeri Journal of Science and Engineering*, *2*(2), 28-40.

Yıldırım, B., & Türk, C. (2018). Sınıf öğretmeni adaylarının STEM eğitimine yönelik görüşleri: Uygulamalı bir çalışma. *Trakya Üniversitesi Eğitim Fakültesi Dergis*i, *8*(2), 195-213. doi:10.24315/trkefd.310112

Yıldırım, P. (2017). Fen, teknoloji, mühendislik ve matematik (STEM) entegrasyonuna ilişkin nitel bir çalışma. *Atatürk Üniversitesi Kazım Karabekir Eğitim Fakültesi Dergisi*, 35, 31-55. https://dergipark.org.tr/tr/pub/ataunikkefd/issue/33367/351798.

Yılmaz, A., Gülgün, C., & Çağlar, (2017). Teaching with STEM applications for 7th class students unit of "force and energy": Let's make a parachute, water jet, catapult, ıntelligent curtain and hydraulic work machine (bucket machine) activities. *Journal of Current Researches on Educational Studies, 7*(1), 97-116.

Zarske, M., Sullivan, J., Carlson, L., & Yowell, J. (2004). Teachers teaching teachers: Linking K-12 engineering curricula with teacher professional development. Proceedings of the 2004 ASEE Annual Conference, Salt Lake City, UT. doi: 10.18260/1-2—13304.
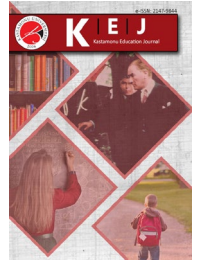
| Research Article / Araştırma Makalesi|

An Investigation of Prospective Mathematics Teachers' Ability to Subtract Integers with a Number Line and Counters

Matematik Öğretmeni Adaylarının Tam Sayılarda Çıkarma İşlemini Sayı Doğrusu ve Sayma Pulları İle Yapabilme Durumlarının İncelenmesi

Ercan Özdemir [1]

Abstract

Purpose: In the present study, the ability of middle school prospective mathematics teachers to subtract integers with counters and a number line was investigated.

Design/Methodology/Approach: A case study method was used for the investigation. The research was conducted with 37 prospective teachers who were training in a state university's undergraduate program on primary mathematics in northern Turkey. Four questions developed by the researcher for subtraction in integers were used as a data collection tool. The data of the study were analyzed in two stages. In the first stage, the answers of the prospective teachers were determined as right or wrong; subsequently, in the second stage, the mistakes that led to the wrong answers were determined.

Findings: The prospective teachers were relatively successful with respect to both modeling types. The prospective teachers had the highest rates of success in modeling with counters, with a rate of approximately 97% in subtracting a negative integer from a positive integer ((+3) − (−5)), and the lowest rates of success in subtracting a negative integer from a negative integer, with a rate of around 89% for the operation ((−4) − (−7)). In modeling with the number line, the highest success rate was approximately 91% for subtracting a positive integer ((+2) − (+5)) from another positive integer, whereas the lowest success rate was around 86% for subtracting a negative integer from a negative integer in the operation of ((−4) − (−7)).

Highlights: According to the results of the research, the prospective teachers were relatively successful in modeling the subtraction of integers using counters and a number line.

Öz

Çalışmanın amacı: Bu çalışmada ortaokul matematik öğretmeni adaylarının tam sayılarda çıkarma işlemini sayma pulları ve sayı doğrusu ile yapabilme durumları araştırılmıştır.

Materyal ve Yöntem: Durum çalışması yöntemi kullanılmıştır. Araştırma Türkiye'nin kuzeyinde yer alan bir devlet üniversitesinin ilköğretim matematik öğretmenliği lisans programında eğitim gören 37 öğretmen adayı ile yürütülmüştür. Veri toplama aracı olarak araştırmacı tarafından geliştirilen ve tam sayılarda çıkarma işlemine yönelik 4 soru kullanılmıştır. Çalışmanın verileri iki aşamada analiz edilmiştir. Birinci aşamada öğretmen adaylarının doğru veya yanlış cevaplara ulaşma durumları belirlenmiş, ikinci aşamada ise yanlış cevaplara sebep olan hatalar tespit edilmiştir.

Bulgular: Çalışmada öğretmen adayları tam sayılarda çıkarma işlemlerini her iki modelleme türünde de oldukça başarılı olmuşlardır. Öğretmen adayları sayma pulları ile modellemede en yüksek başarıyı yaklaşık %97'lik oranla pozitif bir tam sayıdan negatif bir tam sayının çıkarılması ((+3)-(-5)), en düşük başarıyı ise yaklaşık %89'luk oranla negatif bir tam sayıdan negatif bir tam sayının çıkarılması ((-4)-(-7)) işleminde göstermişlerdir. Sayı doğrusu ile modellemede en yüksek başarıyı yaklaşık %91'lik oranla pozitif bir tam sayıdan pozitif bir tam sayının çıkarılması ((+2)-(+5)), en düşük başarıyı ise yaklaşık %86'lık oranla negatif bir tam sayıdan negatif bir tam sayının çıkarılması ((-4)-(-7)) işleminde göstermişlerdir.

Önemli Vurgular: Araştırma sonuçlarına göre, öğretmen adayları tam sayılarda çıkarma işlemini sayma pulları ve sayı doğrusu ile modellemede oldukça başarılı olmuşlardır.

---

[1] **Corresponding Author,** Recep Tayyip Erdogan University, Education Faculty, Primary School Mathematics Education Department, Rize, TURKEY;
https://orcid.org/ 0000-0003-4797-9327

INTRODUCTION

National and international mathematics teaching programs aim to develop students' skills, such as problem-solving, communication, association, representation, reasoning, and providing evidence to learn and use mathematics effectively (Ministry of National Education [MEB], 2013; National Council of Teachers of Mathematics [NCTM], 2000). The skill of representation includes the effective use of manipulatives, diagrams, graphs, tables, and symbols, which are important indicators of expressing mathematical ideas and relationships (NCTM, 2000). There are various classifications for representations. One is a classification in which mathematical ideas are divided into external representation and internal representation (Hiebert & Carpenter, 1992). In this classification, external representations are divided into five categories by Lesh, Post, and Behr. (1987): concrete models, pictures, symbolic expression, spoken language, and real-life situations. The ability of students to switch between these different styles of representation improves their relational understanding (Lesh, Post, & Behr, 1987). Lesh et al. (1987) stated that multiple representations should be used in mathematics teaching. Some examples include moving from counters, fraction bars, and decimal base blocks to concrete models; from a number line model to a picture or a diagram; written symbols or symbolic representations, 5!, and a-1 <6 examples (Özdemir & İpek, 2020).

The arithmetic of whole numbers is relatively intuitive for children because they can think of it in ways that are based on real-world contexts (Carpenter et al., 1999). Children can learn by representing fractions, decimal notations, percentages, and non-negative rational numbers in different ways and by associating them with aspects of daily life (Whitacre et al., 2017). Natural numbers are used to denote multiplicities. However, the set of natural numbers is insufficient in expressing quantities, such as temperature, height, average, and credit–debt; solving equations, such as x + 3 = 0; and doing subtraction operations, such as 3 − 7 (wherein the minuend is less than the subtractive). To eliminate such deficiencies, a set of integers has been defined (Argün, Arıkan, Bulut, & Halıcıoğlu, 2014, p. 507; Baykul, 2009, p. 240; Van de Walle, Karp, & Williams, 2012, pp. 473–482). Integers have two components: direction and quantity. In expressions such as −3 and +7, the signs − and + indicate the direction, and 3 and 7 indicate the quantity (multiplicity or size).

Integers comprise an important and challenging issue in the transition from arithmetic to algebra (Peled & Carraher, 2007). Students experience various difficulties while processing integers (Avcu & Durmaz, 2011; Stephan & Akyüz, 2012). Hativa and Cohen (1995) identified five types of mistakes related to the addition and subtraction of integers. The first is an mistake in subtracting a positive number from zero. For example, in the process of 0 − 6, answers such as 4, 0, or 6 can be given by considering it to mean 10 − 6. The second is an mistake in subtracting a larger positive integer from a positive integer. For example, answers such as 5, 11, −11, 3, or 8 might be given for the operation (+3) − (+8). The third type of mistake is an mistake made with the sum of two negative integers. For example, in the operation (−3) + (−8), the answers of −5, 3, 5, or 11 can be given. The fourth is the mistake of adding an integer and its reverse according to the addition operation. For example, answers such as 6 or 3 might be given for the (−3) + (+3) operation. Finally, the fifth type of mistake is an mistake in adding a positive integer and the number with the reverse sign. For example, answers such as 5, 11, −11, 3, or 8 can be given in the operation (+3) + (−8). (In the study by Hativa and Cohen (1995), mistakes that could be made with negative numbers in addition and subtraction, such as (−4) − (−7), were not mentioned because only a + b, a-b, -a + b, -a-b (with a > 0 and b > 0) operations were included.) The reasons for mistakes and difficulties when dealing with integers include the meanings of the arithmetic operations in integers (Vlassis, 2004), the different meanings of the minus sign (Gallardo & Rojano, 1994; Janvier, 1985; Vlassis 2004; Vlassis, 2008), an inability to physically model negative numbers (Stephan & Akyüz, 2012), transferring the operations and generalizations in natural numbers to integers (Hativa & Cohen, 1995; Kilhamn, 2011), the opposite relationship between negative numbers and size notation (Fischbein, 1987), and all the algebraic properties of negative numbers.

Contexts and models are used when teaching integers. The contexts can be divided into two categories: those that contain quantity and those that contain linearity. Debt-receivable and profit–loss contexts include quantity, whereas contexts related to temperatures, altitudes, elevators, and timelines include linearity. Further, models can also be divided into two as either quantitative or linear. Counters can be given as an example of a quantitative model and a number line as that of the linear model (Van de Walle, Karp, & Williams, 2012). Janvier (1983) defined two models for teaching integers: the equilibrium model and the number line. The equilibrium model can be said to correspond to the quantitative model in the classification of Van de Walle et al. (2012). In the equilibrium model, numbers are represented by elements of two opposite types, such as black and white marbles and negative-positive electric charges. In this model, the addition process is defined as merging and the extraction process as removing or vice versa. In the number line model, numbers are represented either by their position on the number line or by their displacement. Here, addition is a "combination of two movements" or a "displacement from one location to another"; subtraction is defined as "moving in the opposite direction" or a "difference between two positions" (Hativa & Cohen, 1995; Janvier, 1983).

When examining the literature, it is evident that no consensus exists as to which of the two models of the number line and counters are more useful in the teaching of integer and integer operations. Some studies recommended the use of the number line model (Cemen, 1993; Cunningham, 2009; Fischbein, 1977; Peled, Mukhopadahyay, & Resnick, 1989; Thompson & Dreyfus, 1988), while others recommended the use of the counting scale model (Battista, 1983; Hart, 1981; Liebeck, 1990).

Cemen (1993) argued that the most effective method among the monetary model, the two-color tile model, and the number line model in teaching the addition and subtraction of integers is that of the number line. The monetary model includes receiving and giving the money that is owed, which does not make a clear distinction between negative numbers and subtraction. In the

two-color tile model, one color is used for positive numbers and a different color for negative numbers, which helps explain the distinction between negative numbers and subtraction by using various colors. In this approach, operation −2 − (−5) involves removing five negative counters, and the −2 + 5 process requires the addition of five positive counters. However, describing that the removal of five negative counters and the addition of five positive counters give both processes the same result, and these processes remain abstract. In the number line model, positive numbers are considered to represent a forward movement while and negative numbers represent a backward movement. Here, addition is defined as "preserving its direction," and subtraction is defined as "turning in the opposite direction." Thus, it is argued that these properties make the number line model the most useful one.

Liebeck's (1990) "score and forfeits" model and Battista's (1983) "positive and negative charge" model can be regarded to be the same as that of counters because the implementation of both models is done with concrete objects. These researchers argued that the counting scale model was more effective than the number line model because counters are concrete, whereas the number line is pictorial; because counters are appropriate for four integer operations, whereas there are different restrictions with the number line; and so on.

Almeida and Bruno (2014) investigated the strategies used by prospective middle schoolteachers to solve verbal problems requiring addition with negative numbers. From their results, it was determined that the prospective teachers used six different strategies: using operations with positive numbers, using operations with negative numbers, using number lines, counting in order/over, verbal explanations, and drawings. It was observed that the prospective teachers preferred the strategy of "making operations with negative numbers" for the problems they found easy to solve and other strategies for more complex problems; the rate of reaching the correct answers ranged from 76% to 97%.

Durmaz (2017) investigated the situation for teachers and prospective teachers in modeling four processes for integers with counters. Teachers and prospective teachers were more successful in modeling the addition process than in modeling other operations. Moreover, it was determined that teachers were more successful in all types of modeling than prospective teachers.

Kubar and Çakıroğlu (2017) investigated the knowledge of middle-school mathematics prospective teachers about the possible mistakes and mistakes of middle-school students in defining integers. It was observed that prospective teachers had a general knowledge of students' mistakes but lacked detailed information in terms of content and pedagogical aspects.

Research Significance and Problems

Students, prospective teachers, and even teachers are known to experience some difficulties in performing the addition and subtraction operations for integers with number lines and counters (Battista, 1983; Durmaz, 2017; Liebeck, 1990). The lack of studies investigating both the number line and the counting counter model together reveals a gap in the field. Furthermore, prospective teachers might develop misunderstandings or a limited understanding of different basic mathematical concepts (Ball, 1988; Ma, 1999). Such understandings are often passed on by prospective teachers to their future students (Reeder & Bateiha, 2016). This situation reveals the importance of detecting and eliminating the incorrect or limited understandings, if such understandings exist, of prospective teachers. Accordingly, this study investigated the ability of prospective teachers to subtract integers using the counters and number line models. It is thought that the study will contribute to filling the gap in this area and to enhance the knowledge of prospective teachers, teachers, and, consequently, students. For this purpose, the following research problems were identified.

1. How are the prospective teachers' success in modeling subtraction with integers with number lines and counters?

2. What are the mistakes that prospective teachers make in modeling the subtraction of integers with number lines and counters?

Subtracting Integers with the Number Line and Counters

According to the model considered in this analysis, processing begins by looking at the zero point on the number line in the positive direction (to the right). Positive numbers have been defined as a "move forward," whereas negative numbers as a "backward movement." The addition process is considered a process where you "keep your current direction," and the subtraction process is considered one where you "reverse your current direction" (Billstein et al., 2016, p. 230; Cemen, 1993; Teppo & Heuvel-Panhuizen, 2014).
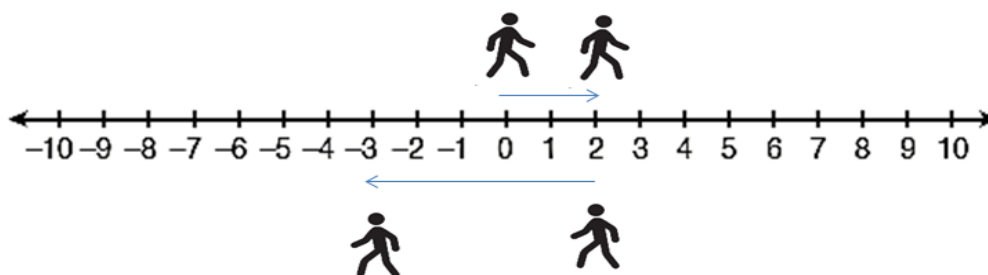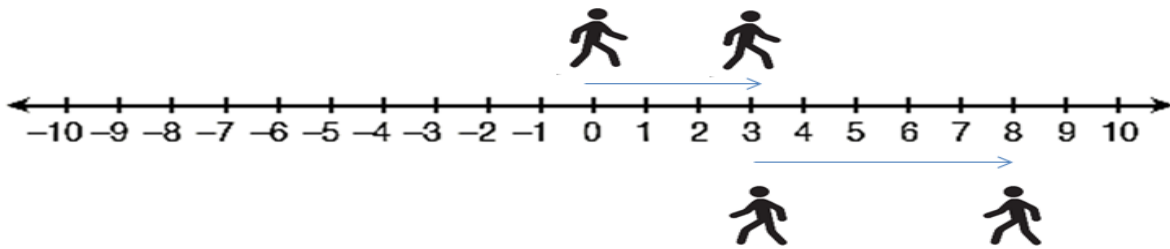

Figure 1. Operation of (+2) − (+5) with the number line

According to this model, the operation of (+2) − (+5) is as follows. On the number line, the zero point is looked at in the positive direction. Because the value +2 is given, we move two units forward. Owing to the subtraction, it is turned from the current point (from the +2 point) to the opposite direction (i.e., the negative axis). Because of the value of +5, we move five units forward from the current point. The point of arrival is −3. Therefore, the result of (+2) − (+5) operation is −3.

Figure 2. Operation of (+3) − (−5) with the number line

According to this model, the operation of (+3) − (−5) is as follows. The positive direction is looked at from the zero point on the number line. Because of the value of +3, we move three units forward. Owing to the subtraction process, we return to the opposite direction (i.e., the negative axis) from the current point (point +3). Because of the −5 value, we move back five units from the current point. The reached point is +8. Therefore, the result of (+3) − (−5) is +8.
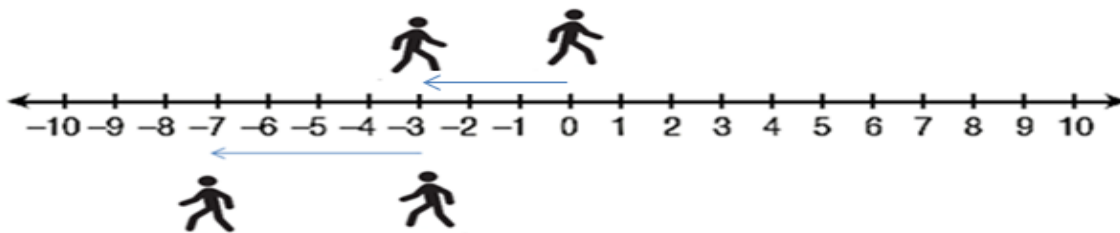
Figure 3. Operation of (−3) − (+4) with the number line

According to this model, the operation of (−3) − (+4) is as follows. The positive direction is looked at from the point of zero on the number line. Because of the −3 value, we move back three units. Owing to the subtraction operation, we turn from the current point (from −3 point) to the opposite direction (i.e., the negative axis). Because of the value of +4, we move four units forward from the current point. The reached point is −7. Therefore, the result of (−3) − (+4) is −7.
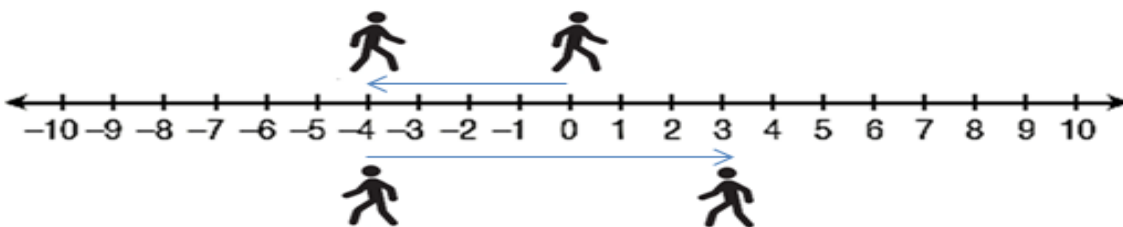
Figure 4. Operation of (−4) − (−7) with the number line

According to this model, the operation of (−4) − (−7) is as follows. On the number line, the positive direction is looked at from the point of zero. Owing to the value of −4, we move four units back. Because of the subtraction operation, we turn from the current point (point −4) to the opposite direction (i.e., the negative axis). Because of the −7 value, we move seven units back from the current point. The reached point is +3. Therefore, the result of (−4) − (−7) is +3.

In this study, in modeling the subtraction of whole numbers with counters, the model used by Billstein et al. (2016, p. 229) has been considered. White scales are used to represent negative integers; blue scales are used to represent positive integers. The addition process is considered to involve adding counters to the box, while the subtraction process involves removing counters from the box. These operations can also be done with electrical charges instead of counters (Battista, 1983; Billstein et al., 2016, p. 229).
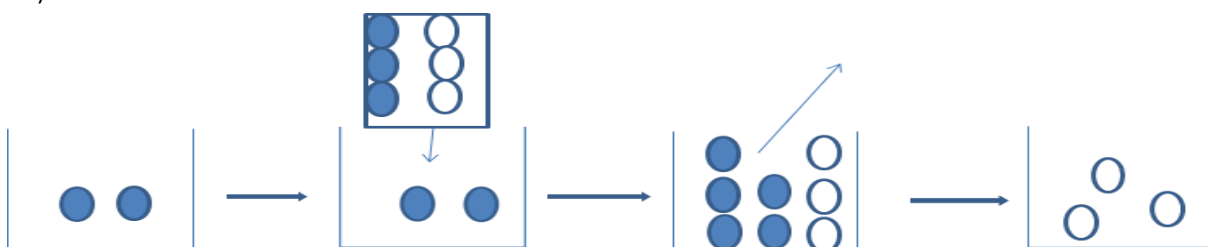
Figure 5. Operation of (+2) − (+5) with counters

According to this model, the operation of (+2) − (+5) is as follows. There are two blue counters inside the box. For subtraction, the counter must be removed from the box. Because of the value of +5, five blue counters must be removed from the box. Since there are five blue counters in the box, three blue and three white scales are added. (This can be expressed as "3 zero pairs or 3 neutral pairs are added"). There are five blue and three white scales in the box. Subsequently, five blue counters are removed from the box, and three white counters remain in the box. Therefore, the result of (+2) − (+5) operation is −3.
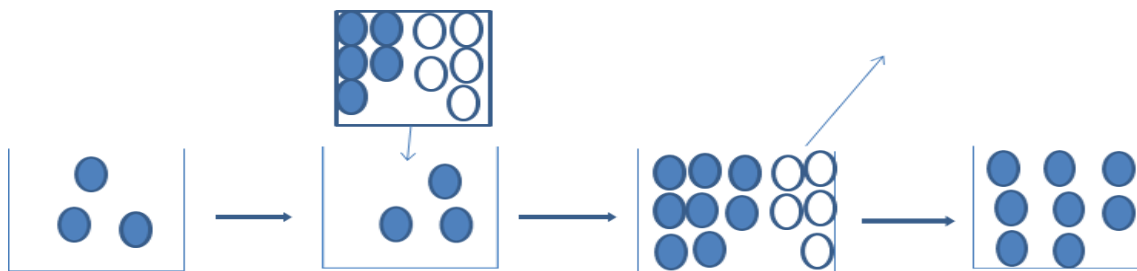
Figure 6. Operation of (+3) − (−5) with counters

According to this model, the operation of (+3) − (−5) is as follows. There are three blue counters inside the box. For subtraction, the counter must be removed from the box. For the value of −5, five white counters should be removed from the box. Since there are no white counters in the box, five white and five blue counters are added. (This can be expressed as "5 zero pairs or 5 neutral pairs are added"). In this case, there are eight blue and five white counters in the box. When five white counters are removed, eight blue counters remain in the box. Therefore, the result of (+3) − (−5) is +8.
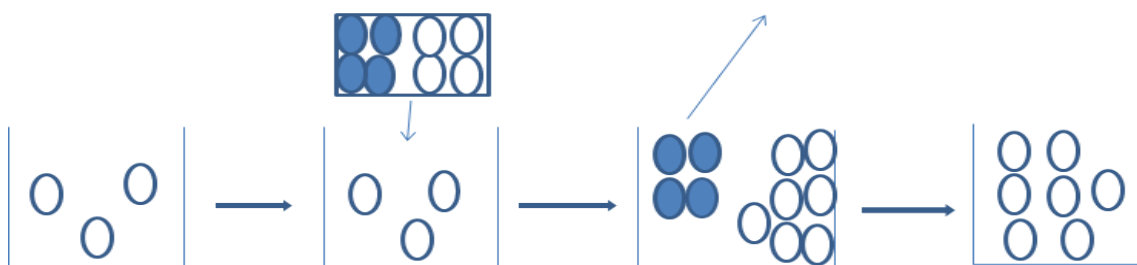
Figure 7. Operation of (−3) − (+4) with counters

According to this model, the operation of (−3) − (+4) is as follows. There are three white counters inside the box. For subtraction, the counter must be removed from the box. Because of the +4 value, four blue counters should be removed from the box. Since there is no blue counter in the box, four white and four blue scales are added. (This can be expressed as "4 zero pairs or 4 neutral pairs are added"). In this case, there are four blue and seven white counters in the box. When four blue counters are removed, seven white counters remain in the box. Therefore, the result of (−3) − (+4) is −7.
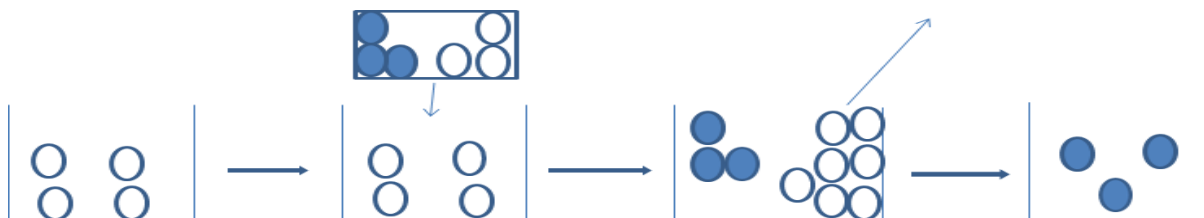
Figure 8. Operation of (−4) − (−7) with counters

According to this model, the operation of (−4) − (−7) is as follows. There are four white counters inside the box. For subtraction, the counter must be removed from the box. Because of the value of −7, seven white counters should be removed from the box. Since there are seven white counters in the box, three white and three blue counters are added. (This can be expressed as "3 zero pairs or 3 neutral pairs are added"). There are three blue and seven white counters in the box. Next, seven white counters are removed from the box, and three blue counters remain in the box. Therefore, the result of (−4) − (−7) is +3.

METHOD/MATERIALS

A case study design was used in the study. Case studies aim to disclose findings regarding a specific situation. The main feature of a case study is an in-depth investigation of one or a few cases (Yıldırım & Şimşek, 2008). This method was used to reveal results concerning prospective teachers' ability to subtract integers with counters and number lines.

Study Group

The research was conducted with 37 prospective teachers who were enrolled in an undergraduate program of a state university on mathematics education in middle school and were in the third grade. In the process of determining the study group,

criteria sampling and easily accessible situation sampling methods were used. Easily accessible situation sampling is preferred because it brings speed and practicality to the research (Yıldırım & Şimşek, 2008). Regarding the criteria sampling, the criteria were "to take the Special Teaching Methods 1 course and to be successful." In the scope of this course, prospective teachers learn about the "basic concepts specific to the field, the relationship of these concepts with field teaching, and the tools and materials used in field teaching." Moreover, an "examination of the relevant aspects of the curriculum in terms of acquisition, unit, activity, and so on" was also carried out. In the course, the concepts of counters, the number line, and zero pairs were introduced to prospective teachers. The information that the prospective teachers received in this course on modeling with integers was limited, and no special training was given in relation to modeling the subtraction process in integers. Prospective teachers who completed the Special Teaching Methods 1 course were informed about the contents of the present study. The study was conducted with 37 prospective teachers who voluntarily agreed to participate after being informed about the research.

Data Collection

A subtraction of Integers Test (SoIT) was developed by the researcher and was used as a data collection tool. In the SoIT, four questions regarding subtraction in integers were included, and the prospective teachers were asked to solve the given questions using counters and number lines. The questions in SIT involved subtracting a positive integer from another positive integer (($+2$) − ($+5$)), subtracting a negative integer from a positive integer (($+3$) − ($−5$)), subtracting a positive integer from a negative integer (($−3$) − ($+4$)), and subtracting a negative integer from another negative integer (($−4$) − ($−7$)). During the process of creating the questions, existing studies on integers were reviewed (Cemen, 1993; Gallardo & Romero, 1999; Stephan & Akyüz, 2012; Teppo & Heuvel-Panhuizen, 2014). The prospective teachers were given 40 minutes to complete the SoIT. The necessary arrangements were made in the classroom where the test was taken so that the prospective teachers would not be affected by each other's solutions.

Data Analysis

The data were analyzed in two stages. In the first stage, the answers given by the prospective teachers for the questions in SoIT were coded as correct, incorrect, or blank. Operations with counters were carried out with the model of Billstein et al. (2016, p. 229). The execution of operations according to this model is given in Figures 5, 6, 7, and 8 with accompanying explanations. Models that were made as indicated in the figures were accepted as correct; the ones that were different were accepted as incorrect. Incorrect modeling examples are presented in Figures 15 and 16 in the Results section. The operations on the number line were evaluated according to the model used by Billstein et al. (2016), Cemen (1993), and Teppo and Heuvel-Panhuizen (2014). The operations according to this model are given in Figures 1, 2, 3, and 4 with accompanying explanations. Models that were made as indicated in the figures were accepted as correct; the ones that were different were accepted as incorrect. Incorrect modeling examples are presented in Figures 11, 12, 13, and 14 in the Results section. In the second stage, the mistakes that caused the wrong answers were determined. The next section of the present study provides some examples of the mistakes and explains the possible reasons for the mistakes. The two stages of the analysis were performed by two math educators. Differences in the analysis were discussed until a consensus was reached between the two experts (Miles & Huberman, 1994). To ensure the validity of the research, how the results obtained herein were acquired has been shown clearly (Yıldırım & Şimşek, 2008). Further, to increase the reliability of the case studies, researchers should clearly define the processes followed and support them with the relevant documents. Therefore, the prospective teachers, who were the sources of the research data, have been clearly defined herein, and the study group and process for determining the group have also been explained for other researchers who may conduct similar studies. The research method, stages, data collection methods, research analysis, and details regarding what was done in terms of obtaining and interpreting the research results have been clearly stated. The data were described in detail by providing direct quotations concerning the operations made by the prospective teachers in the SoIT (Yıldırım & Şimşek, 2008).

FINDINGS

In this section, the data obtained from the solutions of the prospective teachers in the SoIT are presented in accordance with the problems of the study.

Findings Regarding the First Problem of the Study

Table 1 shows the percentage frequency distribution of correct, blank, and incorrect answers given by the prospective teachers to the questions in the SoIT.

Table 1. Percentage frequency distribution of the answers given by the prospective teachers to the questions in the SoIT

Question	Number Line				Counters			
	C	I	B	T	C	I	B	T
	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)	f (%)
(+2) − (+5)	34 (91.8)	3 (8.1)	0 (0)	37 (100)	34 (91.8)	2 (5.4)	1 (2.7)	37 (100)
(+3) − (−5)	33 (89.1)	4 (10.8)	0 (0)	37 (100)	36 (97.2)	1 (2.7)	0 (0)	37 (100)
(−3) − (+4)	33 (89.1)	3 (8.1)	1 (2.7)	37 (100)	34 (91.8)	1 (2.7)	2 (5.4)	37 (100)
(−4) − (−7)	32 (86.4)	3 (8.1)	2 (5.4)	37 (100)	33 (89.1)	1 (2.7)	3 (8.1)	37 (100)

(C: Correct, I:Incorrect, B: Blank, T: Total)

Please It can be seen from Table 1 that the prospective teachers were relatively successful in both types of modeling. The prospective teachers showed the highest rate of success for the (+3) − (−5) operation with counters and the lowest rate of success for the operation of (−4) − (−7) with the number line.

In relation to subtraction with the number line, the prospective teachers showed the highest success rate for the operation of (+2) − (+5) and the lowest for (−4) − (−7). Thus, it is understood that the problem that the prospective teachers had the lowest success in subtracting with counters and the number line concerned subtracting a negative integer from another negative integer. Moreover, it can be seen that the questions with which the prospective teachers showed the highest success in differ in terms of the models used. The highest successes were related to subtracting a negative integer from a positive integer with counters and subtracting a positive integer from a positive integer with the number line.

When the solutions in the SoIT were examined, 35 prospective teachers supported the procedures that they expressed in writing with figures. An example of a solution is given in Figure 9.
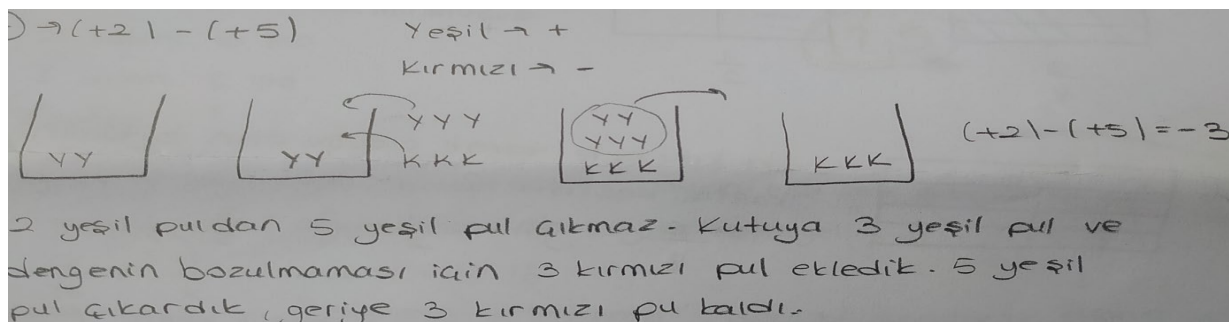
Figure 9. Modeling example for the operation of (+2) − (+5)

(*English translation of the text in the figure*: *Yeşil = Green, Kırmızı = Red..As 5 green counters cannot be subtracted from 2 green counters, I added 3 green counters, and then, I added 3 red counters so as not to break the balance. I removed 5 green counters. There remained 3 red counters.*)

Furthermore, it was found that two prospective teachers solved the questions using only figures. Two examples of solutions are given in Figure 10.
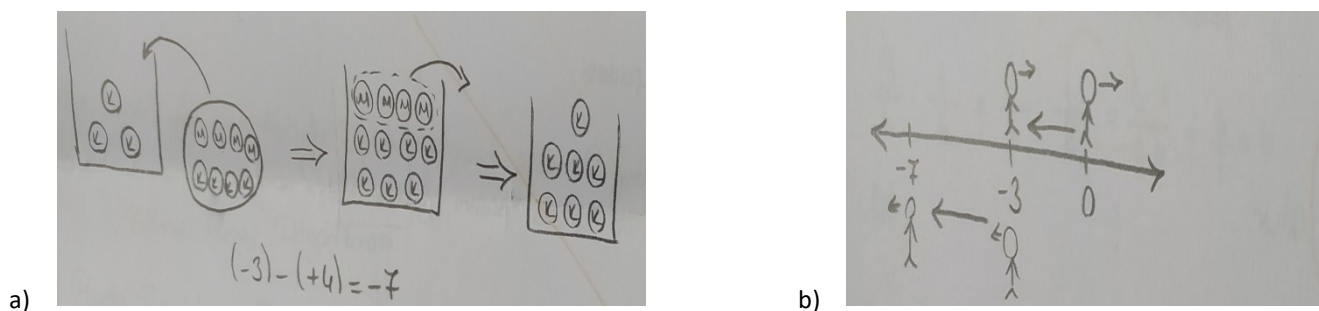
Figure 10. Modeling examples for the operation of (−3) − (+4)

Prospective teachers made more mistakes in the subtraction of integers with a number line than with counters. The types of mistakes made using the number line and their frequencies are given in Table 2.

Table 2. Mistakes in modeling with the number line while subtracting integers

Type of Mistake	Frequency
Not starting the modeling from the starting point (point 0)	7
Ignoring the sign of the number	3
Giving the same meaning to the operation sign and the number sign	1
Ignoring the sign of the operation	5
Arithmetic	1

Table 1 shows that the prospective teachers gave 13 wrong answers when modeling with the number line; however, the number of mistakes in Table 2 is 17. This is because some of the prospective teachers made more than one mistake in solving a problem.
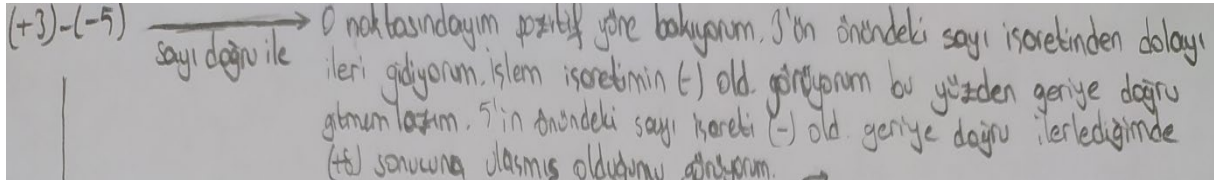
Figure 11. Example of the "giving the same meaning to the operation sign and the number sign" mistake

(*English translation of the text in the figure*: *(+3) − (−5) the number with line >>> I am at point 0 and facing the positive direction. I am moving forward because of the sign in front of the number 3. I see that the sign is (−), because of which, I should go back. When I do so, because of the sign (−) in front of the number 5, I arrive at point (+8).*)

When we look at Figure 11, it is evident that the sign of the operation and the number after the subtraction process are given the same meaning. In addition, if we move back five units while looking to the positive direction from +3, −2 instead of +8 would be reached. Thus, it can be understood that the prospective teacher did not check the action that they performed or took action according to the result.
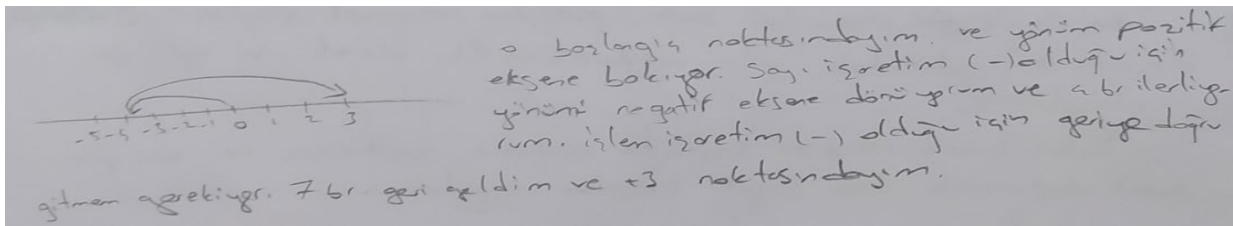
Figure 12. Example of the "ignoring the sign of the number" mistake

(*English translation of the text in the figure*: *I am at point 0 and facing the positive direction. Because the sign of the number is (−), I turn to face the negative direction and move forward 4 units. Because the sign of the process is (−), I should go back. I came back 7 units and now I am at point (+3).*)

In Figure 12, while modeling with the number line, the sign of the number seven is not taken into account. Moreover, the minus sign in front of the number has been given the meaning of turning to the negative axis and the subtraction to go backward. Giving such a meaning to the signs of the number and operation is the opposite of the model adopted in this study. The prospective teachers did not consider the number sign (or did not include it in the modeling process) regardless of whether the modeling was accurate or incorrect.
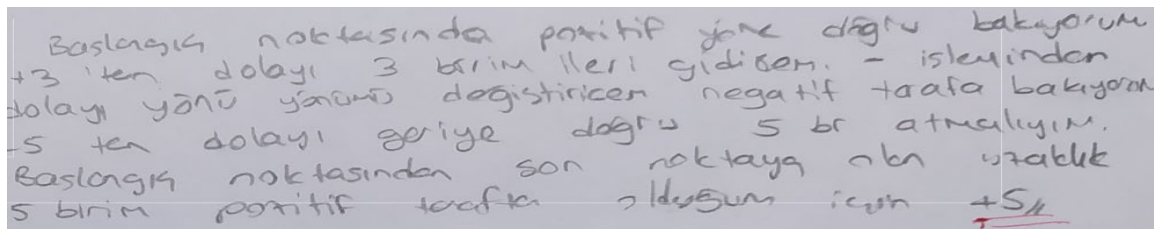
Figure 13. Example of the "arithmetic" mistake

(*English translation of the text in the figure*: *I am facing the positive direction from the starting point. I go forward 3 units because of the number (+3). I change my direction to the negative because of the sign (−). I am facing the negative direction. I should go 5 units back because of the number (−5). This is because the distance from the starting point to the finish point is 5 units in the positive direction (+5).*)

Figure 13 shows that the prospective teacher reached the point of +5 when looking at the negative axis at the +3 point while moving five units back. The prospective teacher correctly applied all stages of modeling with the number line and found the answer to be +5 instead of +8. Thus, it is thought that the wrong answer in this case was reached owing to an arithmetic mistake.
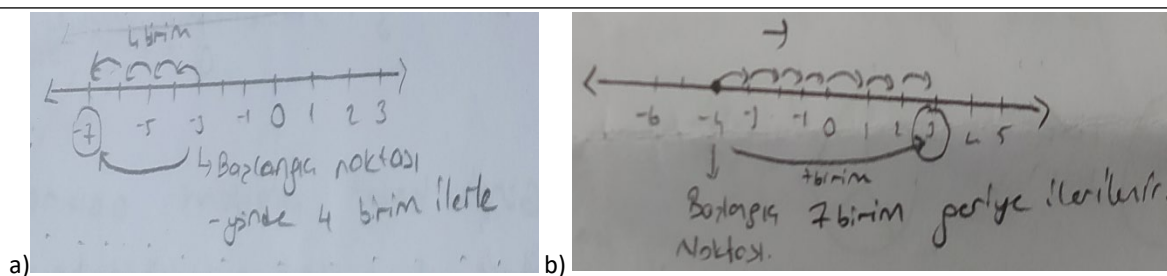
Figure 14. Examples of the "not starting the modeling from the starting point" and "ignoring the sign of the operation" mistakes

In Figures 14a and 14b, the modeling was not started at the starting point (i.e., point 0). It was stated that the sign of the second number will move forward or backward by ignoring the operation signs. Depending on the direction, the concepts of "forward and backward" differ. Although the conclusions reached here were correct, the process was wrong. Clearly, these mistakes arise from not starting the model by looking in the positive direction at the zero point and not including the sign of the subtraction process in the modeling.

Table 3 shows the types of mistakes made by the prospective teachers in modeling with counters and their frequencies.

Table 3. Mistakes in modeling subtraction of integers with counters

Type of Mistake	Frequency
Editing according to the result	3
Arithmetic	2

The prospective teachers used counters less frequently than the number line (see Table 1). Three of the mistakes made in modeling with counters were due to "editing according to the result," while two of the mistakes were related to "arithmetic."
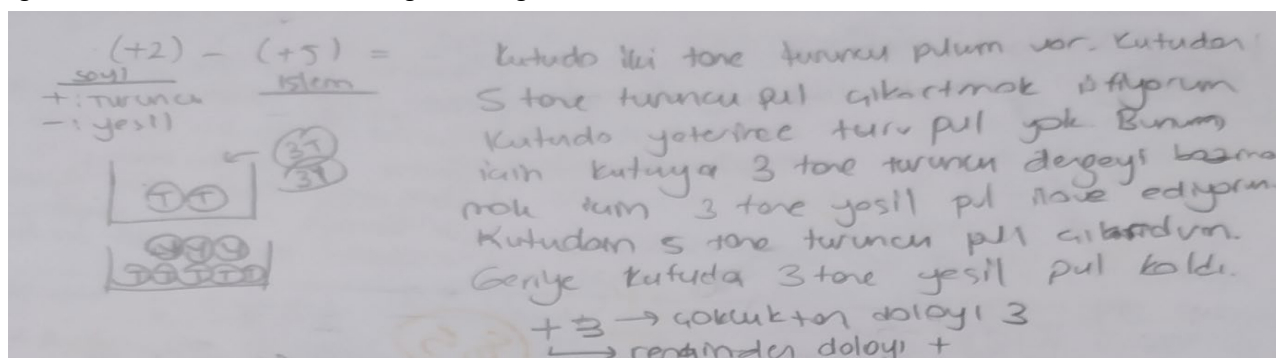
Figure 15. Example of an "arithmetic" mistake in modeling with counters

(*English translation of the text in the figure*: I have 2 orange counters in my box. I want to remove 5 orange counters from the box. There are not enough orange counters in the box. So as not to break the balance, I add 3 orange counters and 3 green counters to the box. I remove 5 orange counters from the box. There remain 3 green counters in the box… + is because of its color …3 is because of the multiplicity.)

Figure 15 shows that the prospective teacher represented positive integers with an orange counter and negative integers with a green counter, as indicated in the upper left of the figure. Although the prospective teacher provided the correct answer by stating that there were three green counters in the box using the counters model, they stated the answer was +3. At the last stage, it was understood that the green counters, which represented negative integers, had escaped the attention of the prospective teacher.
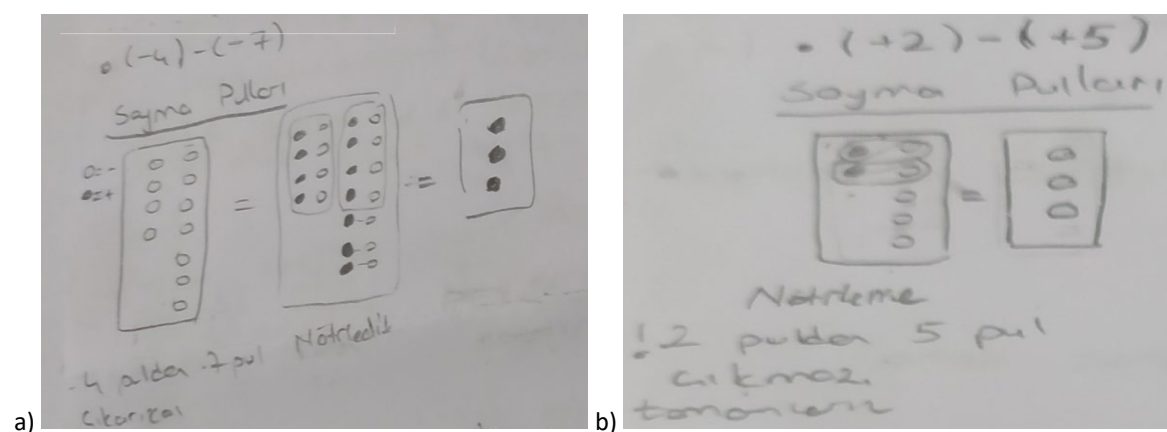
Figure 16. Examples of the "editing according to the result" mistake in modeling with counters

In Figure 16a, it is evident that the prospective teacher started modeling the counters to be used in the subtracting process by initially accepting them in the box. In the second stage, they added a positive counter for each negative counter, neutralized (or added a zero pair) the process, and then found the result to be +3. It can be seen that the prospective teacher performed operations to obtain +3, which is the result of (−4) − (−7). Figure 16b depicts a similar situation.

DISCUSSION AND CONCLUSION

Prospective teachers may develop misunderstandings or a limited understanding of different basic mathematical concepts (Ball, 1988; Ma, 1999). Moreover, prospective teachers often transfer their understandings to their future students (Reeder & Bateiha, 2016). Thus, identifying and amending their misunderstandings, if any exist, is essential. Thus, the present study investigated and analyzed the modeling abilities of prospective teachers of middle school mathematics for subtraction operations in integers with counters and number lines.

In the study, the prospective teachers were relatively successful with respect to both modeling types. The prospective teachers had the highest rates of success in modeling with counters, with a rate of approximately 97% in subtracting a negative integer from a positive integer ((+3) − (−5)), and the lowest rates of success in subtracting a negative integer from a negative integer, with a rate of around 89% for the operation ((−4) − (−7)) (see Table 1). In modeling with the number line, the highest success rate was approximately 91% for subtracting a positive integer ((+2) − (+5)) from another positive integer, whereas the lowest success rate was around 86% for subtracting a negative integer from a negative integer in the operation of ((−4) − (−7)) (see Table 1). Accordingly, it was understood that the question type with which the prospective teachers showed the highest success differed across modeling types, while the question type with the lowest success was the same. One reason for the high success rate of the prospective teachers might be their success in the "special teaching methods 1" course, as efforts in courses on mathematical teaching methods might positively affect prospective teachers' understanding of mathematical concepts and planned pedagogical practices (Reeder & Bateiha, 2016; Sowder, Phillip, Armstrong, & Schappelle, 1998).

It was observed that the mistakes made by the prospective teachers in modeling the subtraction process with counters were caused by a lack of attention and resulted in an editing of the modeling according to the answer because they did not fully know or understand how the model worked. Specifically, prospective teachers who made the mistake of "editing according to the result" may have first found the answer of the process without using a model and then tried to model it with counters according to that answer. Taking Figures 16a and 16b into consideration, the steps of starting the modeling, adding a zero pair, and reaching the answer were not applied correctly; however, the answer itself was correct. This shows that the prospective teacher did not know how to model the procedure with counters and made arrangements according to the answer of the procedure. Furthermore, the prospective teachers made five different types of mistakes in modeling with the number line. These were (1) not starting the modeling at the zero point, (2) ignoring the sign of the resulting number, (3) giving the same meaning to the operation sign and the number sign, (4) ignoring the sign of the operation, and (5) arithmetic mistakes. The literature indicates that difficulties exist in relation to subtracting integers and working with negative numbers. The mistakes revealed in this study are also thought to stem from a lack of understanding of the different meanings of the minus sign (Gallardo & Rojano 1994; Janvier, 1985; Vlassis, 2004) and the limitations of the models used (Battista, 1983; Cemen, 1993; Cunningham, 2009; Liebeck, 1990).

RECOMMENDATIONS

In this study, it was observed that prospective teachers made more mistakes in modeling with a number line than modeling with counters. More activities and studies should be conducted with prospective teachers to improve their ability to operate using the number line because this model is widely used in subjects related to fractions, natural numbers, integers, and real numbers. Thus, it should be ensured that prospective teachers use the number line effectively.

Clinical interviews were not conducted with the prospective teachers in the present research, thereby limiting the information available with respect to their thought processes and sources of mistake in modeling the extraction process. Future studies can overcome this limitation by interviewing the participants regarding these aspects.

The prospective teachers herein were considerably successful in modeling procedures with the number line and counters. Future research can explore teachers' knowledge of the mistakes of middle school students while using these models for integers as well as the teachers' suggestions for potential solutions for such mistakes.

Declaration of Conflicting Interests

Funding

Statements of publication ethics

I hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.
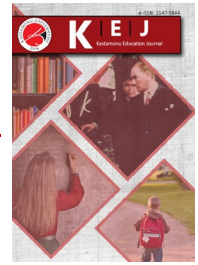
Ethics Committee Approval Information

The study was approved by the Ethics Committee of Recep Tayyip Erdoğan University, and it was determined to be compliant with ethical standards with the letter dated November 10, 2020 and numbered 2020/129.

REFERENCES

Almeida, R. & Bruno, A. (2014). Strategies of pre-service primary school teachers for solving addition problems with negative numbers. *International Journal of Mathematical Education in Science and Technology, 45*(5), 719–737.

Argün, Z., Arıkan, A., Bulut, S. & Halıcıoğlu, S. (2014). *Masthead of basic mathematical concepts*. Ankara: Gazi Kitabevi.

Avcu, T. ve Durmaz, B. (2011). *Mistakes and difficulties encountered at primary education level in operations related to integers*, *2nd ICONTE*, Antalya.

Ball, D. L. (1988). *Knowledge and reasoning in mathematical pedagogy: Examining what prospective teachers bring to teacher education.* (Doctoral Dissertation). Michigan State University, USA.

Battista, M. T. (1983). A complete model for operations on integers. *The Arithmetic Teacher, 30*(9), 26-31.

Baykul, Y. (2009). *Teaching mathematics in middle school (2. Edition)*. Ankara: Pegem Publications.

Billstein, R., Libeskind, S., & Lott, J. (2016). *A problem solving approach to mathematics for elementary school teachers. (12th ed.)*. USA: Pearson Education, Inc.

Carpenter, T. P., Fennema, E., Franke, M. L., Levi, L., ve Empson, S. B. (1999). *Children's mathematics: cognitively guided instruction*. Portsmouth, NH:Heinemann

Cemen, P. B. (1993). Adding and subtracting integers on the number line. *Arithmetic Teacher, 40*(7), 388-389. URL: https://www.jstor.org/stable/pdf/41195814.pdf

Cunningham A.W. (2009). Using the number line to teach signed numbers for remedial community college mathematics. *Math Teaching Res J Online, 3*(4), 1–40.

Durmaz, B. (2017). *The success of service and preservice mathematics teachers' on modeling integer operations*, Ahi Evran University Journal of Kırşehir Education Faculty, 18 (3), 171- 192.

Fischbein, E. (1977). Image and concept in learning mathematics. *Educational Studies in Mathematics, 8*(2), 153-165. http://dx.doi.org/10.1007/BF00241022

Fischbein, E. (1987). *Intuition in science and mathematics: An educational approach* (D.Reidel Publishing Co., Dordrecht), pp. 97-102.

Gallardo, A., & Romero, M. (1999). Identification of difficulties in addition and subtraction of integers in the number line. In F. Hitt, & M. Santos (Eds.), *Proceedings of the twenty-first ınternational conference for the psychology of mathematics* education (Vol. I. pp. 275–282). North American Chapter, Mexico.

Gallardo, A., & Rojano, T. (1994). School algebra. syntactic difficulties in the operativity. In D. Kirshner (Ed.), *Proceedings of the sixteenth ınternational conference for the psychology of mathematics education. North american chapter,* Baton Rouge, LA (pp. 159–165). .

Hativa, N., & Cohen, D. (1995). Self learning of negative number concepts by lower division elementary students through solving computer-provided numerical problems. *Educational Studies in Mathematics, 28*(2), 401–431.

Hart, K. M. (1981). *'Positive and negative numbers', children's understanding of mathematics*. 11-16, pp. 82-87, John Murray, London.

Hiebert, J., & Carpenter, T. P. (1992). *Learning and teaching with understanding*. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning: A project of the national council of teachers of mathematics*. (pp. 65 - 97). New York, NY: Macmillan.

Janvier, C. (1985). Comparison of models aimed at teaching signed numbers. Ninth international conference for the psychology of mathematics education; Noordwijkerhout: The Netherlands, p. 135–139.

Janvier, C. (1983). The understanding of directed numbers. Seventh international conference for the psychology of mathematics education; Jerusalem, Israel; p. 295–301.

Kilhamn, C. (2011). *Making sense of negative numbers*. Göteborg, Sweden: Acta Universitatis Gothoburgensis.

Kubar, A. & Cakiroglu, E. (2017). Prospective teachers' knowledge on middle school students' possible descriptions of integers*. International Journal of Education in Mathematics, Science and Technology (IJEMST), 5*(4), 279-294. DOI:10.18404/ijemst.75211

Lesh, R., Post, T., & Behr, M. (1987). Representations and translations among representations in mathematics learning and problem solving. In C. Janvier (Ed.), *Problems of representation in the teaching and learning of mathematics. (pp. 33-40)*. New Jersey: Lawrence Erlbaum As

Liebeck, P. (1990). Scores and forfeits: An intuitive model for integer arithmetic. *Educational Studies in Mathematics, 21*(3), 221-239. doi:10.1007/BF00305091sociates.

Ma, L. (1999). *Knowing and teaching elementary mathematics*. Mahway, NJ: Lawrence Erlbaum Assoc., Inc.

Ministry of National Education (MoNE). (2013). *Middle school mathematics lesson (5th, 6th, 7th and 8th grades) curriculum.* T.C. Ministry of National Education Board of Education and Discipline, Ankara.

Miles, M.B & Huberman, A.M. (1994). *Qualitative data analysis.* Thousand Oaks, CA: Sage.

National Council of Teachers of Mathematics (NCTM). (2000). *Principles and standards for school mathematics*. Reston, VA.

Özdemir, E. & İpek, A.S (2020). Use of multiple representations in mathematics teaching. Ed. Melihan Ünlü. *New approaches in teaching mathematics with application examples (s. 91-116)*. Ankara: Pegem Publications.

Peled, I., Mukhopadahyay, S., & Resnick, LB. (1989). Formal and informal sources of mental models for negative numbers. 13th international conference for the psychology of mathematics education, Paris, France; p. 106–110.

Peled, I., & Carraher, D. W. (2007). Signed numbers and algebraic thinking. In J. Kaput, D. Carraher, & M. Blanton (Eds.), *Algebra in the early grades* (pp.303–327). Mahwah, NJ: Erlbaum.

Reeder, S. & Bateiha, S. (2016) Prospective elementary teachers' conceptual understanding of integers. *Investigations in Mathematics Learning, 8*(3), 16-29. DOI: 10.1080/24727466.2016.11790352

Sowder, J. T., Phillip, R. A., Armstrong, B. E., & Schappelle, B. (1998). *Middle-grade teachers' mathematical knowledge and its relationship to instruction*. Albany, NY: State University of New York Press.

Stephan, M., & Akyuz, D. (2012). A proposed instructional theory for ınteger addition and subtraction. *Journal for Research in Mathematics Education, 43*(4), 428–464.

Teppo, A & Heuvel-Panhuizen, M. (2014). Visual representations as objects of analysis: The number line as an example. *ZDM Mathematics Education, 46,* 45–58. DOI 10.1007/s11858-013-0518-2

Thompson, P. W. ve Dreyfus, T. (1988). Integers as transformations. *Journal for Research in Mathematics Education, 19*(2), 115-133. doi:10.2307/749406

Whitacrea, I., Azuzb, B., Lambb, L.L.C., Bishop, J. P., Schappelleb, B. P., & Philipp, R. A. (2017). Integer comparisons across the grades: Students' justifications and ways of reasoning. *Journal of Mathematical Behavior, 45*, 47–62.

Van de Walle, A. J., Karp, S.K., & Bay-Williams, M.J. (2012*)., Elementary and middle school mathematics* (Çeviri Ed. Soner Durmuş). Ankara: Nobel Akademik Publications.

Vlassis, J. (2001). Solving equations with negatives or crossing the formalizing gap. In M. Van den Heuvel-Panhuizen (Ed.), Proceedings of the twenty-fifth ınternational conference for the psychology of mathematics education. Vol.4, 375–382, Utrecht, Netherlands.

Vlassis, J. (2004). Making sense of the minus sign or becoming flexible in 'negativity'. *Learning and Instruction, 14*, 469–484. doi:10.1016/j.learninstruc.2004.06.012

Vlassis, J. (2008). The role of mathematical symbols in the development of number conceptualization: The case of the minus sign. *Philosophical Psychology, 21*(4), 555-570. DOI: 10.1080/09515080802285552

Yıldırım, A., & Şimşek, H. (2008). *Qualitative research methods in social sciences* (7. Edition). Ankara: Seckin Publications.

| Research Article / Araştırma Makalesi|

Educational Digital Game Design Process for Different Player Types

Farklı Oyuncu Tiplerine Göre Eğitsel Dijital Oyun Tasarım Süreci[1]

Semra Fiş Erümit[2]**, Furkan Kalyoncu**[3]**, Abdullah Kuzu**[4]**, Hasan Karal**[5]

Abstract

Purpose: This study aims to design and develop an educational digital game that explains the tasks and data transmission of hardware units in the 5th and 6th grade information technologies and software course, suitable for different player types.

Design/Methodology/Approach: The study was conducted with a developmental research method which is one of the design-based research methods. In the game design process, product design, development, and evaluation phases were carried out in accordance with the principles in developmental research method. Product design and development studies were carried out in three stages in accordance with design-based research. The studies conducted at each stage were evaluated by a team of 14 experts. Before moving to the next stage, in each step the necessary corrections were made in the game.

Findings: The first stage of the study deal with game design in which the data on writing scenario, adaptation of this scenario to different player types, and lastly some drawings on the scenario were   obtained. The data was analysed, and necessary arrangements were made before moving to the next stage. In the second stage, evaluations were made for the 3D design studies of the game. At this stage, data were elicited on how different player types collect points, on the duration, on the tasks of the accessories used by different player types, on the way the player reaches to the units in the game and on the design of the characters. After obtaining these data, arrangements were made, we moved to the third stage. In the third stage, depending on the feedback obtained from the players, the interaction of the characters and the dialogue windows that appear on the screen necessary arrangements were made.

Highlights: In this study, the stages in the educational digital game design process were determined, and at the end of the study, a 3D educational game that can be played by different player types was developed in accordance with the learning outcomes in the curriculum.

Öz

Çalışmanın amacı: Bu çalışmanın amacı, 5. ve 6. sınıf bilişim teknolojileri ve yazılım dersindeki donanım birimlerinin görevlerini ve veri iletimini anlatan eğitsel dijital bir oyunun, farklı oyuncu tiplerine uygun tasarlanması ve geliştirilmesidir.

Materyal ve Yöntem: Çalışma tasarım tabanlı araştırma yöntemlerinden gelişimsel araştırma yöntemi ile yürütülmüştür. Oyun tasarım sürecinde gelişimsel araştırma yöntemine uygun olarak ürün tasarımı, geliştirme ve değerlendirme aşamaları gerçekleştirilmiştir. Ürün tasarımı ve geliştirme çalışmaları tasarım tabanlı araştırmaya uygun olarak üç aşamada gerçekleştirilmiştir. Her aşamada yapılan çalışmalar 14 kişilik uzman ekip tarafından değerlendirilmiş, oyunda gerekli düzeltmeler yapılarak bir sonraki aşamaya geçilmiştir.

Bulgular: Çalışmanın ilk aşamasında oyun kurgusuna yönelik değerlendirmeler yapılmıştır. Bu aşamada senaryo yazımı, senaryonun oyuncu tiplerine göre hazırlanması ve senaryo çizimleri ile ilgili veriler elde edilmiştir. Gerekli düzenlemeler yapıldıktan sonra ikinci aşamaya geçilmiştir. İkinci aşamada oyunun üç boyutlu tasarım çalışmalarına yönelik değerlendirmeler yapılmıştır. Bu aşamada farklı oyuncu tiplerinin puan toplama şekli, süre, farklı oyuncu tiplerinin kullandığı aksesuarların görevleri, oyuncunun oyundaki birimlere ulaşma şekilleri ve karakterlerin tasarımı ile ilgili veriler elde edilmiştir. Uzman değerlendirmesinden sonra düzenlemeler yapılarak üçüncü aşamaya geçilmiştir. Üçüncü aşamada oyundaki geri bildirim, karakterlerin birbiriyle etkileşimi ve ekrana gelen diyalog pencereleri ile ilgili veriler elde edilerek, düzenlemeler yapılmıştır.

Önemli Vurgular: Bu çalışmada eğitsel dijital oyun tasarım sürecindeki aşamalar belirlenmiş, çalışma sonunda müfredattaki kazanımlara ve farklı oyuncu tiplerine uygun üç boyutlu eğitsel bir oyun geliştirilmiştir.

---

[1] This study was developed within the scope of the TÜBİTAK 1001 118R034 project and part of the study was presented as an oral presentation at the "2nd International Conference on Science, Mathematics, Entrepreneurship and Technology Education" and included in the abstract book.

[2] **Corresponded Author**, Karadeniz Technical University, Distance Education Application and Research Center, Trabzon, TURKEY; https://orcid.org/0000-0002-7161-8903

[3] Trabzon University, Fatih Education Faculty, Department of Computer and Instructional Technology Education, Trabzon, TURKEY; https://orcid.org/0000-0003-2214-3347

[4] Antalya AKEV University, The Faculty of Economics and Administrative Sciences, Antalya, TURKEY; https://orcid.org/0000-0002-1030-0424

[5] Trabzon University, Fatih Education Faculty, Department of Computer and Instructional Technology Education, Trabzon, TURKEY; https://orcid.org/0000-0002-3555-050X

INTRODUCTION

Digital games are an instructive educational tool due to the benefits they provide in educational environments. Due to the fact that digital games contain audio-visual and fun elements, they increase students' engagement and motivation, and make the classroom environment more interesting and instructive (Connolly et al., 2012; Hainey et al., 2016). For this reason, it is stated that educational games, when designed effectively, help achieve the expected educational goals. Designing digital games for educational purposes, both pedagogically and technically, is a very difficult process, and requires interdisciplinary work (Dimitriadou et al., 2020). In order for educational digital games to reach the targeted instructional goals, the scenario should be well fictionalized; the flow and fun that should be in the games should not be ignored, and all these processes should be well organized technically (Kiili, 2005; Prensky, 2004; Zeng et al., 2020).

In educational digital game designs, to what extent meaningful learning occurs with the products that are the result of the design is still a topic for debate. Although there are many design models for educational games, these models are mostly related to learning theories and game elements used in game design (Qian & Clark, 2016). Considering the point reached by today's technologies, it is seen that the technologies used in game design, game design engines and design processes using these technologies are very important. What can be done to realize learning in game designs and how technology can be used in game design processes is an open subject for improvement (Young et al., 2012). Many educational games are simple designs that focus narrowly on academic content, use low-level visuals, and provide examples of exercises and applications like worksheets (Squire, 2003; Young et al., 2012; Vasalou et al., 2017; Lämsä et al., 2018). These game designs do not only fail to attract the attention of students, but also fall short in providing learning and motivation (Lester et al., 2014; Ninaus et al., 2020). Designing games for educational purposes requires a comprehensive interdisciplinary study, as it requires an in-depth understanding of game theories as well as sufficient knowledge on the academic subject and having high competencies at a technical level (Qian & Clark, 2016). In addition, the graphics quality demanded by the players who experience today's technologies in many areas and the sense of reality given by the games are constantly increasing. Meeting these demanded needs means preparing quality visuals, believable animations, and designs for actors (Vasudevamurt & Uskov, 2015). For this reason, the success of today's educational games depends on well-fictionalized scenarios and game design processes which serve in the best way for all players.

Educational Digital Game Design Process and Difficulties Encountered

Different design processes and models are used for the designing of educational digital games. Bilgili (2020) stated that educational computer game designs are carried out in three phases. The first step is the preparation phase. At this phase, the target audience of the game, the type of game (adventure, strategy, etc.) and the platform on which the game will be developed are determined. In the second phase, scenario designs are made and the elements to be used in the game and 3D models are prepared. In the third phase, the first prototype is developed by combining all game components. Aslan and Balcı (2015) have also developed a cyclic design model for educational digital games in their study. This cycle includes designing the game with game software, applying, and publishing the game, game-based learning, and feedback stages. In this model, the game software and the requirements at the design phase and the features that should be included in the game structure are mentioned. In another educational game design study, Shi and Shih (2015) mentioned the process steps to be carried out in the game design process and the game elements to be used. In this model, the focus is on game elements such as game objectives, game mechanics, interaction, narrations, competition, mystery, socialization, and flow. When many educational game design models in the literature are examined, it is seen that the design process is generally focused, narrations, game elements, game mechanics and learning principles, but the technical processes carried out while performing them are not mentioned in detail.

Designing educational digital games is a difficult and labor-intensive process. Game designers can create interesting games and designs. Educators generally focus on educational goals and effective teaching materials, but they have problems in determining how to design games that can attract students' interest (Shi & Shih, 2015; Squire, 2003). For this reason, it is possible for educational digital games to be in accordance with pedagogical and instructional objectives and to make a technically well-designed design with an interdisciplinary teamwork (Van Eck, 2015). In the literature, in educational game design processes; it has been stated that the story flow is not immersive; the balance of skill and struggle required for the game is not provided; the player-game interaction is not in balance and the appropriate scenario is not selected (Akgün et al., 2011; Kiili, 2005; Song & Zhang, 2008). In the literature it has been stated that there are problems such as lack of engaging story flow in educational game design processes, lack of skill and combat balance required for playing the game, unbalanced player-game interaction and wrong choice of scenario (Aleem et al., 2016).

Story editing and scenario designs have been considered to be problematic in the educational digital game design process. The success of educational digital games depends largely on the scenario to be prepared for the targeted achievements (Jemmali et al., 2019; Zarraonandia et al., 2015). The game scenario is the game component that gives information about what the game is about, the elements in the game, the goals of the game, and the rules required to achieve these goals (Prensky, 2001). It is necessary to pay attention to the fact that the educational game scenarios are related to real life (Desurvire et al., 2004), reflect the sense of the game to the player (Prensky, 2001), attract the attention of the player and the game has an appropriate flow for the player (Kiili, 2005), and offers clear and understandable tasks in the game (Sweetser & Wyeth, 2005). In addition, it is stated that scenarios suitable for educational purposes and target audience are not written in educational digital game designs (Dimaraki et al., 2013), teaching purposes come to the fore, game elements and fun are lacking (Archambault et al., 2008; Taşdemir & Şüyun,

2016), poor game designs are stated to negatively affect their output (Hong et al., 2009; Sung & Hwang, 2018). Mistakes made in both the scenario and the design processes cause the game elements and fun components to remain in the background and the student's motivation in the game decreases, causing disconnections from the game (Kiili, 2005; Kocadere et al., 2019). As well as preparing appropriate scenarios in a game, technical design processes for reflecting these scenarios in the targeted way emerge as an important issue. For this reason, it is of great importance to consider and plan many components from scriptwriting to technical processes and learning theories in educational digital game design.

Player Types and Game Design

While educational digital games focus on instructional purposes, fun elements inherent in games are often overlooked. This situation causes students to be disconnected from the game and decreases their motivation and engagement to play and learn (Ike & Hoe, 2020). It is thought that developing designs suitable for player types will be a good solution to solve the problems related to fun and motivation in educational games (Manero et al., 2016). For this purpose, the game scenario in the study was prepared in accordance with Bartle's (1996) player types, so it was aimed to reveal a game for the players' preferences and interests in playing games. It has been observed that there is limited number of studies similar to this game study in the literature. Busch et al. (2016), is one of the few experimental studies conducted on this subject. They aimed to create an individualized game environment by adapting game mechanics and dynamics according to player types. In the study, two of the 7 player types of BrainHex (achiever, conqueror, daredevil, mastermind, seeker, socialiser, and survivor) and classification, mastermind and seeker player types were compared (Nacke et al., 2014). An experimental study was conducted with 51 students by creating a mobile game that can be adapted to these two player types. In the study, it was aimed to determine the player type from the choices the students made while playing the game. The study revealed that the design included a limited type of player, and the purpose of the game was to test the model created to determine the player type rather than adapting the environment according to the player type.

In the literature, it has been observed that there are multiple types of players (Bartle, 1996; Kallio et al., 2011; Tuunanen & Hamari, 2012; Xu et al., 2012). Among these, Bartle's (1996) classification is a highly preferred taxonomy (Ferro et al., 2013). In this study, four player types (socializers, achievers, explorers, killers) determined by Bartle (1996) are taken as basis. When socializers interact with other players, they have fun in games. They are happy to collaborate to get better things than they could have done by themselves. The achievers are concerned with the points and their situation in the game. They want to show their friends how they are progressing. They want their points, bonuses, and prizes to be displayed in one corner of the screen. Explorers want to see new things and discover new secrets. They do not care much about points or awards. The reward for them is discovery. The killers are worrying players. The killers want to earn points and status like accomplishers. The killers want to see what other players have lost. In the study, designs were made according to Bartle's (1996) player types in the writing of the scenarios, preparation of characters, objects, and game environment. Due to the development of a game for middle school students, the term "hunter" was used instead of the term "killer" player in the study.

Game Engines Used in Game Development Process

One of the most important issues to be decided before starting digital game design is to determine the game engine to be used to develop the game. Game engines are software developed to provide convenience to users during game development. There are many game engines that can be used for this purpose. The point that designers should pay attention to before deciding is the advantages and disadvantages offered by the game engine. Unity 3D, Unreal Engine, Corona Labs and GameMaker Studio are among the most used game engines. The advantages and disadvantages of these game engines are given in Table 1.

Table 1. Advantages and disadvantages of frequently used game engines

Game Engine	Advantages	Disadvantages
Unity 3D	• It can output on different platforms such as Web, iOS, Android, PC, Game consoles. • Coding can be done with JavaScript and C #. • You can work on the interface with drag and drop operation. • The designer community is very large. • You can become a designer for free. • There is a large object store. • There is 2D and 3D development support.	• The graphical interface is complex for beginners. • Optimization may be a problem in graphically developed games.
Unreal Engine	• Graphics support is high. • It has a large object store.	• Since the coding language is C++, it requires more programming knowledge than other languages. • Limited third-party API support. • It is problematic to operate on low specification devices.
Corona Labs	• There is support for 2D game development. • It uses Lua coding language, which is easier to learn for beginners to code.	• There is no support for 3D game development. • Community support is limited. • Printouts can only be made for mobile operating systems.
GameMaker Studio	• It is easy to use. • It is ideal for those with limited programming knowledge. • Suitable for simple projects	• It uses its own programming language. • Programming features are limited. • There is no support for 3D game development.

When the game engines used for game development were examined, it was decided to use the Unity 3D program in the study due to the advantages it provides. Output for web, iOs, Android, PC and game consoles, the ability to adjust the most appropriate graphics performance between devices, to code with JavaScript and C#, comfortable working on the interface, to have a lot of objects in the object store, 2D and 3D development support are the most important reasons for choosing Unity 3D (Labschütz et al., 2011). Although the graphical interface is complex for beginners, Unity 3D program provides many advantages among professional game engines (Vasudevamurt & Uskov, 2015).

Purpose of the Study

The educational digital game designed in the study was developed within the scope of the TÜBİTAK 1001 118R034 project titled "Developing a Game-Based Adaptive Environment for Programming Instruction for Middle School Students and Investigating the Effect on Students' Computational Thinking Skills". Within the scope of the project, it was aimed to design an educational game to explain how data is processed on the computer and the tasks of the hardware units before starting the programming education. For this purpose, in this study, an educational digital game for different player types was designed to teach the role and data transmission of hardware units in the 5th and 6th grade information technologies and software lesson curriculum. Research questions in the study conducted within the framework of this purpose are as follows:

1. What are the stages in the educational digital game design process developed according to the player types?
2. What are the studies done in the process of planning the game design?
3. What are the studies done in the 3D game design process?

METHOD

Research Method

The study was conducted with the developmental research method Type1 which is one of the design-based research methods. Developmental research method Type 1 studies focus on the development of a specific educational product, program, process, or tool (Kuzu et al., 2011; Richey & Klein, 2005). This type of research focuses on determining general design principles or making suggestions for design processes. Type 1 studies include the evaluation process as well as product design and development. It is possible to work with different participants in the design, development, and evaluation processes of a Type 1 study. Richey and Klein (2005) stated in the Type 1 research, designers, developers, users, evaluators, and experts could be participants in the design and development phase. He stated that users (designers, developers, teachers, etc.) and experts could take part in the evaluation phase. In Type 1 studies, data collection techniques such as interviews, observations and document analysis are used. The game-based adaptive system discussed in the current study, is a part of the system prepared within the scope of the project. Although different game design models have been used in the study, the developed game-based adaptive system is not just a game module. It is also an educational material suitable for specific student groups as the game was developed in the light of participation and evaluations of the experts in different fields. The method of the study is given in Figure 1.
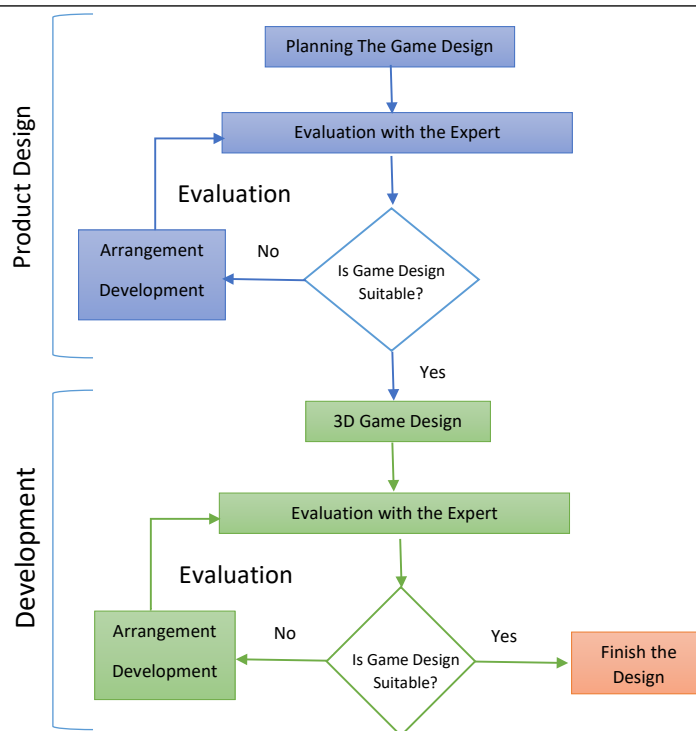
Figure 1. Research method

The product design and development phase of the study were carried out by 4 researchers. The game design was planned in the product design phase. 3D game was designed in the development phase. In the evaluation phase, the studies done during the product design and development phase were evaluated. Throughout the process, the product design, development, and evaluation cycle have been continuously applied. During the product design and development phases, revisions were made when needed and the process was re-evaluated.

Project Team

A team of field experts took part in the design, development, and evaluation phases of the project. The design and development phase were carried out by 4 experts (E1, E2, E7, E12), while the evaluation phase was carried out by the entire project team. The experiences and fields of expertise of the evaluation group members are given in Table 2.

Table 2. Evaluation team in the game design process

Code	Degree	Experience	Fields of Expertise
E1	Prof. Dr.	He has 28 years of experience as an academic.	Intelligent tutoring systems, special education, design of learning environments and content development
E2	Prof. Dr.	He has more than 30 years of experience as an academic.	Design-based research, qualitative research, interface designs
E3	Prof. Dr.	He has more than 30 years of experience as an academic.	Educational software and mathematics education
E4	Prof. Dr.	He has more than 30 years of experience as an academic.	Artificial intelligence, programming, problem solving, intelligent teaching systems
E5	Assist. Prof. Dr.	6 years Teacher, He has 11 years of experience as an academic.	Intelligent tutoring systems, adaptive learning systems and programming teaching
E6	Assist. Prof. Dr.	He has 10 years of experience as an academic.	Distance education, e-learning, special education technologies and content development
E7	Lecturer Dr.	11 years Teacher, She has 4 years of experience as an academic.	Gamification, educational games, game-based learning, instructional design, and content development
E8	Lecturer	He has 12 years of experience as an academic.	Virtual worlds, programming, content development and coding education
E9	Lecturer	He has 6 years of experience as an academic.	21st century skills, computational thinking, unplugged coding activities, content development

Code	Degree	Experience	Fields of Expertise
E10	Research Assistant	She has 4 years of experience as an academic.	Content development
E11	Teacher-PhD Student	He has 14 years of experience as a teacher.	Game-based learning, coding education and content development
E12	Master Student	-	Computer Education and Instructional Technology
E13	Master Student	-	Computer Education and Instructional Technology
E14	Master Student	-	Computer Education and Instructional Technology

E: Expert

Data Collection

The data were collected through audio recordings taken at the project meetings and the researcher diaries kept during the phases. During the project meetings, evaluations were made regarding the whole process such as the scenario of the game, suitability to player types, and the design of the game. Expert opinions on the evaluation of the game and the design process were collected by audio recordings. The data in the audio recordings were transcribed for content analysis.

Another data collection tool was the researcher diaries. The evaluations of the experts and their opinions about the arrangements to be made in the design were noted in the researcher diaries. One of the researchers (E12) who carried out the implementation in the study took notes throughout the process. Information about the meeting date, evaluations, and arrangements to be made were noted in the diaries, too.

Data Analysis

The data collected from the audio recordings were analysed by content analysis. Cohen, Manion, and Morrison (2017) stated that content analysis reveals the common themes occur in the written data. Content analysis is an effective analysis method in organizing, classifying, comparing texts, and producing theoretical results from texts (Yıldırım & Şimşek, 2008). As a result of the analysis, thematic codes were spotted from the expert evaluations. These codes were supported by quoting the experts, which were presented under the evaluation category. In addition, the notes taken about the arrangements to be made in the researcher's diaries were arranged and associated with the codes that emerged. The findings obtained regarding the regulations to be made were given under the correction category.

Educational Game Design Process

The game designed in the study was created by examining many different game design models and frameworks in the literature. Although the game design models discussed have different features, they have been selected according to the aims of this study which considers the features of the subject, the level of the students and the factors that can be used to individualize the environment. In Level-Up (Eagle, 2009), one of these game designs models, learning was modelled based on students' log records. In this way, it was aimed to determine the learning deficiencies of the students. Aleven et al. (2010) emphasized that the success of educational games will be higher by associating game mechanics, game aesthetics and game dynamics in order to achieve learning goals in the framework they created for educational game design and analysis.

Tan et al. (2007) developed an adaptive digital game-based system and proposed an individualized model that analyses the data they receive from users. Game elements such as story, goals, and challenge that make up a game were used to adapt the model. Annetta's (2010) framework for educational games is based on the constructivist approach in which students build their own knowledge by combining their new experiences with their previous experiences. In this way, it was stated that the game designs should be developed by adding on the previous knowledge at every level and should be related to daily life.

On the other hand, Shi and Shih (2015) presented a comprehensive design proposal consisting of 11 factors (game goals, game fantasy, game mechanism, game value, narrative, interaction, challenges, freedom, sociality, sensation, and mystery) in the game-based learning design model they developed using game mechanics and dynamics. It was stated that the game type alone is not enough, so a motivating and interesting game environment should be arranged according to these 11 factors in order to facilitate the learning of the students during the game. In this study, the features of the game design models mentioned above were used in the design and development process. Therefore, a game-based adaptive environment was prepared according to player types. In the current study, inferences were made for the creation of an individualized educational game environment with game mechanics and dynamics by keeping track of students' learning from log records. In addition, with the game-based adaptive system, it was aimed to make use of analogies in the scenario and visual designs of the students to build their new knowledge on their previous experiences and to provide them a meaningful learning environment with a constructivist approach.

The study was carried out in 3 phases according to the design-based research Type 1. These are Product Design, Development and Evaluation phases. The game design was planned in the Product Design phase (Stage I). The processes of 3D game design were carried out during the development phase, and this phase included 2 sub-stages (Stage II and Stage III). The Evaluation phase was carried out continuously in both the product design and the development phases. In the first stage, the problem was determined, the game scenario was prepared according to the goals in the curriculum and the types of players and scenario drawings were

made (Product Design). In the second stage, the game was designed in 3D. At this stage, the game engine to be developed and the technical features to be used in the game were determined, and the graphical elements to be used in the game were created; the general design of the game environment, the placement of the objects, and the creation of the animations in the game were made. In the third phase, the interface design, as a continuation of the development phase, and instruction and feedback designs were made (Figure 2).
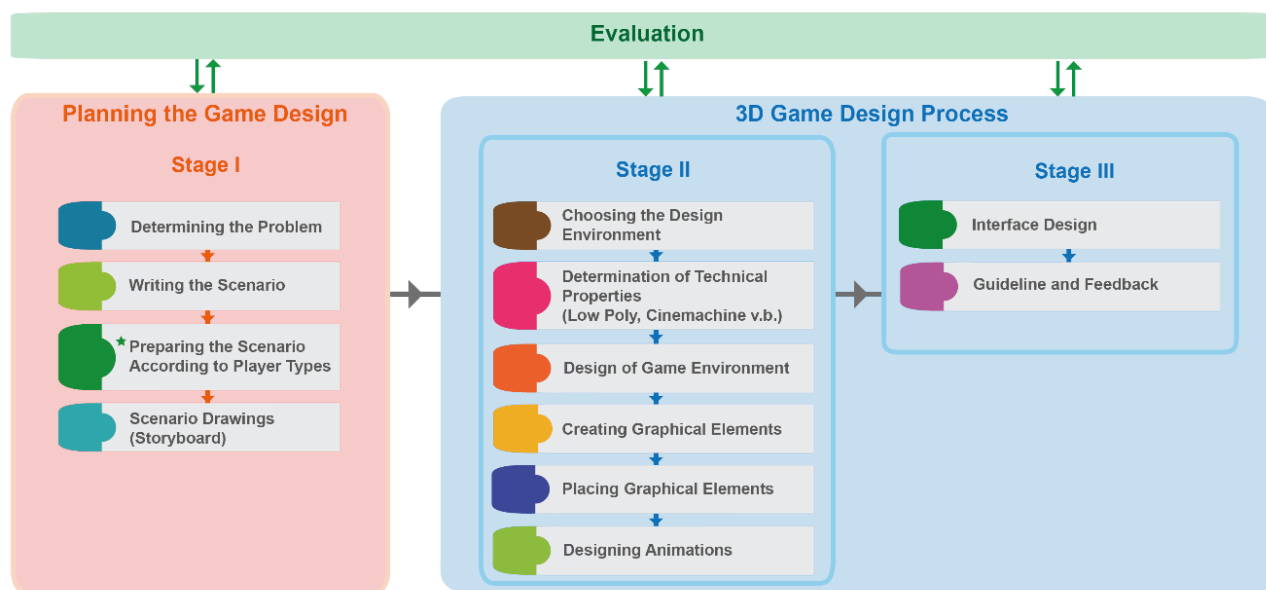
★ In different game designs, this stage can be excluded from the process.

Figure 2. Educational game design process

To achieve the purpose of the study, the game design was planned by considering different player types. In some other studies which only focus on developing a game without regarding different player types, this step is generally skipped. All three stages in the game design process were evaluated in detail by the project team who made necessary corrections at each stage and moved to the next stage. During the process, interim evaluations were also made by the project team making necessary corrections. Finally, the game was designed.

Planning the Game Design (Product Design)

Stage I

Determining the Problem

The game developed within the scope of the project was designed to teach how data is processed on a computer before starting programming education. The aim of the game was to teach students the functions of the hardware's in the computer and how the data is transmitted in the mainboard. Subjects for the content of the game were selected according to the goals in the 5th and 6th grade curriculum of MEB Information Technologies and Software course. The hardware units, whose tasks were described in the game, were the motherboard, processor, hard disk, ram, display card, and power supply.

Writing the Scenario

After determining the subjects for the content of the game the project team decided to design a story-based scenario. For this reason, the events that will take place in the scenario were determined first, and then the scenario was narrated by 4 researchers and converted into text format. In the story-based scenario, the team decided to make the internal of computer case look like a city. The internal of the computer case included buildings in a city, to explain the functions of the hardware units to the players (students) better and to make abstract concepts more concrete. The processor was resembled to the assembly building, the RAM seemed to be a storage area, the Hard disk was likened to hangar, the Video Card resembled to a TV studio, the Ethernet card was likened to bus terminal, and the Power Supply was likened to power plant.

| (a) | (b) |
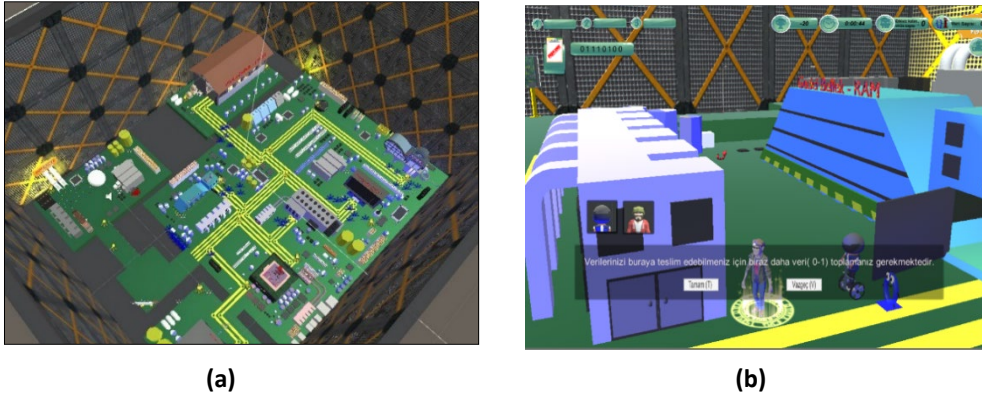
Figure 3. The internal of the computer case designed like a city

According to the scenario, a child who wants to do his homework on the computer learns how the data is transmitted in the hardware units with a character that can enter the safe. Players will be able to play the game by ensuring that the character in the safe collects data and transmits it to the hardware units in the appropriate order. In the game scene, the player first sees the area on the screen where the data is modelled as 1 and 0 coming from the keyboard and mouse buses. In this area, there is a screen with objects that the player can use to collect data. The player can choose from auxiliary objects from this screen. These objects were prepared according to Bartle's (1996) player types. The player takes the collected data to the correct hardware units and earns points during this time. When the player reaches the relevant unit, he will be able to learn the tasks of the unit from the information plates located in front of the units (Figure 3b). If the player performs their tasks in each unit correctly, they will be able to deliver their data. If the player goes to the wrong unit, he will be directed to the correct units with the feedback in the game. Each time the player goes to the correct unit, he will gain points.

Preparing the Scenario According to Player Types

One of the most important points of game concept is that not all players are the same, and there are features that will appeal to different player characters in a game (Bozkurt & Genç Kumtepe, 2014). The different preferences of individuals in a game are explained by the player types. The difference in game preferences is one of the situations that affect the players' motivation to play. Therefore, the designs were made in the current study by considering the player types, and the scenario in the designed game was prepared according to Bartle's (1996) four classification of player types. By preparing the games according to the player types, it was aimed to take the game preferences of the students into consideration, thus making the games more motivating and instructive. Considering other the educational game design processes, taking into account these four player types make the current study different from other studies which disregard player types.

The basic scenario features are the same in the game, which was prepared to teach the transmission of data on the computer and the tasks of the hardware units, and different features suitable for each player type were added to the scenario. The game mechanics used in the game scenario in accordance with the player types vary. These game mechanics, time, points, quests (the way of collecting points), gifting (the accessories that the player will use), challenges (the way they reach the hardware units in the game area), narration, badges, gifting, and leaderboard. Each player can play the game using features suitable for their own player type. There are features suitable for four player types in the whole game, and players can play the game with the game mechanics for the player types they want with the choices they make, and they can change their choices at any time. The scenarios prepared in accordance with the player types were examined by the project team, the necessary arrangements were made, and the scenarios were finalized. An example of how the game environment differs according to player types is given in Table 3.

Table 3. Game scenarios adapted according to player types

Player Type	Player Type Preferences	Game Mechanics	Adapting the Scenario According to the Player Type	Screenshot in Game
Socializers	• Communication oriented • Collaborate with other players • Likes to chat and make other players successful • Helpful	• Point • Gifting • Badges • Leaderboard • Gifting	Since the socializer type players attach importance to communication and cooperation, designs were made to meet these characteristics in the scenario. Since the socializer player type has the characteristics of a social person, the avatar who collects points in the game will be given a headset. Headphones, microphones, and antennas that the avatar can use were designed for socializer players, and screens were created where the avatar could communicate with the player.	
Explorers	• Problem solver • Curious • Discovery • Want to see the limits of the game • Seeks hidden surprises within the game	• Point • Badges • Leaderboard • Gifting • Hidden targets	Since the explorer player type focuses on exploring, these players have been enabled to fly around on the motherboard and explore all units and fulfil the assigned tasks in this way. In the explorer player type, the player can also see the units he reaches on the map. A magnifying glass, binoculars, camera, and a rocket to help fly are designed for explorers to navigate the motherboard and collect prizes	
Achievers	• Powerful • Raid • Successful • Searches secret rewards and points	• Point • Badges • Leaderboard • Gifting • Challenges	Achiever player type attach importance to game mechanics such as awards, points, and ranking. Since it is important for those who achieve to collect a lot of points in a short time, a time limit has been added to the game. Elements that will earn extra points are also added to the game for achiever player type. The reward bag and glasses objects are designed to help achiever player types collect the rewards in the game.	
Killers (Hunters)	• Powerful • Raid • Playing to neutralize their opponents, not to win	• Point • Badges • Leaderboard • Gifting • Fight • Challenges	The hunter player types want to win against the opponent or destroy the objects in the game. For this reason, there are various types of viruses that circulate freely inside the motherboard and can be destroyed by the player. The player earns points for destroying these viruses. Hammer, shield, lightsabre, slingshot objects that can be used in the game are designed for hunter player types.	

Scenario Drawings (Storyboard)

Before starting the 3D design phase, the storyboards of the game scenarios were prepared (Figure 4). These drawings, which are referred to as visual designs (storyboards), enable game designers to present the events in a holistic framework, to integrate different aspects of the game and to show them concretely. Visual designs can show the whole of the characters, places, and objects in the game. With these drawings, it becomes easier to shape the appearance of the game, and it is understood in what kind of world the player will interact with the characters and the interface (Soyluçiçek, 2019). In addition, visual designs enable experts and designers in the game design team to construct events more easily, allowing experts to better understand the process and to make necessary interventions.

In the current study, although the scenarios were adapted according to player types, it was aimed that the player transmits data on the motherboard and understand the working logic of the hardware units in each game. For this reason, the main events

in the game setup were generally explained in the scenario drawings. With the drawings, the regulations for the scenario in the game design process were made easier by the project team, and the designers realized the design process more easily.
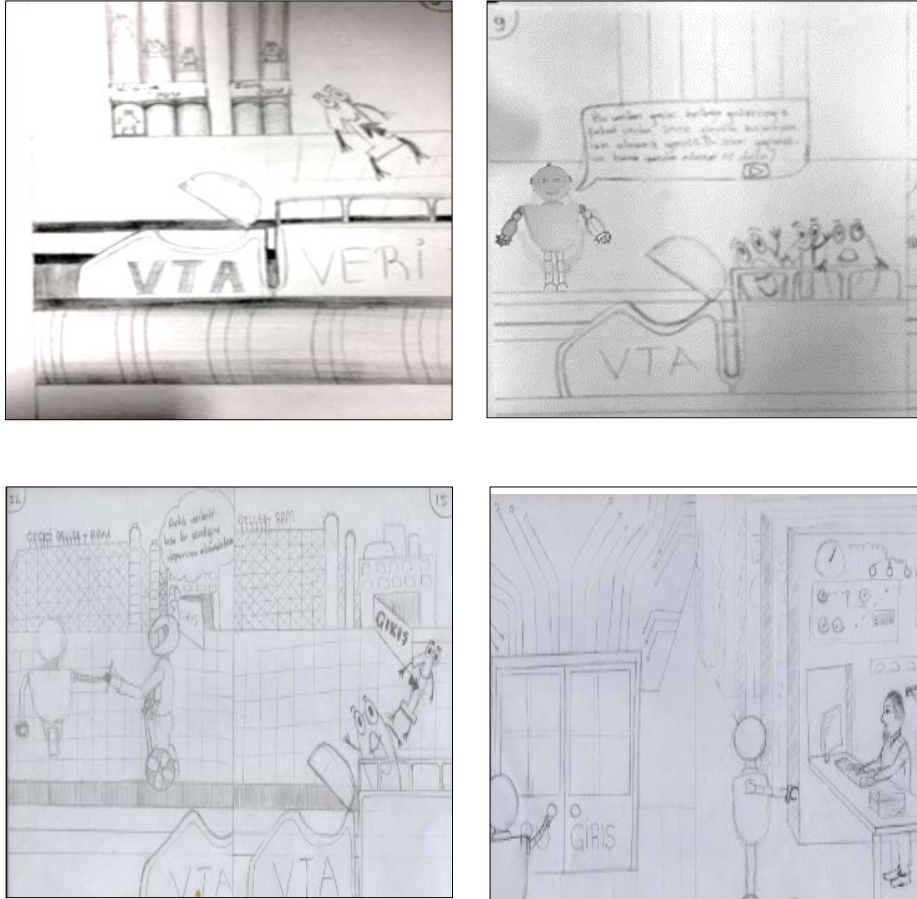
Figure 4. Examples of storyboard

3D Game Design Process (Development)

After the game planning process was completed, the digital design process of the game started. The development stages of the game in digital environment are given in Figure 5.

In the 3D design process, graphical elements were started to be created first. For this purpose, both the characters and the objects to be used in the game were modelled with the modelling program Blender. For the main character selection, a selection was made from the Asset Store in the Unity program. After the graphic elements were designed, these elements were placed in the Unity program. Meanwhile, by adjusting the resolution settings of the objects and characters (Low Poly), the loading problems that may occur during game play have been resolved. With the Recorder plug-in in the Unity object store, screen recording was taken, and animations were created for the interaction of the characters in the game. The project scene was created in Unity by preparing the objects, characters, and animations to be used in the game. In addition, with the codes written on the objects in Visual Studio, the characters were animated and their control in the game was provided. Finally, in-game instructions were created for the player to collect points and perform the correct operation steps in the game, and the feedback to be provided to the player with the score, time, and leaderboard mechanics in the game. With the output of the game in WebGL format, the game has been made playable on the browser. In this way, project outputs can be run on multiple platforms via web browsers without the need for any plug-ins. The 3D design process of the game was given in detail below.
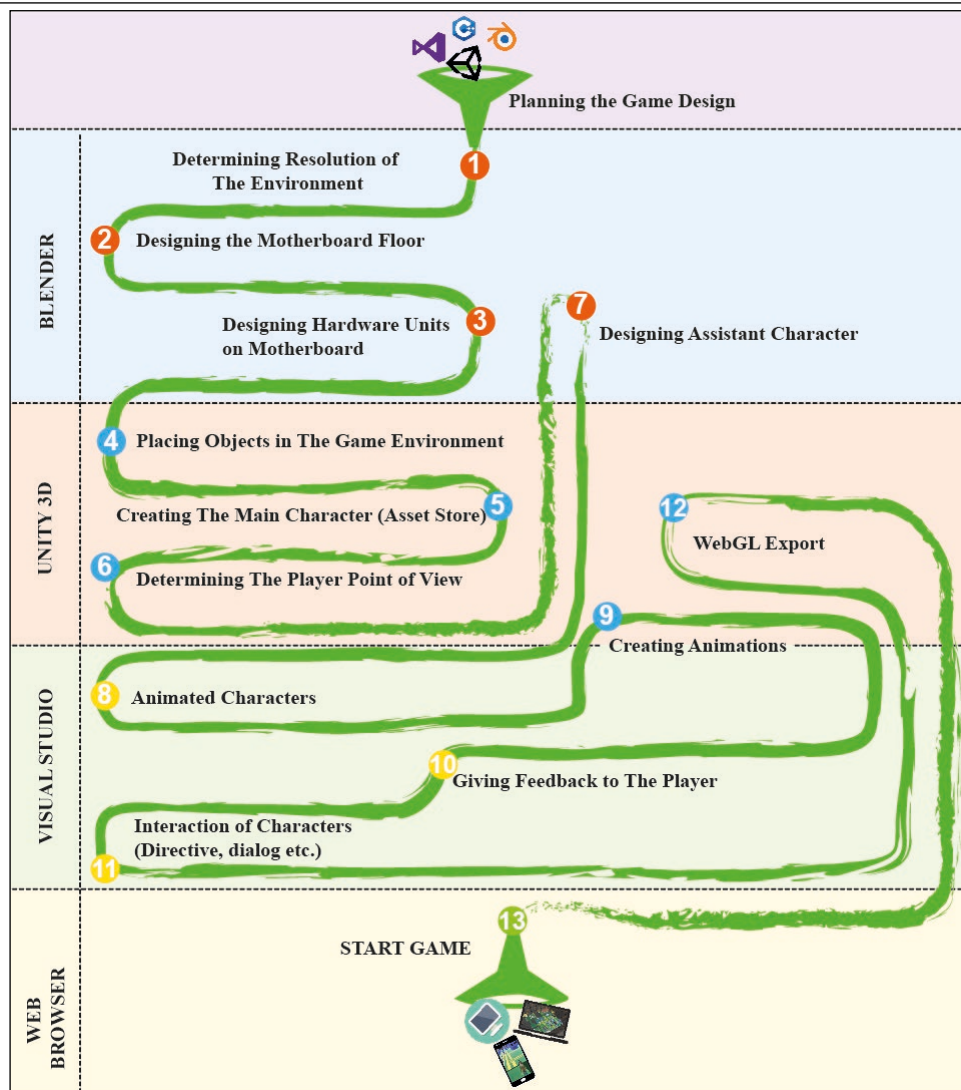
Figure 5. 3D game design process

Second Stage

Choosing the Design Environment

After the planning game process was completed, it was decided to use the Unity 3D program to design the game with the decision of the project team. The advantages and usage reasons of the program were explained in section "Game Engines Used in Game Development Process".

Determination of Technical Properties (Low Poly, Cinemachine)

Before starting the 3D game design, the technical features required for the design and play of the game have been determined. First, regulations were made for the resolution of characters and objects. LowPoly (low resolution) feature was preferred for resolution of character, object, and environment. The reason why low-resolution designs were preferred was to reduce the waiting times during the loading of games and to ensure their comfortable use on mobile devices.

Since the standard camera in Unity offers limited features to the user, the camera plug-in named "CineMachine" in the object store was downloaded and added to the game environment. The "FreeLook camera" code file available in this package has been applied to the main character. With this camera package, the point of view of the player was directed with the mouse and the player was allowed to play the game from the eyes of the third person. In addition, with the "Collider" add-on added to the camera and other objects, the camera was prevented from entering the objects in the environment, allowing the main character to zoom in during any collision. With the CineMachine plug-in, more than one camera was added to the scene, and it was possible to switch between these cameras easily and animated.

Design of Game Environment

A cube object was created to create the ground on which the game will be played, and this object was given the image of a motherboard. Data buses that allow communication of circuits and hardware units were prepared on the motherboard. In order

to transfer these buses to the game environment and to create a realistic image, a plug-in called "Displace" was used and added to the motherboard.

Creating Graphical Elements

In order to create 3D models to be used in the game, object and character designs were made in the Blender modelling program. In addition to the modelled objects, Unity object store (Asset Store) was also used for main character and object selections. Examples of the objects used in the game are given in Figure 6.

| (a) | (b) |

Figure 6. Examples of objects and characters used in the game

The hardware units in the game were compared to the buildings in a city (Figure 6a). These buildings and assistant characters working in these buildings were developed in the Blender program (Figure 6b). In the design of objects such as buildings and officer characters, the design was made by considering the characteristics of the hardware's.

| (a) | (b) | (c) | (d) |
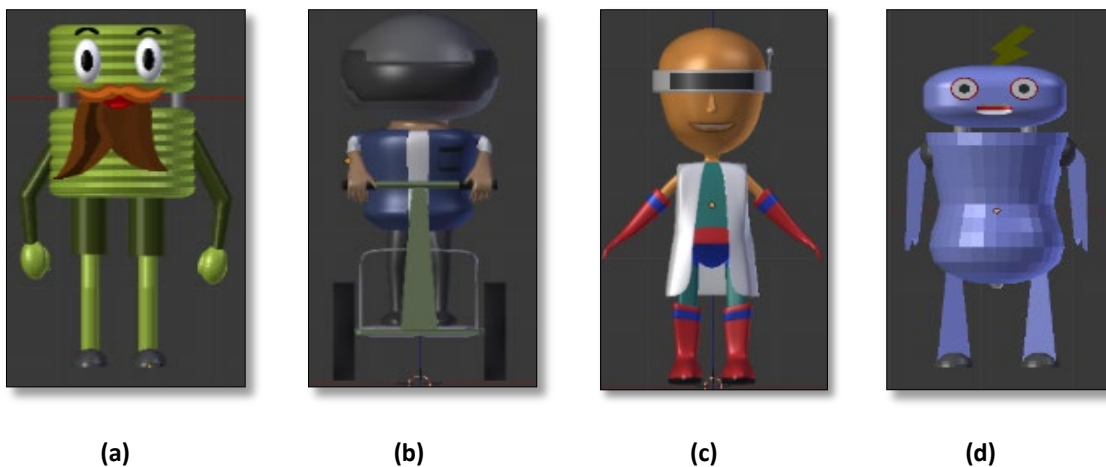
Figure 7. Characters in charge of hardware units

The character in charge of the hard disk unit has been drawn like oval lines and disk structure, in a way to remind the physical structure of the hard disk (Figure 7a). The character is in front of the hard drive and when the main character arrives, it gives information about the hard drive. In addition, it helps to deliver the data by checking whether the necessary permissions have been obtained from the processor unit. The attendant in the ram memory unit was designed as a character that moves quickly with his vehicle, since the operations are performed fast, and it is a temporary data storage unit (Figure 7b). This character also checks whether the main character receives a license from the processor while transmitting the data to the ram memory. Since the processor is in the manager position on the motherboard and allows for all operations to be performed, the manager in this unit, wearing apron and glasses, is designed as a chef-shaped character (Figure 7c). The task of this character in the processor is to create the necessary permission document for the main character in the game to deliver the data collected to the units. Finally, the duty plug in the power supply was designed as a plug (Figure 7d). This officer was designed to help the main character find the problem and continue the game by solving the problem in the power outage due to the scenario.

Placing Graphical Elements

While designing the game environment, keyboard and mouse buses were placed in a corner of the case as a representation. These buses were used to send commands sent by the computer user from the keyboard or mouse to the computer. Since the

commands are processed according to the number system 1 and 0 in the computer, the data coming from the buses were designed as 1 and 0. The task of the player is to collect the data coming from the data buses in a vehicle called the "data collection tool" and move it to the units on the motherboard in the correct order. "Collider" extension has been added to the objects so that the character can collect data. Thanks to this add-on, the collision of two objects was checked with the help of the code and the data was directed to the car chassis. Thus, the main character can collect the data in the safe of the data collection tool. After player collecting data, the vehicle must reach the correct unit. Whether the unit that the player goes to is true or false is controlled by various variables. These variables are controlled by the codes written in the Visual Studio program. In this way, when the player takes the data to the wrong unit, feedback is given in the game and the player is directed to reach the correct units.

Designing Animations

Three types of animations have been created in the game in order to activate, control, and interact with characters and objects.

Movement: Bone structure has been added to the character so that the characters can move in the game. The animations of walking, running, and jumping have been downloaded from the object store, in order to move the bone structure. It was added to the character by editing in the Unity-Animations menu.

Control: In order for the player to move the character, the regulations for the user controls were made in the Visual Studio program. During this regulation, when it is necessary to make an operation regarding the keys to be used to play the game, a code in the form of "Input.GetKey (KeyCode.W)" was used in C # coding language. Controls such as the ability to move the character used in the game when the W, A, S, D keys were pressed or run fast when pressing the Shift key were carried out using this line of code. With the help of the mouse, necessary interventions have been made with different lines of code to change the perspective of the character and move to that direction when the forward button is pressed.

Interaction: In the game, the main character must establish a dialogue with the unit officers there while collecting data and transmitting it to the relevant units. Animations have been prepared to explain this interaction process to the user. In order to add these animations to the game, the "Recorder" plugin in the Unity object store was used. By adding the codes written in the Visual Studio program to the objects in the animation, interaction is provided. During this interaction, the movements of the characters on the screen were recorded in video format by running the Recorder plug-in. In addition, a chat screen was opened during the dialogue between the main character and the assistant character. This chat screen both guided the player to transmit data to the correct unit in the game and taught the player the tasks of the hardware units. In order to create this chat screen, a dialog plug-in called "VIDE Dialogue" has been downloaded from the Unity object store. In order for this add-on to work, the fields in the game were determined and the "Collider" add-on, a feature of the Unity program, was added to these fields. Thanks to this add-on, which is not seen by the players, when the character enters the specified area, the "private void OnTriggerExit (Collider other) {}" function written in the background allows the player to enter that area and run the dialogue plug-in.

Third Stage

Interface Design

In the interface design, a screen was designed to show the game time, score, number of data collected by the player, and game mechanics such as the accessories the player chose to collect data. Interface design was made in line with the opinions of field experts. Objects used in interface design have been downloaded from the Unity object store. The 2D interface design was fixed to certain parts of the game screen as shown in Figure 8, with the use of the Canvas plug-in in Unity.

Figure 8. The interface design of the game

Guideline and Feedback

When the player navigates all the units correctly and completes the tasks, a report window appears. In this report, there are information such as the player's playing time, the number of mistakes, the score he earned. In the game, the instructions, the dialogue system, the report at the end of the game, the time spent in the game, etc. Unity's "Canvas" plugin is used to show the feedback to the player. Canvas plugin is an add-on that allows the user to present content on a 2D screen in the game. This plugin

is preferred for instructions and feedback to be presented to the player. After the content of the Canvas plugin was created, code was written in the Visual Studio program to determine whether it should be shown and hidden on the screen and at what stages. Thus, it is ensured that the visibility of this add-on is made at the appropriate time in the game.

Evaluation

The necessary revisions were made in the game with the evaluations made by the experts involved in the project during the design and development phases of the digital game. In the design phase, evaluations were made regarding the application of player types to the game scenario, the structures that the hardware units will be compared to in the city, the accessories to be used by different player types, the rules, and the general story. Findings about the evaluation and correction processes were given according to the design phases. At these phases, evaluations were made for game design and 3D design processes. The evaluations made by the experts about the game design and the corrections made in the first stage are given in Table 4.

Table 4. Evaluation and corrections made in the first stage

Code	Evaluation	Correction
Student level and learning outcome	E1: "The hard disk is designed as a hangar. However, the data storage areas inside can be shown differently to be able to explain that the data sizes are different."	• Different box and sack sizes are designed in the hangar.
	E6: "Assistant characters describing the mission of the units have been added to the hardware units."	• Assistant characters on duty have been added to hardware units.
	E7: "A fault caused by an object stuck in the power supply can be added to explain the function of the power supply in the case."	• An animation was prepared for smoke emission as a result of a heating problem with an object stuck in the power supply.
	E5: "Assistant characters in hardware units can be designed according to the task and physical characteristics of the hardware."	• The characters of the hardware units were designed according to the features of the hardware.
	E4: "Power outage should be added to the scenario in order to explain that the data in RAM will be lost."	• In the scenario, adjustments were made in which there was a power outage while the player was moving data and the loss of data in the RAM memory was made.
Player Types	E7: "The features of the accessories that students will choose should be determined according to the player types" E8: "Accessories should be designed for the purposes of the player types in games."	• The accessories that the character will choose are designed for player types (flying with a rocket, zooming in with binoculars, getting help with a microphone, etc.).
	E2: "The variety of accessories for player types should be increased." E3: "Accessories should be given by grouping. Accessories of the same type should be given together instead of being mixed. "	• The variety of accessories considered one for each player type has been increased. The number of 12 designed accessories has been increased to 26. Accessories of the same kind were given together.
Game Elements	E1: "When the game is over, information about the player's process in the game should be shown." E5: "The time spent in the game, the remaining lives of the player, the number of data collected, the points should be kept and presented to the student at the end of the game."	• The time to finish the game was recorded and reported to the player at the end of the game.
	E5: "The roles of the shortcut on the keyboard used in the game must be specified on the screen."	• The interface that indicates the instructions for the game and the functions of the keys on the keyboard has been prepared.
	E6: "The instructions in the game must correspond to the game flow. Some of the instructions don't come with the tasks of the hardware units. "	• By using variables in the background, the instructions were arranged according to the game flow.
	E9: "The number of data the player collects should decrease and there should be a rule to end the game."	• The game restarts automatically when the number of data the character has drops to 0.

The second phase of the process has started in the 3D development phase of the game. At this phase, evaluations were made regarding the way different player types collect points, the duration, the tasks of the accessories used by different player types, the way the player reaches the units in the game, and the game design of the characters (Table 5).

Table 5. Evaluation and corrections made in the second stage

Code	Evaluation	Correction
Player Types	E6: "In order for the game to be prepared for different player types, the choices each player will make while playing the game must be different. The choices the player makes must vary according to the player types. Instead of preparing different scenarios, it would be better to give player types in a single game."	• The basic task of each player in the game is the same, and the game elements such as the way the player performs this task in the scenarios and the way they collect points were prepared according to the player types.
Interaction	E1: "When the character passes buildings, he must not go through the walls."	• Physical properties of all the objects on the motherboard have been given to each other and the problem of objects getting into each other has been fixed.
	E1: "There is a problem in opening the videos for the officers of the hardware units."	• Internet browsers have been made compatible with the version of the Unity 3D program.
	U5: "Once the character and the virus come into contact, it would be more appropriate for the virus to follow the character throughout the game and reduce the data collected."	• Interaction areas of characters and viruses have been updated. When the character can move away from the virus at a certain distance, it leaves a virus tracking.
	E7: "In the data collection tool, the player should be able to carry as much data as he wants." E2: "Data should not be transferred to the data collection tool one by one, data should be transferred automatically."	• Instead of moving the data to the data collection tool one by one, the data was automatically transferred to the data collection tool by the main character touching the data.
	E6: "There are difficulties in transferring the data collected by the character to the data collection tool. Data is not collected in the safe"	• It was ensured that the data collected by the character were collected in the tool chassis using the location features.
Characters	E1: "Player point of view should be through the character's eyes." E8: "Games are usually played with the character's point of view."	• In the first stage, the camera angle was next to the character. In the second stage, the player was allowed to play the game from the eyes of the third person.
	E7: "Viruses must be in different shapes. A design should be made for the varieties described in the curriculum."	• Designs were made to suit different types of viruses.
	E1: "When the character comes into contact with viruses, they do not disappear completely, they become ineffective."	• When it comes into contact with viruses, it is made ineffective instead of disappearing.
	E5: "Viruses can come back to life after a certain period of time after they become ineffective."	• It was ensured that the inactivated viruses remained inactive for a certain period of time and then took action again.
	E4: "Permission must be obtained from the processor before transferring data to each hardware unit."	• Allow the player to get permission from the processor before transmitting data to each hardware unit.

In the third stage of the design process, evaluations were made about the interaction of the characters with each other, and the dialogs displayed on the screen (Table 6).

able 6. Evaluation and corrections made in the third stage

Code	Evaluation	• Correction
Feedback / Guideline	E3: "The texts come in mixed order during the dialogue between the character and the officers in the units."	• During the conversations of the character with the unit officers, it was ensured that the texts fit the dialogue flow.
	E9: "In case the collected data is lost, the total number of data collected by the character should not be reduced."	• By tracking the data falling on the ground, it was ensured that the character was dropped from the total number of data it had.
	E1: "When the main character and the virus touch each other in the game, the decrease in the data and the score will be more suitable for the player type."	• With the updates made in the animations prepared for viruses, it was ensured that the player lost data and points in data loss.
	E2: "All variables must be reset when there is a power outage in the game scenario."	• According to the scenario, when there is a power outage in the game, all the data and points of the character are deleted.
	E7: "The player should be bound by a rule to deliver the data he has to the units."	• It is ensured that no data is delivered to any unit unless a certain amount of data is collected.

In the first stage of the design process, evaluations were made about student level and objectives of the subject, player types and game elements. Game elements arranged for player types in the scenario; time, point collection, access to accessories and equipment units. In the second stage of the design process, interactions, characters, data collection and score evaluations were made for the 3D game design process. In this context, evaluations were made on the interactions of objects and characters, the tasks and interactions of accessories designed for player types, the design of the characters, the interaction of the assistant characters in the hardware units with the main character. In the third stage of the design process, data and point collection methods, evaluation and arrangements for dialog windows were made.

DISCUSSION AND CONCLUSION

In this study, the design process of an educational digital game was carried out with a developmental research method. At the end of the study, how an educational digital game setup is designed according to player types, the stages of the design process, and the studies done in the design process with Unity 3D were determined. In order to complete the shortcomings of classical teaching methods, it is stated that digital games, one of the alternative teaching methods, are effective in learning and more studies should be done in this field (Güler & Erdem, 2014). In the study, while the stages of game design such as game subject and scenario were carried out in educational digital game design, the scenario was designed for the player types in order to provide the motivation and fun of the players. As a matter of fact, Ike and Hoe (2020) stated that educational digital games are preferred because the fun element inherent in the game meets the psychological needs of students and provides behavioural change. For this purpose, a design aiming to increase loyalty to the game by keeping player preferences at the forefront has been developed in this study. In addition, the preparation of the scenario according to the player types in the study led to the realization of different design studies in the Unity program. The adaptation of educational games according to player types to increase motivations of the students has become more popular with studies in recent years (Bontchev & Georgieva, 2018; Streicher & Smeddinck, 2016). Similarly, Malva et al. (2020) developed an educational game for primary school students to develop computational thinking skills that include abstract and conceptual information. In this game, an individually adaptable design was developed in order to attract the attention of each child, and positive results were obtained for the children at the end of the study. For this reason, the design process of the current study serves as an example in terms of both making the game design and showing how this setup can be designed technically.

During the game design process, the game scenario was written by four experts, and the project team made evaluations in terms of the suitability of this scenario to the student level and target achievements, the suitability for the player types and the use of the game elements. In the study, after the scenarios were prepared in accordance with the objectives specified by the Ministry of National Education, these scenarios were arranged according to the characteristics of Bartle (1996) player types. Although the preparation of the scenario according to the player types is a design specific to this study, it is seen as an important issue for an educational game. Educational digital games are preferred because of their motivation, fun, active participation, and interest in educational environments (Byun & Loh, 2015; Ronimus et al., 2014; Sung & Hwang, 2018). However, it is stated that the features that make the game play are moved away with faulty scenario designs or scenario and environment designs that are only focused on learning that do not attract the attention of the players (Prensky, 2001). In addition, to prevent the advantages offered by digital games to educational environments from turning into disadvantages, care should be taken to keep the game components such as goal, purpose, rule, scenario, interaction, and fun in balance (Bağcı & Çoklar, 2014; Devary, 2008). With the preparation of the game scenarios according to the player types, it was ensured that a game design was created for the personal preferences of the students without leaving the fun.

In the process of designing with the Unity 3D game engine, it has been observed that the design of the characters, the interaction of the characters and objects in the game with the player, the design of the points that the player will collect and the way to collect points are important. The visual design program Blender was used for the design of the 3D objects in the game, and the Visual Studio program was used to perform animation and interactions. Interoperability of the game engine and the utilities used in digital game designs and ensuring program compatibility is an important issue to be considered. As a matter of fact, Indraprastha and Shinozaki (2009) stated in their study that the Unity 3D game engine is software that can be used comfortably in creating an interaction system, supporting the object-oriented programming language and the use of different programs, and this is important in design processes. Thanks to this flexibility provided by Unity, the interactions in the game with data such as pictures, animations, and text were easily provided in the game designed in the study. One of the issues to be considered in the game design process with Unity is the design features of the characters and objects to be used. The high resolution of the characters and objects in the game can adversely affect the performance of both the device where the game is developed and the devices on which the game will be played. For this reason, before starting the design, it is necessary to consider the technical features of the devices on which the game is developed and the compatibility with the programs designed. In addition, measures to prevent excessive data load on devices in the process should be planned from the beginning. The code files that enable the characters to move or interact in the game create a significant load during the design and play of the game. For this reason, the recorded code files should be organized systematically. Thus, the code files can be used for different characters and objects in the game without creating a load on the system.

The game design in the study was carried out through the design, development, and evaluation processes of the developmental research method. Education designers face many difficulties when creating a product. One of the problems encountered is the pedagogical design processes of products that require engineering and computer applications (McKenney & Reeves, 2014). It has

been observed that developmental research designs that combine the expertise of educators, designers, researchers, and practitioners are a good solution in solving these problems. In the study, the design-based research method was used as an appropriate method for both educational design and for technical development of the game design process.

During the game design and development phase, student levels and player types were taken into consideration while determining the technical processes, preparing the scenario, choosing the game mechanics, and conducting the cyclical processes. Thus, formative evaluations were carried out with the feedback received from experts, and these evaluation and regulation studies have gained continuity with a cyclical process. Therefore, this process has facilitated the achievement of concrete solutions for the targeted goals of the current study. As a matter of fact, Schmitz et al. (2015) carried out gradual regulation studies using the design-based research method in the design of the mobile game-based learning environment. They stated that the design-based research approach is a valid and useful method for educational game design. Although a product is put forward with the evaluation of an expert, it is also necessary to evaluate the game by using it by the target audience. Thus, data regarding the evaluation of the designed game in terms of players should also be obtained. Scenario writing in educational games is also one of the important issues to be emphasized. For this reason, different studies focusing on scenario writing can be done in educational game design processes. In this study, in which scenarios and designs were made for player types, different designs and comparison studies can be made for the use of player types in educational games. Developed game is an example study for educators and designers as it is an educational game specifically designed for player types. There are many studies on educational games in the literature (Busch et al., 2016). These studies aimed to provide education by playing the same game for each player to teach a specific subject. When the results of the study are considered, the current study has gone some way towards enhancing design of an educational game trend by regarding player types in the design process as well. Therefore, the present study is one of the leading studies in the literature on individualized game designs adaptable to player types. In this context, the following recommendations are made for researchers:

- In the study, the design process of the educational game environment according to player types is explained. With experimental studies, the effects of the designed educational game on students' cognitive skills and academic achievement can be examined.
- A model for educational digital game designs can be created by replicating the digital game development processes determined in the study in different game designs.
- Games for different lessons and subjects can be designed according to player types and the effects of these designs on learning can be investigated.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

Statements of publication ethics

We declare that the study has not unethical issues and that research and publication ethics have been observed.

Researchers' contribution rate

The study was conducted and reported with equal collaboration of the researchers.

Ethics Committee Approval Information

Ethics approval was obtained from the Ethics Committee of Karadeniz Technical University with the letter dated 08/09/2017 and numbered 82554930-400-3335.

REFERENCES

Akgün, E., Nuhoğlu, P., Tüzün, H., Kaya, G., & Çınar, M. (2011). Bir eğitsel oyun tasarımı modelinin geliştirilmesi. *Eğitim Teknolojisi Kuram ve Uygulama, 1*(1), 41-61.

Aleem, S., Capretz, L. F., & Ahmed, F. (2016). Game development software engineering process life cycle: A systematic review. *Journal of Software Engineering Research and Development, 4*(6), 1–30. doi:10.1186/s40411-016-0032-7

Aleven, V., Myers, E., Easterday, M., & Ogan, A. (2010, April). Toward a framework for the analysis and design of educational games. In *2010 third IEEE international conference on digital game and intelligent toy enhanced learning* (pp. 69-76). IEEE.

Archambault, D., Gaudy, T., Miesenberger, K., Natkin, S., & Ossmann, R. (2008, June). Towards generalised accessibility of computer games. In *International Conference on Technologies for E-Learning and Digital Entertainment* (pp. 518-527). Springer, Berlin, Heidelberg.

Aslan, S., & Balcı, O. (2015). GAMED: digital educational game development methodology. *Simulation*, *91*(4), 307-319. doi: 10.1177/0037549715572673

Bağcı, H., & Çoklar A. N. (2014). The evaluation of Ceıt teacher candidates in terms of computer games, educational use of computer games and game design qualifications. *Kuramsal Eğitim Bilim Dergisi, 7*(2), 195-211.

Bartle, R. (1996). Hearts, clubs, diamonds, spades: Players who suit MUDs. *Journal of MUD research, 1*(1), 1-27.

Bilgili, S. (2020). *Oyun programlama başarısının çeşitli değişkenler açısından incelenmesi.* (Yayımlanmamış Yüksek Lisans Tezi). Ondokuz Mayıs Üniversitesi, Lisansüstü Eğitim Enstitüsü. Samsun.

Bontchev, B., & Georgieva, O. (2018). Playing style recognition through an adaptive video game. *Computers in Human Behavior*, *82*, 136-147. doi:10.1016/j.chb.2017.12.040

Bozkurt, A., & Genç-Kumtepe, E. (2014). Oyunlaştırma, oyun felsefesi ve eğitim: Gamification. *Akademik Bilişim, 14*, 147-156.

Byun, J., & Loh, C. S. (2015). Audial engagement: Effects of game sound on learner engagement in digital game-based learning environments. *Computers in Human Behavior*, *46*, 129–138. doi: 10.1016/j.chb.2014.12.052

Busch, M., Mattheiss, E. E., Hochleitner, W., Hochleitner, C., Lankes, M., Fröhlich, P., ... & Tscheligi, M. (2016). Using player type models for personalized game design-an empirical investigation. *Interaction Design and Architecture Journal*, *28*, 145-163.

Cohen, L., Manion, L., & Morrison, K. (2017). *Research methods in education*. UK:Routledge.

Connolly, T. C., Boyle, E. A., Hainey, T., Macarthur, E., & Boyle, J. M. (2012). A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education, 59*(2), 661- 686. doi: 10.1016/j.compedu.2012.03.004

Desurvire, H., Caplan, M., & Toth, J. A. (2004, April). Using heuristics to evaluate the playability of games. In *CHI'04 extended abstracts on Human factors in computing systems* (pp. 1509-1512). 24-29 April, Vienna, Austria.

Devary, S. (2008). Educational gaming, interactive edutaintment. *Distance Learning, 5,* 35-4.

Dimaraki, E. V., Schmoelz, A., & Koulouris, P. (2013). Scenarios as pedagogical devices: designing activities for game-based learning. *ICERI2013 Proceedings*, 3203-3209.

Dimitriadou, A., Djafarova, N., Turetken, O., Verkuyl, M., & Ferworn, A. (2020). Challenges in serious game design and development: Educators' experiences. *Simulation&Gaming, 52*(2). 132-152. doi:1046878120944197.

Eagle, M. (2009, April). Level up: a frame work for the design and evaluation of educational games. In Proceedings of the *4th International Conference on Foundations of Digital Games* (pp. 339-341). Orlando, Florida.

Ferro, L. S., Walz, S. P., & Greuter, S. (2013, September). Towards personalised, gamified systems: an investigation into game design, personality and player typologies. In *Proceedings of The 9th Australasian Conference on Interactive Entertainment: Matters of Life and Death* (p. 7). ACM.

Güler,O., & Erdem. O. A. (2014). Mesleki eğitimde etkileşimli 3B eğitimin uygulanması ve stereoskopik 3B teknolojisi kullanımı. *Bilişim Teknolojileri Dergisi, 7*(3), 1-11. doi: 10.12973/bid.2019

Hainey, T., Connolly, T. M., Boyle, E. A., Wilson, A., & Razak, A. (2016). A systematic literature review of games-based learning empirical evidence in primary education. *Computers & Education, 102*, 202-223. doi: 10.1016/j.compedu.2016.09.001

Hong, J. C., Cheng, C. L., Hwang, M. Y., Lee, C. K., & Chang, H. Y. (2009). Assessing the educational values of digital games. *Journal of Computer Assisted Learning, 25,* 423–437.

Ike, T. C., & Hoe, T, W. (2020). Exploring the link between the psychological needs and the elements of game design for educational games. *Journal of ICT in Education, 7*(2), 65-73.

Indraprastha, A., & Shinozaki, M. (2009). The investigation on using Unity3D game engine in urban design study. *Journal of ICT Research and Applications*, *3*(1), 1-18.

Jemmali, C., Kleinman, E., Bunian, S., Almeda, M. V., Rowe, E., & El-Nasr, M. S. (2019). Using game design mechanics as metaphors to enhance learning of introductory programming concepts. In *Proceedings of the 14th International Conference on the Foundations of Digital Games - FDG '19* (pp.1–5). New York, New York, USA: ACM Press. doi:10.1145/3337722.3341825

Kallio, K. P., Mäyrä, F., & Kaipainen, K. (2011). At least nine ways to play: Approaching gamer mentalities. *Games and Culture, 6*(4), 327-353.

Kiili, K. (2005). Digital game-based learning: Towards an experiential gaming model. *The Internet and Higher Education, 8*(1), 13-24. doi: 10.1016/j.iheduc.2004.12.001

Kocadere, S. A., Özhan, Ş. Ç., Bayrak, F., & Nuhoğlu, P. (2019). Herkül'ün hikâyesi: eğitsel bir oyun geliştirme modeli önerisi. *Eğitim Teknolojisi Kuram ve Uygulama, 9*(1), 230-250.

Kuzu, A., Çankaya, S., & Mısırlı, A. (2011). Tasarım tabanlı araştırma ve öğrenme ortamlarının tasarımı ve geliştirilmesinde kullanımı. *Anadolu Journal of Educational Sciences International, 1*(1), 19-35.

Labschütz, M., Krösl, K., Aquino, M., Grashäftl, F., & Kohl, S. (2011). Content creation for a 3D game with Maya and Unity 3D. Proceedings of CESCG 2011: *The 15th Central European Seminar on Computer Graphics Vienna University*, 2- 4 May, 2011, Viničn, Slovakia 1-8.

Lämsä, J., Hämäläinen, R., Aro, M., Koskimaa, R., & Äyrämö, S. M. (2018). Games for enhancing basic reading and maths skills: A systematic review of educational game design in supporting learning by people with learning disabilities. *British Journal of Educational Technology, 49*(4), 596-607. doi: :10.1111/bjet.12639

Lester, J. C., Spires, H. A., Nietfeld, J. L., Minogue, J., Mott, B.W., & Lobene, E. V. (2014). Designing game-based learning environments for elementary science education: A narrative-centered learning perspective. *Information Sciences, 264*, 4-18. doi: 10.1016/j.ins.2013.09.005

Malva, L., Hooshyar, D., Yang, Y., & Pedaste, M. (2020, July). Engaging Estonian primary school children in computational thinking through adaptive educational games: A qualitative study. In *2020 IEEE 20th international conference on advanced learning technologies (ICALT)* (pp. 188-190). IEEE.

Manero, B., Torrente, J., Freire, M., & Fernández-Manjón, B. (2016). An instrument to build a gamer clustering framework according to gaming preferences and habits. *Computers in Human Behavior, 62,* 353–363.doi: 10.1016/j.chb.2016.03.085

McKenney S., & Reeves T.C. (2014). *Educational Design Research*. In Spector J., Merrill M., Elen J., Bishop M. (Eds) Handbook of Research on Educational Communications and Technology. Springer, New York, NY. Doi:10.1007/978-1-4614-3185-5_11

Nacke, L. E., Bateman, C., & Mandryk, R. L. (2014). BrainHex: A neurobiological gamer typology survey. *Entertainment Computing, 5*(1), 55-62.

Ninaus, M., Kiili, K., Wood, G., Moeller, K., & Kober, S. E. (2020). To add or not to add game elements? Exploring the effects of different cognitive task designs using eye tracking. *IEEE Transactions on Learning Technologies, 13*(4), 847-860.

Prensky, M. (2001). Digital natives, digital immigrants. Digital Natives, Digital Immigrants Part 1, *On the Horizon, 9*(5), 1-6. doi:10.1108/10748120110424816

Prensky, M. (2004). Digital game-based learning, *ACM Computers in Entertainment, 1*(1), 1-4.

Qian, M., & Clark, K. R. (2016). Game-based learning and 21st century skills: A review of recent research. *Computers in Human Behavior, 63*, 50-58. doi: 10.1016/j.chb.2016.05.023

Richey, R. C., & Klein, J. D. (2005). Developmental research methods: Creating knowledge from instructional design and development practice. *Journal of Computing in Higher Education, 16*(2), 23-38.

Ronimus, M., Kujala, J., Tolvanen, A., & Lyytinen, H. (2014). Children's engagement during digital game-based learning of reading: The effects of time, rewards, and challenge. *Computers & Education, 71*, 237–246.doi: 10.1016/j.compedu.2013.10.008

Schmitz, B., Klemke, R., Walhout, J., & Specht, M. (2015). Attuning a mobile simulation game for school children using a design-based research approach. *Computers & Education, 81*, 35-48. doi: 10.1016/j.compedu.2014.09.001

Shi, Y. R., & Shih, J. L. (2015). Game factors and game-based learning design model. *International Journal of Computer Games Technology*, *2015*, 1-11. doi: 10.1155/2015/549684

Song, M., & Zhang, S. (2008). EFM: A Model for Educational Game Design, in Lecture Notes in Computer Science, Z. Pan et al. (Eds.): Edutainment 2008, Springer US. 509-517.

Soyluçiçek, S. (2019). Dijital oyunların sanatsal gücü; konsept tasarımı Süreci. *Sanat ve Tasarım Dergisi, 23*, 315-327.

Streicher, A., & Smeddinck, J. D. (2016). Personalized and adaptive serious games. In *Entertainment Computing and Serious Games* (pp. 332-377). Springer, Cham.

Sung, H. Y., & Hwang, G. J. (2018). Facilitating effective digital game-based learning behaviors and learning performances of students based on a collaborative knowledge construction strategy. *Interactive Learning Environments, 26*(1), 118-134. doi: 10.1080/10494820.2017.1283334

Squire. K. (2003). Video games in education. *International Journal of Intelligent Games & Simulation 2*(1), 49-62.

Sweetser, P., & Wyeth, P. (2005). GameFlow: a model for evaluating player enjoyment in games. *Computers in Entertainment, 3*(3), 1-24. doi:10.1145/1077246.1077253.

Taşdemir, Ş., & Şüyun, S. B. (2016). Bilgisayar oyun tasarımı ve eğitsellik kazandırılmasına yönelik bir yaklaşım. *Selçuk-Teknik Dergisi, 15*(2), 113-124.

Tuunanen, J., & Hamari, J. (2012). Meta-synthesis of player typologies. Proceedings of *Nordic Digra 2012 Conference: Games in Culture and Society*, Tampere, Finland.

Van Eck, R. (2015). Digital game-based learning: Still restless, after all these years. *Teaching, Leadership & Professional Practice Faculty Publications, 50*(6), 13-28.

Vasalou, A., Khaled, R., Holmes, W., & Gooch, D. (2017). Digital games-based learning for children with dyslexia: a social constructivist perspective on engagement and learning during group game-play. *Computers & Education, 114*, 175–192. doi: 10.1016/j.compedu.2017.06.009

Vasudevamurt, V. B., & Uskov, A. (2015, May). Serious game engines: Analysis and applications. *2015 IEEE International Conference on Electro/Information Technology (EIT)*. 440-445.

Xu, Y., Poole, E. S., Miller, A. D., Eiriksdottir, E., Kestranek, D., Catrambone, R., & Mynatt, E. D. (2012). This is not a one-horse race: Understanding player types in multiplayer pervasive health games for youth. In *Proceedings of the ACM 2012 conference on computer supported cooperative work* (pp.843–852). Seattle, Washington DC: ACM. doi:10.1145/2145204.2145330

Yıldırım, A., & Şimşek, H. (2008) .*Sosyal Bilimlerde Nitel Araştırma Yöntemleri* (6. Baskı). Ankara: Seçkin Yayıncılık

Young, M. F., Slota, S., Cutter, A. B., Jalette, G., Mullin, G., Lai, B., et al. (2012). Our princess is in another castle: A review of trends in serious gaming for education. *Review of Educational Research, 82*(1), 61-89. doi: 10.3102/0034654312436980

Zarraonandia, T., Diaz, P., Aedo, I., & Ruiz, M. R. (2015). Designing educational games through a conceptual model based on rules and scenarios. *Multimedia Tools and Applications, 74*(13), 4535–4559. doi:10.1007/s11042-013-1821-1

Zeng, J., Parks, S., & Shang, J. (2020). To learn scientifically, effectively, and enjoyably: A review of educational games. *Human Behavior and Emerging Technologies*, *2*(2), 186-195. https://doi.org/10.1002/hbe2.188

Investigation of Peer Relationships of Gifted and Non-Gifted High School Students

Özel Yetenek Tanısı Almış ve Normal Gelişim Gösteren Lise Öğrencilerinin Akran İlişkilerinin İncelenmesi[1]

Yunus Emre Aydın[2], **Ramazan Çok**[3], **Güney Dengiz**[4], **Erhan Tunç**[5]

Abstract

Gifted individuals has an important role in the progress of societies, it would be beneficial to better identify these individuals and understand their needs and differences. For that reason, the peer relationships of gifted and non-gifted (showing normal development) high school students were examined in this study. The study was carried out as survey model. The study group consisted of 156 students in total, including 60 students registered to Şahinbey Science and Art Center (BILSEM) in Gaziantep, and 96 students who were not identified as gifted. All students were in the same classes as those with talented, where secondary education was received. In the study, the "Personal Information Form" and "Peer Relationship Scale" that was developed by Atik, Çok, Çoban & Doğan (2014) were used as data collection tools. According to the results of the research, no significant difference was observed in terms of peer relationships between high school students, who were and were not identified as gifted. When peer relationships of male high school students who were and non-gifted are examined in terms of sub-dimensions, it is seen that there is a significant difference between the sub-dimensions of "companionship", "protection" and "closeness" in favor of gifted male students. There is no significant difference in peer relationship mean scores of non-gifted female students. It can be said that there is greater differentiation in peer relationship sub-dimensions in terms of being identified as gifted in the students of 16-18 age group, compared to the 13-15 age group. The findings were discussed in the light of the relevant literature.

Öz

Özel yetenekli bireylerin toplumların ilerlemesinde önemli bir rolü vardır. Bu bireylerin daha iyi tanınabilmesi, farklılıklarının ve ihtiyaçlarının belirlenmesi faydalı olacaktır. Bu nedenle bu araştırmada, özel yetenekli tanısı almış ve almamış (normal gelişim gösteren) lise öğrencilerinin akran ilişkileri incelenmiştir. Araştırma tarama modelinde yürütülmüştür. Çalışma grubu, Gaziantep ilindeki Şahinbey Bilim ve Sanat Merkezi (BİLSEM)'ne kayıtlı 60 özel yetenekli öğrenci ile bu öğrencilerin ortaöğretimine devam ettiği sınıflarda bulunan özel yetenekli tanısı almamış 96 öğrenci olmak üzere toplam 156 öğrenciden oluşmaktadır. Araştırmada veri toplama araçları olarak "Kişisel Bilgi Formu" ve Atik, Çok, Çoban ve Doğan (2014) tarafından geliştirilen "Akran İlişkileri Ölçeği" kullanılmıştır. Araştırma sonucuna göre, akran ilişkileri açısından özel yetenekli tanısı almış ve almamış lise öğrencileri arasında anlamlı bir farklılık görülmemiştir. Özel yetenek tanısı almış ve almamış "erkek" lise öğrencilerinin akran ilişkileri alt boyutlar açısından incelendiğinde ise "birliktelik", "koruma", "yakınlık" alt boyutları arasında özel yetenek tanısı almış erkeklerin lehine anlamlı bir farklılaşma olduğu görülmektedir. Özel yetenek tanısı almış ve almamış kız öğrencilerin akran ilişkileri puan ortalamaları arasında anlamlı farklılaşma görülmemektedir. Özel yetenek tanısı alıp almamanın 16-18 yaş grubundaki öğrencilerde 13-15 yaş grubuna göre akran ilişkileri alt boyutlarında daha fazla ayrışma oluşturduğu belirlenmiştir. Bulgular ilgili literatür ışığında tartışılmıştır.

[1] This study was presented as oral presentation at the 27th International Conference on Educational Sciences held in Antalya on April 18-22, 2018.

[2] **Corresponding Author,** Ministry of National Education, Şahinbey Guidance and Research Center, Gaziantep, TÜRKİYE; pd.yemreaydin@gmail.com , https://orcid.org/0000-0002-6227-4926

[3] Ministry of National Education, Şahinbey Guidance and Research Center, Gaziantep, TÜRKİYE; ramazancokpdr44@gmail.com , https://orcid.org/0000-0002-7520-0301

[4] Ministry of National Education, Şahinbey Guidance and Research Center, Gaziantep, TÜRKİYE dengizguney@gmail.com , https://orcid.org/0000-0002-9958-9139

[5] Gaziantep University, Faculty of Education, Department of Guidance and Psychological Counseling, Gaziantep, TÜRKİYE; erhantunc.gaun@gmail.com , https://orcid.org/0000-0002-6328-8545

INTRODUCTION

When considering human development, it can be said that it involves successive developmental circles with the end of one period starting another. This process starts with conception, and the conceived human being, which is a unique being, becomes an embryo that is attached to the mother (Kılıç, 2013). After completing its development in the womb, the baby finds itself in the outer world (Kılıç, 2016, p.21). After emerging from the mother's womb into the outside world, the baby has to adjust itself to a new environment in order to survive, in other words, to adapt (Kılıç, 2016). Since its existence, humankind has been a social being and maintains almost all of its life by establishing social relationships. This process is thought to encompass the period from conception, to death of the human (Goleman, 2016). According to Klein (2013), a psychodynamic theorist who discussed the first years of human and created the basis of many theories, the first six years are very critical while Feist (1994) adopts a psychodynamic approach and claims that experiences until the age of 12 shape personality. In the initial stages of life, there is complete dependency on the mother and other primary caregivers. The first area of socialization for the baby consists of people who interact with them. It is thought that a social environment enables communication with the external life outside the baby's autistic world, while contacting the outside world, which facilitates mental and emotional adjustment (Gökler, 2014). Socialization starts at birth and the baby establishes relationships with its environment (Gençtan, 2012). In this relationship, the mother and father are "primary socialization" sources (Kılıç, 2016).

This social environment constitutes a discovery area for the child. When the life outside the mother's womb starts, children tend to separate themselves and orient their circles outwards (Kılıç, 2016). With increasing age, a child can develop meaningful relationships with strangers around apart from the mother and father (primary caregivers). In the beginning, the environment is complex and also the child might have problems in making sense of their behaviors. They interpret their behaviors by eventually comparing themselves to those of strangers, and thus develop a social understanding (Bronfenbrenner, 1979). Putting forward some ideas on the relationship between the mother, child or other caregivers, Bowlby (1969) states that the foundation of solid relationships can be established with a secure relationship of the baby with primary caregivers during these stages. The attachment types of children might be related to the types of differentiation. Particularly, the first three years of life might be considered an important period being the first period of separation (as cited: Mahler, Pine & Bergman, 2003).

The pre-school period, which is referred as initial childhood, early childhood or play age, covers the ages between 2-6. In this period, the child starts to have a more balanced and adaptable disposition. Symbolic and language development is complete. Play, which is at the center of children's discovery process, is a means of relationship for a child in this period (Kılıç, 2016). Play helps a child develop a sense of friendship, sharing, love, compassion, trust, helpfulness, independently acting, freedom, self-expression and self-confidence (Schaefer, 2013). The subsequent school age is a period in which children open up from the family to the external world and join a social environment (Kılıç, 2016). Relationships with the environment also shape the peer relationships of a child with his/her friends in the same age group. Peer relationships during the pre-school period might bring about new skills in children such as seeing individual differences, identifying genders, developing speaking skills (language development), contributing to social-emotional development, etc. (Gülay, 2010).

When stages of life are examined, it can be seen that an orientation to one's own age group is more frequent in the case of having a relationship with the environment in every period, whether it be childhood or adolescence, adulthood or old-age (Kılıç, 2013). While orientation to one's peer group is very intense in some periods of life, sometimes it can be replaced with new areas such as family, business circle, or a political environment. The cultural dimension should not be ignored in such changes (Kağıtçıbaşı, 2006). According to the review of the relevant literature, there are two important periods of individuation, in other words, the separation process of a child while moving out of the family and caregiver circle. The first period in this separation process is the period between the ages 0-3 (Mahler et al., 2003). Another period is adolescence when a child establishes a distance from objects related to the attachment elements in the infancy period and orients towards their own peer groups (Blos, 1989). In the adolescence period, individuals need to not feel alienated, staying within groups, sharing, and spending time with people who are close to them in emotional and conceptual terms. An individual creates a social atom within the group of friends they have relationships with, and this social atom includes confidants, best friends, close friends, familiar friends, acquaintances, friends known in the group, passive group acquaintances, etc. of the adolescent according to closeness to them (Kılıç, 2016).

An individual establishes many relationships at school, work, among peers and in other areas starting from the family. The intensity and significance of these relationships change depending on the periods of life; however, the relationship with peers is a form of relationship which exists from the beginning to the end of life, affects the individual socially, emotionally and psychologically and has a multidimensional structure (Atik et al., 2014). In this sense, the entire interaction between individuals who are of the same age or developmental level and share similar life experiences is called peer relationships (Gülay, 2009).

Adolescents and Peer Relationships

Although relationships and interactions are significant throughout the life of every individual, adolescence is a period when friendships have an undeniable importance, and is different from other development periods. According to Cüceloğlu (1991), the most important source of confidence for an individual during adolescence is friendship. Moreover, Delagrave (2016) stated that friendship for adolescents, is as vital as light is for plants. Individuals in this period feel the need for independence from parents and seek emotional satisfaction with social relationships. In this sense, emotional support which was previously taken from

parents is given through friends in this period. Friendships in this period have important functions for adolescents, such as learning social skills, getting to know oneself, building relationships with the opposite sex and building an identity (İnanç, Bilgin & Atıcı, 2011). Friendships in the adolescence period play a role in enabling individuals to experience justice, confidentiality and resistance to oppression by other people, feeling oneself as an individual, controlling their social functions and envisaging their social image (Delagrave, 2016). In brief, peer relationships in adolescence period might be a significant factor for an individual in developing a healthy and consistent personality (Köse, 2015).

An adolescent needs a peer group to ensure individuation; however, peer groups do not meet all needs of a young person. An individual has their own inner and outer limits. The inner limit covers the area where it is more difficult for others to perceive the individual. The outer limit refers to the sense of developing of self-concept in the adolescent and young individual. Strengthening of the adolescent's outer limits refers to a freer existence of the individual in peer environments, making free decisions about their own decisions. The adolescent finds the characteristics such as strengthened limits, sense of self-sufficiency, etc. in the relationships with the group of friends and gains this emotion thanks to the developed self-concept (Geldrad & Geldrad, 2013, p.70). Friendship plays a central role in the adolescent's learning of social skills, self-awareness, building relationships with the opposite sex and approving of their own identity. In addition, problems with making friendships and having conflicts might be the predictor of psychological problems of the adolescent. Friends are significant people in terms of companionship, trust, sharing ideas, protection, togetherness and adaptation in stressful situations (Lempers & Clark-Lempers, 1993). As young people move out of the family circle, they develop different relationships with their families and family members (Geldrad & Geldrad, 2013, p.70).

The friendships of adolescents encompass an area which is deeper, with a special sense of sharing differently from the family and relative circle, and other individuals of the society. Adolescents feel the need for acting with their peers against the authority of parents at home, the teachers and school administration at school, institutions and people steering their social life. When they are not understood by the adults around them, they share the same idea that expectations and behaviors of adults are inconsistent and unjust. They believe they will never copy their parents when they become adults. Parents of adolescents however, think that their children will understand them in time as they are young and inexperienced at the moment, and they share this idea at length with their children as a reaction. When they come together with their peers, adolescents try to understand each other by discussing that the parenting attitudes of their mothers and fathers are completely the same with the parents of their peers. This situation paves the way for distancing themselves from their parents and spending more time together. The terms "Daddy, Mommy" in the childhood period are replaced with the terms such as "old man, my folks, pops" etc. However, adolescents call each other more possessive and intimate terms like *"brother, sister, dude, buddy, BFF, etc."*. While the time spent and the things shared with family decrease, the adolescents become more generous with the time and things that they share with their peers. For an adolescent, a friend is the only person that can understand their world. The adolescent feels more accepted and special in their group of peers. Peers support them when they need without any condition, giving advice or preaching continuously. An adolescent rush to help their friends especially in case of trouble, does everything for them and makes sacrifices for them. At this stage, adolescents attach to each other more. Having friends who make sacrifices, spare time for them, give financial and emotional support and having such a group of peers make the adolescent feel a unique sense of self-confidence and worthiness. All these summarize the transition of an adolescent from "egoism" to "altruism" (Kılıç, 2013). Based on the opinions of the investigators and the review of the literature, it is understood that peer relationships of adolescents are very significant and comprise a great part of their lives. Accordingly, studies on peer relationships of adolescents have been reviewed and the following results have been obtained.

A study investigating the relationships of adolescents with peers and family conducted a study with 89 adolescents. It was found that the adolescents who had a high perception of peer and family relationships had more friends, greater family togetherness, lower tendency for depression and substance use and higher levels of success (Field, Diego & Sanders, 2002). A study investigating the overall connection of peer relationships with social anxiety and depression carried out a study with a total of 421 adolescents aged 14-19, 57% and 53% of whom were females and males, respectively. The study found that variables such as one's status in peer affiliation, positive feelings towards best friendship, and positive emotional signs to peers were properties that decrease social anxiety. On the contrary, it was seen that victimization in peer relationships and negative feelings towards the best peer friend positively predicted social anxiety. Popularity in peer relationships, having a romantic relationship or having a positive romantic partner had effects that decreased depressive emotions. In addition, victimization in peer relationships, negative romantic relationship and negative approaches to best friendship predicted depressive feelings in a positive sense (La Greca & Harrison, 2005, p.54-56).

Gifted Individuals and Peer Relationships

Peer relationships and friendships constitute a significant source in shaping social-emotional development, physical development, cognitive development, achievement of identity and the concept of self. With respect to understanding this pattern and gaining a scientific perspective on the world of adolescents, the reflection of the intelligence and talent factors, which are significant elements in education, on friendships are among matters that arouse curiosity. Intelligence level is considered a significant variable that has an influence on the student profile in education system. Giftedness not only reflects the cognitive potential but also is associated with affective, behavioral, physical and social development areas (Kanlı, 2011).

The lexical meaning of the word "talent" is the ability to do something correctly, a skilled competence, and having a special capability. In some cases, some people have more advanced skills than others. Gifted children are individuals who deliver outstanding intelligence performance in one or more skills; demonstrate a higher level of motivation, performance and duty responsibility in creative, art and academic areas; and need opportunities suitable for advancing in such skills, when compared to their peers (Kuzucu, 2014, p.471).

In Turkey, gifted students are supported with dedicated programs at Science and Art Centers (BILSEM) of the Ministry of National Education so that they can improve their abilities. The diagnosis process is conducted with group surveys followed by individual assessments during the primary school period. All group and individual assessments are performed only by the Ministry of National Education. Group survey tests are carried out as electronic central exams using tablets. Students who get a certain passing grade in the group survey test according to the skill area are assessed individually. An "Intelligence test" and practical exams are held for those who are assessed in the mental areas, music and art areas, respectively, and students who get a score above "130" in the intelligence test and those who do well in the practical music and painting exams are deemed eligible to receive education at BILSEM. Individual intelligence tests are held in Counseling and Research Centers and individual assessments in music and art areas are held in the BILSEM, respectively (Ministry of Education [MEB], 2018).

Over the last 25-30 years, there has been increasing interest in studies on emotional characteristics of gifted children. However, in previous periods, certain prejudices and stereotyped opinions regarding gifts (talents) were dominant (Kelly & Jordan, 1990; Winner, 1997). Characteristics attributed to gifted (talented) individuals included being physically weak, unhealthy and introverted. Furthermore, students with high IQ levels were considered less popular groups with more problems in peer relationships compared to their peers showing normal development (Austin and Draper, 1981; Feldman & Goldsmith, 1986; Ross and Parker, 1980). On the contrary, according to Silverman (1993), gifted (talented) children have an extroverted maturity level, are sensitive to social problems, care about the needs, wishes and opinions of others and try to find solutions accordingly. When Sak (2004: p.75) synthesized 19 studies on gifted children, 49% of the subjects in the study identified themselves as introverted and 35% as extroverted. Cross (2015) reported that some gifted children generally perceived themselves as good at outward-looking friendship relationships, but did not generalize to all studies. Austin and Draper (1981) emphasize that it is not possible to make a universally accepted remark with respect to opposing thoughts on gifted individuals.

When searching for studies on gifted (talented) individuals, studies focusing on how gifted students perceive their own characteristics were found. According to Kerr, Colangelo & Gaeth (1988), gifted individuals consider giftedness as a personal advantage, while it can also be a disadvantage in social terms. Bain & Bell (2004, p.172-173) discovered that gifted individuals had significantly more positive perceptions in the variables of physical appearance, perception of skills, peer relationships, and overall self-concept compared to non-gifted individuals. Mueller (2009, p. 9-10) found that gifted and non-gifted students had similar mean values in terms of self-concept, parent-family connectedness and school belonging. Studies on self-perceptions of the gifted individuals and their perception of their abilities were examined. In a meta-analysis study, 40 studies were examined and according to the findings of this study, gifted children had significantly higher scores in terms of academic self-concept, perceived competence and global self-concept than non-gifted children (Litster & Roberts, 2011: p.130). In a study by Ağyar & Gündoğdu (2017), it is seen that gifted students have higher level of self-esteem than non-gifted students.

In a review of the literature, it is seen that peer relationships of gifted (talented) adolescents have been examined in terms of different dimensions. Among these studies, a study by Kline & Meckstroth (1985) reported that highly gifted (talented) individuals had difficulty in making friends while moderately gifted individuals were popular in their group of friends. Janos, Fung & Robinson (2015, p.78–80) found that 37% of gifted participants reported feeling different in terms of peer relationships and this group had lower self-esteem scores than the group who did not report feeling different. Additionally, friendship expectations of gifted children differ from the expectations of their peers showing normal development (Gross, 2002).

Since the existence of humankind, individual differences have been present and every community has had groups which create difference, are talented and might be considered superior in terms of common intelligence level and abilities (Çağlar, 2004, p.95). The contribution of gifted individuals to the development and advancement of societies in areas such as art, education, science, literature and technology is an undeniable truth (Ciğerci, 2006). One of the most important missions of modern education is to discover gifted children and contribute to social improvement by educating these individuals in line with their abilities (Koçak & İçmenoğlu, 2012, p.74). One of the topics which has drawn the attention of society and science is to understand the differences and needs of gifted individuals who constitute such a significant part of the society. There are many questions regarding gifted individuals just as every individual who is seeking an identity and propriate striving particularly in the adolescence period. What are the developmental characteristics of gifted adolescents? What difficulties do they face in adolescence? How are their friendships? What is their level of relationships with peer groups showing normal development? What are the differences in friendships and peer relationships compared to peer groups showing normal development? It is thought that such questions are among the topics that draw the interest of educators, psychologists, psychological counselors, parents and others in humanity-related fields. In this regard, this study aimed to examine peer relationships of adolescents in high schools according to being identified as gifted (talented). It is foreseen that this study, which was conducted with this stated purpose, might give an idea to parents, educators, psychologists, psychological counselors and school counseling services

to know adolescents better. In accordance with this general purpose, answers to the following questions are sought in the study:

1. In terms of peer relationship levels;

    a. Mean score of male high school students with and without gifted,

    b. Mean score of female high school students with and without gifted,

    c. Mean scores of gifted students by gender,

    d. Mean score of high school students with and without gifted,

    e. Mean scores of high school students with and without gifted according to the "age" variable,

    f. Mean scores of high school students with and without gifted according by the variable of "science high school".

Is there a significant difference between?

METHOD/MATERIALS

Study Design

Descriptive studies serving the description purpose of science, aim at putting forth an existing situation (Erkuş, 2013, p.107-108). This study is a descriptive study that aims to examine peer relationships of students who are identified as gifted.

Population and Sample

The study population is comprised of high school students at the Science and Art Center in Gaziantep, and the 9th, 10th, 11th and 12th grade students of Science, Anatolian and Private high schools where these students study, in Gaziantep. Convenience sampling method was used to identify the sample from the study population. The study sample is comprised in a total of 156 students, including 60 students who were identified as gifted at Gaziantep Science and Art Center and 96 students who were not identified as gifted and studied where the first group of students received formal education.

Convenience sampling is "a (voluntary) type of sampling on individuals who are in the immediate circle, easy to access, readily available and want to participate in the study" (Erkuş, 2013, p.122). The technique of sampling convenient ones was used in this study and the study group is comprised of 156 students in total including 60 students who were identified as gifted at Gaziantep Science and Art Center and 96 students who were not identified as gifted and studied where the first group of students received formal education. Given the time that high school students spend receiving formal education at school, it was thought that taking the possibility that school and classroom environment could cause certain changes in peer relationships into consideration might decrease potential differences in terms of social context. In this regard, the underlying reason why students not identified as gifted were chosen from classrooms of the schools at which gifted students received their formal education was to minimize the above-mentioned differences as much as possible. The demographic information of the participants is provided in Table 1 in a detailed manner.

Table 1. Participants' demographic information

	Frequency	%
School		
Science High Schools	133	85.3
Other (Anatolian and Private High Schools)	23	14.7
Grade		
9th Grade	49	31.4
10th Grade	41	26.3
11th Grade	34	21.8
12th Grade	32	20.5
Talent Status		
Showing Normal Development (Not Identified as Gifted)	96	61.5
Identified as Gifted	60	38.5
Gender		
Male	72	46.2
Female	84	53.8
Age Interval		
Aged 13-15	73	46.8
Aged 16-18	83	53.2
Number of Siblings		

Only Child and Two Children	63	40.4
Three or More Children	93	59.6
Birth Order		
First-born	91	58.3
Middle Child	40	25.6
Last-born	25	16.0
Education Status of Mother		
Not literate or Primary education	49	31.4
Secondary education (high school)	43	27.6
Higher Education (Graduate, Post-graduate)	64	41.0
Education Status of Father		
Not literate or Primary education	24	15.4
Secondary education (high school)	44	28.2
Higher Education (Graduate, Post-graduate)	88	56.4
Total	156	100

Data Collection Tools

This section provides the assessment tools that were used for the purpose of study. The scale used in the study is comprised of two parts. The first part of the scale is the Personal Information Form created by the researcher and the second part is "Peer Relationship Scale" adapted to Turkish by Atik et al. (2014).

Personal Information Form: Personal information form is comprised of two parts. In the first part, questions about demographic information such as age, gender, educational status of mother and father were asked of the participants of the study. In the second part, questions about academic information such as the school at which they studied, skill areas (general cognitive skills, painting, music) were asked of the participants.

Peer Relationship Scale: The Peer Relationship Scale (PRS) was prepared with draft items to assess relationships of children and adolescents with their closest friends through the interview method by Berndt and Perry. The tool was scaled by Bukowski, Hoza & Boivin (1994), adapted to Turkish by Atik et al. (2014) and validity and reliability studies were conducted. The scale is made up of 23 items and five sub-dimensions. The scale is answered on the basis a five-point Likert-type grading design (1= Not Correct, 5= Completely Correct). The participants are asked to concentrate on each item and answer by thinking of their currently closest friends while grading their friendships. The scale can be not only assessed based on dimensions but also used by adding up the scores to totalize. Confirmatory Factor Analysis was run to test the structural validity of the scale and the five-factor construct was supported (x^2/sd=19.83/12, p=0.08, NNFI=0.98). The coefficients of internal consistency of sub-dimensions of PRS vary from α=0.71 to α=0.86 (Bukowski et al., 1994). The scores of the entire scale or sub-dimensions are calculated with arithmetic mean of responses to relevant items. An increase of the scores in the assessment tool indicates an increase in the quality of peer relationships. The extent of "companionship" is indicated the rate of time that the individual volunteers with his/her peer. The "conflict" sub-dimension is about the frequency of disagreements in friendships and "help" dimension is about the size to defend another against injustices and help each other mutually. The "protection" dimension points to the trust they have in dealing with the problems together, and lastly, "closeness" dimension is indicated the emotional attachment to each other (Atik et al., 2014).

Data Collection

The study data was obtained from 60 high school students who were identified as gifted and studied in the 9th, 10th, 11th, and 12th grades at Gaziantep Şahinbey BILSEM in 2017-2018 academic year. Except this, 96 students who were not identified as gifted and studied at Science High School of the Ministry of National Education in Gaziantep, where most of BILSEM students studied. The application time of the scale is seven minutes. Scale data were collected from the participants via paper and pencils.

Data Analysis

Table 2. Skewness and Kurtosis values

	N	Skewness	Kurtosis
Companionship	156	.068	-.498
Conflict	156	-.707	-.212
Help	156	-2.125	6.340
Protection	156	-.362	-.580
Closeness	156	-.799	.328
Peer Relationship (Total)	156	-.806	.956

In this study, Skewness and Kurtosis values were examined to determine whether the data were normally distributed or not. When Table 2 is examined, skewness values between -3 and +3 and kurtosis values between -10 and +10 indicate that the data are suitable for normal distribution (Kline, 2011).

Sample sizes, which are the data sources of the research, affect the statistical choices in the data analysis. In groups with a sample size of 30 or more, the data are considered to be close to the normal distribution. In this study, when analyzing the data, parametric statistics are used in cases where 30 or more samples are formed in the selection of statistical analysis between two or more groups, and non-parametric statistics are used in the sample numbers below 30 (Büyüköztürk, 2016, p.8; Ural & Kılıç, 2013, p.81).

The T-test was used in the study for the variables of gender, being identified as gifted or not and, Mann-Whitney U test was used in cases without normal distribution, for the variable age, respectively.

FINDINGS

This section provides data obtained from the study as well as results and comments related to such data.

Table 3. Statistics on education status of mothers and fathers of high school students who were and were not identified as gifted

Level of Education		Those Identified as Gifted		Those Not Identified as Gifted	
		N	%	N	%
Mother	Not Literate or Primary Education	6	10	43	44.8
	Secondary Education (High School)	19	31.7	24	25
	Higher Education	35	58.3	29	30.2
Father	Not Literate or Primary Education	5	8.3	19	19.8
	Secondary Education (High School)	12	20	32	33.3
	Higher Education	43	71.7	45	46.9
Total		60	100	96	100

When Table 3 is examined, it is seen that the most common educational statuses of mothers and fathers of high school students showing normal development are "not literate or with primary education" with 44.8% and "higher education (graduate or post-graduate)" with 46.9%, respectively. The most common educational statuses of mothers and fathers of high school students identified as gifted are "higher education (graduate or post-graduate)" with 58.3% and "higher education (graduate or post-graduate)" with 71.7%, respectively.

Table 4. T-Test table comparing the mean score of peer relationships scale of male high school students with and without gifted

Sub-Dimensions	Male Individuals Not Identified as Gifted		Male Individuals Identified as Gifted		t	p
	X	S_X	X	S_X		
Companionship	12.31	2.796	14.00	3.096	-2.394	**0.019***
Conflict	15.21	2.832	15.06	3.685	0.198	0.844
Help	22.24	3.638	23.10	2.509	-1.173	0.245
Protection	14.21	3.275	15.96	3.134	-2.261	**0.027***
Closeness	18.12	4.523	20.80	2.940	-3.018	**0.004****
Total	82.12	13.06	88.93	9.698	-2.409	**0.019***

*p<0.05,**p<0.01

When Table 4 is examined, it is seen that there is a significant difference between the mean value of total peer relationship scores of male high school students who were and were not identified as gifted (p<0.05). When examined in terms of sub-

dimensions, a significant difference is seen between the sub-dimensions of "companionship", "protection" and "closeness" in favor of male students who were identified as gifted. It was found that male high school students who were identified as gifted were more qualified in terms of peer relationships, spent more time with their peers, had more trust in their peers to overcome problems and to attach each other more emotionally compared to those who were not identified as gifted.

Table 5. T-Test table comparing the mean score of peer relationships scale of female high school students with and without gifted

Sub-Dimensions	Female Individuals Not Identified as Gifted		Female Individuals Identified as Gifted		t	p
	X	S_X	X	S_X		
Companionship	12.56	3.270	12.83	3.464	-0.352	0.726
Conflict	15.18	3.416	14.90	4.245	0.313	0.756
Help	23.03	2.617	22.80	4.063	0.326	0.745
Protection	15.05	3.460	15.53	3.775	-0.590	0.557
Closeness	20.58	4.085	20.63	4.097	-0.055	0.956
Total	86.42	12.918	86.70	12.23	-0.097	0.923

*p<0.05,**p<0.01

When Table 5 is examined, no significant difference is seen between the mean values of peer relationship sub-dimensions and the total scores of female individuals who were and were not identified as gifted (p>0.05).

Table 6. T-Test table comparing the mean scores of gifted students from the peer relations scale by gender.

Sub-Dimensions	Male individuals identified as gifted		Female individuals identified as gifted		t	p
	X	S_X	X	S_X		
Companionship	14.00	3.096	12.83	3.464	1.375	0.174
Conflict	15.06	3.685	14.90	4.245	0.162	0.872
Help	23.10	2.509	22.80	4.063	0.344	0.732
Protection	15.96	3.134	15.53	3.775	0.484	0.630
Closeness	20.80	2.940	20.63	4.097	0.181	0.857
Total	88.93	9.698	86.70	12.230	0.784	0.436

*p<0.05,**p<0.01

When Table 6 is examined, no significant difference is seen between the mean values of peer relationship sub-dimensions and the total scores of gifted male high school students and gifted female high school students, in terms of gender (p>0.05).

Table 7. T Test table comparing the mean score of peer relationships scale of high school students with and without gifted

Sub-Dimensions	High School Students Not Identified as Gifted		High School Students Identified as Gifted		t	p
	X	S_X	X	S_X		
Companionship	12.46	3.064	13.41	3.310	-1.806	0.073
Conflict	15.19	3.164	14.98	3.942	0.356	0.723
Help	22.69	3.102	22.95	3.351	-0.470	0.639
Protection	14.69	3.390	15.75	3.447	-1.866	0.064
Closeness	19.53	4.427	20.71	3.537	-1.845	0.067
Total	84.58	13.087	87.81	11.001	-1.657	0.100

*p<0.05, **p<0.01

When Table 7 is examined, no significant difference is seen between the mean values of peer relationship sub-dimensions and the total scores of high school students in terms of the variable of being identified as gifted or non-gifted (p>0.05).

Table 8. T-Test table comparing the mean score of peer relationships scale of 13-15 years high school students with and without gifted

Sub-Dimensions	Not Identified as Gifted, Aged 13-15		Identified as Gifted, Aged 13-15		t	p
	X	S_X	X	S_X		
Companionship	12.90	3.348	12.95	3.515	-0.051	0.960
Conflict	16.72	2.295	15.15	3.826	2.175	**0.033***
Help	23.72	2.125	22.37	3.814	1.816	0.074
Protection	16.21	2.966	15.07	3.604	1.451	0.151
Closeness	21.33	3.424	20.17	3.734	1.369	0.175
Total	90.90	10.852	85.72	11.834	1.933	0.057

*p<0.05, **p<0.01

When Table 8 is examined, a significant difference is seen in the peer relationship sub-dimension of "conflict" between individuals who were and were not identified as gifted in the 13-15 age group (p<0.05).

When peer relationships of students aged 13-15 who were or were not identified as gifted were compared, it was found that the frequency of conflicts in friendships was higher in students who were identified as gifted.

Table 9. Mann Whitney U table comparing the mean score of peer relationships scale of 16-18 years high school students with and without gifted

	Age Level	(N)	Mean Value of Rank	Total of Rank	U	p
Companionship	Not identified as Gifted Aged 16-18	63	37.91	2388.50	372.500	**0.006****
	Identified as Gifted, Aged 16-18	20	54.88	1097.50		
Conflict	Not identified as Gifted, Aged 16-18	63	41.20	2595.50	579.500	0.589
	Identified as Gifted, Aged 16-18	20	44.53	890.50		
Help	Not identified as Gifted, Aged 16-18	63	38.22	2408.00	392.000	**0.008****
	Identified as Gifted, Aged 16-18	20	53.90	1078.00		
Protection	Not identified as Gifted, Aged 16-18	63	36.72	2313.50	297.500	**0.000****
	Identified as Gifted, Aged 16-18	20	58.63	1172.50		
Closeness	Not identified as Gifted, Aged 16-18	63	37.78	2380.00	364.000	**0.004****
	Identified as Gifted, Aged 16-18	20	55.30	1106.00		
Total	Not identified as Gifted, Aged 16-18	63	36.67	2310.00	294.000	**0.000****
	Identified as Gifted, Aged 16-18	20	58.80	1176.00		

*p<0.05, **p<0.01

When Table 9, based on the results of Mann-Whitney U test which was conducted to find out whether there was a significant difference between 63 individuals showing normal development and 20 gifted individuals in the 16-18 age group is examined, a statistically significant difference is seen in the mean values of "companionship, help, protection, closeness" sub-dimensions and the total peer relationship scores of gifted individuals aged 16-18 (p<0.05).

It was found that male high school students aged 16-18 who were identified as gifted were more qualified in terms of peer relationships, spent more time with their peers, advocated others against injustice and helped each other more, had more trust in their peers regarding overcoming problems and were attached to each other more emotionally compared to those who were not identified as gifted.

Table 10. T-Test Table comparing the score of peer relations scale of "science high school" students with and without gifted talent.

Sub-Dimensions	Not Identified as Gifted, Science High School		Identified as Gifted, Science High School		t	p
	X	S_X	X	S_X		
Companionship	12.46	3.064	13.45	2.930	-1.706	0.090
Conflict	15.19	3.164	14.75	4.051	0.596	0.554
Help	22.69	3.102	22.72	3.819	-0.050	0.961
Protection	14.69	3.390	16.05	3.357	-2.072	**0.040***
Closeness	19.53	4.427	20.75	3.788	-1.593	0.115
Total	84.58	13.087	87.75	11.089	-1.304	0.195

*p<0.05, **p<0.01

When Table 10 is examined, a significant difference is only seen in the sub-dimension of "protection" between the mean values of peer relationship sub-dimensions and the total scores of science high school students who were or were not identified as gifted (p<0.05).

In the comparison of peer relationships of science high school students in the same environment who were or were not identified as gifted, it was found that students who were identified as gifted had more trust than those who were not identified as gifted regarding overcoming problems together.

CONCLUSION AND DISCUSSION

Conclusion and Discussion of Peer Relationships of High School Students with Gifted and Normal Development According to Gender

Results obtained in this study by gender can be explained as follows. When peer relationships of male high school students who were and were not identified as gifted are examined in terms of sub-dimensions, it is seen that there is a significant difference between the sub-dimensions of "companionship", "protection" and "closeness" in favor of male students who were identified as gifted. There is no significant difference in mean peer relationship scores of female individuals who were and were not identified as gifted. No significant difference is seen between the mean values of peer relationship sub-dimensions and the total scores of gifted male high school students and gifted female high school students in terms of gender.

In the literature, there are some notable results in studies examining gifted high school students by the variable of gender. A study investigating opinions on close friendships and attachment types included 28 (male: 14, female: 14) gifted students and 28 (male: 14, female: 14) students showing normal development in the 9th grade. According to the study results, gifted high school students of both genders have lower perceptions of close relationships with their friends of same sex compared to high school students showing normal development. Moreover, they reported to have lower levels of sincerity and spontaneity, sensitivity and ability of knowing the qualities of the other party, attachment, exclusiveness (private closeness), sharing and generosity, trust and loyalty, and common activities in their close friendships than the group of peers showing normal development. The difference between the scores of scale items including the above-mentioned qualities seemed to be significant (Mayseless, 1993, p.139–142). In another study investigating the impact of gender of 496 students in total including 64 gifted individuals and 432 individuals showing normal development, a 2x2 sociometric plan was created to see the distribution in peer relationships. According to sociometric distribution, non-gifted students were rejected more than the gifted students in terms of peer relationships. Girls were selected more than boys in both groups. According to analyses, gifted girls represented the least popular group while gifted boys were the most popular group. No such difference was seen in the non-gifted group; however, non-gifted girls were considered more popular than gifted girls (Luftig & Nichols, 1990: 113). In a study about emotional intelligence and giftedness, the students who were gifted and showed high level of achievement were studied. In terms of interpersonal relationships and stress control, girls scored higher than boys, whereas males scored higher in terms of adjustment than girls (Prieto, Ferrándiz, Ferrando, Sánchez & Bermejo, 2016: s.36). The mediating role of gender in social adaptation to giftedness of gifted students group divided into two groups according to intelligence test and teacher assessment criteria was examined. While there was no significant difference in the selection of positive characteristics in sociometric measurements between gifted and non-gifted individuals, gifted individuals reported their academic and general self-concept at a high level but peer relationships self-perception at a low level. In addition, a significant relationship was found between peer relationships self-perception and gender in gifted students (Košir, Horvat, Aram & Jurinec, 2015).

Conclusion and Discussion of the Peer Relationships of High School Students with Gifted and Normal Development According to Age Variable

When the data is examined according to age groups, it can be said that there is a greater differentiation in peer relation sub-dimensions in terms of being identified as gifted in the students of the 16-18 age group compared to the 13-15 age group. In the assessment of this result, the length of time spent might affect the status of friendship in adolescents and they can build closer relationships in time (Kılıç, 2016, p.134). Adolescents are influenced by their friendships to a great extent. Personality is shaped with age; particularly the age of 18 is considered significant in terms of personality formation and the quality of friendships increases as the individual approaches to this age (Yörükoğlu, 2013). A study of a total of 305 students including 162 boys and 143 girls aged 9-17 investigated the acceptance of the gifted label, perception of abilities and skills, struggle for educational opportunities and perceived social links as compared to non-gifted peers. According to the study results, gifted individuals in the 15-17 and 12-14 age groups accepted the gifted label less than the 9-11 age group. There was no significant difference in the variables of perception of abilities and struggling against educational difficulties. The study also found a positive significant correlation between accepting the gifted label and perception of abilities as incremental and struggling for educational opportunities. It was found that, with increasing age, there occurred a tendency to neglect the perceived social links to non-gifted peers (peers not gifted) when 9-11 age group was compared to the 12-14 and 15-17 age groups (Feldhusen & Dai, 1997).

While giftedness is seen as a popular situation in primary education, it may be more common in adolescence to be excluded from peer groups. Having differences, having different characteristics from the group of friends can lead the individual to loneliness (Bishop, Bishop, Gelbwaser, Green, Peterson & Zuckerman, 2004). The gifted paradigm is a bit more frightening and unknown in this adolescence (Swiatek, 2012). In another study examining the peer relationship in adolescence, it was stated that gifted individuals adopted an egalitarian, reciprocal peer relationship in peer relationships (Peairs, 2010). According to age periods, the subjects that gifted students give importance in peer relationship may change. According to Kiefer & Ryans (2010), while 6th grade gifted children give importance to sincerity and responsibility in peer relations, dominant character and physical

appearance are important in 7th grade children. When the results obtained are examined, it is seen that the findings vary according to the characteristics of the research groups, age groups and the variables subject to the research.

Conclusion and Discussion of the Peer Relationships of High School Students with Gifted and Normal Development According to Variable Diagnosis

One of the most important results of this study is as follows. No significant difference was seen between the mean values of peer relationship sub-dimensions and the total scores of high school students in terms of the variable of being identified as gifted or non-gifted.

Studies on the characteristics, diagnosis, programs and educational models of gifted children have provided some ideas about the social, emotional and academic fields of these children (Sak, 2014). While being positively influenced by the characteristics such as self-esteem, self-esteem, increase in environmental expectations, social contribution, there may be negative sides such as social exclusion, unreal self-confidence, esteem anxiety, normalization efforts, excessive expectations, and excessive expectations of adults (Sak, 2014: p. 322-330). Gifted individuals can be aware of the negative effects of being gifted. Especially in adolescence, they may prefer to share with other people in order to strengthen their self-esteem (Yılmaz, 2015, p.97).

In the literature review, there are some studies investigating peer relationships of gifted and non-gifted adolescents. In a study examining personality factors, social support, emotional well-being and academic achievement, teachers assessed gifted students as being well-adjusted and reported that they were less likely to have behavioral or emotional problems than non-gifted students (students that are not gifted). The gifted students reported feeling more upset and being unsatisfied with social support from their environment than the non-gifted group (group without gifted). It was seen that being identified as gifted (special talented) or not had no significant effect on the variables such as self-esteem, hope levels, problem orientation or attitudes towards education (Vialle, Heaven & Ciarrochi, 2007, p.577-579). In this study, it is seen that being directly unrelated to peer relationship dimension and identified as gifted or not does not constitute a significant difference in attitude, orientation and personality traits towards certain psychological qualities. The friendship of gifted adolescents and those showing normal development has been investigated in various studies in terms of the attitudes perceived by others. Gallagher & Crowder (1957) examined peer relationships of 20 male and 10 female gifted students who scored 150 and above in the Stanford-Binet test. A sociometric test including the students showing normal development was applied, and the study concluded that gifted students were more popular and were embraced more by both students and teachers due to their achievements in lessons and projects. Another study compared gifted students to regular adolescents in terms of peer acceptance, participation in group activities and personality traits. The study included 300 gifted students and 111 students showing normal development. According to these study results, students showing normal development were more agile, independent, uninhibited, socially adept, dominant, radical, creative, emotionally stable, extroverted, popular, athletic, socially attractive, and socially active than the gifted students, and they had greater sense of being part of a group. When differences were examined, it was seen that differences between personality traits, such as being socially more adept, uninhibited and extroverted were significant (Dauber &Benbow, 1990, p.12).

According to other studies in this field, adolescents who were identified as gifted perceived themselves to be more successful in friendships and skills in other social areas than the adolescents who were not identified as gifted. Interpersonal competence and peer relationships of 1,526 talented adolescents who had previously participated in a program at the Center for Talent Development were examined by using an online survey. When gifted students were compared to the non-gifted peer group having similar mean academic values had generally positive perceptions regarding their abilities to initiate, develop and maintain relationships with other people. The gifted students perceived themselves more positively in terms of interpersonal competence and peer relationships compared to non-gifted students in the same class. The gifted) students did not consider giftedness as an obstacle affecting their interpersonal relationships but perceived their academic self-concept more positively than their social self-concept. The results obtained also showed that the students who were gifted in verbal-linguistic area were more likely to face difficulties in peer relationships than the students who were gifted) in mathematics, life sciences and social sciences (Lee, Olszewski-Kubilius and Thomson, 2012). In another study comparing gifted high school students (n= 62) and those showing normal development (n= 162), intimacy with family and friends, social support, family responsibilities, self-esteem, depression and risk-taking behaviors were assessed. The gifted students perceived themselves as being more intimate in friendships, assuming family responsibilities occasionally and taking more risks (risks related to sports and danger). In contrast to the literature suggesting delays in social development of the gifted individuals, this study showed that the gifted students perceived themselves socially better compared to students showing normal development. According to data from their teachers, the gifted students perceived themselves to be better than the non-gifted group in terms of their academic skills and social peer relationships. However, teachers of the gifted students attributed lower levels of happiness to the gifted students than the perception of happiness of the gifted students themselves (Field, Harding, Yando, Gonzalez, Lasko, Bendell & Marks, 1998).

RECOMMENDATIONS

From the results of this study, the following recommendations can be made for future studies.

- Variables by which gifted students and non-gifted students are compared in this study are generally sociodemographic and more extensive comparisons can be made by using different variables in future studies.

- Given the fact that friendships in this period have important functions for adolescents such as learning social skills, getting to know oneself, building relationships with the opposite sex and forming an identity, an explanation of similar situations in terms of friendships for gifted and non-gifted individuals would contribute to the relevant literature.

- Studies might be conducted for the effectiveness of BILSEM, where the gifted students receive education, on peer relationships.

- Adolescent individuals orient to their peer groups by moving out of the circle of parents and family. Studies can be designed on how parents of gifted students regard peer relationships.

- Group counseling studies can be carried out by schools or BILSEM counseling services to increase the quality of peer relationships of the gifted individuals. Group counseling events can be organized. Additionally, psychoeducation on the inner world, developmental properties and needs of the gifted children can be organized for teachers and parents of the gifted students.

- Although studies on gifted students have been showing an increase lately, studies are still limited in Turkey. It is predicted that increasing studies on this group, both qualitatively and quantitatively, would enhance the future plans for these students. Investigating different abilities of these students in joint studies with other disciplines is significant in terms of ensuring integration in emotional, cognitive and social developments of this group of students.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, author-ship, and/or publication of this article.

Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Ethics Committee Approval Information

This research was carried out with the approval of the Gaziantep Provincial Directorate of National Education, dated 05.06.2017 and numbered 8249386.

REFERENCES

Atik, Z. E., Çoban, A. E., Çok, F., Doğan, T. & Karaman, N. G. (2014). Akran ilişkileri ölçeği'nin Türkçeye uyarlanması: Geçerlik ve güvenirlik çalışması. *Kuram ve Uygulamada Eğitim Bilimleri*, 14, 433–446. Doi: http://dx.doi.org/10.12738/estp.2014.2.1778

Austin, A.B. & Draper, D.C. (1981). Peer relationships of the academically gifted: Areview. *Gifted Child Quarterly*, 25, 129-133.

Ayğar, B., B & Gündoğdu, M. (2017). The relationship between gifted and ungifted students' self- perceptions and their parents' parenting styles: A Structural Equation Model**. *European Journal of Education Studies*. 3(3), 334-350. doi:10.5281/zenodo.292953

Bain, S. K. & Bell, S. M. (2004). Social self-concept, social attributions, and peer relationships in fourth, fifth, and sixth graders who are gifted compared to high achievers. *Gifted Child Quarterly*, 48(3),167-178.

Baker, J. A., Bridger, R. & Evans, K. (1998). Models of under achievement among gifted preadolescents: The role of personal, family, and school factors. *Gifted Child Quarterly*, 42(1), 5-15.

Blos, P. (1989). The place of the adolescent process in the analysis of the adult, *The Psychoanalytic Study of the Child*, 44(1), 3-18. Doi:10.1080/00797308.1989.11822636

Bishop, J. H., Bishop, M., Bishop, M., Gelbwasser, L., Green, S., Peterson, E., ... & Zuckerman, A. (2004). Why we harass nerds and freaks: A formal theory of student culture and norms. *Journal of School Health*, 74(7), 235-251.

Bronfenbrenner, U. (1979). *The ecology of human development. experiment by the nature and design.* Hardward University Press, Cambridge Massachusetts London England, (Printed in the Unites States of America).

Buescher, T. M. (1985). A frame work for understanding the social and emotional development of gifted and talented adolescents. *Journal of Roeper Review*, 8 (1), 10-15, Doi:10.1080/02783198509552919

Bukowski, W.M., Hoza, B. & Boivin, M. (1994). Measuring friendship quality during pre and early adolescence: The development and psychometric properties of the Friendship Qualities Scale. *Journal of Social and Personal Relationships*, 11, 471-84. Doi: 10.1177/0265407594113011

Büyüköztürk, Ş. (2016). *Sosyal bilimler için veri analizi el kitabı* (Genişletilmiş 18. Baskı). Ankara: Pegem Akademi Yayıncılık.

Chan, D. W. (2003). Dimensions of emotional intelligence and their relationships with social coping among gifted adolescents in Hong Kong. *Journal of Youth and Adolescence*, 32(6),409 418.

Ciğerci, Z. C. (2006). *Üstün yetenekli olan ve olmayan ergenlerde benlik saygısı, başkalarının algılaması ve psikolojik belirtiler arasındaki ilişkiler.* (Yayınlanmamış yüksek lisans tezi). Sakarya Üniversitesi Sosyal Bilimler Enstitüsü, Sakarya.

Clark, B. (2007). *Growing up gifted*. (7th edt.), New Jersey: Pearson Education, Inc.

Cross, R.,J.(2015). Gifted Childreen and Peer Relationships. *School of education book chapters*. 20. https://scholarworks.wm.edu/educationbookchapters/20/

Cüceloğlu, D. (1991). *İnsan ve davranışı, psikolojinin temel kavramları* (2.Baskı). İstanbul: Remzi Kitabevi.

Cüceloğlu, D. (2012). *İnsan ve davranışı.* (25 Baskı). İstanbul: Remzi Kitabevi.

Çağlar, D. (2004). *Üstün yetenekli çocukların özellikleri. 1. üstün yetenekli çocuklar kongresi seçilmiş makaleler kitabı.* İstanbul: Çocuk Vakfı Yayınları.

Dauber, S. L. & Benbow, C. P. (1990). Aspects of personality and peerrelations of extremely talented adolescents. National association for gifted children. *Gifted Child Quarterly*, 34 (1), 10-14. Doi: https://doi.org/10.1177/001698629003400103

Delagrave, M. (2016). *Ergen kullanma kılavuzu.* (E.Özdoğan, çev.) İstanbul: Yapı Kredi Yayınları.

Erkuş, A. (2013). *Davranış bilimleri için bilimsel araştırma süreci.* (4.b.s.), Seçkin Yayıncılık: Ankara.

Feist, J. (1994). *Theories of personality* (3. Edition). Orlando, FL, US: Harcourt Brace College Publishers.

Feldhusen, J. F. & Dai, D. Y. (1997). Gifted students' attitudes and perceptions of the gifted label, special programs, and peer relations. *Journal of Secondary Gifted Education*, 9(1),15-20.

Feldman, D.H. & Goldsmith, L.T. (1986). *Nature's gambit: child prodigies and the development of human potential.* New York: Basic Books.

Ferguson,L.R. & Maccoby, E.E. (1966). Interpersonal correlates of different abilities. *Society for Research in Child Development,* 37, 549-571. Doi: 10.2307/1126678

Field, T., Harding, J., Yando, R., Gonzalez, K., Lasko, D., Bendell, D. & Marks, C. (1998). Feelings and attitudes of gifted students. *Adolescence*, 33(130), 331-342.

Field, T., Diego, M. & Sanders, C. (2002). Adolescents' parent and peer relationships. *Adolescence*, 37(145), 121.

Galagher, J., J & Crowder, T. (1957). The adjustment of Gifted Children in the Regular Classroom. *Journal of Exceptional Children* 306-319. http://journals.sagepub.com/doi/abs/10.1177/001440295702300705?journalCode=ecxc

Geldard, K., & Geldard, D. (2013). *Counselling children: a practical introduction* (4th ed.). Thousand Oaks, CA: Sage Publications.

Gençtan, E. (2012). *Psikanaliz ve sonrası.* Metis Yayıncılık: İstanbul.

Goleman, D. (2016). *Sosyal zekâ, insan ilişkilerinin yeni bilimi.* (O, Deniztekin, çev.), (6. Baskı). Varlık Yayınları: İstanbul.

Gökler, B. (2014). *Çocuk istismarı ve ihmaline yaklaşım "temel bilgiler".* Editör: Orhan Derman. Çocuk İstismarını Önleme Derneği. Akademisyen Kitabevi: Ankara.

Gross, M. U. (2002). Musings: gifted children and the gift of friendship. *Understanding Our Gifted*, 14(3), 27-29.

Gülay, H. (2009). Okul öncesi dönemde akran ilişkileri. *Balıkesir Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 12, (22),82-93.

Janos, P. M., Fung, H. C. & Robinson, N. M. (1985). Self-concept, self-esteem, and peer relations among gifted children who feel "different". *Gifted Child Quarterly*, 29(2),78-82.

İnanç, B. Y., Bilgin, M., Atıcı, M.K. (2011). *Gelişim psikolojisi.* (6.bs.) Pegem Akademi. Ankara.

Kağıtçıbaşı, Ç. & Üskül, A (2006). *Yeni insan ve insanlar: sosyal psikolojiye giriş.* Evrim Yayınevi: İstanbul.

Kanlı, E. (2011). Üstün zekâlı ve normal lise öğrencilerin mükemmeliyetçilik, depresyon ve kaygı düzeyleri arasındaki ilişkilerinin incelenmesi. *M.Ü. Atatürk Eğitim Fakültesi Eğitim Bilimleri Dergisi*. 2011, (33), 103-121.

Kelly, K.R. & Jordan L., K. (1990). Effects of academic achievement and gender on academic and social self-concept: a replication study. *Journal Of Counseling & Development*, 69,69-73.

Kerr, B., Colangelo, N. & Gaeth, J. (1988). Gifted adolescents' attitudes toward their giftedness. Gifted Child Quarterly, 32(2),245-247.

Kılıç, M. (2013). *Gerçek yaşam tadında: gelişim dönemleri 2 erinlik-ergenlik* (1.baskı). Ankara: Pegem Akademi.

Kılıç, M. (2016). *Gerçek yaşam tadında: gelişim dönemleri 1 çocukluk-okul* (2.baskı). Ankara: Pegem Akademi.

Kiefer, S. M. & Ryan, A. M. (2011). Students' perceptions of characteristics associated with social success: Changes during early adolescence. *Journal of Applied Developmental Psychology*, 2(4), 218–226. Doi: https://doi.org/10.1016/j.appdev.2011.05.002

Klein, M. (2013). *Çocuk psikanalizi.* (A. Demir, çev., Eserin Orjinali 1932 yılında yayımlandı). İstanbul: Pinhan Yayıncılık.

Kline, B. E. & Meckstroth, E. A. (1985). Understanding and encouraging the exceptionally gifted. *Journal of Roeper Review*, 8 (1), 24-30, Doi:10.1080/02783198509552922

Kline, R. (2011). *Principles and practice of structural equation modeling*, (3rd ed.). New York: The Guilford Press.

Koçak, R. & İçmenoğlu E. (2012). Üstün yetenekli öğrencilerin duygusal zekâ ve yaratıcılık düzeylerinin yaşam doyumlarını yordayıcı rolü. Emotional intelligence and creativity as predictors of life satisfaction among gifted students. *Türk Psikolojik Danışma ve Rehberlik Dergisi*. 2012, 4 (37),73-85.

Košir,K., Horvat, M., Aram, Y. & Jurinec, N. (2015): Is being gifted always an advantage? Peer relations and self-concept of gifted students. *High Ability Studies*. Doi:10.1080/13598139.2015.1108186

Köse, N. (2015). Ergenlerde akran ilişkilerinin mutluluk düzeyine etkisi. *İnönü Üniversitesi Eğitim Bilimleri Dergisi*, 2 (4),1-6.

Kuzucu, Y. (2014). *Küçükler için büyüklere, çocuk ve ergen ruh sağlığı*. Pegem Akademi. Ankara.

La Greca, A. M. & Harrison, H. M. (2005). Adolescent peer relations, friendships and romantic relationships: Do they predict social anxiety and depression? *Journal of clinical child and adolescent psychology*, 34(1), 49-61.

Lee, S.Y., Olszewski-Kubilius, P. & Thomson, D. T. (2012). Academically gifted students' perceived interpersonal competence and peer relationships. *Gifted Child Quarterly*, 56(2), 90-104.

Lempers, J. D. & Clark-Lempers, D.S. (1993). A Functional Comparison of Same-Sex and Opposite-Sex Friendships during Adolescence. *Journal of Adolescent Research*, 8, 89-108.

Levine, E. S. & Tucker, S. (1986). Emotional needs of gifted children: A preliminary, phenomenological view. *Creative Child &Adult Quarterly*, 11(3),156-165.http://psycnet.apa.org/record/1988-12183-001

Litster, K. & Roberts, J. (2011). The self-concepts and perceived competencies of gifted and non-gifted students: A meta-analysis. *Journal of Research in Special Educational Needs*, 11(2), 130-140. Doi: 10.1111/j.1471-3802.2010.01166.x

Luftig, R. L., & Nichols, M. L. (1990). Assessing the social status of gifted students by their age peers. *Gifted Child Quarterly*, 34(3), 111-115.

Mahler, M. S., Pine, F. & Bergman, A. (2003). *İnsan yavrusunun psikolojik doğumu.* (A. N. Babaoğlu, çev.). İstanbul: Metis Yayıncılık.

Mayseless, O. (1993). Gifted adolescents and intimacy in close same-sex friendships. *Journal of Youth and Adolescence*, 22(2),135-146.

MEB. (2017). Çocuk gelişimi ve eğitimi üstün zekâlılar ve özel yetenekliler. http://megep.meb.gov.tr/mte_program_modul/moduller/%C3%9Cst%C3%BCn%20Zek%C3%A2l%C4%B1lar%20ve%20%C3%96zel%20Yetenekliler.pdf

MEB. (2018). Bilim ve Sanat Merkezleri Öğrenci Tanılama ve Yerleştirme Kılavuzu. http://orgm.meb.gov.tr/meb_iys_dosyalar/2018_11/09171525_2018-2019_BYLSEM_YYRENCY_TANILAMA_VE_YERLEYTYRME_KILAVUZU.pdf

Mueller, C. E. (2009). Protective factors as barriers to depression in gifted and nongifted adolescents. *Gifted Child Quarterly*, 53(1),3-14.

Oğurlu, Ü. (2010). Üstün zekâlı ve yeteneklilerde sosyal uyum ve arkadaşlık ilişkileri: Literatür taraması. *Çukurova Eğitim Fakültesi Dergisi*. 03 (39),90-99.

Özbay, Y. & Palancı, M. (2011). Üstün yetenekli çocuk ve ergenlerin psikososyal özellikleri. *Sakarya Üniversitesi Eğitim Fakültesi Dergisi*, 22,89-108.

Parker, J.G. & Asher, S.R. (1987). Peer relations and later personal adjustment: Are low-accepted children at risk? *Psychological Bulletin*, 102,357-389.

Peairs, F., K. (2010). *The social world of gifted adolescents: sociometric status, friendship and social network centrality.* (Unpublished doctoral dissertation),Department of Psychology and Neuroscience Duke University. https://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/5628/Peairs_duke_0066D_10583.pdf?sequence=1

Prieto, D.M., Ferrándiza, C., Ferrando, M., Sánchez, C., & Bermejo, R. (2016). *Inteligencial emocional y alta habilidad*. Cristina Palhares (Ed. Director). https://www.aneis.org/revista-sobredotacao-2016/

Reis, S. M. & Rezulli, J. S. (2004). Current research on the social and emotional development of gifted and talented students: Good news and future possibilities. *Psychology in the Schools*, 41(1), 119-130. Doi: https://doi.org/10.1002/pits.10144

Ross, A. & Parker, M. (1980). Academic and social self-concepts of the academically gifted. *Exceptional Children*, 47,6-10.

Sak, U. (2004). A synthesis of research on psychological types of gifted adolescents. *Journal of Secondary Gifted Education*, 15(2), 70-79.

Sak, U. (2014). *Üstün zekalılar: özellikleri, tanılanmaları, eğitimleri* (4.Baskı). Ankara: Vize Yayıncılık.

Schaefer, C.E. (2013). *Oyun terapisinin temelleri, faundations of play therapy.* (Tortamış, çev.), (2. baskı). Ankara: Nobel Eğitim Yayıncılık.

Silverman, L.K. (1993). *Social development, leadership and gender issues*. 291-329. Counseling the Gifted and Talented. Love Publishing Company: Denver.

Swiatek, M. A. (2012). Social coping. In T. L. Cross & J. R. Cross (Edt.), *Handbook for counselors serving students with gifts and talents,* 665–679. Prufrock Press, Waco, TX.

Terman, L. M. (1925). *Genetic studies of genius: mental and physical traits of a thousand gifted children.* (Vol. 1). Palo Alto, CA: Stanford University Press.

Ural, A. & Kılıç, İ. (2013). *Bilimsel araştırma süreci ve spss ile veri analizi* (4. Baskı). Ankara: Detay Yayıncılık

Vialle, W., Heaven, P. C. & Ciarrochi, J. (2007). On being gifted, but sad and misunderstood: Social, emotional, and academic outcomes of gifted students in the wollongong youth study. *Educational Research and Evaluation*, 13(6),569-586.

Winner, E. (1997). Exceptionally high intelligence and schooling. *American Psychologist*, 52(10), 1070-1081. Doi: http://dx.doi.org/10.1037/0003-066X.52.10.1070

Yılmaz, D. (2015). *Üstün yetenekliler için psikolojik danışma ve rehberlik uygulamaları: gereksinimler, sorunlar ve müdahaleler*. Ankara: Nobel Yayıncılık.

Yörükoğlu, A (2013). *Çocuk ruh sağlığı: çocuğun kişilik gelişimi, eğitimi ve ruhsal sorunlar* (3.baskı).İstanbul: Özgür Yayınları

Thematic Content Analysis of Postgraduate Dissertations on Technological Pedagogical Content

Knowledge: The Case of Turkey

Teknolojik Pedagojik Alan Bilgisi Üzerine Lisansüstü Tezlerin Tematik İçerik Analizi: Türkiye Örneği

Sinan Çınar [1]

Abstract

Purpose: The aim of this study is to carry out an in-depth analysis on postgraduate dissertations in Turkey addressing Technological Pedagogical Content Knowledge (TPACK).

Design/Methodology/Approach: It was conducted with thematic content analysis method. The data were obtained from the postgraduate dissertations published between 2009 and 2019 through a review of the National Thesis Center website of Higher Education Board (YÖK). The review yielded a total of 101 postgraduate dissertations on TPACK, 26 of which are doctoral and 75 of which are at master's level. The dissertations were analyzed using a matrix. Descriptive and content analysis methods were applied to reveal the aim, subject area, method, sample, data collection tools, results and recommendations in each of the dissertations.

Findings: The findings obtained from the analyses were translated into percentage and frequency values given in tables for comprehensibility. It was found out that most of the dissertations deal with the definition of TPACK competencies of teachers and teacher candidates and the relationship between TPACK and a number of variables including gender/grade level/ seniority year, and so forth. On the other hand, only few were intended to figure out the impact of the lessons or courses developed within the framework of TPACK. Lastly, most of the publications were conducted with screening model, and a considerable number of them used embedded design and multiple case designs

Highlights: The conclusion of the research is that there are many potential gaps to guide deeper change in education within the framework of TPACK, and in particular, further development and exploration of specific domain-based technological environments are needed.

Öz

Çalışmanın amacı: Bu çalışmanın amacı Türkiye'deki teknolojik pedagojik alan bilgisi (TPAB) konusunda yapılan lisansüstü tezleri kapsamlı bir şekilde incelemektir.

Materyal ve Yöntem: Araştırmada tematik içerik analizi yöntemi kullanılmıştır. Veriler, YÖK Ulusal Tez Merkezi incelenerek 2009-2019 yılları arasında yayımlanan lisansüstü tezlerinden elde edilmiştir. Taramalar sonucunda TPAB konusunda 26'sı doktora ve 75'i yüksek lisans tezi olmak üzere toplamda 101 lisansüstü teze ulaşılmıştır. Araştırmada yer alan lisansüstü tezleri matris kullanılarak analiz edilmiştir. Çalışmaların her biri, betimsel ve içerik analizi yöntemi kullanılarak çalışmanın amacı, konu alanı, yöntemi, örneklemi, veri toplama araçları, elde edilen sonuçlar ve öneriler bağlamında incelenmiştir..

Bulgular: Elde edilen bulgular anlaşılır şekilde düzenlenerek yüzde ve frekans değerleriyle birlikte tablo haline dönüştürülmüştür. Araştırmadan elde edilen bulgularda, tez çalışmalarının büyük bir çoğunluğunun öğretmen ve öğretmen adaylarının TPAB yeterliliklerinin tanımlanması ve TPAB ile cinsiyet/sınıf düzeyi/kıdem yılı vb. değişkenler arasındaki ilişkinin belirlenmesi üzerine olduğu görülürken, TPAB çerçevesinde geliştirilen ders veya kursların etkisi ile ilgili çalışmalar ise az sayıdadır. Çalışmaların çoğunluğunda yöntem olarak tarama modelinin kullanıldığı, ayrıca dikkate değer sayıda gömülü desen ve çoklu durum desenlerine başvurulduğu ortaya çıkmıştır.

Önemli Vurgular: Araştırmanın sonucunda TPACK çerçevesinde eğitimde daha derin değişime rehberlik etmek için birçok potansiyel boşluk olduğunu ve özellikle de spesifik alana dayalı teknolojik ortamların daha fazla geliştirilmesi ve araştırılması gerekmektedir.

[1] **Assoc. Prof. Dr., S,** Recep Tayyip Erdogan University, Education Faculty, Rize, TURKEY; *sinan.cinar@erdogan.edu.tr,* https://orcid.org/ 0000-0002-5208- 8986

INTRODUCTION

With the advancement of technology, TPACK has become the focus of study for teacher educators and researchers in many countries in recent years (American Association of Colleges for Teacher Education [AACTE], 2008). TPACK is defined as a teacher's knowledge of integrating technology with pedagogical techniques in teaching a topic and knowing the effectiveness of presentations made with technological tools on students' learning (Graham, Burgoyne, Cantrell, Smith, St. Clair & Harris, 2009). The TPACK framework was defined by Koehler and Mishra (2005) and expanded with the incorporation of Technological Knowledge (TK) into the concept of Pedagogical Content Knowledge (PCK) referred by Schulman (1987) in teacher competencies (Kaya, Kaya and 2013). PACK is considered to be a unique feature that characterizes the teaching profession. Teachers can integrate appropriate pedagogical approaches into their content knowledge, and students can better understand the topic in question (Voogt, Fisser, Pareja Roblin, Tondeur, & van Braak, 2013). Shulman (1987) stated that teacher competencies should include the titles of "content knowledge, pedagogical knowledge, pedagogical content knowledge, curriculum knowledge, learner characteristics knowledge, educational context knowledge, educational outcomes, goals, values, philosophical and historical foundations". Koehler (2012) argued that Shulman could not emphasize technology in his PACK model and could not associate technology with content knowledge (CK) and pedagogical knowledge (PK) because of the limited technological materials in classrooms such as blackboards, overhead projectors, typewriters, models and periodic tables, but the integration of technology into classrooms is a natural process now thanks to equipment such as computers, projectors, large digital screens and software in today's classrooms (Wang, Schmidt-Crawford & Jin, 2018).

As far as the existing literature is concerned, Kohler and Mishra (2005) cannot be said to be the first to use the term TPACK. Rather, it was first used by Pierson (2001) to describe the integration of technology into a teacher's classroom. Other researchers also used similar terms such as "PCK-related to Information and Communication Technology (ICT) (Angeli & Valanides, 2005)" or "Technology-Enhanced PCK (Niess, 2005)" (Voogt et al., 2013; Yigit, 2014). In addition, these researchers examined the development of technological, pedagogical and content knowledge of teachers and teacher candidates in both in-service and pre-service education, using a similar framework to the TPACK framework (Yiğit, 2014).

TPACK is a model that embraces both the relationships and interactions of content knowledge, pedagogical knowledge and technological knowledge that teachers are supposed to have (Abitt, 2011). TPACK and the types of knowledge it interacts with are shown in Figure 1.
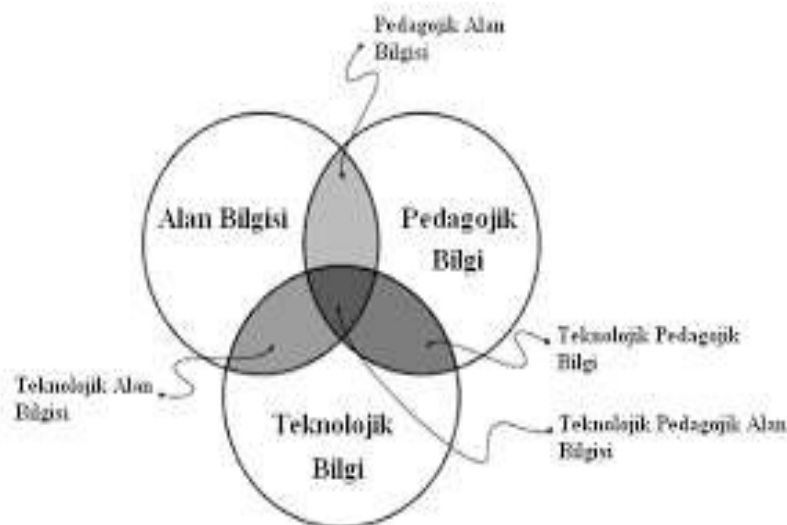
Figure 1. TPACK components

As seen in Figure 1, TPACK is the presentation of new concepts with different teaching styles thanks to technology rather than simply adding it to the teaching field in perspective. In respect to the teacher, it can be defined as having technological knowledge, using educational technologies and integrating these technologies into the classroom environment (Koehler & Mishra, 2008).

As can be understood from the explanations above, teachers must first have an effective TPACK in order to be able to integrate technology into their lessons. Due to this necessity, it can be said that the studies carried out within the framework of TPACK have gained significant momentum in recent years. In Table 1, studies related to TPACK are briefly summarized.

Table 1. Summary of studies on TPACK

Scope of the Studies	Studies in the Literature
Studies on teacher candidates' TPACK	Ayvaz, 2019; Bulut, 2012; Canbolat, 2011; Gündüz, 2018; Janssen & Lazonder, 2015; Kabakçı, 2011, Karakaya, 2012; Kaya, 2010; Keser, Karaoğlan Yılmaz & Yılmaz, 2015; Kılıç, 2011; Kılıç, 2015; Kocakaya, 2015; Öztürk, 2013; Tokmak, Yelken, & Konakman 2013; Savaş, 2011
Studies on teachers' TPACK	Ay, 2015; Archambault & Crippen, 2009; Kılıçkeser, 2019
Studies on instructors' TPACK	Şimşek, Demir, Bağçeci & Kinay, 2013
Studies on the impact of experimental applications on TPACK development	Baran, Canbazoğlu Bilici, Albayrak Sarı & Tondeur, (2019); Chai, Koh & Tsai, 2011; Çelik, Hebebci & Şahin, 2014; Ersoy, Yurdakul & Ceylan, 2016; Koh & Chai, 2014; Niess, 2005;
Content analysis studies	Abbit, 2011; Baran & Bilici, 2015; Chai, Koh & Tsai, 2013; Gür & Karamete, 2015; Kaleli-Yılmaz,2015; Korucu, Usta & Atun, 2017; Dikmen & Demirer, 2016; Rahmawatib, Budiyantoa & Basori, 2019; Setiawan, Phillipson, Sudarmin & Isnaeni, 2019; Yigit, 2014; Voogt, Fisser, Pareja Roblin, Tondeur & van Braak, 2013; Wang, Schmidt-Crawford & Jin, 2018; Willermark, 2018

As can be seen from Table 1, many studies have been conducted on the contribution of TPACK to teacher competencies for integration of technology into teaching, and analysis studies examining those studies also exist. In particular, exploring different dimensions of data revealed by scientific studies and performing content analyses help educators to identify potential areas of development. What is more, content analyses are considered important for a holistic look at the matter under consideration, to make sense of the trend about the matter and to understand various aspects of the studies (Göktaş et al., 2014). From this point of view, the data obtained from the content analysis studies on TPACK in Turkey seem quite useful as they hint at the types and disciplines of further studies in the relevant literature by providing a broad perspective on the matter. In other words, it is predicted that such documents indicate the missing parts in the TPACK literature and topic to be dealt by related researchers, consequently providing a more holistic picture. Content studies on TPACK in Turkey are presented in Table 2.

Table 2. Summary of content analysis studies on TPACK

Researcher(s)	Year	Data sources	Studies analyzed	Criteria of analysis	Results
Kaleli-Yılmaz (2014)	2000-2014	Google search engine, DergiPark, YÖK National Thesis Center, SPRINGER and EBSCOhost-ERIC	37 articles, 15 dissertations, 7 proceedings	Aim, subject area, method, sample, data collection tools, instructional practices used, results.	The majority of the studies were carried out on scale development and examination of TPACK competencies and improvement; the most common methods were quantitative research methods employing data collection tools like scales; the most frequent sample group contained teacher candidates and the participants often had high levels of TPACK competencies; and TPACK training improved the participants' TPACK competencies.
Baran & Bilici (2015)	2005-2013	EBSCOHost, ERIC, ISI Web of Science, Scholar Google search engine	30 articles	Aim, TPACK approaches, method, sample, data collection tools, data analysis methods, discipline/subject area.	The majority of the studies were carried out with qualitative research methods employing measurement tools like scales; the most common sample group contained teacher candidates; deficiencies were determined in portraying the TPACK context; the most common disciplines under consideration were science and mathematics.
Dikmen & Demirer (2016)	2009-2013	Databases containing SSCI journals, ULAKBİM database, YÖK thesis database	32 articles, 17 dissertations	Year and type, aim, areas of implementation, participants, methods, data collection tools and analysis methods.	The number of studies increased gradually over the years; the most common study aim targeted the relationship between various variables and TPACK; the most common research methods and data collection tools were quantitative methods and questionnaire, respectively; the most common sample group contained convenient teacher candidates; the most common implementation areas of TPACK were science and mathematics.

Researcher(s)	Year	Data sources	Studies analyzed	Criteria of analysis	Results
Korucu, Usta & Atun (2017)	2010-2016	Science Direct and Scholar Google databases	71 articles	Journal and year of publication, aim, research method, data collection tools and participants.	The most popular journal was Computers & Education; the number published papers increased by year; the aim of the studies was technology integration; the most common methods and tools were quantitative methods and questionnaires, respectively; the most common sample group contained teacher candidates and teachers.

Table 2 shows that the studies on TPACK in Turkey increased yearly, the studies often looked into the TPACK developments of teachers/teacher candidates and the integration of technology into education, the most frequently used research methods included qualitative methods such as survey and experimental, and the most common data collection tools were scales/questionnaires. Besides, sampling targeted teacher candidates with the highest frequency. In short, it can be said that certain types of studies on TPACK have been replicated in the context of Turkey for a while.

It is thought that analyzing the popular and frequently studied topics, especially TPACK, will contribute exceptionally to the literature. Therefore, studies carried out on this subject are valuable for the literature. On the other hand, the current result might have appeared because only the TPACK studies published in journals (a total of 175 papers, see Table 2) were included and postgraduate dissertations are included in such publications at a lesser extent. Performing content analysis on more than one specific field may hinder analyzing the subject thoroughly. It is seen that TPACK tendencies were not clearly revealed separately in the available papers or dissertations. The thesis center database of the Higher Education Board (YÖK) shows that TPACK was the research topic of 25 postgraduate dissertations, 20 of which are master's and 5 doctoral dissertations, between 2009 and 2013. However, the number has shown a significant increase lately. The same topic was studied in 76 postgraduate dissertations, 55 being at master's and 21 at doctoral level, from 2013 to 2019 (YÖK, 2013; YÖK, 2019). Apart from these, the most recent content analysis study was carried out by Korucu, Usta, and Atun (2017) analyzing the studies carried out between the years 2010 and 2016. Another motive for the current study is that nearly 58 postgraduate dissertations were posted on the National Thesis Center database of YÖK in a short period between 2016 and 2019. Departing from these facts, this study was planned with a broader scope attempting to discuss postgraduate dissertations on TPACK written between 2009 and 2019 in Turkey against a set of variables. Answer was sought to the following questions:

1. How are the postgraduate dissertations on TPACK distributed by type, university and department of implementation, and year of publication?

2. What theme was discussed most frequently as the aim of the published postgraduate dissertations about TPACK?

3. How are the postgraduate dissertations on TPACK distributed by research method, sample type and data collection tools?

4. What subjects/fields did the postgraduate dissertations on TPACK target?

5. What theme was implied most frequently in the results of the published postgraduate dissertations about TPACK?

6. What themes were implied mostly in the recommendations of the published postgraduate dissertations about TPACK?

Significance and Value of the Study for the Literature

The main purpose of this content analysis study is to interpret the postgraduate studies on "Technological Pedagogical Content Knowledge (TPACK)" implemented by educational researchers so far in relation to selected criteria. In this scope, the studies were examined in terms of research pattern (qualitative, quantitative, etc.), participants (teacher candidates, senior teachers, etc.), data collection tools (interview, scale, multiple-choice test, observation, etc.), field of implementation and educational background (science, mathematics, classroom teaching, preschool teaching, etc.), results and recommendations put forth. The study is also intended to provide a different perspective to the postgraduate studies on TPACK in Turkey and to figure out studies needed in the future in consideration of the current literature. In other terms, it will provide a more holistic picture by showing the missing parts of the TPACK literature to the researchers who will do a postgraduate dissertation in this field and give them advice for well-directed new researches in this area. It would not too harsh to say that Turkish researchers of TPACK from various disciplines have been repetitive for a while ending up with no authentic products. Therefore, this study is needed in order to determine the lagging sides of the related literature (how TPACK develops, the impact of pre-service/in-service training on the development of TPACK, devising a teacher training TPACK model unique to the Turkish culture, etc.) so that future postgraduate studies can be directed to close this gap. Lastly, recommendations will be brought to increase the quality of new postgraduate dissertations on TPACK.

Limitations of the Study

This study intends to analyze postgraduate dissertations on TPACK. The majority of the existing analysis studies in the literature are aimed at revealing the trends in research papers. Unlike those, the current study included theses at postgraduate level to scrutinize a sufficient number of dissertations on TPACK and to reach reliable results in this segment. However, an exhaustive analysis of the subject and discipline content might be impeded by the thematic content analysis of more than one field. With this

concern, the scope of this study was narrowed down to postgraduate studies on TPACK. The inclusion of only theses at postgraduate level can be seen as a limitation of this study. Since this study was aimed to reveal the latest research trends, the studies published from 2009 to 2019 were taken into consideration. The range of publication years can be considered as another limitation of the study. As the final limitation, some master's and doctoral dissertations on TPACK may have been overlooked or not uploaded to the system despite careful screening.

METHOD

In this study, "thematic content analysis" was chosen from content analysis techniques as it is about critical examination of the themes and templates created to expose the trends and results of studies in a selected field (Çalık & Sözbilir, 2014). In this way, this technique provides a comprehensive resource to researchers with limited access to adequate researches in their (Ültay & Çalık, 2012). In general, content analysis method is the summarizing, classifying, comparing and presenting of the research content in numerical terms with the aid of scientific applications (Cohen, Monion & Morrison, 2007). There are applicable techniques such as content analysis to perform frequency analysis, relationship analysis, categorical analysis, evaluative analysis, closure indicator, vocabulary richness, readability indicator, thematic content analysis, descriptive content analysis, structural content analysis, emotional analysis, semantic content analysis (semantic analysis) and intent-motive inferences. The current study aims at interpreting the study data based on certain concepts and themes besides summarizing, classifying and comparing the contents and implications in the postgraduate dissertations. Thematic content analysis technique was preferred here since it was aimed to examine postgraduate level TPACK studies in Turkey in order to identify the common tendencies.

Data Collection

In this study, YÖK National Thesis Center database was scanned by using certain keywords in both Turkish and English to be able to access to all postgraduate dissertations on TPACK across Turkey and to be able to describe TPACK in Turkey and the world. The following Turkish and English key phrases were used for the search:

- "Teknolojik Pedagojik Alan Bilgisi,'' or "TPAB"

- ''Teknolojik Pedagojik İçerik Bilgsi'' or ''TPİB''

- "Technological Pedagogical Content Knowledge" or "TPACK" - "Technological Pedagogical Content Knowledge" or "TPCK".

As a result of the search, 75 master's and 26 doctoral dissertations were found to address TPACK and they all were included in the study. The other inclusion criterion was the deadline of April 2020 for publication of the dissertations.

Document Analysis

The theses collected were subjected to thematic review analysis by using the thematic analysis matrix developed by Ormancı Çepni, Deveci and Aydın (2015). The matrix consists of two sections as general features and content features. The general features investigate the type of publication, the university and department of implementation, and the year of publication whereas the other part deals with the aim and method of the studies, population-sample/study group type and size, grade level of the participants, data collection tools, subjects/fields, and results and recommendations (Table 3).

Table 3. Publication Classification Matrix

Theme	Code	Explanation
General features	Type of publication	Degree of study (master's and doctorate)
	University of implementation	The university where the study was carried out
	Department of implementation	The departments where the study was carried out
	Publication year	The year when the study was published
Content features	Aims	Aim of the study
	Methods	Qualitative (case study, phenomenology, etc.) Quantitative (questionnaire, experimental, etc.)
	Data collection tools	Instruments used for collecting study data (observation, interview, scale, etc.)
	Population-sample	Size and educational background of the study participants

Theme	Code	Explanation
	Subjects/Fields	Science, mathematics, social studies, physics, chemistry, biology, physical education…
	Results and recommendations	Findings obtained from the study and recommendations brought accordingly

Data Analysis

The matrix above 3 was used for reviewing the dissertation studies reached through the YÖK's thesis database. As the first step, codes relevant to each category were elicited. To exemplify, each study was divided into categories according to the year it was published and the university and the department it was implemented in. Then, codes concerning the study aims were extracted and the studies sharing the same aims were put under the same code. Studies with a similar goal were clustered under relevant codes and synthesized under a representative theme. The same procedure was followed for grouping other codes and themes.

As mentioned earlier, the second part of the matrix used in this study exhibit content-related data about the reviewed items, such as aim, method, size and grade level of population-sample/study group, data collection tools, subjects/fields, results and recommendation. To analyze the data about the method and subject area of the dissertations, descriptive analysis was performed while the other type of data (i.e. aim, results and recommendations) was analyzed with the content analysis method. During the content analysis, first, the research data were converted to codes and then connected codes were brought together to generate themes. Lastly, frequency and percentage values were calculated for the derived codes and themes, and they were tabulated as can be seen in the following section.

Validity and Reliability: In the first stage of the classification, the researcher titled the common elements in the reviewed studies with a common theme. In the following stage, the themes and other elements used were compared with the coding made by a researcher of TPACK who is an expert in science teaching, and the disagreements were determined. For this purpose, prior to the classification of the publications, a consistency check was performed on the themes derived by the researcher and the expert. Coders' agreement was checked by using the formula "(reliability=agreement)/(agreement+disagreement)" (Miles & Huberman, 1994). There was a high level (93%) of agreement between the two coders. The rest of the codes and themes, which were the subject of disagreement, were rechecked by the researcher. Finally, the researcher's codes and themes were verified by the expert. As a result, internal and external validity and reliability of the study was ensured.

FINDINGS

The findings obtained through the data collection tools developed in the study are presented under 6 separate headings in parallel to the sub-problems of the study.

Distribution of Postgraduate Dissertations on TPACK by Type, University of Implementation, Department of Implementation, and Publication Year

The distribution of the postgraduate dissertations by level is given in Table 4.

Table 4. Distribution of postgraduate dissertations on TPACK by type

Theme	Code	f	%
Dissertation type	Master's	75	75
	Doctorate	26	25
	Total	101	100

Table 4 shows that 75% of the studies is composed of master's theses and 25% are doctoral theses.

The distribution of the postgraduate dissertations on TPACK by implementing university is given in Table 5.

Table 5. Distribution of postgraduate dissertations on TPACK by university of implementation

Theme	Code	f	%
University of implementation	Middle East Technical University	11	11
	Gazi University	10	10
	Fırat University	8	8
	Necmettin Erbakan University	8	8
	Marmara University	5	5
	Sakarya University	5	5
	Atatürk University	4	4
	Anadolu University	3	3
	Karadeniz Teknik University	3	3
	Amasya University	2	2
	Balıkesir University	2	2
	Bolu Abant İzzet Baysal University	2	2
	Celal Bayar University	2	2
	Cumhuriyet University	2	2
	Çanakkale Onsekiz Mart University	2	2
	Dicle University	2	2
	Dokuz Eylül University	2	2
	Dumlupınar University	2	2
	İnönü University	2	2
	Kastamonu University	2	2
	Mustafa Kemal University	2	2
	Muğla Sıtkı Koçman University	2	2
	Selçuk University	2	2
	Aksaray University	1	1
	Bahçeşehir University	1	1
	Boğaziçi University	1	1
	Bülent Ecevit University	1	1
	Erzincan University	1	1
	Eskişehir Osmangazi University	1	1
	Hacettepe University	1	1
	İstanbul University	1	1
	İstanbul Aydın University	1	1
	İstanbul Gelişim University	1	1
	Mersin University	1	1
	Mevlâna University	1	1
	Ondokuz Mayıs University	1	1
	Süleyman Demirel University	1	1
	Trabzon University	1	1
	Yüzüncü Yıl University	1	1
	Total	101	100

According to Table 5; 11% of the dissertations were conducted at Middle East Technical University, 10% at Gazi University, 8% at Fırat and Necmettin Erbakan University. Another 5% of the dissertations were found to be take place at Marmara and Sakarya Universities, and 4% at Atatürk University. There are two universities with 3% of the theses, 14 universities with 2% and 16 universities with 1%.

The distribution of postgraduate dissertations on TPACK by implementing department is shown in Table 6.

Table 6. Distribution of postgraduate dissertations on TPACK by department of implementation

Theme	Code	f	%
Department of implementation	Science Teaching	28	27
	Physical Education and Sports	1	1
	Physics Teaching	1	1
	Business Administration	1	1
	Chemistry Teaching	1	1

Theme	Code	f	%
	Pre-school Teaching	1	1
	Basic Education	1	1
	Turkish Language and Literature Teaching	1	1
	Total	101	100

Table 6 displays that 27% of the dissertations were implemented in Science Teaching Department and 23% in Mathematics Teaching. Another 12% of the dissertations were related to Computer and Instructional Technologies Teaching and 8% were about Arts in Teaching. The smallest portion, 1%, of the studies were found to belong to the departments of Turkish Language and Literature Teaching, Physics Teaching, Chemistry Teaching, Pre-school Teaching, Basic Education, Physical Education and Sports and Business Administration.

The distribution of the dissertations on TPACK by the year they were published is shown in Table 7.

Table 7. Distribution of postgraduate dissertations on TPACK by publication year

Theme	Code	f	%
Year	2009	2	2
	2010	1	1
	2011	7	7
	2012	6	6
	2013	5	5
	2014	10	10
	2015	12	12
	2016	14	13
	2017	16	16
	2018	15	15
	2019	13	13
	Total	101	100

Table 7 shows that 2 of the dissertations were published in 2009, 12 in 2015, and 13 in year 2019. The highest number of publications was recorded during 2017 (16 studies). It can be said that the number of dissertations saw a gradual increase over the years.

Aims of Reviewed Postgraduate Dissertations on TPACK

The distribution of the dissertations studies on TPACK by study aim is given in Table 8.

Table 8. Distribution of postgraduate theses on TPACK by aim

Theme	Code	Unit f	Unit %	Total f	Total %
TPACK competenncies	Examination of teacher candidates' TPACK competencies	57	20.2	109	38.6
	Examination of teachers' TPACK competencies	50	17.7		
	Examination of instructors' TPACK competencies	2	0.7		
	Examining the relationship between teacher candidates' TPACK knowledge and specific variables (gender, grade level, age, high school type)	46	16.3	161	57.0
	Examining the relationship between teachers' TPACK knowledge and specific variables (gender, seniority year, major, type of school worked)	42	14.9		
TPACK and variables relationship	Examining the relationship between teachers' TPACK knowledge and their instructional strategies/classroom management/teaching self-perception/technology attitude/owning technology/technology use levels	39	13.8		

Theme	Code	Unit f	Unit %	Total f	Total %
	Examining the relationship between teacher candidates' TPACK knowledge and their learning strategies/instructional strategies/thinking styles/teacher self-efficacy/technology attitude/technology use levels	32	11.3		
	Examining the relationship between instructors' TPACK knowledge and their teaching styles	2	0.7		
Impact of developed implementations on TPACK	The effect of IST/Course/Workshop training on the development of TPACK of teachers.	6	2.1	10	3.5
	The effect of IST/Course/Workshop training on the TPACK development of teacher candidates.	4	1.4		
TPACK scale adaptation	Developing and adapting a scale on TPACK	1	0.3	1	0.3
	Total	281*	100	281	100

*The number is different because some studies have more than one purpose.

As can be seen in the table above; 38.6% of the studies were conducted to measure TPACK competency levels of teachers/ teacher candidates/instructors, 57.0% researched the relationship between TPACK and gender/grade level/seniority year, etc, leaving the last portion for examinint the impact of the developed classes/training courses on TPACK development of teachers/teacher candidates (3.5%) and scale development (0.3%). As a note, it is seen that TPACK knowledge of teachers/teacher candidates was addressed frequently (f=107) whereas the impact of training courses/classes on TPACK development of teachers/teacher candidates (f=10) and TPACK scale development (f=1) was not studied so often.

Research Methods, Sample Sizes and Data Collection Tools of Reviewed Postgraduate Dissertations on TPACK

The research approaches and methods adopted in the reviewed postgraduate dissertations about TPACK are listed in Table 9 below.

Table 9. Distribution of postgraduate dissertations on TPACK by research approach and method

Theme	Code	Unit f	Unit %	Total f	Total %
Quantitative Research Meethod	Screening Model	46	45.5	57	56.4
	Experimental Design	8	7.9		
	Correlational Research Model	3	2.9		
Mixed Research Method	Embedded/Integrated Pattern	16	15.8	22	21.8
	Multiple Case Design	2	1.9		
	Convergent Parallel Design	2	1.9		
	Explanatory Design	1	0.9		
	Exploratory Sequential Design	1	0.9		
Qualitative Research Method	Multiple Case Study	14	13.8	22	21.8
	Case Study	8	7.9		
Total		101	100	101	100

Table 9 proves that 56.4% of the studies used quantitative research methods, 21.8% used qualitative research methods and another 21.8% used mixed methods. Also, the most widespread quantitative method was screening model (45,5%), and experimental design (7,9%) and correlational research model (2,9%) were employed relatively less frequently. The other most popular research patterns were seen to be embedded pattern (15,8%) and multiple case study (13,8%).

The distribution of postgraduate dissertations on TPACK by sample/study group type is displayed in Table 10.

Table 10. Distribution of postgraduate dissertations on TPACK by sample type

Theme	Code	Unit f	Unit %	Total f	Total %
Teacher candidates	Science Teacher Candidates	24	22.4	57	53.3
	Elementary School Mathematics Teacher Candidates	9	8.4		
	Secondary Mathematics Teacher Candidates	7	6.5		
	Social Studies Teacher Candidates	6	5.6		
	Classroom Teacher Candidates	3	2.8		
	English Language Teacher Candidates	3	2.8		
	Biology Teacher Candidates	2	1.8		
	Physical Education Teacher Candidates	1	0.9		
	Pre-school Teacher Candidates	1	0.9		
	Physics Teacher Candidates	1	0.9		
Teachers	Elementary School Mathematics Teachers	14	13.8	50	46.7
	Science Teachers	13	12.1		
	English Language Teachers	7	6.5		
	Classroom Teachers	3	2.8		
	Secondary Mathematics Teachers	2	1.8		
	Instructors	2	1.8		
	High School Teachers	2	1.8		
	Secondary Chemistry Teachers	1	0.9		
	Pre-school Teachers	1	0.9		
	Social Studies Teachers	1	0.9		
	French Language Teachers	1	0.9		
	German Language Teachers	1	0.9		
	Geography Teachers	1	0.9		
	Turkish Language and Literature Teachers	1	0.9		
Total		107	100	107	100

Table 10 shows that 53.3% of the dissertations about TPACK were carried out on teacher candidates while 46.7% were on teachers. Within the group of teachers itself, the most frequent sub-group was composed of science teacher candidates (f=24) followed by elementary school mathematics teacher candidates (f=9), secondary school mathematics teacher candidates (f=7) and social studies teacher candidates (f=6), respectively. Going back to the teachers, elementary school mathematics teachers (f=14) constituted the most frequent study group of all the dissertatons. The second most addressed sample was of science teachers (f=13) and the third one composed of English language teachers (f=7).

The distribution of postgraduate dissertations about TPACK by sample/study group size is shown in Table 11 below.

Table 11. Distribution of postgraduate dissertations on TPACK by sample size

Theme	Code	f	%
	0 – 10	15	14.8
	11 - 30	4	3.7
	31 - 50	9	8.9
Sample Size	51 – 70	6	5.9
	71 – 100	3	3.7
	101 – 200	20	19.8

Theme	Code	f	%
	201 ve üstü	44	43.6
Total		101	100

Table 11 shows that 43.6% of the postgraduate dissertations on TPACK were conducted with more than 201 participants and 19.8% were implemented with 101-200 people. A smaller percentage, 14.8% of the studies, was conducted with 0-10 people and 8.9% with 31-50 people.

Another criterion of review of the current study, an analysis was performed on the measurement tools, and the results are exhibited in Table 12.

Table 12. Distribution of postgraduate dissertations on TPACK by data collection tools used

Theme	Code	Unit f	Unit %	Total f	Total %
Scale	Placement Scale	58	21.3		
	Self-Efficacy Scale	36	13.1	119	43.4
	Perception/Belief/Attitude/Interest Scale	13	4.7		
	Scale of Teaching Styles	4	1.4		
	Tendency Determination Scale	3	1.0		
	Scale of Thinking Styles	3	1.0		
	Implementation Scale	1	0.3		
	Burnout Scale	1	0.3		
Observation	Observation	32	11.7	47	17.2
	Video footages	15	5.4		
Interview	Semi-formal interview	38	13.9	45	16.4
	Focus group interview	7	2.5		
Document analysis	Lesson plans	20	7.2	25	9.1
	Diary	2	0.7		
	Mind map	2	0.7		
	Drawing	1	0.3		
Questionnaire/Form/Inventory	Placement Questionnaire	11	4.1	24	8.7
	Lesson Evaluation Form	9	3.2		
	Pre-service training questionnaire	3	1.0		
	Perception Inventory	1	0.3		
Testler	Conceptual Knowledge Test	11	4.1		
	Word Association Test	2	0.7	14	5.1
	Kolmogorov - Smirnov Test	1	0.3		
Total		274	100	274	100

* The figure differs because multiple data collection tools were employed in some of the studies.

It can be understood from Table 12 that a large variety of data collection tools such as scale, observation, interview, document analysis, tests and questionnaire were used in the postgraduate dissertations on TPACK examined here. The breakdown of the tools was as following: Scales account for 43,4%, observation accounts for 17,1%, document analysis 9,1%, questionnaires/forms 8,7% and tests account for 5,1% of the all data collection tools used. Additionally, it was seen that a considerable number of studies were completed by using more than one single tool.

Subjects/Fields of Reviewed Postgraduate Dissertations on TPACK

The postgraduate dissertations related to TPACK are exhibited by theirv study subjects/fields in Table 13 below.

Table 13. Distribution of postgraduate dissertations on TPACK by subject of study

Theme	Code	Unit f	Unit %	Total f	Total %
Science	Photosynthesis and Cellular Respiration	2	7.2	17	60.7
	Electricity	2	7.2		
	Electrical current	1	3.6		
	Basic Astronomy	1	3.6		
	Electrostatics	1	3.6		
	Mixtures	1	3.6		
	Acid rains	1	3.6		
	Global Environmental Issues	1	3.6		
	Structure of Matter	1	3.6		
	Protein Synthesis	1	3.6		
	Refraction of Light	1	3.6		
	Light and Sound	1	3.6		
	Heat and temperature	1	3.6		
	Force and Motion	1	3.6		
	Genetics	1	3.6		
Mathematics	Derivatives	3	10.7	9	32.1
	Polygones	2	7.2		
	Geometry	2	7.2		
	Trigonometry	1	3.6		
	Second-Degree Functions	1	3.6		
Social Studies	Life on Earth	1	3.6	2	7.1
	Geography Information System	1	3.6		
Total		28	100	28	100

It was found out that only 28 of the studies were focused on a specific subject area while the others were conducted to figure out opinions/perceptions/competencies etc. related to TPACK as a generic matter of consideration. Interestingly, 60.7% of the subjects covered in the studies fall under sciences, 32.1% under mathematics and the last 7.1% relate to sub-fields of social sciences.

Results of Reviewed Postgraduate Dissertations on TPACK

As regards the results obtained in the postgraduate dissertations on TPACK, the findings are given in Table 14.

Table 14. Distribution of postgraduate dissertations on TPACK by their results

Theme	Code	Unit f	Level	Level f	Level %	Total f	Total %
			Good	19	42.2		

Theme	Code	Unit f	Level	Level f	Level %	Total f	Total %
TPACK knowledge levels	TPACK knowledge of teacher candidates	46	Medium	5	11.1		
			Poor	21	46.7		
			Good	16	47.0		
	TPACK knowledge of teachers	34	Medium	6	17.6		
			Poor	12	35.2		
			Good	-	-		
	TK of teachers	18	Medium	8	44.4		
			Poor	10	55.6	114	38.26
	TK of teacher candidates	12	Good	-	-		
			Medium	3	25.0		
			Poor	9	75.0		
	TPACK knowledge of instructors	2	Good	-	-		
			Medium	-	-		
			Poor	2	100		
	TK of instructors	2	Good	-	-		
			Medium	-	-		
			Poor	2	100		
TPACK relationship with variables	Relationship of teacher candidates' gender and TPACK	28	Significant	18	55.6		
			Non-significant	10	43.4		
	Relationship of teachers' seniority year and TPACK	23	Significant	19	82.6		
			Non-significant	4	17.3		
	Relationship of teachers' gender and TPACK	17	Significant	16	94.1		
			Non-significant	1	5.9		
	Relationship of teacher candidates' TPACK level and technology owning/using level	12	Significant	12	100		
			Non-significant	-	-		
	Relationship of teachers' TPACK and their students' success	9	Significant	9	100		
			Non-significant	-	-		
	Relationship of teacher candidates' TPACK and grade level	7	Significant	6	85.7		45.30
			Non-significant	1	14.3		
	Relationship of teachers' self-efficacy and TPACK level	6	Significant	6	100		
			Non-significant	-	-		
	Relationship of teacher candidates' TPACK level and thinking styles	5	Significant	5	100		
			Non-significant	-	-	135	
	Relationship of teacher candidates' PCK and TPACK	5	Significant	5	100		
			Non-significant	-	-		
	Relationship of teachers' owning technology/technology use level and TPACK	5	Significant	5	100		
			Non-significant	-	-		
	Relationship of teachers' TPACK level and the school they work	5	Significant	2	40		
			Non-significant	3	60		
	Relationship of teachers' major and TPACK level	4	Significant	1	25		
			Non-significant	3	75		
	Relationship of teachers'technology attitude and TPACK	3	Significant	3	100		
			Bo difference	-	-		

Theme	Code	Unit f	Level	Level f	Level %	Total f	Total %
TPACK effect of developed applications	Relationship of teacher candidates' TK and their high school type of graduation	3	Significant	3	100		
			Non-significant	-	-		
	Relationship of teacher candidates' TPACK and Technopedagogical Education Competencies	1	Significant	1	100		
			Non-significant	-	-		
	Relationship of instructors' TPACK level and academic title	1	Significant	1	100		
			Non-significant	-	-		
	Relationship of instructors' gender and TPACK	1	Significant	-	-		
			Non-significant	1	100		
	Impact of training courses/workshops on pre-service teachers' TPACK development	20	Positive	20	100		
			Neutral	-	-		
	Impact of pre-service/in-service training on teachers' TPACK development	13	Positive	9	69.23	33	11.07
			Neutral	4	30.77		
Necessity of TPACK	Instructors' purpose of using the TPACK in teaching topics Instructors' need for training on technology integration	16	Too abstract concepts	6	40		
			Diffcult to understand concepts	6	40		
			Interest/entertainment	3	20	16	5.37
			Necessary	1	100		
			Unnecesary	-	-		
Total		298	Total	298	100	298*	100

* The figure differs in some studies due to reaching multiple results.

Table 14 shows that 38.26% of the dissertations obtained results related to TPACK and TK levels of teachers/teacher candidates/instructors, 45.3% reached findings about the relationship between the TPACK knowledge of teachers/teacher candidates/instructors and several variables and % 11.07 of them obtained results on the impact of the developed training courses on the TPACK level of teachers/teacher candidates. Moreover, it was found that there is a visible weight on the results about TPACK and TK levels of teachers/teacher candidates/instructors (f=114), the relationship of teachers/teacher candidates and gender (f=45) and the relationship of TPAB levels of teachers and their seniority year (f=23).

Basic Recommendations Brought in Reviewed Postgraduate Dissertations on TPACK

As the last components of this review study, the recommendations offered in the postgraduate dissertations on TPACK were analyzed and summarized in Table 15 below.

Table 15. Distribution of postgraduate dissertations on TPACK by the theme of recommendations made

Theme	Code	Unit f	Unit %	Total f	Total %
Restructuring of education faculties	Content of lesson plans should be based on TPACK	27	18.37		
	Teaching Practice and School Experience should be replanned by considering TPACK	20	13.61		
	Technology-aided implementations and activities should be used to for subject field teaching in lessons	19	12.93		
	Teacher candidates should be taught how to develop and use technological software specific to subject field education	16	10.88		
	TPACK components should be covered gradually in lessons	13	8.84		

Theme	Code	Unit f	Unit %	Total f	Total %
	Teacher candidates should be provided opportunities to acquire and use new technologies	12	8.17		
	Instructional environments should be created to incorporate gamified TPACK Activities into lessons	8	5.44	147	57
	TPACK levels of faculty members should be measured	8	5.44		
	New teaching approaches should be included in lessons considering TPACK and thinking styles	6	4.08		
	TPACK knowledge of practice teachers should be improved	5	3.40		
	Practice teachers should be selected among those with high levels of TPACK	5	3.40		
	Simulation programs should be provided and enabled for use as a part of subject area education	5	3.40		
	TPACK knowledge of faculty members should be developed and in-service training should be given as a part of subject field education	2	1.36		
	Studies should be carried out to increase the technology knowledge of female teacher candidates	1	0.68		
Restructuring in-service training on TPACK	In-service trainings should be restructured according to teachers' areas of expertise	13	20		
	Teachers with more seniority years should be given priority for in-service trainings	9	13.85		
	In-service training groups should be formed based on teachers' branches and seniority year	8	12.31		
	Teachers should be given opportunities to acquire and use new technologies	7	10.76		
	Courses should be run by specialized staff	6	9.23		
	TPACK components should be handled one by one during in-service courses	6	9.23	65	25.2
	Continuous in-service training should be available on TPACK	6	9.23		
	In-service trainings should simulations specific to subject field education	4	6.15		
	TPACK courses should be in applied mode	2	3.08		
	(Such hardware) should be arranged so as to increase technological knowledge of female teachers	2	3.08		
	Technology standards and performance indicators should be developed for students and administrators	1	1.54		
	Professional development programs should be run during the regular semi-annual "seminar" period in schools	1	1.54		
Offering technological hardware	Technological infrastructure should be built in classrooms	26	56.52		
	Faculties should provide teacher candidates with technology-based teaching materials	6	13.04		
	Schools should provide teachers with technology-based teaching materials	6	13.04		
	A technician should be employed in each school to take care of technology infrastructure	4	8.70	46	17.8
	Software specific to teachers' branches should be diversified	4	8.70		

Theme	Code	Unit f	Unit %	Total f	Total %
Total		258	100	258	100

According to the table above, 57% of the recommendations in the postgraduate dissertations targeted restructuring of education faculties for TPACK development of teacher candidates and a 25.2% were mainly about restructuring in-service trainings to improve teachers' TPACK levels. Additionally, some dissertations recommended provision of technological hardware for restructuring the learning environments (%17.8). Other prominent recommendations included building the curricula of education faculties on TPACK for TPACK development of teacher candidates (f=27), running in-service training courses specific to teachers' branches and seniority years for their TPACK development (f=13) and giving senior teachers the priority to participate in such trainings (f=9).

DISCUSSION AND CONCLUSIONS

This part of the paper is devoted to associating the study findings with each other, comparing them with findings in similar domestic and international researches, and discussing the extent at which the sub-problems could be resolved. The findings elaborated in the foregoing part will be discussed under relevant headings in compliance with the sub-problems.

Aims of Reviewed Postgraduate Dissertations on TPACK

According to our findings, the majority of the postgraduate dissertation on TPACK aimed at describing TPACK competencies and examining the relationship between TPACK and certain variables such as gender/grade level/seniority etc. (Table 8). There are few studies handling the impact of special training courses or classes on TPACK. Similar findings were also resported by other content analysis studies in the literature (Baran & Canbazoğlu Bilici, 2015; Dikmen & Demirer, 2016; Kaleli-Yılmaz, 2015; Setiawan et al., 2019; Voogt et al. 2013; Willermark, 2018). In their content analysis study on TPACK in science education, Setiawan et al. (2019) found out that the largest part of such studies were aimed at determining TPACK competencies of pre-service/in-service science teachers while the rest of them were concerning the relationship between TPACK and other elements of technology integration, teacher candidates' TPACK development strategies, how teachers apply TPACK and developing a tool for TPACK. Researching the TPACK of teachers or teacher candidates and measuring their levels is an important topic. In addition to that, ways of helping teacher candidates and teachers to improve their technology knowledge and integrate technology into their lessons should be sought. Rahmawati, Budiyanto and Basori (2019) also conducted a content analysis study of researches on blended learning within the framework of TPACK. They found out that the teachers lag behind the TPACK levels required for successfully integrating educational technology, and they recommended that training courses or classes should be organized where diverse models are applied in order to elevate their TPACK levels and the outcomes should be announced. As one takes a look at the in-service trainings carried out within the framework of the FATIH project implemented in Turkey, it can be said that such initiatives seem to have an important effect on teachers' technology knowledge development and TPACK awareness, but it is not the case with integration of technology into teaching, to TPACK skills namely (Sezer, 2015). Chai et al. (2013) argued that since TPACK is a practice-dependent research area, training courses based on certain models (*Situated Technology Integration (SiTI) Model*, *TPACK-Comprehension, Observation, Practice and Reflection (TPACK-COPR) Model*, *Technology Mapping (TM) Model, etc*.) could increase the capacity of teachers to integrate ICT into the lesson and suggested that such learning environments should be further developed and researched in consideration of TPACK. On top of these, increasing the number of longitudinal pre-service/in-service studies designed within the framework of TPACK would be quite beneficial for clearly depicting what should be done to improve TPACK of both teachers and teacher candidates, which models should be preferred and how the course contents should be designed in our country (Kaleli-Yılmaz, 2015). For instance, when there is a technology-based course where concrete life is provided for individuals to acquire the necessary TK knowledge and experience within the framework of the Du-TE model, similar training is offered in the TPACK-COPR and TM models through in-class activities. In the TPACK-COPR model, the learning setting or context is attached more importance compared to the other models for TPACK development (Kaya & Yılayaz, 2013). In this context, the fact that long-term postgraduate studies to be carried out in the field of course development within the framework of TPACK are high in terms of quality and quantity will shed light on teacher education as to which model is effective.

Research Methods, Sample Sizes and Data Collection Tools of Reviewed Postgraduate Dissertations on TPACK

In this study, examination of the dissertation studies from the perspective of research approach demonstrates that quantitative approach was used more frequently than other research conceptions, and mixed method studies and qualitative studies were in equal numbers (Table 9). In a similar vein, other researchers concluded that the majority of TPACK studies (Baran & Canbazoğlu Bilici, 2015; Dikmen & Demirer, 2016; Kaleli-Yılmaz, 2015; Korucu, Usta & Atun, 2017) were carried out with quantitative research approach. This finding is in congruence with the results of Sözbilir, Kutu, Yaşar, and Arpacik (2010), which looked into the general trends in chemistry education research in Turkey and in the world and found a large number of studies based on quantitative research approach. Ekiz (2013) explained this with superiority of quantitative research approach thanks to fast, easy and convenience sampling as well as easier and faster data collection and interpretation. It must be said that there is a greater need for mixed method studies on TPACK in which quantitative and qualitative approaches are blended. Such studies are likely to not only offer more sound results about TPACK levels of the participants but also pave the way for other studies on TPACK. Researchers (Koehler et al., 2012; Tondeur et al., 2012) stated that the use of mixed research ideas using qualitative data to

support quantitative data in TPACK research will promote understanding and evaluation of the theoretical structure of TPACK and thus eliminate much of the concern in this regard. Researchers should take these recommendations into consideration in the context of Turkey like other countries. International TPACK review studies did not report standardized results. For example, the review of Chai et al. (2013) found out that qualitative research methods and practical studies were heavily employed. Willermark (2018) found that quantitative and mixed research methods were the most preferred approaches in TPACK studies. The TPACK review study by Wang, Schmidt-Crawford and Jin (2018) found that mixed method was the most broadly used methodology for the sake of data triangulation, validity and reliability. The dispute between the national and international findings on this aspect might be attributed to the fact that the examples in our country are still far from being longitudinal qualitative applications because TPACK researches have gained momentum in Turkey after 2014 (Table 7).

When the studies in the present review were checked regarding research methods, it was seen that screening model was in the lead, yet embedded design and multiple case designs showed considerable occurance (Korucu, Usta & Atun, 2017). On the other hand, Chai et al. (2013) reported a far higher number of case studies in similar studies. The disagreement between the local and international literature might be due to the fact that quantitative research approaches are more popular in Turkey whereas qualitative and mixed research methods are adopted much more in researches carried out in other countries. The point of screening model is to describe the person with their surrounding conditions without intervention (Karasar, 2010). Most of the studies carried out in Turkey are of quantitative type designed for scale development/application or appraisal of a given situation. Screening model might have been applied so often in the context of Turkey because of the abovementioned reason. To go into further details, half a dozen of reasons can be counted for lower popularity of other research methods compared to screening model: experimental studies are usually implemented with experimental and control groups, data collection and analysis process is more complex and laborious for the researcher than non-experimental studies, those methods require a longer period of time; likewise, case studies, correlational studies, descriptive studies are also extended over a long period of time.

When it comes to the participants of the TPACK theses in Turkey, the samples of the studies were largely composed of education faculty students or teachers, but only a small number of academic staff was picked for such studies (Table 10). By the same token, content analysis studies on TPACK researches indicated similar characteristics of sample groups in Turkey (Baran & Canbazoğlu Bilici, 2015; Dikmen & Demirer, 2016; Kaleli-Yılmaz, 2015; Korucu, Usta & Atun, 2017) and other countries (Wu, 2013; Setiawan et al.,2019; Wang, Schmidt-Crawford 2018; Willermark, 2018). It could be explained with the position of teachers and teacher candidates as focus group groups in education field and researchers' preference of easily accessible participants. Further examination into the study participants shows that teacher candidates appeared in more studies than teachers. To give an example, Setiawan et al. (2019) stated that most of the TPACK researches were implemented with teacher candidates, only one third of the studies were conducted with teachers, and the remaining was done with mixed study participants seeking to compare the TPACK of teachers and teacher candidates. In another example, Dikmen and Demirer (2016) pointed out that the majority of the TPAB study participants were comprised of teacher candidates, some were teachers and a very small number corresponded to academic staff. Kaleli-Yılmaz (2015) claim that teachers in our country generally abstain from volunteering in academic researches thinking that it will put extra time and burden onto them with no benefit in return and their weaknesses will be disclosed. They add that the majority of the participating teachers feel pushed to fill out questionnaires or scales and they pretend to be knowledgeable and well-trained; therefore, the researcher has to put so much effort to convince the teachers to take part and be truthful while responding to questions.

As for the branchs of the participant teacher candidates in the studies, they predominantly come from the fields of science, primary school mathematics, secondary school mathematics and social studies whereas the teachers often teach primary school mathematics, science and English (Table 10). Although the number of studies carried out with teachers other than mathematics, science and English language teaching is low, it was seen that studies were conducted with teachers and teacher candidates from almost every branch including physics, chemistry, biology, geography, and physical education (Baran & Canbazoğlu Bilici, 2015; Dikmen & Demirer, 2016; Kaleli-Yılmaz, 2015; Korucu, Usta and Atun, 2017). Also, the scanned studies were substantially done with teachers/teacher candidates at secondary school education while primary and high school levels did not get the same level of attention. In other words, no attempt has been undertaken yet to discover TPACK levels of teachers from various branches working in primary and secondary schools and what they do to better teach the subjects/topics to their students. Likewise, TPACK analysis studies in our country (Dikmen & Demirer, 2016; Kaleli-Yılmaz, 2015; Korucu, Usta & Atun, 2017) revealed that there exist no TPACK studies with branch teachers at secondary education. However, equivalent foreign studies (Chai et al. 2013; Setiawan et al. 2019; Willermark, 2018) show that nearly all branches have been touched upon in the scope of TPACK studies. This difference might arise from the fact that most of the researchers working on TPACK in our country specialize in science and mathematics.

It can be seen that a wide range of data collection tools such as scale, observation, interview, document analysis, test and questionnaire were used in the postgraduate dissertations on TPACK (Table 12). It should be added that use of more than one single tool was not an exception. Rather, it was recurrent in the studies scanned here. The use of multiple tools is considered important for both the authenticity and usefulness of the studies and strengthening the studies in terms of validity and reliability. Another finding reveals that scales, questionnaires/forms and tests were preferred more often than other data collection tools like observation and document analysis. In support of this situation, the bulk of the postgraduate dissertations on TPACK were conducted with a large number of participants (201 + people and 101-200 people) (Table 11). The number of studies employing methods such as observation, interview and document analysis (lesson plan, diary, etc.) revealing the change throughout a process

seems to be low. The majority of TPACK review studies in the literature (Baran & Canbazoğlu Bilici, 2015; Dikmen & Demirer, 2016; Kaleli-Yılmaz, 2015; Korucu, Usta & Atun, 2017; Wang, Schmidt-Crawford & Jin, 2018; Willermark, 2018) concluded that scale was the most common data collection tool. It is probable that scales were the most preferential data collection tool as a subsequent tendency following quantitative research approach and large sample use. Ekiz (2013) believes that the frequent use of scales in studies is due to the fact that they are easily accessible, are low-cost, are more labor-saving and time-saving compared to other data collection tools, and they minimize bias arising from prejudices and personal disposition. The researcher adds that describing the existing situation in the literature through developing scales are more preferred by researchers since they have clear-cut boundaries in terms of analysis, findings and results. Koehler, Shin and Mishra (2012) stated that the studies examining teachers' TPACK development rarely used open-ended questionnaires, performance evaluation questionnaires, interviews and observation since data coding and other operations needed in the analysis of the data obtained from these tools stand as a complex process. Another reason might be the existence of TPACK scales created to make the TPACK structure operational. The literature accommodates several TPACK scales: "Survey of Preservice Teachers' Knowledge of Teaching and Technology" (Schmidt, Baran, Thompson, Koehler, Mishra & Shin, 2009), "PT-TPACK'' (Lux, Bangert & Whittier, 2011), "IWB-based TPACK" (Jang & Tsai, 2012), ''TPACK'' (Chai et al., 2013), "Web Pedagogical Content Knowledge'' (Kavanoz, Yüksel & Özcan, 2015), ''TPCK-SRL'' (Kohen & Kramarski, 2012) and ''TPACK-EFL'' (Baser, Kopcha, & Ozden, 2016). Regarding the demand for these scales, Willermark (2018) found in the TPACK content analysis study that the "Survey of Preservice Teachers' Knowledge of Teaching and Technology" of Schmidt et al. (2009) was used with the highest frequency. Since the diversity of the scales allows the researcher to describe the problem situation in a different way, it can be counted as another reason for the intense demand for scales as a data collection tool. Nevertheless, Voogt et al. (2013) argue that the data to be obtained with the TPACK scales are more likely to reveal teachers' knowledge level they think they have within the framework of TPACK rather than the real TPACK levels of teachers/teacher candidates. The researchers defend the use of joint use of multiple data collection tools like interview and lesson plan to expose the actual TPACKs of individuals. Another finding worth of noting is that there were not found any meta-synthesis and meta-analysis studies on TPACK in the literature review. Conducting studies with these methods and identifying trends in the field of TPACK holds a potential to fill an important deficiency. However, such studies, also called analysis of analyses, require a high level of analysis and synthesis skills. These recommendations should also be taken into account before carrying out new studies in Turkey.

Subjects/Fields of Reviewed Postgraduate Dissertations on TPACK

A small part of the postgraduate studies focused on a specific subject while the rest attempted to figure out opinion/perception/competency etc. related to TPACK in a more general sense. It has been seen that it is trying to be determined (Kaleli-Yılmaz, 2015). It is notable that the subjects covered in the dissertations are largely linked to science followed by mathematics and social sciences, respectively (Table 13). Particularly, secondary school physics was handled while chemistry, biology and astronomy remained as the least discussed fields. As for mathematics, studies at high school level were more apparebt, such as derivatives, polygons, geometry and mathematical functions. This finding is in agreement with the literature (Chai et al. 2013, Setiawan et al. 2019; Wu, 2013). In the study of Chai et al. (2013), it was concluded that the majority of TPACK studies examined TPACK independently. Wu (2013) also found in the literature review that TPACK was examined independent of subject areas in most cases, while science and mathematics were dominant in field-specific studies. Setiawan et al. (2019) pointed out that the majority of the studies were in the context of science as an umbrella discipline, but there were few studies on specific fields of science such as biology, chemistry, and physics. Remembering that TPACK is a field-based knowledge structure, there rises the need for studies on defining TPACK in various fields as well as studies examining field-specific technologies (Baran & Canbazoğlu Bilici, 2015; Voogt et al., 2013, Kaleli-Yılmaz, 2015). It can be suggested that education is still full of gaps to be closed for guiding deeper change within the framework of TPACK; therefore, further development and exploration of especially field-specific technological environments is required. It is also recommended that researchers should create different data collection templates, questionnaires or process evaluations suitable for the nature of these fields.

Results of Reviewed Postgraduate Dissertations on TPACK

Most of the results of the studies were found to relate to the TPACK and TK (Technological Knowledge) of teachers and teacher candidates and the relationship between this knowledge and various variables. Only a small number of them reached results on the impact of the developed classes/training courses on the TPACK knowledge of the teachers and teacher candidates (Table 14). While TPACK of teacher candidates and that of half of the teachers was at a sufficient level, their TK was almost at an insufficient level. It was unclear whether there was a significant relationship between teacher candidates' TPACK and gender. But there was a significant relationship between teachers' TPACK and genders in support of males. As to the relationship between teacher candidates' TPACK and grade level, there was not a significant relationship. However, the relationship was significant between the teachers' TPACK and seniority years. Despite that, the TPACK level was found to be low among the teachers with bigger seniority years. Again, a significant relationship was found between teacher candidates' and teachers' TPACK and ability to own/use technology. There was also a significant relationship between the teachers' TPACK and student success. As another sub-component, it was seen that the classes/training courses developed within the framework of TPACK had a positive impact on the TPACK development of teacher candidates and teachers. In the TPACK content analysis study conducted by Kaleli-Yılmaz (2015), it was also concluded that most of the teachers and teacher candidates had sufficient TPACK but insufficient TK. On the whole,

the results of the studies were suitable for the respective study aim, and in line with the expectations with the most studied subject, the participants' TPACK and TK levels were good. The recommendation in this respect would be to perform meta-analysis studies on variables that have been studied extensively, such as TPACK and TK. Secondly, outcomes of TPACK training courses and the subsequent implementations can be made public for insight about the impact of training attempts.

Basic Recommendations Brought in Reviewed Postgraduate Dissertations on TPACK

According to the findings above, the recommendations in more than half of the dissertations were oriented towards restructuring of education faculties for the TPACK development of teacher candidates, and the rest implied restructuring in-service training for the development of teachers' TPACK levels. There were also recommendations for the provision of technological equipment for building active learning environments. In particular, there were recommendations for redesigning the curriculum based on TPACK for TPACK development of teacher candidates, teaching teacher candidates knowledge and skills necessary for technology-supported applications as a part of subject field education, developing technological software specific to field education and teaching to use them, and restructuring certain courses mainly including Teaching Practice for the application of the acquired TPACK and skills. It is crucial to integrate and apply new technologies to subject field education courses during the pre-service period because teacher candidates' having sufficient TPACK will help them be more successful in integrating technology into their lessons when they start work (Rahmawati, Budiyanto, & Basori, 2019). Kaya and Yılayaz (2013) stated that it is of vital importance to reconsider the content, duration and teaching of "Special Teaching Methods", "School Experience" and "Teaching Practice" courses in the light of TPACK since those courses are offered at education faculties in Turkey to show how to teach a specific field (mathematics, science, social studies, etc.) (PCK). It was also emphasized in the studies that in-service trainings organized for the development of teachers' TPACK should be arranged to fit into the teachers' branches/years of experience. Senior teachers should be given priority in participation in the course. In addition to this, it was recommended to address TPACK components one by one in pre-service/in-service training. To summarize, it can be suggested that the postgraduate dissertations reviewed here contained recommendations about teacher education and researchers put forward recommendations under several themes.

RECOMMENDATIONS

In this study, a total of 101 postgraduate dissertations dealing with TPACK were analyzed and it was understood that the number of postgraduate dissertations increased gradually after 2009. In this respect, it is unquestionable that the dissertations on TPACK are important. What is even more important is to produce authentic studies as required by the nature of science instead of replicating some kinds of studies. In the dissertations published on TPACK, teacher candidates and teachers took part more often as study participants. It is critical to study the TPACK of teachers or teacher candidates and to identify their levels, but that would be incomplete without looking for alternative ways by which teachers and teacher candidates can integrate technology into lessons. There should be more classes during pre-service period to help teacher candidates learn how to integrate technology into lessons in their subject field and how to improve their TK Such classes or courses should be taught by instructors who are competent in the relevant field and TPACK. At the same time, course contents in education faculties should be rearranged within the framework of TPACK and necessary updates mandated by the field-specific ICTs should be performed. In order to achieve the targeted results in the FATIH project carried out in our country, it can be thought that in-service trainings based on different TPACK models will be developed and a teacher training TPACK model suitable for Turkish culture can be created based on the findings obtained. It is recommended that future research should be inclusive of students as the way the teacher integrates technology into the lesson affects students' success, attitudes and behaviors towards the lesson. For example, research can be done on how the teacher's TPACK level affects the students. Moreover, it was seen that science and mathematics lessons and secondary school teachers were mostly chosen for the reviewed dissertations. Primary and high school teachers should be preferred in future research and more research weight should be placed onto verbal skill courses such as Turkish Language, Geography and History. The recommendation is about focusing on qualitative and mixed methods as well as quantitative methods in future TPACK studies for a great contribution to the literature. To conclude, examining the studies on TPACK in the light of these recommendations is expected to enrich the relevant literature and shed light on future studies by the same token.

Declaration of Conflicting Interests

Funding

Statements of publication ethics

REFERENCES

Abbitt, J.T. (2011). Measuring technological pedagogical content knowledge in preservice teacher education: A review of current methods and instruments. Journal of Research on Technology in Education, 43(4), 281–300.

American Association of Colleges of Teacher Education (AACTE) (2008). Handbook of technological pedagogical content knowledge (TPCK) for educators. New York: Routledge/Taylor & Francis Group

Angeli, C., & Valanides, N. (2005). Preservice elementary teachers as information and communication technology designers: An instructional systems design model based on an expanded view of pedagogical content knowledge. Journal of Computer Assisted Learning, 21(4), 292–302.

Archambault, L., & Crippen, K. (2009). Examining TPACK among K-12 online distance educators in the United States. Contemporary Issues in Technology and Teacher Education, 9(1), 71-88.

Ay, Y. (2015). Öğretmenlerin teknolojik pedagojik alan bilgisi (TPAB) becerilerinin uygulama modeli bağlamında değerlendirilmesi. Doktora Tezi, Eskişehir Osmangazi Üniversitesi Eğitim Bilimleri Enstitüsü.

Ayvaz, M. (2019). Sosyal bilgiler öğretmen adaylarının 6. sınıf yeryüzünde yaşam ünitesine ilişkin teknolojik pedagojik alan bilgisiyle ilgili düzeylerinin incelenmesi. Trabzon Üniversitesi Lisansüstü Eğitim Enstitüsü.

Baran, E., ve Canbazoğlu Bilici S. (2015). Teknolojik Pedagojik Alan Bilgisi (TPAB) Üzerine Alanyazın İncelemesi: Türkiye Örneği, Hacettepe Üniversitesi Eğitim Fakültesi Dergisi 30(1), 15-32.

Baran, E., Canbazoglu Bilici, S., Albayrak Sari, A., & Tondeur, J. (2019). Investigating the impact of teacher education strategies on preservice teachers' TPACK. British Journal of Educational Technology, 50(1), 357-370.

Baser, D. Kopcha, T.J. & Ozden, M.Y. (2016) Developing a technological pedagogical content knowledge (TPACK) assessment for preservice teachers learning to teach English as a foreign language, Computer Assisted Language Learning, 29:4, 749-764, DOI:

10.1080/09588221.2015.1047456

Bulut, A. (2012). İlköğretim matematik öğretmen adaylarının geometri konusu ile ilgili algıladıkları teknolojik pedagojik alan bilgilerinin (TPAB) araştırılması. Yüksek Lisans Tezi, Orta Doğu Teknik Üniversitesi Sosyal Bilimler Enstitüsü.

Çalık, M. ve Sözbilir, M. (2014). İçerik analizinin parametreleri. Eğitim ve Bilim, 39(174), 33-38.

Canbolat, N. (2011). Matematik öğretmen adaylarının teknolojik pedagojik alan bilgileri ile düşünme stilleri arasındaki ilişkinin incelenmesi. Yüksek Lisans Tezi, Selçuk Üniversitesi Eğitim Bilimler Enstitüsü.

Çelik, İ., Hebebci, M.T., & Şahin, İ. (2014). Çevrimiçi örnek olay kütüphanesi kullanımının teknoloji entegrasyonundaki rolü: TPAB temelinde bir araştırma. Gaziantep Eğitim Fakültesi Dergisi, 15(3), 739-754.

Chai, C. S., Koh, J. H. L., & Tsai, C. C. (2011). Facilitating preservice teachers' development of technological, pedagogical, and content knowledge (TPACK). Journal of Educational Technology & Society, 13(4), 63–73.

Chai, C. S., Koh, J. H. L., ve Tsai, C. C. (2013). A review of technological pedagogical content knowledge. Educational Technology & Society, 16(2), 31-51

Cohen, L., Manion, L., & Morrison, K. (2007). Research methods in education. New York, NY: Routledge.

Dikmen, C. H. & Demirer, V. (2016). Türkiye'de Teknolojik Pedagojik Alan Bilgisi Üzerine 2009-2013 Yılları Arasında Yapılan Çalışmalardaki Eğilimler. Turkish Journal of Education, 5(1), 33-46.

Ekiz, D. (2009). Bilimsel araştırma yöntemleri (2. bs.). Ankara: Anı Yayıncılık

Ersoy, M., Yurdakul, I. K., & Ceylan, B. (2016). Öğretmen adaylarının bit becerileri ışığında teknopedagojik içerik bilgisine ilişkin yeterliklerinin incelenmesi: Deneysel bir araştırma. Eğitim ve Bilim, 41(186), 119-135.

Göktaş, Y., Küçük, S., Aydemir, M., Telli, E., Arpacık, O., Yıldırım, G., & Reisoğlu, I. (2012). Educational technology research trends in Turkey: A content analysis of the 2000-2009 decade. Educational Sciences: Theory & Practice, 12(1), 177–199.

Graham, C. R., Burgoyne, N., Cantrell, P., Smith, L., St. Clair, L., & Harris, R. (2009). TPACK development in science teaching: Measuring the TPACK confidence of inservice science teachers. TechTrends, 53(5), 70-79.

Gündüz, R. (2018). Fen ve teknoloji öğretmen adaylarının teknolojik pedagojik alan bilgisi ve özgüven düzeylerinin incelenmesi. Yüksek Lisans Tezi, İnönü Üniversitesi Eğitim Bilimleri Enstitüsü.

Gür H., ve Karamete A. (2015). A SHORT REVIEW Of TPACK For TEACHER EDUCATION, Educational Research And Reviews, 10(7), 777-789. DOI:

10.5897/ERR2014.1982

Jang, S.J., & Tsai, M.F. (2012). Exploring the TPACK of Taiwanese elementary mathematics and science teachers with respect to use of interactive whiteboards. Computers & Education, 59(2), 327-338.

Janssen, N., & Lazonder, A. W. (2015). Implementing innovative technologies through lesson plans: What kind of support do teachers prefer? Journal of Science Education and Technology, 24(6), 910–920.

Kabakçı, I. (2011). Öğretmen adaylarının teknopedagojik eğitim yeterliklerinin bilgi ve iletişim teknolojilerini kullanımları açısından incelenmesi. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 40,397-408.

Kaleli-Yılmaz, G. (2015). Türkiye'deki Teknolojik Pedagojik Alan Bilgisi Çalışmalarının Analizi: Bir Meta-Sentez Çalışması. Eğitim ve Bilim, 40(178), 103-122.

Karakaya, D. (2012). Fen bilgisi öğretmen adaylarının küresel boyuttaki çevresel sorunlara ilişkin teknolojik pedagojik alan bilgisi ve sınıf içi uygulamalarının araştırılması. Yüksek Lisans Tezi, Fırat Üniversitesi Eğitim Bilimleri Enstitüsü.

Karasar, n. (2010). Bilimsel Araştırma Yöntemi. Ankara: Nobel Yayıncılık

Kavanoz, S., Yuksel, H. G., & Ozcan, E. (2015). Pre-service teachers' self-efficacy perceptions on web pedagogical content knowledge. Computers & Education, 85, 94–101.

Kaya, Z. (2010). Fen ve teknoloji öğretmen adaylarının fotosentez ve hücresel solunum konusundaki teknolojik pedagojik alan bilgisinin (TPAB) araştırılması. Yüksek Lisans Tezi, Fırat Üniversitesi Fen Bilimleri Enstitüsü.

Kaya, Z., ve Yılayaz, Ö. (2013) Öğretmen Eğitimine Teknoloji Entegrasyonu Modelleri Ve Teknolojik Pedagojik Alan Bilgisi, Batı Anadolu Eğitim Bilimleri Dergisi, 4(8), 57-83.

Kaya, Z., Kaya, O. N. ve Emre, İ. (2013) Teknolojik pedagojik alan bilgisi (TPAB) ölçeği'nin Türkçeye uyarlanması. Kuram ve Uygulamada Eğitim Bilimleri,13(4), 2355-2377.

Keser, H., Karaoğlan Yılmaz, F. G., & Yılmaz, R. (2015). Öğretmen adaylarının TPİB yeterlilikleri ve teknoloji entegrasyonu öz-yeterlik algıları. İlköğretim Online, 14(4), 1193-1207.

Kılıç, A. (2011). Fen ve teknoloji öğretmen adaylarının elektrik akımı konusundaki teknolojik pedagojik alan bilgilerinin ve sınıf içi uygulamalarının araştırılması. Yüksek Lisans Tezi, Fırat Üniversitesi Fen Bilimler Enstitüsü.

Kılıç, A. (2015). Teknolojik pedagojik alan bilgisi (TPAB) temelli harmanlanmış öğrenme ortamının fen bilgisi öğretmen adaylarının temel astronomi konularındaki TPAB ve sınıf içi uygulamalarına etkisi. Doktora Tezi, Fırat Üniversitesi Eğitim Bilimleri Enstitüsü.

Kılıçkeser, M. (2019). İlköğretim öğretmenlerinin teknolojik pedagojik alan bilgileri (TPAB) ile öğretim teknolojilerine yönelik tutumları arasındaki ilişki (Akyazı örneği). Yüksek Lisans Tezi, Bolu Abant İzzet Baysal Üniversitesi Eğitim Bilimleri Enstitüsü.

Kocakaya, F. (2015). Türkiye, Fransa ve İsviçre'de öğrenim gören fen alanları öğretmen adaylarının teknopedagojik yeterliklerinin yapısal eşitlik modeli ile incelenmesi. Doktora Tezi, Dicle Üniversitesi Eğitim Bilimleri Enstitüsü.

Koh, J. H. L., & Chai, C. S. (2014). Teacher clusters and their perceptions of technological pedagogical content knowledge (TPACK) development through ICT lesson design. Computers & Education, 70, 222-232.

Koehler, M. (2012). TPACK image. Retrivede from http://www.matt-koehler.com/tpack/using-the-tpack-image/

Koehler, M. J., & Mishra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. Journal of Educational Computing Research, 32(2), 131–152.

Koehler, M. J. ve Mishra, P. (2008). Introducing TPCK in AACTE committee on innovation and technology: The handbook of technological pedagogical content knowledge (TPCK) for educators. New York: American Association of Colleges of Teacher Education and Routledge.

Kohen, Z., & Kramarski, B. (2012). Developing a TPCK-SRL assessment scheme for conceptually advancing technology in education. Studies in Educational Evaluation, 38(1), 1–8.

Koehler, M. J., Shin, T. S., & Mishra, P. (2012). How do we measure TPACK? Let me count the ways. In Educational technology, teacher knowledge, and classroom impact: A research handbook on frameworks and approaches (pp. 16–31). Hershey, PA: IGI Global

Korucu, A. T., Usta, E. & Atun, H. (2017). Teknolojik Pedagojik Alan Bilgisi Üzerine Yapılan 2010-2016 Dönemi Araştırmalardaki Eğilimler. Amasya Üniversitesi Eğitim Fakültesi Dergisi, 6(1), 104-133.

Lux, N. J., Bangert, A. W., & Whittier, D. B. (2011). The development of an instrument to assess preservice teacher's technological pedagogical content knowledge. Journal of Educational Computing Research, 45(4), 415–431.

Miles, M, B., & Huberman, A. M. (1994). Qualitative data analysis: An expanded Sourcebook. (2nd ed). Thousand Oaks, CA: Sage.

Niess, M. L. (2005). Preparing teachers to teach science and mathematics with technology: Developing a technology pedagogical content knowledge. Teaching and Teacher Education, 21(5), 509-523.

Ormancı, Ü., Çepni, S., Deveci, İ., & Aydın, O. (2015). A thematic review of interactive whiteboard use in science education: rationales, purposes, methods and general knowledge. Journal of Science Education and Technology, 24(5), 532-548.

Öztürk, E. (2013). Sınıf öğretmeni adaylarının teknolojik pedagojik alan bilgilerinin bazı değişkenler açısından değerlendirilmesi. Uşak Üniversitesi Sosyal Bilimler Dergisi, 6(2), 223-238.

Pierson, M. E. (2001). Technology integration practice as a function of pedagogical expertise. Journal of Research on Computing in Education, 33(4), 413.

Rahmawati,N., Budiyantoa Cucuk., &, Basori (2019). Revisting Blended Learning in TPACK: Literature Review The 2nd International Conference on Science, Mathematics, Environment, and Education AIP Conf. Proc. 2194, 020096-1–020096-6; https://doi.org/10.1063/1.5139828

Savaş, M. (2011). Investigating pre-service science teachers' perceived technological pedagogical content knowledge regarding genetics. Yüksek Lisans Tezi, Orta Doğu Teknik Üniversitesi Sosyal Bilimler Enstitüsü.

Setiawan , H., Phillipson, S., Sudarmin and Isnaeni, W. (2019). Current trends in TPACK research in science education: a systematic review of literature from 2011 to 2017, IOP Conf. Series: Journal of Physics: Conf. Series 1317 (2019) 012213. doi:10.1088/1742-6596/1317/1/012213

Sezer, B. (2015). Examining technopedagogical knowledge competencies of teachers in terms of some variables. Procedia-Social and Behavioral Sciences, 174, 208–215. doi: 10.1016/j.sbspro.2015.01.648

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological pedagogical content knowledge (TPACK) the development and validation of an assessment instrument for preservice teachers. Journal of Research on Technology in Education, 42(2), 123–149.

Shulman, L. (1987). Knowledge and teaching: Foundations of the new reform. Harvard Educational Review, 57(1), 1-23.

Sözbilir, M., Kutu, H., Yaşar, M. D. ve Arpacık, Ö. (2010). Dünyada ve Türkiye'de kimya eğitimi araştırmalarında genel eğilimler. IX. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, İzmir

Şimşek, Ö., Demir, S., Bağçeci, B., & Kinay, İ. (2013). Öğretim elemanlarının Teknopedagojik eğitim yeterliliklerinin çeşitli değişkenler açısından incelenmesi. Ege Eğitim Dergisi, 14(1), 1-23.

Tokmak, H. S., Yelken, T. Y., & Konokman, G. Y. (2013). Pre-service teachers' perceptions on development of their IMD competencies through tpack-based activities. Educational Technology & Society, 16(2), 243–256.

Tondeur, J., van Braak, J., Sang, G., Voogt, J., Fisser, P., & Ottenbreit-Leftwich, A. (2012). Preparing pre-service teachers to integrate technology in education: A synthesis of qualitative evidence. Computers & Education, 59(1), 134–144. https://doi.org/10.1016/j.compedu.2011.10.009

Ültay, N. ve Çalık, M. (2012). A thematic review of studies into the effectiveness of context-based chemistry curricula. Journal of Science Education and Technology, 21(6), 686-701. doi:10.1007/s10956-011-9357-5

Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J., & van Braak, J. (2013). Technological pedagogical content knowledge – A review of the literature. Journal of Computer Assisted Learning, 29(2), 109–121.

Wang, W., Schmidt-Crawford D., & JinY. (2018) Preservice Teachers' TPACK Development: A Review of Literature, Journal of Digital Learning in Teacher Education, 34:4, 234-258, DOI: 10.1080/21532974.2018.1498039

Willermark, S. (2018). Technological Pedagogical and Content Knowledge: A Review of Empirical Studies Published From 2011 to 2016, Journal of Educational Computing Research. 56(3), 315–343.

Wu, Y. T. (2013). Research trends in technological pedagogical content knowledge (TPACK) research: A review of empirical studies published in selected journals from 2002 to 2011. British Journal of Educational Technology, 44(3), E73–E76.

Yigit, M (2014). A Review of the Literature: How Pre-service Mathematics Teachers Develop Their Technological, Pedagogical, and Content Knowledge, International Journal of Education in Mathematics, Science and Technology, 2(1), 26-35.