2024

Volume 17, Issue 3
Cilt 17, Sayı 3

Kuramsal
Eğitimbilim Dergisi
JOURNAL OF THEORETICAL EDUCATIONAL SCIENCE

Afyon Kocatepe University
Faculty of Education

ISSN: 1308-1659

http://www.keg.aku.edu.tr

KURAMSAL EĞİTİMBİLİM DERGİSİ*
Journal of Theoretical Educational Science
ISSN: 1308-1659

Publisher
Afyon Kocatepe University

Owner
Dr. Nusret KOCA (Dean) on behalf of Afyon Kocatepe University

* **Journal of Theoretical Educational Science** is a quarterly peer-reviewed online journal.

Abstracting and Indexing
ERIC, ULAKBİM TR Dizin, EBSCO, ERIH Plus, Türk Eğitim İndeksi (TEİ), SOBIAD

Redactions
Assoc. Prof. Dr. Fatih GÜNGÖR

English Language Editor
Res. Asst. Gamze KAPUCU

Address
Afyon Kocatepe Üniversitesi, Eğitim Fakültesi, A.N.S. Kampüsü, 03200 Afyonkarahisar, Turkey
Tel: +90 272 2281418
e-mail: editorkebd@gmail.com

CONTENTS

FROM THE EDITOR

Dear Colleagues,

The *Journal of Theoretical Educational Science* is happy to publish the third issue of 2024! In this issue, you will find ten research articles by 23 authors. We are glad that these articles represent the different disciplines of education.

We should also express our sincere thanks to the Editorial Board, reviewers, and authors for their invaluable contributions. We look forward to receiving submissions from different parts of the world for the following issues!

Kindest regards,

Fatih GÜNGÖR, PhD
Afyon Kocatepe University
Faculty of Education

Journal of Theoretical Educational Science, 17(3), 499-538, July 2024
Kuramsal Eğitimbilim Dergisi, 17(3), 499-538, Temmuz 2024
[Online]: http://dergipark.org.tr/akukeg
DOI number: http://doi.org/10.30831/akukeg.1388214

Teacher Self-Efficacy Scale Towards Context-Based Science Learning: Validity and Reliability Study

Bağlam Temelli Fen Öğrenimine Yönelik Öğretmen Özyeterlik Ölçeği: Geçerlik ve Güvenirlik Çalışması

Büşra ARIK GÜNGÖR[**] **Oktay BEKTAŞ**[***] **Sibel SARAÇOĞLU**[****]

Received: 9 November 2023 **Research Article** **Accepted:** 24 February 2024

ABSTRACT: This study aims to develop a valid and reliable scale for determining the self-efficacy of teachers toward context-based science education. This study employed a survey design. The sample has formed 433 science teachers working in Kayseri province in the 2020-2021 spring semester. Firstly, an item pool of 85 items was developed by reviewing the literature. Secondly, a five-point Likert-type draft scale consisting of 67 items was developed. Required arrangements have been performed according to expert opinions to provide content validity. Explanatory and confirmatory factor analyses have been run to provide construct validity. As a result of explanatory factor analysis, a structure with four factors as "Learning/Teaching Process", "Self-efficacy Resources", "Academic Self-efficacy" and "Planning Instruction" consisting of 47 items has been reached. Factors have been confirmed by confirmatory factor analysis. Cronbach Alpha internal consistency coefficient has been calculated as 0.98. To provide criterion validity, the Pearson correlation coefficient has been found as 0.86 between the draft and criteria scales. Based on the findings, researchers have determined that the scale was valid and reliable, and they recommended that this scale should be used to determine self-efficacy beliefs towards context-based learning of science teachers.

Keywords: Context-based learning, scale development, science education, self-efficacy.

ÖZ: Bu çalışmanın amacı, öğretmenlerin bağlam temelli fen öğrenimine yönelik özyeterliklerini belirlemede kullanılabilecek geçerli ve güvenilir bir ölçek geliştirmektir. Çalışmada nicel araştırma yönteminin desenlerinden biri olan tarama deseni kullanılmıştır. Tarama desenlerinden ise kesitsel tarama modeli kullanılmıştır. Çalışmanın örneklemini, 2020-2021 eğitim ve öğretim yılında Kayseri ilinde görev yapan 433 fen bilimleri öğretmeni oluşturmuştur. İlk olarak alan yazın taraması yapılarak 85 maddelik madde havuzundan 67 maddelik beşli Likert tipinde taslak ölçek oluşturulmuştur. Ölçeğin kapsam geçerliğini sağlamak için uzman görüşleri alınmış, gelen dönütlere göre gerekli düzenlemeler yapılmıştır. Ölçeğin yapı geçerliğini sağlamak için açımlayıcı ve doğrulayıcı faktör analizleri yürütülmüştür. Açımlayıcı faktör analizi sonucunda "Öğrenme/Öğretme Süreci", "Özyeterlik Kaynakları", "Akademik Özyeterlik" ve "Öğretimi Planlama" olmak üzere dört faktörlü ve 47 maddeden oluşan bir yapıya ulaşılmıştır. Doğrulayıcı faktör analizi ile açımlayıcı faktör analizi sonuçları doğrulanmıştır. Ölçekten elde edilen puanların güvenirliği için, ölçeğin tamamının ve alt faktörlerin Cronbach Alfa iç tutarlık katsayıları hesaplanmıştır. Ölçeğin ölçüt geçerliğini sağlamak için benzer nitelikte bir ölçek belirlenerek iki ölçeğin arasında Pearson korelasyon katsayısı 0.86 bulunmuştur. Yapılan analizler sonucunda, araştırmacılar ölçeğin geçerli ve güvenilir olduğunu belirlemiş ve fen bilimleri öğretmenlerinin bağlam temelli öğrenmeye yönelik öz-yeterliklerini belirlemek amacıyla kullanılmasını önermişlerdir.

Anahtar kelimeler: Bağlam temelli öğrenme, fen eğitimi, özyeterlik, ölçek geliştirme.

** *Corresponding Author*: PhD student, Kayseri Measurement and Assessment Center, Kayseri, Türkiye, busrarik38@gmail.com, https://orcid.org/0000-0002- 0334-0786
*** Prof. Dr., Erciyes University, Kayseri, Türkiye, obektas@erciyes.edu.tr, https://orcid.org/0000-0002-2562-2864
**** Prof. Dr., Erciyes University, Kayseri, Türkiye, saracs@erciyes.edu.tr, https://orcid.org/0000-0001-9023-7383

Citation Information
Arık Güngör, B., Bektaş, O., & Saraçoğlu, S. (2024). Teacher self-efficacy scale towards context-based science learning: Validity and reliability study. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 17*(3), 499-538.

ISSN: 1308-1659

International research institutions such as the Program for International Student Assessment (PISA) and The Trends in International Mathematics and Science Study (TIMSS) reveal that many countries have common problems in science teaching. (Gilbert et al., 2011; Pilot & Bulte, 2006; Yaman, 2009). Intensive curriculum, subjective concepts, the inability of students to associate knowledge with daily life, and not being able to use them in new problem situations are considered the main problems. These problems reduce students' interest in science lessons (Genç et al., 2017; Gilbert, 2006; Yaman, 2009). Research shows that existing problems continue today (Education Monitoring Report (EIR), 2021; Mutual Responbility, 2021; OECD, 2023).To solve these problems, education programs have started to use context-based learning (CBL) (Bahtaji, 2015; Bennett & Lubben, 2006; Çepni 2015; Gilbert, 2006; Knoef, 2017; Tariq ve Saeed, 2021; Ültay & Çalık, 2011).

The CBL is an approach that adopts the relationship between the concepts and daily life events (Ayas et al. 2007; Kutu & Sözbilir, 2011). The CBL expects students to think that the concepts are essential to them. It also aims to build these concepts in their inner world. In addition, it expects students to find their unique solutions to problems with the help of these concepts (Cobos et al., 2017; De Jong, 2008). The use of this approach increases the learning motivations and desires of students and contributes to the occurrence of meaningful and permanent learning (Gilbert, 2006; Gül, 2016; Hırça, 2012; Karslı-Baydere & Aydın, 2019; King et al.,2011; Sevian et al., 2018).

Teachers with academic proficiency in the CBL provide students with contextual skills that they can use in their daily lives and enable them to learn meaningfully. Such teachers can develop their thoughts on the use of this approach in a positive way and include the CBL practices in the teaching process (Ayvacı, 2010; İlhan et al., 2015; Topuz et al., 2013). However, teachers must have sufficient self-efficacy levels to use the CBL effectively in their lessons (Van Driel et al., 2001; Stolk et al., 2009).

The appearance of the self-efficacy concept is based on the social-cognitive theory developed by Albert Bandura. The social cognitive theory states that personal, environmental, and behavioral factors mutually affect each other and this interaction determines the behavior of individuals (Bandura, 1997). Albert Bandura defines self-efficacy as people's beliefs in their ability to regulate and control their actions to overcome a problem that affects their lives (Bandura, 1997; Tschannen-Moran et al.,1998). A person's belief in high self-efficacy is important for motivation, well-being, and personal accomplishment. Mastery experiences, vicarious experiences, social persuasion, and emotional states influence and develop one's self-efficacy belief. Individuals with high self-efficacy can cope with difficulties and stress and be successful in education (Bandura, 1997). On the other hand, teachers' self-efficacy is also important in the learning process. Teachers' self-efficacy is effective in choosing learning approaches that they can use and their willingness to use the approaches. In addition, teachers' self-efficacy is an effective factor in the preparation of learning environments that enable the development of student's cognitive and sensory competencies and in increasing their interest, motivation, and achievement (Elmas et al., 2011; Stolk et al., 2009; Van Driel et al., 2001). While high self-efficacy may positively affect teachers' professional performance and their efforts to reach goals, a low level of belief may cause negative consequences (Bong, 2001; Chemers et al.,2001; Karaoğlu, 2019; Özdemir et al., 2018; Schmitz & Scwarzer, 2000; Schwarzer & Hallum, 2008).

De Putter-Smits et al. (2012) have collected the CBL adequacies of teachers under five headings. These headings are context handling, regulation (arranging the learning process), emphasis on learning (encouraging students for active learning), design (material arrangement), and school innovation (leadership for innovation). They expected that the level of self-efficacy of teachers on these headings would be high. The self-efficacy of teachers is influenced by past experiences, social interactions, physiological and psychological stimulations, and cultural differences (Bandura, 1997). Within this context, the self-efficacy of teachers needs to be determined towards the use of CBL. Therefore, valid and reliable scales should be developed to determine their self-efficacy beliefs regarding the use of CBL (Capa Aydin et al., 2018; Çolak et al., 2017; Karaoğlu, 2019).

Many studies have been completed about the CBL in the literature (Broman, et al., 2020; Cabbar & Şenel 2020; Deveci & Karteri, 2020; Hoşbaş,2018; Karaş & Gül, 2020; King et al., 2011), but the studies executed with teachers are limited l (Dolfing et al., 2020; Kurnaz, 2013; Parchmann et al. 2006). Some of these studies carried out with teachers aim to provide professionel developmant in teaching context-based science curriculum (Dolfing et al., 2020; Kurnaz, 2013; Parchmann et al. 2006). In some studies conducted with teachers on CBL, but they do not have sufficient knowledge about the application of the approach and their use of the approach is limited/These studies suggest that teachers' context-based science teaching competencies should ve increased(Arık Güngör vd., 2023; Ayvacı, 2010; De Putter-Smits et al.,2012; Kurnaz, 2013; Stolk et al., 2011; Topuz et al., 2013; Vos et al., 2011; Wijaya et al., 2015). In addition, although there are scale development and scale adaptation studies for teacher self-efficacy in the literature (Çolak et al., 2017; Denizoğlu, 2008; Hacıömeroğlu, 2020; Bıkmaz, 2002; Şensoy & Aydoğdu, 2008; Tortop &Akyıldız, 2019; Yaman et al., 2018), no study was found to measure teacher self-efficacy towards the use of CBL. On the other hand, these studies did not present detailed explanations about the validity and reliability. Teacher self-efficacy is one of the most important factors in teacher functioning (Soini et al., 2015). Prominent features such as being able to turn crises into opportunities, managing the process well under difficult conditions and having a solid motivation, providing effective guidance and touching the lives of students are related to teacher self-efficacy levels (Demirtaş and Yener, 2019; Marschall, 2022). Researchs conducted; it shows that teachers with high self-efficacy are more willing to apply innovative teaching approaches and are more effective in behavior management (Nie et al., 2013; Thurlings et al., 2015; Zee and Koomen, 2016). This situation reveals the need to determine teacher self-efficacy. Valid and reliable scales are needed to determine teacher self-efficacy. This need also applies to science teachers. Since CBL is a frequently used learning strategy in science education, it is necessary to develop a valid and reliable scale to be used to determine the self-efficacy of science teachers for context-based science teaching. In this context, a scale to be developed will be a resource for the professional development of science teachers. Based on all of these, this study aims to develop a valid and reliable data collection tool that will determine the self-efficacy beliefs of science teachers regarding the use of CBL. The answer has been investigated for the following questions in line with this purpose:

• Is the Context-based Science Learning (CBSL) Teacher Self-efficacy Scale valid?

• Is the Context-based Science Learning (CBSL) Teacher Self-efficacy Scale reliable?

Method

Research Design

The research uses the survey, one of the quantitative research designs. The research also prefers the cross-sectional model belonging to this design. Survey design is the study to determine the participants' affective characteristics and psychomotor skills and is carried out with large samples (Fraenkel et al., 2012). A cross-sectional survey model is a study in which a certain affective or psychomotor feature is measured at once (Fraenkel & Wallen, 2006). Self-efficacy is the affective trait. Therefore, this study develops a scale to determine teachers' self-efficacy beliefs towards the use of CBL and make one measurement at a time. Therefore, this study prefers a cross-sectional survey model.

Population and Sample

The accessible population of the study is science teachers working in Kayseri in the spring term of 2020-2021. For this purpose, the study prefers random sampling. The researchers administered the draft scale to 504 teachers who voluntarily participated in the study at the beginning of the study. The authors excluded 71 participants from the study. Although these participants do not know about context-based learning, they are the ones who mark the items and mark the "Always" or "Never" option in all the items. Therefore, the sample of the study consists of 433 science teachers assigned in Kayseri province. Demographic characteristics of teachers are given in Table 1. The number of participants (433) corresponds to at least 10 percent of the 840 science teachers in the accessible population.

Table 1

Demographic characteristics of teachers

Demographic Variables	Category	Frequency	Percent
Gender	Female	241	55.60%
	Male	192	44.40%
Age	20-30	90	20.80%
	31-40	114	26.30%
	41-50	140	32.30%
	51-60	81	18.70%
	61 and above	8	1.80%
Place of Profession	Province Center	243	56.10%
	District Center	102	23.60%
	Town/Area	38	8.80%
	Village	50	11.50%
Grade Level	Undergraduate	404	93.30%

	Graduate	27	6.20%
	Doctorate	2	0.50%
Professional Experience	1-5 years	76	17.60%
	6-10 years	71	16.40%
	11-15 years	61	14.10%
	16-20 years	76	17.60%
	21-25 years	90	20.80%
	26 years and above	59	13.60%

First, the authors have formed an item pool of 85 items, consisting of 56 positive and 29 negative items (Gelen et al. 2019; Hacıömeroğlu, 2020; Sevian et al., 2018; Tal, et al., 2021; Tortop & Akyıldız, 2018; Yaman & Tulumcu, 2016). The authors rearranged the items in line with the opinions of three experts in science education and reduced them to 67 items. Expert opinions are explained in detail in the "Content Validity" section.

In the first part of the scale form, the authors asked participants if they knew about CBL. They also identify demographic information such as gender, age, place of employment, educational background, and professional experience. In the second part of the scale form, 67 items aim to measure science teachers' self-efficacy beliefs regarding the use of CBL. The authors prepared the draft scale form in a five-point Likert type. The first researcher delivered the draft scale form to the participants electronically. The first and third authors reverse-coded the negative statements in the SPSS 25 program.

Procedure

The authors followed a five-stage process in scale development. While determining the five-stage process, the scale development steps of many researchers were taken into account in the literature (Davis, 1992; Keçe et al., 2020; Pallant, 2020; Sireci et al., 2005; Şahin et al., 2018; Taşkın & Aksoy, 2019). These stages are forming the item pool, seeking expert opinions for content validity, pre-testing, constructing a validity study, reliability analysis, and criterion validity study. The authors explain these stages in detail below.

The Literature Review and Forming an Item Pool

Firstly, the first author has performed the literature review to form an item pool. The first author has examined the theoretical foundations of "Context-Based Science Learning" and "Teacher Self-Efficacy" in this context. De Putter-Smits et al. (2012) identified context-based learning competencies as context handling, regulation, emphasis, design, and school innovation. On the other hand, Bandura (2018) stated that teacher self-efficacy is affected by "mastery experiences", "vicarious experiences", "verbal persuasion" and "psychological situations". Therefore, the authors created the item pool by considering the context-based learning competencies and self-efficacy factors. For example, the "material arrangement" competency and the "direct experiences" factor were considered to create the item "I can make effective use of materials in the CBSL". While creating the item pool, the first author took the written

opinions of 53 science teachers in Kayseri via Google Form about the characteristics that teachers should have while using the CBL. For this aim, two questions have been asked. The first was “What is the CBL?” and the second was “What are the competencies that teachers should have while using the CBL?” Some answers are as follows: (1) The teacher should be able to write context-based questions. (2) The teacher should be able to make an assessment based on context”. The authors have utilized the thoughts of the teachers while writing the scale items. Some items are described by Hacıömeroğlu (2020), Yaman et al. (2018), Colak et al. (2017), and Tortop & Akyıldız (2018) because the items were suitable for socio-cognitive theory and the CBL competencies. For example, Yaman et al. (2018) have employed the item “I am at a level to take part in projects related to STEM education." The authors have arranged this item as “I can take part in project studies related to the CBSL.” The competency of “school innovation” and the factor of “mastery experiences” were considered to write this item. In addition, the studies of Sevian et al., 2018 and Tal et al., 2021 were also used when creating the items. Table 2 presents the scale items and the CBL competencies and sources of self-efficacy.

Table 2

Evaluation of items in terms of the CBL competencies and self-efficacy factors

Items	Competencies	Factors
I have adequate knowledge about the CBSL (1).	School innovation	Mastery experiences
I can express my opinion in discussions related to the CBSL (2).	School innovation	Verbal persuasion
I have difficulty in time management when using the CBSL (3).	Regulation	Mastery experiences
I can help my colleagues to use the CBSL (4).	School innovation	Verbal persuasion
I can discuss current subjects by using the CBSL (5).	Emphasis	Verbal persuasion
I may not create a suitable environment for cooperative studies by using the CBSL (6).	Regulation	Mastery experiences
I can ensure that students need the subject they will learn by using the CBSL (7).	Emphasis	Verbal persuasion
I can perform the CBSL activities more effectively with my previous experience (8).	Regulation	Mastery experiences
I can prepare a measuring tool consisting of context-based questions (9).	Context handling	Mastery experiences
I may not provide students to put forward their opinions by using the CBSL (10).	Regulation	Verbal persuasion
In the process of using the CBSL, I find it difficult to develop students' social skills (11).	Regulation	Verbal persuasion
I can do the CBSL more effectively by reviewing previous CBSL activities (12).	Regulation	Vicarious experiences
I can share my teaching responsibility with students by	Regulation	Verbal persuasion

the CBSL (13).		
I can solve problems that arise when planning for CBSL (14).	Design	Mastery experiences
I can provide students to structure their knowledge by using the CBSL (15).	Emphasis	Mastery experiences
I can utilize sources related to the CBSL effectively (16).	School innovation	Vicarious experiences
I can identify examples of everyday life that attract students' attention when using the CBSL (17).	Context handling	Mastery experiences
I cannot develop material that can be used in the CBSL activities (18).	Design	Mastery experiences
I can select materials that can be used in CBSL (19).	Design	Mastery experiences
I can't increase the attention of students towards a lesson in CBSL (20).	Regulation	Verbal persuasion
I become excessively stressed in CBSL (21).	Regulation	Psychological conditions
I can use an example to be selected from daily living while starting to lesson in CBSL (22).	Context handling	Mastery experiences
I can write context-based questions (23).	Context handling	Mastery experiences
I become anxious in CBSL (24).	Regulation	Psychological conditions
I can determine examples of daily living suitable for the level of students in CBSL (25).	Context handling	Mastery experiences
I can explain with justifications why CBSL is needed (26).	School innovation	Verbal persuasion
I can prepare a lesson plan suitable for CBSL (27).	Design	Mastery experiences
I can determine examples of daily living suitable for the subject of a lesson in CBSL (28).	Context handling	Mastery experiences
I can decide for which gains CBSL can be used (29).	Emphasis	Mastery experiences
30. I can provide students can apply their gained knowledge in a new situation (30).	Emphasis	Verbal persuasion
I can manage the learning process effectively in CBSL (31).	Regulation	Mastery experiences
I consider the advice of other people in my CBSL applications (32).	Regulation	Vicarious experiences
I can develop the self-development skills of students in CBSL (33).	Regulation	Mastery experiences
I can increase the motivation of students in CBSL (34).	Regulation	Vicarious experiences
I become excited about CBSL (35).	Regulation	Psychological conditions
I can give examples from daily life in CBSL (36).	Context handling	Mastery experiences
I search for application examples for CBSL (37).	School innovation	Mastery experiences
I can produce solutions that may be met in CBSL applications (38).	Regulation	Mastery experiences
I constrain in preparing a lesson plan suitable for	Design	Mastery experiences

CBSL (39).		
I can provide an increase of self-confidence of students in CBSL (40).	Regulation	Mastery experiences
I can provide students solve their problems of daily living in CBSL (41).	Emphasis	Vicarious experiences
I can follow the agenda for purpose of CBSL (42).	School innovation	Vicarious experiences
I can have a task in project studies related to CBSL (43).	School innovation	Mastery experiences
I don't think to reuse it when I am constrained in CBSL (44).	Regulation	Mastery experiences
I can develop the cognitive skills of students in CBSL (45).	School innovation	Mastery experiences
I can apply CBSL in a classroom environment (46).	Regulation	Mastery experiences
I can increase the curiosity of students about a lesson in CBSL (47).	Regulation	Verbal persuasion
I can reach the targets of the lesson in CBSL (48).	Emphasis s	Mastery experiences
I can develop the communication skills of students in CBSL (49).	Regulation	Verbal persuasion
I am constrained in making evaluations in CBSL (50).	Regulation	Mastery experiences
I constrain in using materials in CBSL (51).	Regulation	Mastery experiences
I can develop myself for purpose of CBSL (52).	School innovation	Mastery experiences
I can increase the interest of students in science in CBSL (53).	School innovation	Mastery experiences
I can develop the sensory skills of students in CBSL (54).	Regulation	Mastery experiences
I can get students to make applications where they can use their preliminary knowledge in CBSL (55).	Emphasis	Mastery experiences
I can make guidance to students in CBSL (56).	Regulation	Mastery experiences
I can develop myself for purpose of CBSL (57).	School innovation	Mastery experiences
I can use the time effectively in CBSL (58).	Regulation	Mastery experiences
Advice from other people doesn't influence me in CBSL (59).	School innovation	Verbal persuasion
I can develop my professional performance through CBSL (60).	School innovation	Mastery experiences
I can provide meaningful learning for students in CBSL (61).	Emphasis	Mastery experiences
62. I can answer the questions related to CBSL (62).	School innovation	Verbal persuasion
I can decide which methods/techniques can be used in CBSL (63).	Emphasis	Mastery experiences
I am adequately equipped for CBSL (64).	School	Mastery experiences

	innovation	
I can provide students to make associations between preliminary knowledge and life experiences in CBSL (65).	Context handling	Mastery experiences
I enjoy CBSL (66).	Regulation	Psychological conditions
I can design an activity suitable for CBSL (67).	Emphasis	Mastery experiences

Content Validity

Expert opinion has been applied for providing content validity of the draft scale. The draft scale has been examined by three experts in science education who have scale development (U1, U2 and U3) and context-based learning approach studies (U2 and U3), and arrangements have been made in line with feedback from experts. Experts have evaluated the scale for the aspect of characteristics of form, meaning, and content validity. Some examples from expert opinions are presented in Table 3.

Table 3

Examples related to expert opinion

Expert	Item Pool	Expert Recommendation	Arranged Form
U1, U2	I think current subjects can be discussed in CBSL.	*I can declare opinion in discussions related to CBSL.*	I can declare opinion in discussions related to CBSL.
U1, U2	I don't think that using CBSL would help students understand scientific research processes.	U1: *Remove it because it is an item measuring attitude, not self-efficacy.* U2: *It may be removed because it is an item not related to the teacher.*	The item was removed.
U1, U2	I believe in that I can develop myself in the use of CBSL.	U1: *I can develop myself on the use of CBSL.* U2: *On which side can it be developed?*	I can't develop myself for purpose of applying to CBSL.
U1, U2	I believe in that I would provide meaningful learning for students by using CBSL.	U1: *Remove it because it is an item measuring attitude, not self-efficacy.* U2: *This item doesn't measure the academic self-efficacy of a teacher, but focuses on students' self-efficacy.*	The item was removed.
U1	I don't believe that I can share the responsibility of teaching with students by using CBSL.	*Remove it because it is an item measuring attitude, not self-efficacy.*	The item was removed.
U2	I think that making a design suitable for CBSL is difficult.	*There is another item having the same meaning.*	The item was removed.
U2, U3	I cannot create an aim suitable for CBSL.	U2: *Creating gain isn't among the task of the teacher. Adapt this approach to objectives in the program.* U3: *Creating objectives may not be understood by teachers.*	The item was removed.

U1	I can provide students be interested in technical and scientific subjects by developing their interest in a lesson by using CBSL.	*Technique and science may be handled separately. Technology is also a product of science, therefore only the second can also be used.*	I can increase the interest of students in science in CBSL.
U1, U3	I can determine contexts that take the attention of students while using BTFÖ.	U1: *Word of context may not be understood.* U3: *Use another word instead of a word of context.*	I can determine examples of daily living which take the attention of students while using CBSL.
U1, U3	Persuasion and encouragement from others are the greatest factors in the development of my belief about the usability of CBSL.	U1: *Remove it because it is an item measuring attitude, not self-efficacy.* U3: *I take into account the advice of other people in my CBSL implementations.*	I take into account the advice of other people in my CBSL implementations.

Preparing Draft Scale and Administration

The items have been arranged in the light of feedback coming from experts in the field of science education who have studies on scale development and context-based learning approach and have been ranked randomly before the process. Participants aren't influenced by the administration process; the purpose of the study has been mentioned at the beginning of the scale form and explanations related to CBSL haven't been made.

The pilot study has been conducted and the draft scale has been administered to 18 science teachers. Information has been collected from teachers about answering time of scale, understandability of items, and if it is suitable for the teachers. The result has been reached from the opinion of teachers that 67 items were understandable and suitable for teachers and that duration is adequate. The draft scale has been administered to the sample and validity and reliability analyses have been performed by considering data.

Descriptive Analysis

Skewness and kurtosis values have been looked at to understand if scores obtained from answers that science teachers have given to the draft scale showed normal distribution or not. Being skewness and kurtosis values of items between (+2) and (-2) demonstrates that scores were distributed normally (George & Mallery, 2003).

Construct Validity

To provide construct validity, firstly explanatory factor analysis (EFA) and subsequently confirmatory factor analysis (CFA) have been executed. Kaiser Mayer Olkin (KMO) and Barlett Test (Barlett Test of Sphericity) have been examined to execute EFA and to understand if data is distributed normally and to understand if it is studied with an adequate sample. We have considered that the KMO value was above 0,70 and the Barlett test was significant (Kline, 2005; Pallant, 2020; Seçer, 2017). Also, items, having an Eigen-value of more than one, have been determined to determine the number of factors, and we have considered that the factor loading of each item became

at least 0,30 (Seçer, 2017; Turgut & Baykul, 1992). To determine the ideal factor structure, the "direct oblimin" method has been applied. We considered that loading values weren't superposed in the distribution of data in factors as a result of rotation. The higher the variance ratios obtained, the stronger the factor structure of a scale. It is recommended that variance would be above 40% for significant factors (Kline, 2005; Scherer et al., 1988). Also, factor names have been given by considering the items. If factor structure appeared as a result of EFA analysis is suitable has been checked by using CFA. Although it was recommended that the sample be divided into two randomly and EFA and CFA be applied to different samples, it is expressed that making analyses on a single sample wouldn't cause any problem. (Worthington & Whittaker, 2006). Doğan et al. (2017) have indicated that results obtained when EFA and CFA were performed with the same sample and results obtained when it was applied to different halves of a sample were similar. For this purpose, both EFA and CFA have been applied to the data of a group of 433 persons, and afterward, the sample group has been divided into two randomly as 200-233 persons, and EFA has been applied to the data of the group of 233 persons and CFA has been applied on data of the group of 200 persons. Results obtained in both situations have been compared. The suitability of the model has been evaluated by taking criteria of RMSEA, CFI, GFI, and chi-square as a measure in CFA. While EFA has been tested by SPSS 25.0 program, LISRELL 8.7 program has been used for applying CFA.

Criterion Validity

Another method for providing validity is to make a criterion validity study. Criterion validity is that item scores show similarity with another measuring tool, which we think has characteristics that item measures (Büyüköztürk et al., 2021). In this study, the method of parallel forms has been used for providing criterion validity and "teachers' self-efficacy belief scale towards applying structuring approach" with a correlation coefficient of 0.92 developed by Eskici and Özen (2018) used within this context. The reason for choosing this scale is that it is a scale measuring self-efficacy of teachers towards an approach similar to the draft scale. The criterion scale has been obtained with items measuring the same gains compared to the draft scale by removing items that measure different gains in the criterion scale. After applying both scales to participants in the sample, correlation coefficients between scores obtained from the criterion scale have been obtained with item scores measuring the same gains compared to the draft scale by removing items that measure different gains in the criterion scale. While looking at correlation coefficients, we have aimed to determine the correlation between the scale scores (Pallant, 2017). Being the correlation between the draft scale and the criterion scale between 0.70-0.90 as an absolute value has been defined as high, being between 0.69-0.30 has been defined as moderate, and being between 0.30-0.01 has been defined as a low level of relationship (Büyüköztürk et al., 2021).

Reliability of Draft Scale Scores

In this study, Cronbach alpha internal correlation coefficient, reliability coefficient belonging to sub-factors, and corrected total item score correlation values have been looked for to calculate the reliability of the draft scale. When Cronbach's alpha value is above 0.70, it can be told that the reliability of the scores is high (Pallant, 2020). To describe the relationship between the score of any item and the total score of

test items, corrected total item score correlation is utilized. Being this value high and positive shows that the scale has internal consistency (Pallant, 2020).

Ethical Procedures

The pilot application of the scale was carried out by obtaining an 'Ethics Committee Permission Certificate' from Erciyes University Social and Human Sciences Scientific Research and Publication Ethics Committee and 'MEB Research Permit' from the Provincial Directorate of National Education where the application will be carried out. Following the permissions, the application was started by obtaining informed consent from the participants.

Results

Descriptive Analysis of the Draft Scale

We have examined if item scores showed a normal distribution. Skewness and kurtosis values have been examined within this context.

Table 4

Skewness and kurtosis values of draft scale items

Item No	Skewness	Kurtosis	Item No	Skewness	Kurtosis	Item No	Skewness	Kurtosis
M1	-1.07	0.35	M22	-1.28	0.43	M47	-1.07	0.03
M2	1.11	2.92	M23	-1.34	0.59	M48	-1	-0.17
M3	-0.89	0.03	M25	-0.80	-0.44	M49	-1	-0.15
M4	-0.84	-0.06	M27	-0.35	-0.79	M50	-0.67	-0.65
M6	-0.81	-0.56	M30	-0.81	-0.55	M51	-0.85	-0.55
M7	-1	-0.31	M31	-1.45	2.32	M52	-1.15	0.30
M8	-0.48	4.44	M33	-0.62	-0.67	M53	-1.07	-0.36
M9	-0.91	-0.26	M34	-0.86	-0.50	M54	-1.27	0.21
M10	-0.97	-0.1	M35	0.18	0.93	M55	-0.96	-0.36
M11	-0.85	-0.59	M36	-0.53	-0.72	M56	-1.26	0.48
M12	0.2	0.92	M38	-0.78	-0.71	M58	-0.27	-0.69
M13	-0.83	-0.41	M40	-0.71	-0.62	M61	-0.98	-0.17
M15	-0.81	-0.46	M41	-0.92	-0.32	M63	-0.72	-0.54
M17	-0.71	-0.78	M43	-0.50	-0.85	M65	-0.94	-0.19
M19	-0.34	-0.67	M45	-1.05	-0.07	M67	-0.07	-0.34
M20	-0.91	-0.26	M46	-0.77	-0.82			

Table 4 indicates that skewness and kurtosis values have occurred between +2 and -2 (Pallant, 2020). Therefore, it can be said that item scores showed a normal distribution.

Construct Validity

Explanatory factor analysis applied to the same sample group

EFA has been executed four times to determine factors of items in the draft scale. To determine the suitability of data for factor analysis, KMO and Barlett tests have been considered (Table 5). The result of the Barlett test demonstrates that item scores showed a normal distribution. KMO value was found as 0.973. Therefore, the selected sample size is adequate for determining factors (Pallant, 2020).

Table 5

KMO and Bartlett Test Value According to First-Factor Analysis

Kaiser-Meyer-Olkin Sample Adequacy.		.973
Bartlett Sphericity Test	Approximate Chi-Square	20126.090
	df	1431
	Significance Value	.000

The extraction values of 67 items have been looked at as a result of first-factor analysis and values have been presented in Table 6. Extraction values are above 0.30, and there is no need to exclude any item from the scale (Pallant, 2020).

Table 6

Extraction Values of Items in Draft Scale According to First-Factor Analysis

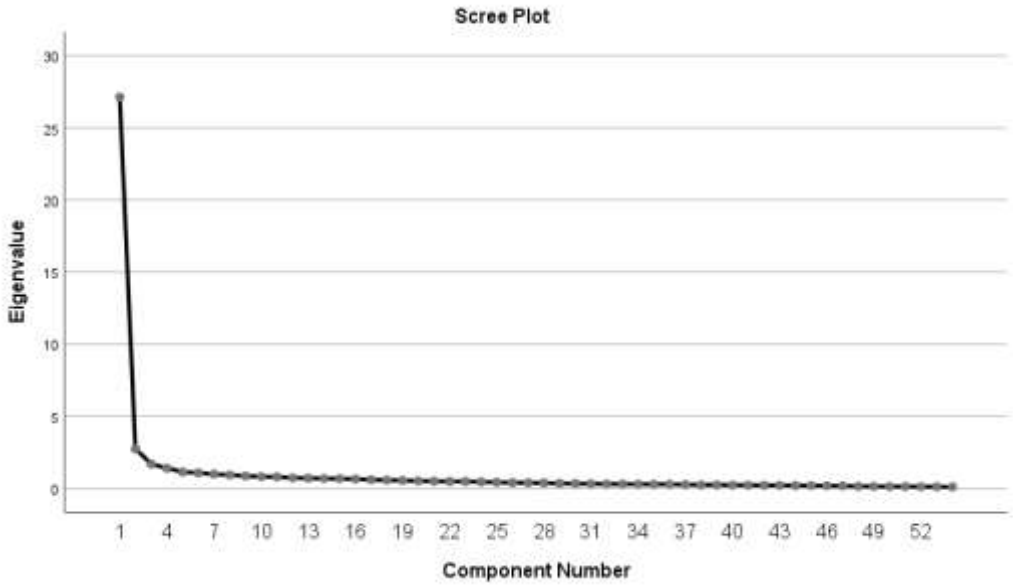
Item No	Extraction	Item No	Extraction	Item No	Extraction
M1	0.83	M24	0.54	M47	0.74
M2	0.52	M25	0.54	M48	0.74
M3	0.82	M26	0.63	M49	0.82
M4	0.77	M27	0.59	M50	0.72
M5	0.78	M28	0.53	M51	0.80
M6	0.74	M29	0.42	M52	0.77
M7	0.70	M30	0.77	M53	0.63
M8	0.59	M31	0.61	M54	0.61
M9	0.57	M32	0.54	M55	0.79
M10	0.77	M33	0.63	M56	0.74
M11	0.74	M34	0.75	M57	0.74
M12	0.66	M35	0.74	M58	0.64
M13	0.66	M36	0.63	M59	0.66
M14	0.57	M37	0.69	M60	0.52

M15	0.75	M38	0.80	M61	0.78
M16	0.55	M39	0.56	M62	0.72
M17	0.70	M40	0.66	M63	0.64
M18	0.57	M41	0.74	M64	0.65
M19	0.48	M42	0.44	M65	0.79
M20	0.74	M43	0.64	M66	0.60
M21	0.50	M44	0.60	M67	0.55
M22	0.64	M45	0.68		
M23	0.60	M46	0.73		

Nine factors have been found as a result of the first-factor analysis. These nine factors meet 66.15% of the explained variance. If an item is loaded under more than one factor and the factor load difference of that item in these two factors is less than 0.10, it means that the item will be overlapped (Pallant, 2020). Therefore, 13 different items that overlapped first-factor analysis have been excluded from the analysis and factor analysis has been repeated for a second time. Six different items that overlapped in the second-factor analysis have been excluded from the analysis. To determine the number of factors as a result of the second-factor analysis, the Scree Plot graph has been examined. The slope accumulation curve of items after the second-factor analysis has been given in Figure 1. Each space between two points starting from the point where the inclining trend was seen means a factor (Çokluk et al., 2010).

Figure 1

Scree Plot Graph According to Second-Factor Analysis



A breakpoint is seen between 0-5 according to Figure 1. This situation shows that the number of factors is less than five. The number of factors was limited to four and a third-factor analysis was performed again. and one more item showing overlapping has also been excluded from the draft scale, and factor analysis has been

conducted on the draft scale of a total of 47 items for the fourth time. Explained variance values of the four-factor scale have been given in Table 7.

Table 7

Explained Variance Values of Factors in Draft Scale

Factor	Characteristic Value	Variance Percent	Total Variance Percent
1st Factor	25.57	54.41	54.41
2nd Factor	1.80	3.84	58.25
3rd Factor	1.61	3.42	61.67
4th Factor	1.37	2.92	64.59

Table 7 states that 47 items have been collected under four factors having an Eigenvalue of greater than 1 (Pallant, 2020). The total variance value related to the four-factor scale is 64.59%. Being total variance ratio owned by the scale between 40% and 60% is an indication that the factor structure was powerful (Scherer et al., 1988; Kline, 2005). Items collected under four factors and their load values have been presented in Table 8.

Table 8

Items and Their Load Values

Item No	Item	Load Values of Factors			
		1st Factor	2nd Factor	3rd Factor	4th Factor
49	I can develop the communication skills of students in CBSL.	1.00			
52	I can provide an increase of self-confidence of students in CBSL.	0.96			
56	I can make guidance for students in CBSL.	0.91			
48	I can reach the targets of the lesson in CBSL.	0.90			
61	I can provide meaningful learning for students in CBSL.	0.88			
65	I can provide students can make an association between their preliminary knowledge and life experiences in CBSL.	0.86			
10	I may not provide students to put forward their own opinions in CBSL.	0.83			
47	I can increase the curiosity of students towards lessons in CBSL.	0.83			
11	I constrain in developing social skills of students in CBSL.	0.79			
7	I can provide students need the subject they will learn in CBSL.	0.79			
55	I can get students to make applications where they can use	0.78			

	their preliminary knowledge in CBSL.				
20	I cannot increase the interest of students towards the lessen CBSL.	0.78			
51	I constrain in using materials in CBSL.	0.78			
41	I can provide students can solve problems of daily living in CBSL.	0.77			
6	I may not create an environment for cooperative studies of students in CBSL.	0.75			
15	I can provide students to structure their knowledge in CBSL.	0.75			
34	I can increase the motivation of students in CBSL.	0.74			
22	I can use an example selected from daily life in CBSL while starting a lesson.	0.70			
30	I can provide students would apply the knowledge gained in CBSL to a new situation.	0.69			
38	I can solve problems that may be faced in CBSL applications.	0.67			
23	I can write context-based questions.	0.67			
53	I can increase the interest of students in science in CBSL.	0.66			
46	I can apply CBSL in a classroom environment.	0.64			
45	I can develop the cognitive skills of students in CBSL.	0.59			
54	I can develop the sensory skills of students in CBSL.	0.59			
33	I can develop the self-management skills of students in CBSL.	0.44			
50	I constrain in making evaluations in CBSL.	0.43			
13	I can share my teaching responsibility with students through CBSL.	0.43			
58	I can use time effectively in CBSL.	0.42			
31	I can manage the learning process effectively in CBSL.	0.38			
12	I can perform CBSL more effectively by examining sample applications.		0.74		
35	I get excited in CBSL.		0.70		
8	I can perform my CBSL applications more effectively with my previous experiences.		0.45		
2	I can declare opinion in discussions related to CBSL.			0.81	
4	I can help my colleagues in CBSL.			0.70	
3	I constrain in time management in CBSL.			0.67	
1	I have adequate academic knowledge of context-based science education.			0.66	
27	I can prepare a lesson plan suitable for CBSL.				0.73
40	I can decide for which gains CBSL can be used.				0.57

43	I would be happy to have a task in project studies related to CBSL.	0.54
36	I can give examples from daily life in CBSL.	0.52
9	I can prepare a measuring tool consisting of context-based questions.	0.52
25	I can determine examples of daily living suitable for the level of a student in CBSL.	0.52
19	I can choose materials that can be used in CBSL.	0.51
17	I can determine examples of daily living which attract the interest of students in CBSL.	0.45
67	I can design activities suitable for CBSL.	0.36
63	I can decide which method/techniques can be used in CBSL.	0.34

Table 8 displays those 30 items that have been collected under the first factor. Similarly, three items under the second factor, four items under the third factor, and 10 items under the fourth factor have been grouped. While naming factors, the semantic suitability of the content of items included under factors is considered (Çakır, 2014). When the first factor is examined, we have seen that it contains items expressing the self-efficacies of teachers towards applying the CBL in the process of learning-teaching. Therefore, the first factor has been named as "Teaching-Learning Process". Because expressions related to self-efficacy resources from which teachers are influenced in the second factor, we have named "Self-adequacy Resources". Expressions related to academic adequacy of teachers towards the CBL approach are included in the third factor, which we have named "Academical Self-efficacy". Items related to the self-efficacy of teachers in planning education are included in the fourth factor, which we have named "Planning Education".

Explanatory factor analysis applied to different sample groups

After EFA and CFA have been run on the same sample, the sample group of 433 persons has been randomly divided into two groups of 200-233 participants. EFA has been run on data from the group of 233 persons and CFA has been conducted on data from 200 persons. EFA has been executed four times to determine factors in the draft scale. KMO value and Barlett test results have been presented in Table 9. KMO value found as 0.91 as a result of the analysis demonstrate that the selected sample size is adequate for determining factors.

Table 9

KMO Value and Bartlett Test for The First-Factor Analysis in The Different Samples

Kaiser-Meyer-Olkin Sample Adequacy.		.906
Bartlett Globality Test	Approximate Chi-Square	16076.68
	Df	2211
	Significance Value	.000

The extraction values of 67 items have been presented in Table 10. The extraction values are above 0.30 (Pallant, 2020).

Table 10

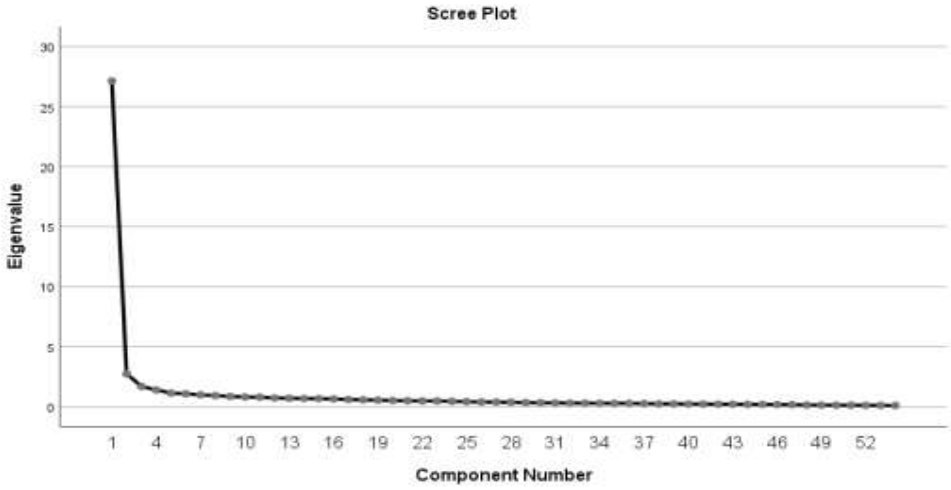
Extraction Values According to First-Factor Analysis in the Different Samples

Item No	Extraction	Item No	Extraction	Item No	Extraction
M1	0.82	M24	0.68	M47	0.83
M2	0.66	M25	0.72	M48	0.76
M3	0.72	M26	0.75	M49	0.89
M4	0.79	M27	0.74	M50	0.76
M5	0.61	M28	0.74	M51	0.84
M6	0.89	M29	0.64	M52	0.78
M7	0.75	M30	0.84	M53	0.76
M8	0.59	M31	0.66	M54	0.76
M9	0.73	M32	0.66	M55	0.88
M10	0.83	M33	0.84	M56	0.76
M11	0.81	M34	0.69	M57	0.76
M12	0.78	M35	0.63	M58	0.81
M13	0.75	M36	0.69	M59	0.81
M14	0.69	M37	0.86	M60	0.61
M15	0.84	M38	0.69	M61	0.88
M16	0.76	M39	0.69	M62	0.77
M17	0.75	M40	0.71	M63	0.77
M18	0.79	M41	0.86	M64	0.77
M19	0.62	M42	0.79	M65	0.81
M20	0.86	M43	0.79	M66	0.54
M21	0.57	M44	0.81	M67	0.47
M22	0.77	M45	0.79		
M23	0.74	M46	0.85		

We have found 14 factors as a result of the first analysis. These 14 factors meet 75.05% of the variance. Twelve different items that overlapped in the first-factor analysis have been excluded from the analysis and factor analysis has been repeated for the second time. Five different items that overlapped in the second-factor analysis have been excluded from the analysis. Scree Plot graphs have been looked at as a result of the second-factor analysis to determine the number of factors.

Figure 2

Scree Plot Graph According to Second-Factor Analysis



The slope accumulation curve of items after the second-factor analysis has been given in Figure 2. The breakpoint is seen between 0-5 according to Figure 2. This situation demonstrates that the number of factors was less than five. The number of factors has been limited to four and factor analysis has been run again for the third time. Three items showing overlapping have been excluded from the draft scale and factor analysis has been run to the draft scale of a total of 47 items. The explained variance values of the four-factor scale have been performed in Table 11.

Table 11

Explained Variance Values in Draft Scale for Different Sample

Factor	Characteristic Value	Variance Percent	Total Variance Percent
1st Factor	25.69	54.66	54.66
2nd Factor	1.76	3.75	58.41
3rd Factor	1.58	3.37	61.77
4th Factor	1.44	3.07	64.85

When Table 11 is examined, we have seen that 47 items have accumulated under four factors having the Eigenvalue of greater than 1 (Pallant, 2020). The total variance value related to the four-factor scale is 64.85%. Scale items collected under four factors and their load values have been given in Table 12.

Table 12

Items Located under Factors and Their Loading Values

Item No	Item	Load Values of Factors			
		1st Factor	2nd Factor	3rd Factor	4th Factor
49	I can develop the communication skills of students in CBSL.	0.79			
52	I can provide an increase self-confidence of students in CBSL.	0.82			
56	I can make guidance for students in CBSL.	0.85			
48	I can reach the targets of the lesson in CBSL.	0.88			
61	I can provide meaningful learning for students in CBSL.	0.87			
65	I can provide students can make an association between their preliminary knowledge and life experiences in CBSL.	0.86			
10	I may not provide students to put forward their own opinions in CBSL.	0.83			
47	I can increase the curiosity of students towards lessons in CBSL.	0.91			
11	I constrain in developing social skills of students in CBSL.	0.90			
7	I can provide students need the subject they will learn in CBSL.	0.88			
55	I can get students to make applications where they can use their preliminary knowledge in CBSL.	0.83			
20	I cannot increase the interest of students towards the lessen CBSL.	0.88			
51	I constrain in using materials in CBSL.	0.83			
41	I can provide students can solve problems of daily living in CBSL.	0.87			
6	I may not create an environment for cooperative studies of students in CBSL.	0.81			
15	I can provide students to structure their knowledge in CBSL.	0.90			

34	I can increase the motivation of students in CBSL.	0.89			
22	I can use an example selected from daily life in CBSL while starting a lesson.	0.67			
30	I can provide students would apply the knowledge gained in CBSL to a new situation.	0.81			
38	I can produce solutions for problems that may be faced in CBSL applications.	0.83			
23	I can write context-based questions.	0.82			
53	I can increase the interest of students in science in CBSL.	0.76			
46	I can apply CBSL in a classroom environment.	0.72			
45	I can develop the cognitive skills of students in CBSL.	0.81			
54	I can develop the sensory skills of students in CBSL.	0.69			
33	I can develop the self-management skills of students in CBSL.	0.46			
50	I constrain in making evaluations in CBSL.	0.60			
13	I can share my teaching responsibility with students through CBSL.	0.79			
58	I can use time effectively in CBSL.	0.82			
31	I can manage the learning process effectively in CBSL.	0.85			
12	I can perform CBSL more effectively by examining sample applications.		0.46		
35	I get excited in CBSL.		0.71		
8	I can perform my BTFÖ applications more effectively with my previous experiences.		0.45		
2	I can declare opinion in discussions related to CBSL.			0.633	
4	I can help my colleagues in CBSL.			0.67	
3	I constrain in time management in CBSL.			0.63	
1	I have adequate academic knowledge of context-based science education.			0.72	
27	I can prepare a lesson plan suitable for CBSL.				0.56
40	I can decide for which gains CBSL can be used.				0.65
43	I would be happy to have a task in project studies related to CBSL.				0.61
36	I can give examples from daily life in CBSL.				0.67

9	I can prepare a measuring tool consisting of context-based questions.	0.67
25	I can determine examples of daily living suitable for the level of a student in CBSL.	0.66
19	I can choose materials that can be used in CBSL.	0.51
17	I can determine examples of daily living which attract the interest of students in CBSL.	0.70
67	I can design activities suitable for CBSL.	0.46
63	I can decide which method/techniques can be used in CBSL.	0.52

Table 12 indicates that 30 items have been collected under the first factor. Also, three-item under the second factor, four items under the third factor, and 10 items under the fourth factor have been grouped. We have seen results of EFA performed with both sample groups are close to each other.

Confirmative Factor Analysis Applied to Data of the Same and Different Sample Groups

CFA has been conducted on data of the same and different sample groups. Firstly, the results of the chi-square test have been looked at. The value of 3.284 has been obtained for data of the same sample when the chi-square value (3222.58) was divided by the df value (981), which is the degree of freedom, and the value of 2.210 has been obtained for data of the different sample when chi-square value (2272.60) was divided by the df value (1028), which is the degree of freedom. If the obtained value is five or below, the structure is acceptable (Hooper & Mullen, 2008; Şimşek, 2007). Therefore, it can be said that obtained values are acceptable for the analysis. Also, RMSEA values (0.073 in the same sample and 0.078 in the different sample) below 0.080 demonstrate that the determined model is within the acceptable limit (Seçer, 2017). CFA models applied to data of the same and different samples have been given in Figure 3a and Figure 3b.

Figure 3a

CFA Model of the Same Sample Data

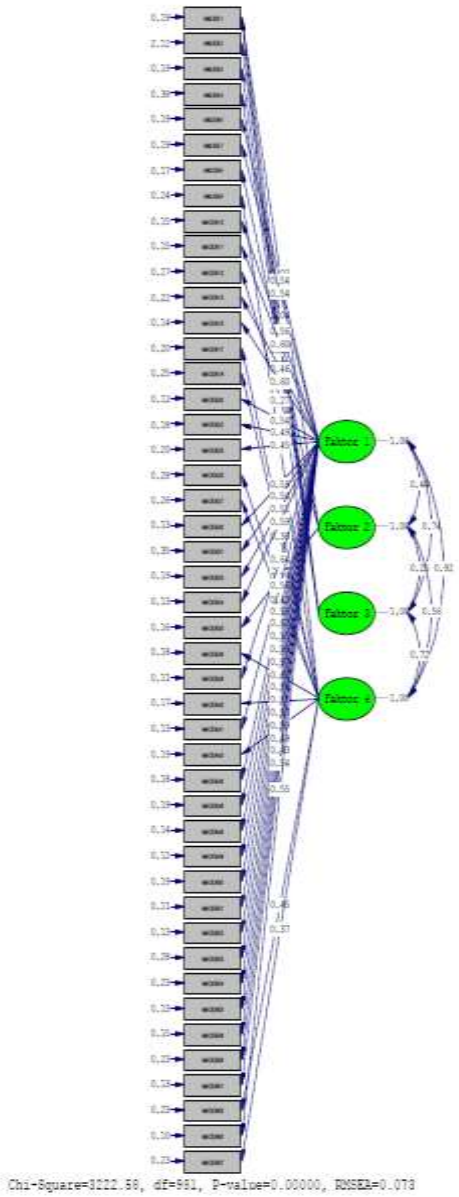
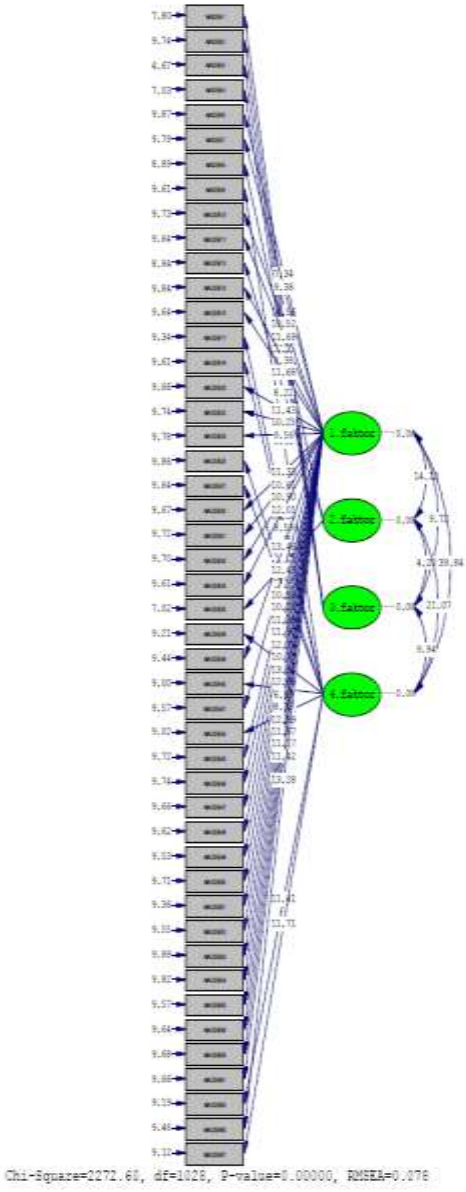


Figure 3b

CFA Model of Different Sample



Model fit indices for data of the same and different samples to confirm the four-factor structure have been indicated in Table 13.

Table 13

Correlation Values Obtained as a Result of CFA

DFA Results	*χ2*	*Sd*	*χ2/sd*	*RMSEA*	*GFI*	*CFI*	*IFI*
Same sample	3222.58	981	3.284	0.073	0.76	0.98	0.98
Different sample	2272.60	1028	2.210	0.078	0.70	0.97	0.97

The values of GFI (The goodness of fit index) are 0.76 and 0.70. This value above 0.70 shows the applicability of the determined model (Durkan, 2017). For this

reason, the GFI values of the study are within the acceptable range. Being CFI and IFI values above 0.95 for both analyses mean that correlation between data of the factor model is perfect (Sümer, 2000; Bentler, 1990). The data of the same and different samples have been confirmed, and a draft scale having a structure of 47 items and four factors has been developed.

Criterion Validity

To provide criterion validity of the draft scale, the relationship between the draft scale and the criterion scale has been considered. For this aim, the criterion scale has been performed on 100 participants. The correlation has been calculated by the Pearson test and has been shown in Table 14.

Table 14

Results of Correlation Coefficient between Draft Scale and Criterion Scale

Scale	Correlation	Draft	Criterion
Draft	Pearson Correlation	1.000	.862**
	Significance Value	.	.000
	Number of Persons	100	100
Criterion	Pearson Correlation	.862**	1.000
	Significance Value	.000	.
	Number of Persons	100	100

**Correlation is significant at 0.01 level.

The correlation coefficient between the draft scale and the criterion scale has been found as 0.86. This value shows that the draft scale provided criterion validity.

Reliability

Cronbach Alpha reliability coefficient has been calculated after providing construct validity and we have found α =0.98. When the total correlation of items belonging to each item in the draft scale was examined, we have seen that each item has a positive value between 0.31 and 0.84 and close to one. This situation means that the internal consistency of items is high (Büyüköztürk et al., 2021). Besides, the reliability coefficient belonging to each factor has been calculated and the results have been presented in Table 15.

Table 15

Reliability Coefficients of Factors

Factors	Cronbach Alpha Coefficient
1st Factor: Learning/Teaching Process	0.98
2nd Factor: Self-adequacy Resources	0.70
3rd Factor: Academical Self-adequacy	0.82
4th Factor: Planning Education	0.91

Table 15 displays that the reliability coefficient of each factor is above 0.70. For this reason, it can be told that the scores obtained from the draft scale are reliable (Pallant, 2020).

Discussion and Conclusion

A valid and reliable scale has been developed in this study to determine the self-efficacies of science teachers toward CBL.

Discussion on Validity

Content, construct, and criterion validities have been controlled for the validity study of the draft scale. Expert opinion has been obtained for content validity. The route used in many investigations in which context validity study has been made in the scale development process in the literature (Biçer et al., 2018; Bolat et al., 2021; Candaş & Özmen, 2020; Davis, 1992; Gözüm & Güneş. 2018; Ocak & Hocaoğlu, 2020) has been followed in the current research. A group of field experts has evaluated items. In this direction. some items have been extracted and revisions have been made for some items. It can be said that the content validity of the current study is high by taking feedback into account.

EFA and CFA have been applied to provide construct validity. KMO value and Barlett test results have been looked at to determine the suitability of the current study for factor analysis. Similar studies are performing a factor analysis in the literature (Buldur & Alisinanoğlu, 2020; İnaltekin & Saka, 2019; Kurnaz & Bayraktar, 2012; Yıldırım, 2015; Tepe et al., 2020). In the light of these studies, being KMO value of the sample group of 433 as 0.973, and being KMO value of the sample group of 233 as 0.906 may be the proof that the study is suitable for factor analysis in both situations (Bryman & Cramer, 1999; Şeker et al., 2004). As a result of EFA, the explained variance value of the scale has been calculated as 64% for the same sample and 65% for a different sample. According to Henson and Roberts (2006), values of 52% and above should be provided for variance in scale studies. Therefore, this variance value declared is at an acceptable level. There should be a minimum of two acceptable items in each factor in factor analysis. The more there are items under each factor the higher reliability of the scale and the explaining capability of factors (Seçer, 2017). In the EFA applied on both the same sample and the different sample, 30 items under the first factor, three factors under the second factor, four items under the third factor, and 13 items under the fourth factor demonstrate that factors of the scale are acceptable. CFA has been performed for each group separately both on the same group and a different

group for confirmation of four factors. Factors have been confirmed for both situations and obtained results were similar. There are discussions related to the use of the same sample for CFA in the literature. Worthington and Whittaker (2006) have suggested that data structure would be put forward experimentally when AFA and DFA are performed on the same sample. But, Fabrigar et al. (1999) have recommended that samples would be divided into two randomly and AFA would be made in one and DFA in the other. Analyses containing both applications have been made in the current research. and similar results have been found. Therefore, it can be said that different sample groups aren't compulsory for AFA and DFA and that each item and factor in the scale has a feature of the ability to measure the desired character within the context of the scale. This situation has a quality to confirm that results of EFA and CFA made with the same sample and results obtained when they are applied to different halves of a sample were similar in the study of Doğan et al. (2017).

To determine the criterion validity of the scale, a scale developed by Eskici & Özen (2013) and measuring similar adequacies in this research has been used. The correlation between items included in the two scales has been looked at for criterion validity. The result that the current scale has provided criterion validity has been reached by finding the value of the Pearson correlation coefficient as 0.862. This result may result from that the scale selected as a criterion is a scale measuring the adequacy of teachers on BTÖ, which is a scale measuring the adequacy of teachers about structuring approach and which is a social structuring approach of the scale within the context of the study. The status of both scales measuring similar characteristics proves that criterion validity was high. Although there are researches in which criterion validity studies were made in the literature (Ergün, 2021; Güçer et al., 2020; Keçe et al., 2020; Varinlioğlu & Bektaş; 2020), it seems that they are in a limited number. However, Cureton (1951) has put forward that validity, expressed as the degree of the scale for serving its purpose, can be determined by criterion validity most suitably. Shepard (1993) has expressed that criterion validity is an important type of validity for diagnostic and evaluation decisions in case a correlation appears especially between scale performance in practice and aimed criterion. For this reason, performing a criterion validity study and being criterion validity provided by the study may prove that the developed scale validity was high.

Discussion on Reliability

Cronbach Alpha coefficient has been calculated as 0.98 for the whole of the scale and calculated as 0.98, 0.70, 0.82, and 0.91 for each factor, respectively. Because calculated values are 0.70 and above, which is the acceptable reliability coefficient in scales (Anastasi, 1982; Büyüköztürk, 2020), it can be told that scores obtained from the scale are reliable. When item-total correlation was examined for each item, it has been seen that values were between 0.31 and 0.84. When item-total correlation was examined, it can be told that items in the scale were consistent with each other because having scores of 0.20 and above means that they were consistent and made a positive contribution to reliability (Büyüköztürk, 2020). When scale development and adaptation studies are examined, similar methods have been met for determining reliability in almost all studies (Aka, 2016; Biçer et al., 2018; Demirci, 2017; Günşen & Uyanık, 2020; Kurnaz & Bayraktar, 2012; Ocak & Hocaoğlu, 2021; Özlü et al., 2013). It is seen

that Cronbach Alpha internal correlation coefficients were calculated above 0.70, and item-total correlation values were positive, and they are values close to one in the present study as in the mentioned studies. This status may be sourced from that context validity was provided by a literature survey and expert opinions while creating items of the scale. Creating items of a quality, which can sample the subject content of the scale in a balanced way and which provides context validity increases validity and reliability of measuring results (Ercan & Kan, 2004).

The scale contains items including the whole of context-based education efficacies (context use, arranging learning process, education emphasis, material usage, and leadership for innovation) and the whole of resources of teacher self-efficacy (direct experiences, indirect livings, verbal persuasion, psychological situations) (Bandura, 1984; De Putter-Smits et al., 2012). We have seen that items include adequate context selection suitable for students and how they will be used. subject selection suitable for the context (context usage), encouraging students for active learning, students' having their responsibility of learning and being teacher in a guide position (arranging learning process), combining knowledge with science-technology-public instead of describing only science subjects in lessons (emphasizing education) and self-efficacy resources (verbal persuasion, direct experiences and indirect livings) were collected under the first factor, "Learning/Teaching Process". This situation has a feature to explain why thirty items were collected under the first factor. According to Gilbert (2006), it is expected from teachers to create suitable learning environments for the learning process would be effective. Also, Bandura (1994) has expressed that the key to the teaching and learning process being successful is the belief of the teacher towards his/her influence on the success of students and towards his/her adequacy in teaching. Moving from there, we have stated that the first factor includes items that can measure the self-efficacies of the teaching/learning process of science teachers toward CBL.

We have seen items expressing three (direct experiences. indirect living and psychological situations) of four basic resources influencing self-efficacy belief suggested by Bandura (1984) have been collected under the second factor named "Self-efficacy Resources". Although this situation seems like a limitation, a factor should consist of at least three items and factor loads should also be high so that a factor can be stable (Ford et al., 1986; Hogarthy et al., 2005; Maccallum et al., 1999). Also, it is accepted that internal correlation coefficients of 0.70 and above is the adequate level for the reliability of internal correlation coefficients (Pallant, 2020). Therefore. it can be said that the second factor is reliable and highly valid and contained items that can measure the self-efficacy resources of science teachers towards CBL. In addition, the remaining three items in the second factor may be sourced from the latest items that were excluded from the scale and excluded items are the items included by this factor when items were mixed and applied to the sample group. Though an increasing number of questions increases the sensitivity of the scale, it may cause mixing of errors in measuring tools because it would influence situations such as tiredness, boredom, inability to catch time, etc. (Baştürk, 2018).

Teachers applying a context-based learning approach should know the approach and should have adequacy for sharing the knowledge they have (leadership for innovation) (De Putter- Smits, 2012). It is seen that the items related to this dimension of adequacy and two self-efficacy resources (direct experiences and verbal persuasion)

were collected under the third factor named "Academical Self-efficacy". Being a person's self-efficacy belief high supports that he/she would be consistent and strong against difficulties as well as the increase in moral level, making cognitive decisions (Bandura, 1997; Pajares, 2002). For this reason, it can be said that the inclusion of the third factor including items that measure the academic self-efficacy of teachers is important.

According to Berns & Erickson (2001), teachers should plan lessons to be suitable for the developmental level of students, their social and cultural environment, and their psychological development in BTFÖ, and they should consider this criteria. It is seen that items including their adequacies of material prepared according to the needs of the class and material update when necessary (material arrangement) and two self-efficacy resources (direct experiences and indirect living) have been collected under the fourth factor named "Planning Education". It can be indicated that the fourth factor is also important and required for the self-efficacy scale for containing items measuring the self-efficacy of planning education in context-based learning by starting the road from the definition of self-efficacy by Bandura (1986) as the belief of a person towards the ability to plan the required activities and processes successfully.

Conclusion

Consequently, we have said that the developed self-efficacy scale can be used to determine the self-efficacy of science teachers in context-based learning and that it is a valid and reliable tool at the same time.

Recommendations

A scale, confidence of which has been proven, can be used for measuring the self-efficacy of science teachers towards a context-based learning approach.

Depending on the limitations of the research conducted, the following suggestions are offered:

- The study has been performed only with teachers located in Kayseri province. Studies can be conducted with a different province and larger sample.
- The study can also be conducted with teachers in different branches apart from science teachers.

Depending on the findings of the research conducted, the following suggestion is offered:

- Having a small number of items under the factor of "Self-efficacy Resources" in the scale may cause remaining inadequate in measuring related characteristics. Therefore, a scale study may be conducted by expanding resources from which teacher self-efficacy is influenced.

Acknowledgements

Our study was not supported by any institution, organization or person.

Statement of Responsibility

Büşra Arık Güngör and Oktay Bektaş in conceptualization, design, data collection, analysis, and literature review; Sibel Saraçoğlu in supervision, data analysis, and critical review. All authors participated in writing and critical review.

Conflicts of Interest

The authors have no conflict of interest to disclose.

Author Bios:

Büşra ARIK GÜNGÖR is a science teacher at the Measurement and Evaluation Center of the Ministry of National Education. His current research interests are science education, context-based learning, and measurement and evaluation in education.

Oktay BEKTAŞ is a Professor in the Department of Mathematics and Science Education at Erciyes University. His current research areas are social sciences and humanities, education, science education, chemistry education, secondary school science and mathematics teaching.

Sibel SARAÇOĞLU works as a Professor in the Department of Mathematics and Science Education at Erciyes University. Current research areas are chemistry, analytical chemistry, separation techniques, chromatography, spectroscopic methods, basic sciences.

References

Aka, E.İ. (2016). An investigation into prospective science teachers' attitudes towards laboratory courses and self-efficacy beliefs in laboratory use. *International Journal of Environmental and Science Education, 11*(10), 3319-3331. https://files.eric.ed.gov/fulltext/EJ1114664.pdf accessed from the page.

Anastasi, A. (1982). *Psychological Testing.* Mac Millan Publishing Co. Inc.

Arık Güngör, B., Metin, M., & Saraçoglu, S. (2022). Perspective of teachers to context-based learning and its use in science education. *Canadian Journal of Science, Mathematics and Technology Education, 23*(1), 27-47.

Ayas, A., Çepni, S., Akdeniz, A.R., Özmen. H., Yiğit, N. & Ayvacı, H.Ş. (2007). Science and technology teaching from theory to practice. S. Çepni (Ed.). (6th ed.). Pegem A Publishing.

Ayvacı, H. (2010). A pilot survey to improve the use of scientific process skills of kindergarten children. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, 4*(2), 1-24.

Bandura, A. (1984). Recycling misconceptions about perceived self-efficacy. *Cognitive Therapy and Research, 8*(3), 231-255. https://doi.org/10.1007/BF01172995

Bahtaji, M. A. A. (2015). Improving transfer of learning through designed context-based instructional materials. *European Journal of Science and Mathematics Education, 3*(3), 265-274. https://doi.org/10.30935/scimath/9436

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs. NJ: Prentice-Hall.

Bandura, A. (1994). Self-sufficiency. In VS Ramachaudran (Ed.). Encyclopedia of Human Behavior (Vol. 4. pp. 71-81). New York: Academic Press. (Reprinted in H. Friedman (Ed.). Encyclopedia of mental Health. San Diego: Academic Press. 1998).

Bandura, A. (1997). Self-Efficacy: The exercise of control. W. H. Freeman and Company

Bandura, A. (2018). Toward a psychology of human agency: Pathways and reflections. *Perspectives on Psychological Science, 13*(2), 130–136. https://doi.org/10.1177/174569617699280

Baştürk, S. (2018). *Measurement and evaluation in education* (2nd ed.). Nobel Publications

Bennett, J. & Lubben, F. (2006). Context-based chemistry: The Salters approach. *International Journal of Science Education, 28*(9), 999-1015. https://doi.org/10.1080/09500690600702496

Bentler, P.M. (1990). Comparative fit indexes in structural models. *Psychol Bull, 107*(2), 238-246.

Berns, R.G. & Erickson, P.M. (2001). Contextual teaching and learning: preparing students for the new economy. *Highlight Zone Research, 5*, 1–8. https://files.eric.ed.gov/fulltext/ED452376.pdf accessed from the page.

Bıkmaz, H.F. (2002). Self-efficacy belief scale in science teaching. *Journal of Educational Sciences and Practice, 1*(2), 197-210.

Biçer, B.G., Uzoğlu, M. & Bozdoğan, A.E. (2018). Scale development study for determining the views of science teachers about STEM. *OPUS International Journal of Society Studies, 9*(16), 551-574. https://doi.org/10.26466/opus.461791

Bolat, A., Korkmaz, Ö. & Karamustafaoğlu, S. (2021). Question development self-efficacy scale measuring high-level learning level of science teachers: validity and reliability. *Journal of Ahi Evran University Kırsehir Education Faculty, 22*(1), 372-416. https://doi.org 10.29299/kefad.800889

Bong, M. (2001). Role of self-efficacy and task-value in predicting college students' course performance and future enrollment intentions. *Contemporary Educational Psychology, 26*(4), 553–570. http://doi.org/10.1006/ceps.2000.1048

Broman, K., Bernholt, S. & Christensson, C. (2020). Relevant or interesting according to upper secondary students? Affective aspects of context-based chemistry problems. *Research in Science & Technological Education,* 1-21. http://doi.org/10.1080/02635143.2020.1824177

Bryman, A. & Cramer, D. (1999). Quantitative data analysis with SPSS release 8 for Windows. London and New York. Taylor & Francis e-Library, Routledge.

Buldur, A. & Alisinanoğlu, F. (2020). Development of self-efficacy scale for science education in pre-school education. *Kastamonu Journal of Education, 28*(1), 512-520. https://doi.org/10.24106/kefdergi.3704

Büyüköztürk, Ş. (2020). Data analysis handbook (28th ed.). Pegem Academy.

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş. & Demirel, F. (2021). Scientific research methods (31st ed.). Pegem Academy.

Cabbar, B.G. & Şenel, H. (2020). Content analysis of biology education research that used context-based approaches: the case of Turkey. *Journal of Educational Issues, 6*(1), 203-218.

Candaş, B. & Özmen, H. (2020). A study on developing self-efficacy scale in the context of science-specific field competencies. *Hacettepe University Faculty of Education Journal, 35*(4), 746-758. https://doi.org/10.16986/HUJE. 2019052872

Chemers, M.M., Hu, L. & Garcia, B.F. (2001). Academic self-efficacy and first-year college student performance and adjustment. *Journal of Educational Psychology, 93*(1), 55–64. http://doi:10.1037/0022-0663.93.1.55

Cobos, T.L., Castilla, R.L. & López, Á.B. (2017). Oxidation processes an approach to his study in ESO. *Revista del Grupo de Investigación HUM-974, 1*(1), 7-8.

Cureton, E.E. (1951). Validity. In E. F. Lindquist (Ed.), Educational measurement (1st ed. pp. 621- 694). American Council on Education.

Çakır, A. (2014). *Factor analysis* (Doctoral Thesis). Istanbul Commerce University..

Çapa-Aydin, Y., Uzuntiryaki-Kondakci, E. & Ceylandağ, R. (2018). The relationship between vicarious experience, social persuasion, physiological state, and chemistry self-efficacy: The role of mastery experience as a mediator. *Psychology in the Schools,* 55, 1224-1238. https://doi.org/10.1002/pits.22201

Çepni, S. (2015). Science and technology teaching from theory to practice (pp. 21-68). Pegem A Publishing.

Çokluk, Ö., Şekercioğlu, G. & Büyüköztürk, Ş. (2010). SPSS and LISREL applications for multivariate statistics for social sciences. Pegem Academy.

Çolak, İ., Yorulmaz, Y. & Altınkurt, Y. (2017). The validity and reliability study of teacher self-efficacy beliefs scale. *MSKU Journal of Education, 4*(1), 20-32. https://doi.org/10.21666/muefd.319209

Davis, L. L. (1992). Instrument review: Getting the most from a panel of experts. *Applied Nursing Research, 5*(4), 194–197. https://doi.org/10.1016/S0897-1897(05)80008-4

De Jong, O. (2008). Context-based chemical education: how to improve it? *Chemical Education International, 8*(1), 1-7.

De Putter-Smits, L. G. A. (2012). *Science teachers designing context-based curriculum materials: Developing context-based teaching competence* [Doctoral Thesis]. Technische Universiteit Eindhoven. https://doi.org/10.1080/09500693.2012.656291

Demirci, N.S. (2017). The relationship between scale-based some credits and economic growth in Turkey: Cointegration and causality analysis (2006-2016). *Anadolu University Journal of Social Sciences, 18*(1), 113-128.

Demirtaş, H., & Yener, E. M. (2019). Öğretmen adaylarının denetim odağı ve öz yeterlik inançları arasındaki ilişki. *İnönü Üniversitesi Eğitim Bilimleri Enstitüsü Dergisi, 6*(12), 81-107.

Denizoğlu, P. (2008). *The assessment of the relationship between self-efficacy belief levels, learning styles of science teacher candidates towards science teaching, and their attitudes towards science teaching* [Master's Thesis]. Çukurova University.

Deveci, I. & Karteri, I. (2020). Context-based learning supported by environmental measurement devices in science teacher education: mixed-method research. *Journal of Biological Education, 1*(26). https://doi.org/10.1080/00219266.2020.1821083.

Doğan, N., Soysal, S. & Karaman, H. (2017). Can exploratory and confirmatory factor analysis be applied to the same sample? In Demirel, Ö. & Dinçer, S. (Ed), Education in a globalizing world (pp. 373-400). Pegem Academy.

Dolfing, R., Prins, G. T., Bulte, A. M. W., Pilot, A., & Vermunt, J. D. (2020). Strategies to support teachers' professional development regarding sensemaking in context-based science curricula. *Science Education,* 1-39. https://doi.org/10.1002/saniye.21603.

Durkan, E. (2017). Evaluation of the class teachers' applications that enable their students to use metacognitive reading strategies during fourth-grade Turkish lessons: the sample of Giresun province. *Turkish Studies, 13*(4), 519-550. http://doi.org/10.7827/TurkishStudies.12822

Elmas, R., Bülbül, M.Ş. & Eryılmaz, A. (2011). Thematic classification of eligible contexts for a holistic perspective in curriculum development. *Science Learning & Citizenship, 9th International Conference of ESERA* (p. 60). Lyon.

Ercan, İ. & Kan, İ. (2004). Reliability and validity in the scales. *Journal of Uludag University Faculty of Medicine, 30*(3), 211-216.

Ergün, A. (2021). Adaptation of the stem career interest and preferences survey a study of validity and reliability. *Cumhuriyet International Journal of Education, 10*(2), 533-555. http://doi.org/10.30703/cije.737661

Eskici, M. & Özen, R. (2013). Abstract for implementing the constructivist approach of teachers' adaptation of the efficiency belief scale. *Adnan Menderes University Education Faculty Journal of Educational Sciences, 4*(2), 19-29.

Eskici, M. & Özen, R. (2018). Teachers' self-efficacy perceptions and attitudes about the constructivist approach. *Abant İzzet Baysal University Journal of the Faculty of Education, 18*(4), 2050-2070.

Fabrigar, L.R., Wegener. D.T., MacCallum, R.C. & Strahan, E.J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods, 4*(3), 272-299. https://doi.org/10.1037/1082-989X.4.3.272

Ford, J.K., MacCallum, R.C. & Tait, M. (1986). Application of explanatory factor analysis in applied psychology: A critical review and analysis. *Staff Psychology, 39*(2), 291-314.

Fraenkel, J. R. & Wallen, N. E. (2006). *How to design and evaluate research in education* (7th ed.). McGraw-Hill.

Fraenkel, J. R., Wallen, N. E. & Hyun, H. H. (2012). *How to design and evaluate research in education* (8th ed.). McGraw-Hill.

Gelen, B., Akçay, B., Tiryaki, A. & Benek, İ. (2019). Pre-service science teachers' self-efficacy toward Science, Technology, Engineering, Mathematics (STEM) survey: An adaptation to Turkish, validity and reliability study. *Journal of Theory and Practice in Education, 15*(1), 88-107. https://doi.org/10.17244/eku.395204

Genç, M., Ulugöl, S. & Ünsal, S. (2017). Secondary school students' views on life-based learning. *Researcher: Social Science Studies, 5*(9), 244-255. https://doi.org /10.18301/rss.325.

George, D. & Mallery, P. (2003). SPSS for Windows step by step: A simple guide and reference. 11.0 Update (4th ed.). Boston, MA: Allyn & Bacon.

Gilbert, J. K. (2006). On the nature of context in chemical education. *International Journal of Science Education, 28*(9), 957-976. https://doi.org/10.1080/09500690600702470

Gilbert, J.K., Bulte, A.M.W. & Pilot, A. (2011). Concept development and transfer in context-based science education. *International Journal of Science Education, 33*(6), 817-837. https://doi.org/10.1080/09500693.2010.493185

Gözüm, A.İ.C. & Güneş, T. (2018). Science teaching self-efficacy scale: Validity and reliability study. *Mersin University Journal of the Faculty of Education, 14*(3), 1176-1199. https://doi.org/0.17860/mersinefd.393098

Güçer, H., Fırat, N.Ş. & Yurdabakan, İ. (2020). The study on developing of the scale of the scientific attitude of instructors. *Western Anatolian Journal of Educational Sciences, 11*(2), 358-375.

Gül, Ş. (2016). Teaching "Photosynthesis" topic through context-based instruction: an implementation-based REACT strategy. *Necatibey Education Faculty Electronic Journal of Science and Mathematics Education, 10*(2), 21-45. https://doi.org/10.17522/balikesirnef.273962

Günşen, G. & Uyanık, G. (2020). Validity and reliability study of preschool teachers' science education self-efficacy beliefs scale. *Eurasian Journal of Teacher Education, 1*(1), 1-24.

Hacıömeroğlu, G. (2020). Turkish adaptation study of the instrument of self-efficacy and concerns about STEM education for pre-service teachers. *Journal of Theory and Practice in Education, 16*(2), 165-177. https://doi.org/0.17244/eku.788985

Hırça, N. (2012). The effects of hands-on activities depend on a context-based learning approach to an understanding of physics and attitudes towards physics courses. *Journal of Mustafa Kemal University Institute of Social Sciences, 9*(17), 314-323.

Hogarty, K.Y., Hines, C.V., Kromrey, J.D., Ferron, J.M. & Mumford, K.R. (2005). Quality of factor solutions in exploratory factor analysis: Sample size. community and the effect of overdetermination. *Journal of Educational and Psychological Measurement, 65*(2), 202-226. https://doi.org/10.1177/0013164404267287

Hooper, C.J. & Mullen, M.R. (2008). Structural equation modeling: Guidelines for determining model fit. *The Electronic Journal of Business Research Methods, 6*(1), 53-60.

Hoşbaş, A.A. (2018). *The effect of life-based learning approach on learning products in science teaching* [Master's Thesis]. Kırıkkale University.

Ilhan, N., Doğan, Y. & Çiçek, Ö. (2015). Life-based teaching practices in the special teaching methods course of science teacher candidates. *Bartin University Journal of Faculty of Education, 4*(2), 666-681. https://doi.org/10.14686/buefad.v4i2.5000143534

İnaltekin, T. & Saka, M. (2019). Developing pre-service science teachers' self-efficacy scale to understand students: validity and reliability study. *Journal of Education and Humanities: Theory and Practice, 10*(20), 84-129.

Karaoğlu, İ.B. (2019). Adaptation of teacher sense of self-efficacy scale short form to Turkish: a study of validity and reliability. *The Journal of Academic Social Science, 7*(99), 123-139. http://dx.doi.org/10. 29228/ASOS.37797

Karaş, Ö.E. & Gül, Ş. (2019). The effect of teaching of the 'The Cell and Divisions' unit through REACT strategy on 7th Graders' attitude and motivation. *International Journal of Turkish Educational Sciences, 7*(13), 30-50. https://doi.org/doi:10.17051/ilkonline.2020.734721

Karslı Baydere, F. & Aydın. E. (2019). Teaching "The Eye" topic through the explanation assisted REACT strategy of the context-based approach. *Journal of Gazi University Faculty of Education, 39*(2), 755-791. https://doi.org/10.17152/gefad.345897

Keçe, B., Saraçoğlu, S. & Bektas, O. (2020). Developing a scientific attitude scale: Validity and reliability study. *MM-International Journal of Educational Sciences, 4*(2), 32-56. https://doi.org/10.46762/mamulebd.774267

King, D.T., Winner, E. & Ginns, I. (2011). Outcomes and implications of one teacher's approach to context-based science in the middle years. *Teaching Science, 57*(2), 26–30.

Kline, R.B. (2005). Principles and practice of structural equation modeling (pp. 154-186). Guilford Press.

Knoef, M. J. (2017). Attending to the knowledge, skills, and attitudes of teachers and students: Guidelines for context-based chemistry curricula. *Master Educational Science and Technology*, University of Twente Faculty of Behavioural, Management and Social Sciences Enschede, Netherland.

Kurnaz, M.A. (2013). An investigation of physics teachers' perceptions of context-based physics problems. *Kastamonu Journal of Education, 21*(1), 375-390.

Kurnaz, M.A. & Bayraktar, G. (2012). Nanotechnology attitude scale: Development, validity, and reliability. *Journal of Bayburt Education Faculty, 7*(1), 41-53.

Kutu, H. & Sözbilir, M. (2011). Teaching "Chemistry in Our Lives" unit in the 9th-grade chemistry course through context-based ARCS instructional model. *Ondokuz Mayis University Journal of Education, 30*(1), 29-62.

MacCallum, R.C., Widaman, K.F., Zhang, S. & Hong, S. (1999). Sample size in factor analysis. *Psychological Methods, 4*(1), 84–99. https://doi.org/10.1037/1082-989X.4.1.84

Marschall, G. (2022). The role of teacher identity in teacher self-efficacy development: the case of Katie. *Journal of Mathematics Teacher Education, 25*(6), 725-747. https://doi.org/10.1007/s10857-021-09515-2

Mutual Responsibility (2021). What is systems thinking? – Peter Senge explains systems thinking approach and principles. http://www.mutualresponsibility.org/science/what-is-systems-thinking-peter-senge-explains-systems-thinking-approach-and-principles.

Nie, Y., Tan, G. H., Liau, A. K., Lau, S., & Chua, B. L. (2013). The roles of teacher efficacy in instructional innovation: Its predictive relations to constructivist and didactic instruction. *Educational Research for Policy and Practice, 12*(1), 67–77

Ocak, İ., & Hocaoğlu, N. (2020). Developing co-constructivism scale in science courses for secondary school students. *Journal of Theoretical Educational Science, 14*(4), 665-696. https://doi.org/10.30831/akukeg.892910

OECD (2023). PISA 2022 assessment and analytical framework. OECD Publications. https://doi.org/10.1787/dfe0bf9c-en

Özdemir, A., Yaman, C. & Vural, R. (2018). Development of the teacher self-efficacy scale for STEM practices: A Validity and reliability study. *Adnan Menderes University Journal of Social Sciences Institute, 5*(2), 93-104. https://doi.org/10.30803/adusobed.427718

Özlü, G., Keskin, M.Ö. & Gül, A. (2013). The development of "Self-Efficacy Scale for Environmental Education": A study of validity and reliability. *Gazi University Journal of Gazi Educational Faculty (GUJGEF), 33*(2), 393-410.

Pajares, F. (2002). Gender and perceived self-efficacy in self-regulated learning. *Theory into Practice, 41*(2), 116-125. https://doi.org/10.1207/s15430421tip4102_8

Pallant, J. (2017). *SPSS user guide* (Translated by S. Balcı & B. Ahi). Anı Publications.

Pallant, J. (2020). SPSS Survival Guide (7th ed.). Taylor ve Francis. https://www.perlego.com/book/2194248/spss-survival-manual-pdf accessed from the page.

Parchmann, I., Graselb, C., Baerc, A., Nentwigc, P., Demuth, R., Ralled, B. & the Chik Project Group (2006). Chemie in context: A symbiotic implementation of a context-based teaching and learning approach. *International Journal of Science Education, 28*(9), 1041–1062. https://doi.org/10.1080/09500690600702512

Pilot, A. & Bulte, A.M.W. (2006). The use of "contexts" as a challenge for the chemistry curriculum: Its successes and the need for further development and understanding. *International Journal of Science Education, 28*(9), 1087-1112. https://doi.org/10.1080/09500690600730737

Roberts, H. (2006). *Handbook of univariate and multivariate data analysis and interpretation with SPSS*. (1st ed.). Chapman & Hall/CRC. https://doi.org/10.1201/978142001111

Scherer, R.F., Wiebe, F.A., Luther, D.C. & Adams, J.S. (1988). The dimensionality of coping: Factor stability using the ways of the coping questionnaire. *Psychological Reports, 62*(3), 763–770. https://doi.org/10.2466/pr0.1988.62.3.763

Schmitz, G.S. & Schwarzer, R. (2000). Self-efficacy expectations of teachers: longitudinal findings with a new. *Zeitschrift für Pädagogische Psychologie, 14*(1), 12–25. https://doi.org/10.1024/1010-0652.14.1.12

Schwarzer, R. & Hallum, S. (2008). Perceived teacher self-efficacy as a predictor of job stress and burnout: mediation analyses. *Applied Psychology,* 57, 152-171. https://doi.org/10.1111/j.1464-0597.2008.00359.x

Seçer, İ. (2017). *Practical data analysis with SPSS and LISREL*. (3rd extended ed.). Anı Publishing.

Sevian, H., Dori, Y.J. & Parchman, I. (2018). How does STEM context-based learning work: what we know and what we still do not know? *International Journal of Science Education, 40*(10), 1095-1107. https://doi.org/10.1080/09500693.2018.1470346

Shepard, L.A. (1993). Evaluating test validity. *Review of Research in Education, 19*, 405-450.

Sireci, S. G., Patsula, L., & Hambleton, R. K. (2005). Statistical methods for identifying flaws in the test adaptation process. In *Adapting Educational and Psychological Tests for Cross-Cultural Assessment* (pp. 93–115). Psychology Press.

Soini, T., Pietarinen, J., Toom, A., & Pyhältö, K. (2015). What contributes to first-year student teachers sense of professional agency in the classroom? *Teachers and Teaching, 21*(6), 641–659.

Stolk, M.J., Bulte, A.W.M., De Jong, O. & Pilot, A. (2009). Towards a framework for a professional development program: Empowering teachers for context-based chemistry education. *Chemistry Education Research and Practice, 10*, 164-175. https://doi.org/10.1007/978-94-6300-684-2_11

Stolk, M.J., De Jong, O., Bulte, A.M.W. & Pilot, A. (2011). Exploring a framework for professional development in curriculum innovation: empowering teachers for designing context-based chemistry education. *Research in Science Education, 41*, 369-388. https://doi.org/10.1163/9789463006842_012

Sümer, N. (2000). Structural equation models: basic concepts and examples. *Turkish Psychology Writings, 6*(3), 49-73.

Şahin, M.G. & Öztürk, N.B. (2018). The scale development process in education: A content analysis study. *Kastamonu Journal of Education, 26*(1), 191-199. https://doi.org/10.24106/kefdergi.375863

Şeker, H., Deniz, S. & Gürgen, İ. (2004). Teacher competencies scale. *Journal of National Education, 164*, 105-118.

Şensoy, Ö., & Aydoğdu, M. (2008). The effect of inquiry-based science instruction approach on the development of self-efficacy belief levels intended for science teaching of secondary science education teacher candidates. *Gazi University Journal of Gazi Education Faculty, 28*(2), 69-94.

Şimşek, Ö.F. (2007). *Introduction to structural equation modeling: Basic principles and LISREL applications*. Ekinoks.

Tal, M., Herscovitz, O., & Dori, Y. J. (2021). Assessing teachers' knowledge: Incorporating context-based learning in chemistry. *Chemistry Education Research and Practice, 22*(4), 1003-1019. https://doi.org/10.1039/D0RP00359J

Tariq, S. & Saeed, M. (2021). Effect of context-based teaching on grade VIII students' academic achievement and intrinsic motivation in science. *Pakistan Journal of Educational Research and Evaluation (PJERE), 9*(1), 1-23.

Taşkın, G. & Aksoy, G. (2019). Developing an attitude scale for science course: Validity and reliability study. *Inonu University Journal of the Graduate School of Education, 6*(12), 20-35. https://doi.org/10.29129/inujgse.542568

Tepe, M.E., Sarı, E., & Ocak, İ. (2020). Attitudes of secondary school students towards outdoor learning in science lessons: a scale development study. *International*

Journal of Science and Education, 3(2), 119-134. https://doi.org/10.47477/ubed.824089

Thurlings, M., Evers, A. T., & Vermeulen, M. (2015). Toward a model of explaining teachers' innovative behavior a literature review. *Review of Educational Research, 85*(3), 430–471.

Topuz. F., Gençer, S., Bacanak, A., & Karamustafaoğlu, O. (2013). Science and technology teachers' views about the context-based approach and the applying levels. *Journal of Amasya University Faculty of Education, 2*(1), 240-261.

Tortop, H. & Akyıldız, V. (2018). Development study of gifted students' education for STEM self-efficacy belief scale for the teacher. *Journal of Gifted Education and Creativity, 5*(3), 11-22.

Tschannen –Moran, M. Woolfolk-Hoy, A. & Hoy, W.K. (1998). Teacher efficacy: Its meaning and measure. *Review of Educational Research, 68*, 202-248.

Turgut, M.F. & Baykul, Y. (1992). Scaling techniques. ÖSYM Publications.

Ültay, N. & Çalık, M. (2011) Distinguishing 5E model from REACT strategy: An example of 'Acids and Bases' topic. *Necatibey Faculty of Education Journal of Electronic Science and Mathematics Education, 5*(2), 199-220.

Van Driel, J.H., Beijard, D. & Verloop, N. (2001). Professional development and reform in science education: The role of teachers' practical knowledge. *Journal of Research in Science Teaching, 38*, 137-158. https://doi.org/10.1002/1098-2736(200102)38:2%3C137::AID-TEA1001%3E3.0.CO;2-U

Varinlioğlu, S. & Bektaş, O. (2020). Determination of self-efficacy levels of seventh-grade students. *Necatibey Faculty of Education Journal of Electronic Science and Mathematics Education, 14*(2), 1189-1221. https://doi.org/10.17522/balikesirnef.801665

Vos, M.A.J., Taconis, R., Jochems, W.M.G. & Pilot, A. (2011). Classroom implementation of context-based chemistry education by teachers: the relationship between experiences of teachers and the design of materials. *International Journal of Science Education, 33*(10), 1407-1432. https://doi.org/10.1080/09500693.2010.511659

Wijaya, A., Heuvel-Panhuizen, M. & Doorman, M. (2015). Teachers' teaching practices and beliefs regarding context-based tasks and their relation with students' difficulties in solving these tasks. *Mathematics Education Research Journal, 27*(4), 637-662. https://doi.org/10.1007/s13394-015-0157-8

Worthington, R. & Whittaker, T. (2006). Scale development research: A content analysis and recommendations for best practices. *Counseling Psychologist, 34*, 806-838.

Yaman, C., Özdemir, A., & Vural, R.A. (2018). Development of the teacher self-efficacy scale for STEM practices: a validity and reliability study. *Adnan Menderes University, Journal of Institute of Social Sciences, 5*(2), 93-104. https://doi.org/10.30803/adusobed.427718

Yaman, H. & Tulumcu, F.M. (2016). Developing a listening skill self-efficacy scale for learners of Turkish as a foreign language. *Electronic Turkish Studies, 11*(3). http://dx.doi.org/10.7827/TurkishStudies.9327

Yaman, M. (2009). Context and methods of respiration and energy gain that attract students' attention. *Journal of Hacettepe University Faculty of Education, 37*(37), 215-228.

Yıldırım, B. (2015). Science learning anxiety scale: validity and reliability study. *Mus Alparslan University Journal of Social Sciences, 3*(1), 33-43. https://doi.org/10.18506/anemon.71733

Zee, M., & Koomen, H. M. Y. (2016). Teacher self-efcacy and its efects on classroom processes, student academic adjustment, and teacher well-being: A synthesis of 40 years of research. *Review of Educational Research, 86*(4), 981–1015.

ANNEX 1. BAĞLAM TEMELLİ ÖĞRENME YAKLAŞIMINA YÖNELİK ÖĞRETMEN ÖZYETERLİK ÖLÇEĞİ

Öğrenme/Öğretme Süreci

1. BTFÖ'de öğrencilerin iletişim becerisini geliştirebilirim.
2. BTFÖ'de öğrencilerin özgüvenlerinin artmasını sağlayabilirim.
3. BTFÖ'de öğrencilere rehberlik edebilirim.
4. BTFÖ'de dersin hedeflerine ulaşabilirim.
5. BTFÖ'de öğrencilerin anlamlı öğrenmelerini sağlayabilirim.
6. BTFÖ'de öğrencilerin ön bilgisi ile yaşam tecrübeleri arasında ilişki kurmalarını sağlayabilirim.
7. BTFÖ'de öğrencilerin kendi fikirlerini ortaya koymalarını sağlayamayabilirim.
8. BTFÖ'de öğrencilerin derse karşı meraklarını artırabilirim
9. BTFÖ'de öğrencilerin sosyal becerilerini geliştirmekte zorlanırım.
10. BTFÖ'de öğrencilerin öğrenecekleri konuya ihtiyaç duymalarını sağlayabilirim.
11. BTFÖ'de öğrencilerin ön bilgilerini kullanabilecekleri uygulamalar yaptırabilirim.
12. BTFÖ'de öğrencilerin derse karşı ilgilerini artıramam.
13. BTFÖ'de materyal kullanmakta zorlanırım.
14. BTFÖ'de öğrencilerin günlük yaşam problemlerini çözmelerini sağlayabilirim.
15. BTFÖ'de öğrencilerin işbirlikli çalışmalarına uygun ortam oluşturamayabilirim.
16. BTFÖ'de öğrencilerin bilgilerini yapılandırmasını sağlayabilirim.
17. BTFÖ'de öğrencilerin motivasyonlarını artırabilirim.
18. BTFÖ'de derse başlarken günlük hayattan seçilen bir örnek kullanabilirim
19. BTFÖ'de öğrencilerin edindikleri bilgileri yeni durumda uygulamalarını sağlayabilirim.
20. BTFÖ uygulamalarında karşılaşılabilecek problemlere çözüm üretebilirim.
21. Bağlam temelli soru yazabilirim.
22. BTFÖ'de öğrencilerin bilime yönelik ilgilerini artırabilirim.
23. BTFÖ'yü sınıf ortamında uygulayabilirim.
24. BTFÖ'de öğrencilerin bilişsel becerilerini geliştirebilirim.
25. BTFÖ'de öğrencilerin duyuşsal becerilerini geliştirebilirim.
26. BTFÖ'de öğrencilerin kendini yönetme becerilerini geliştirebilirim.
27. BTFÖ'de değerlendirme yapmakta zorlanırım.
28. BTFÖ ile öğretme sorumluluğumu öğrencilerle paylaşabilirim.
29. BTFÖ'de zamanı etkili biçimde kullanabilirim.
30. BTFÖ'de öğrenme sürecini etkili biçimde yönetebilirim.

Özyeterlik Kaynakları

31. BTFÖ'yü örnek uygulamaları inceleyerek daha etkili gerçekleştirebilirim
32. BTFÖ'de heyecanlanırım.
33. BTFÖ uygulamalarımı geçmişteki deneyimlerim ile daha etkili gerçekleştirebilirim.

Akademik Özyeterlik

34. Bağlam (Yaşam) temelli fen öğrenimi konusunda yeterli akademik bilgiye sahibim.
35. BTFÖ ile ilgili tartışmalarda görüş belirtebilirim.
36. BTFÖ'de meslektaşlarıma yardım edebilirim.
37. BTFÖ'de zaman yönetiminde zorlanırım.

Öğretimi Planlama

38. BTFÖ'ye uygun ders planı hazırlayabilirim.
39. BTFÖ'nün hangi kazanımlar için kullanılabileceğine karar verebilirim.
40. BTFÖ ile ilgili proje çalışmalarında görev almak beni mutlu eder.
41. BTFÖ'de günlük hayattan örnekler verebilirim.
42. Bağlam temelli sorulardan oluşan ölçme aracı hazırlayabilirim.
43. BTFÖ'de öğrenci düzeyine uygun günlük yaşam örnekleri belirleyebilirim.
44. BTFÖ 'de kullanılabilecek materyal seçebilirim.
45. BTFÖ'de öğrencilerin ilgilerini çekecek günlük yaşam örnekleri belirleyebilirim.
46. BTFÖ'ye uygun etkinlik tasarlayabilirim.
47. BTFÖ'de hangi yöntem/tekniklerin kullanılabileceğine karar verebilirim

Journal of Theoretical Educational Science, 17(3), 539-562, July 2024
Kuramsal Eğitimbilim Dergisi, 17(3), 539-562, Temmuz 2024
[Online]: http://dergipark.org.tr/akukeg
DOI number: http://doi.org/10.30831/akukeg.1346366

The Effect of Web 2.0 Supported Social Studies on the Digital Literacy Skills of Secondary School Students

Web 2.0 Araçlarıyla İşlenen Sosyal Bilgiler Dersinin Ortaokul Öğrencilerinin Dijital Okuryazarlık Becerilerine Etkisi

İlhan KULACA* **Hakkı YAZICI**** **Tuğba SELANİK AY*****

Received: 16 October 2023 **Research Article** **Accepted:** 22 March 2024

ABSTRACT: The focus of this study is to investigate the effects of using Web 2.0 tools in the social studies "Global Connections" learning area on students' digital literacy levels. A quasi-experimental model was used and 38, seventh graders participated the research. The digital literacy scale, created by Ng (2012) and translated into Turkish by Hamutoğlu, Güngören, Kaya-Uyanık, and Gür-Erdoğan (2017) was employed for data collection. Pre-testing was carried out using the digital literacy test. Courses were imparted according to the current curriculum in the control group and through Web 2.0 tools to the experimental throughout the application. For the experimental group, WordArt, StoryJumper, Canva, YouTube and Renderforest were used in the teaching of learning outcomes, along with Edmodo, which also allowed students interacting with teacher and among themselves outside the classroom. Then a digital literacy test was administered as a post-test. Ultimately, it was determined that the experimental group's digital literacy skills differed statistically significantly from the control group. It is thought that this research, which is limited to the seventh grade "Global Connections" learning area, should be conducted at different learning areas, levels and results should be evaluated.

Keywords: Digital literacy, web 2.0 tools, social studies, global connections, global issues.

ÖZ: Bu araştırmanın amacı, 7. sınıf sosyal bilgiler "Küresel Bağlantılar" öğrenme alanında yer alan dört kazanımın öğretiminde kullanılan Web 2.0 araçlarının, ortaokul öğrencilerinin dijital okuryazarlık becerilerine etkisini belirlemektir. Araştırmada, nicel araştırma yöntemi, yarı deneysel model kullanılmıştır. Araştırmanın çalışma grubu, 2021-2022 Eğitim Öğretim döneminde, Aydın ili Köşk ilçesinde, bir devlet ortaokulundaki 38, 7. sınıf öğrencisinden oluşmaktadır. Araştırma verilerinin toplanmasında, Ng (2012)'nin geliştirdiği, Hamutoğlu, Güngören, Kaya-Uyanık ve Gür-Erdoğan (2017)'ın Türkçe' ye uyarladığı, dijital okuryazarlık ölçeği kullanılmıştır. Dört haftalık uygulama öncesinde öğrencilere, dijital okuryazarlık testi ön-test olarak uygulanmıştır. Uygulama sürecinde dersler, deney grubu öğrencileri ile Web 2.0 araçları kullanılarak, kontrol grubunda ise mevcut öğretim programına uygun şekilde işlenmiştir. Deney grubu için ders dışında öğrencilerin kendi arasında ve öğretmenle etkileşimine de olanak sağlayan Edmodo ile birlikte, WordArt, StoryJumper, Canva, Renderforest, YouTube, kazanımların öğretiminde kullanılmıştır. Uygulama sonunda, öğrencilere dijital okuryazarlık testi son-test olarak uygulanmıştır. Analizlerin sonucunda, Web 2.0 araçları destekli Sosyal Bilgiler öğretiminin uygulandığı deney grubuyla, kontrol grubu öğrencilerinin dijital okuryazarlık becerilerinde, deney grubunun lehine istatistiksel olarak anlamlı bir fark oluştuğu görülmüştür. 7. sınıf "Küresel Bağlantılar" öğrenme alanı ile sınırlı bu araştırmanın, farklı öğrenme alanları ve sınıf düzeyinde de yapılıp sonuçlarının değerlendirilmesinin faydalı olacağı düşünülmektedir.

Anahtar kelimeler: Dijital okuryazarlık, web 2.0 araçları, sosyal bilgiler, küresel bağlantılar, küresel sorunlar.

* *Corresponding Author*: Dr. Social Studies Teacher, the Ministry of National Education, Aydın, Türkiye, ilhan.kulaca@gmail., http://orcid.org/0000-0003-4842-8594

** Prof. Dr., Afyon Kocatepe University, Afyonkarahisar, Türkiye, hyazici@aku.edu.tr, http://orcid.org/0000-0001-8631-6126

*** Prof. Dr., Afyon Kocatepe University, Afyonkarahisar, Türkiye, tsay@aku.edu.tr, http://orcid.org/0000-0003-1368-052X

Citation Information

Kulaca, İ., Yazıcı, H., & Selanik Ay T. (2024). The effect of Web 2.0 supported social studies on the digital literacy skills of secondary school students. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 17*(3), 539-562.

ISSN: 1308-1659

The search for knowledge by humans has undergone major changes over time. In the future, it will gain a different dimension than today. The influences of technology, which are felt in practically every stage of life in the 21st century, are growing every day (Acikgoz, & Akman, 2023; Akman, & Guven, 2015; Aküzüm, 2013). In the 21st century, literacy assumes a new dimension and adopts a complicated structure that incorporates a variety of abilities. Therefore, a teaching environment that allows both teachers and students to adapt to the digital world is necessary for the 21st century (Richardson, 2010). The traditional teacher paradigm and the traditional methods used in the classroom discourage involvement and learning among today's digital natives (Prensky, 2001).

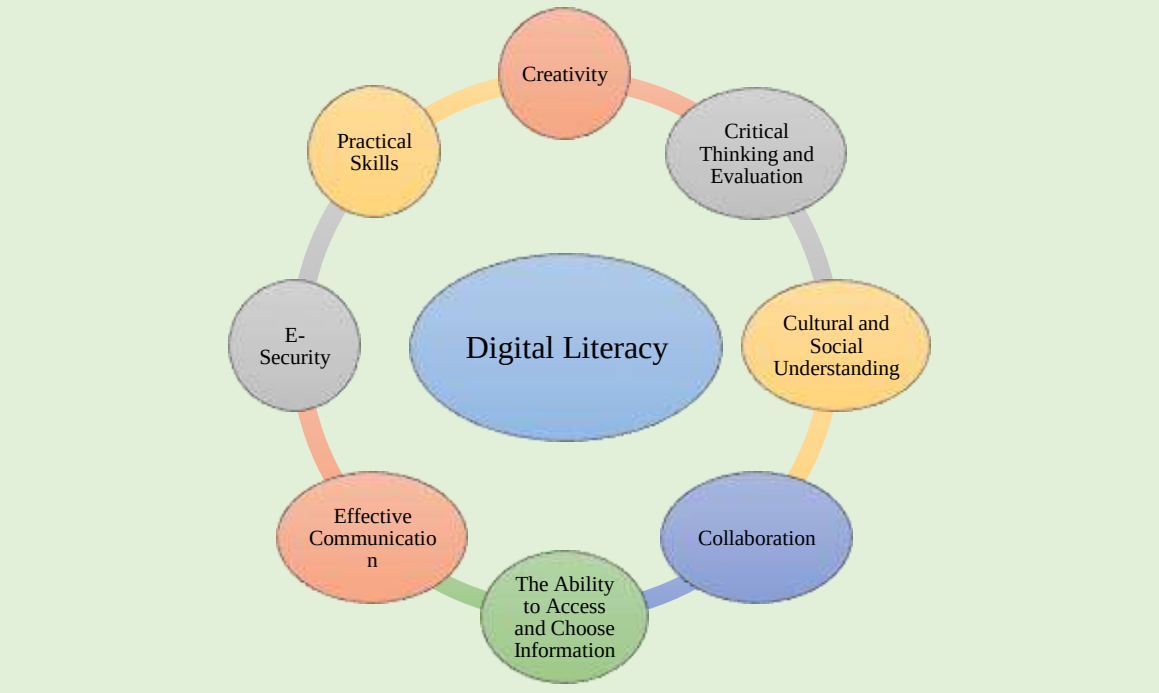
Students nowadays view classrooms, tables, and courses without technology as noncompliant with their conception of learning. Teachers should employ the technology in which today's students were born and grew up in addition to providing them with relevant and trustworthy experiences, and they should consider teaching methods for this (Başaran, 1972, p. 256). Teachers in Türkiye now have the chance to use digital technologies because interactive whiteboards have mainly taken the place of traditional classrooms. According to scholarly studies (Baki, 2022; Çenesiz, 2020; Çocuk, 2020; Ekemen, 2022; Merç, 2017; Nerse, 2021), using technology in the classroom helps pupils succeed academically and develop positive attitudes. By 2020, it will be impossible to dispute the role that digital technologies play in education whose significance has grown along with the epidemic process. In addition, it is necessary to use digital technologies safely. It is thought that it is necessary to be aware of its rights and responsibilities while using it, to know the right information channels in addition to effective communication skills, to have a social understanding both in their own society and in communication with individuals from different cultures, in short, to be digitally literate individuals. The significance of digital literacy has been made clear by this circumstance.

Information and communication technology use that goes beyond traditional literacy promotion is referred to as "digital literacy" (Erstad, 2008, p.188). The term "digital literacy" describes the combination of cognitive, emotional, psychomotor, and social abilities people need in order to use digital tools and function efficiently with digital devices (Blummer, 2008; Eshet- Alkali, 2004; Eshet- Alkali & Chajut, 2009). Digital literacy also requires adapting to new technologies, evaluating with a critical perspective, creating collaborative knowledge, confronting the situations that may arise, observing the rights of individuals and taking responsibility (Calvani, Cartelli, Fini, & Ranieri, 2008, p.186). In a study conducted in Türkiye (Akdoğan- Mindivanli, & Öner, 2023), secondary school seventh grade teachers and students defined digital literacy as accessing, sharing and producing information using digital tools.

The ability to adapt digital technology, which is now essential in our daily lives, is known as digital literacy. To guarantee the sustainability of many businesses and transactions in social life, it requires revealing and understanding the capacity to use digital technologies that we now have to use, knowing that we also have legal responsibilities (Rodriguez- de-Dios, Igartua, Gonzales, & Vaquez, 2016). Digital literacy consists of eight main components. These are shown in Figure 1:

Figure 1

Components of Digital Literacy



Note. (Payton, & Hague, 2010).

As seen in Figure 1, digital literacy consists of a combination of different interrelated components and imposes responsibilities on individuals. Testing the accuracy of the information is necessary to obtain reliable and precise data. The digital content created is affected by the society in which individuals live. In the understanding of critical thinking, being aware of the values of the society in which they live, in the understanding of critical thinking, individuals have to look at their worldview both from their own perspective and when cooperating with people from different cultures. They ought to be informed of their legal obligations and rights in relation to the security of private data in digital settings. This situation imposes important duties on social studies teaching.

Social studies, which by its nature is everything for the past, present and future of human beings (Barr, Barth, & Shermis, 2013) includes different disciplines. In this diversity, the nature of social studies is based on understanding the situation and conditions in the socio-cultural context in which people live (Akdağ, 2014; Kottler, & Gallavan, 2013; Öztürk, & Dilek, 2004). It has a rich content in teaching many acquisitions and concepts belonging to different disciplines in social studies, such as environment, international relations, democracy, history, society, law, economy, technology and society (Ministry of National Education (MoNE), 2004). The inclusion of digital literacy skills in the social studies curriculum shows that this course is crucial in helping students adjust to the digital information society of the 21st century. Developing digital literacy skills is closely related to students' use of digital tools in courses.

The method, technique, and tools utilized in teaching have a direct impact on its success. Web 2.0 tools, the number of which is increasing day by day take learning environments out of traditional understanding and provide students with the opportunity

to discover, design and disseminate information; makes classroom environments attractive to digital natives (Davidson- Shivers, Rasmussen, & Lowenthal, 2018). O'Reilly, who introduced the concept of Web 2.0 for the first time in 2004, characterizes Web 2.0 tools as those that provide a more mature, varied learning environment marked by network effects, user interaction, and openness (Musser, O'Relly, & The O'Relly Radar Team, 2007, p.5). With the possibilities that Web 2.0 tools provide both inside and outside of the classroom, students have the opportunity to make connections between information, to think critically and analytically and to develop cooperation (Huang, Hood, & Yoo, 2013, p. 633; Olaniran, 2009, p. 261). Byrne (2009) claims that using Web 2.0 tools gives teachers a variety of opportunities. In the classroom, utilizing Web 2.0 tools offers four advantages: efficiency, learning, learning to learn, and desire. Additionally, it supports the learning process by helping students gain 21st century skills. With its ability to host several disciplines, social studies is said to be one of the subjects whereby Web 2.0 techniques are applicable. By acquiring the knowledge, abilities, and Web 2.0 tools geared for social studies, students will be able to learn more successfully and will also advance their digital literacy. Digital literacy is essential in today's informal learning environments, and as was already said, it is one of the fundamental social studies abilities.

The World Economic Forum (WEF) (2020) listed the following 10 most crucial skills for 2025 in its Future of Professions Report:

- Active learning and learning strategies
- Analytical thinking and innovation
- Complex problem solving
- Critical thinking and analysis
- Creativity, originality and initiative
- Leadership and social influence
- Technology use, monitoring and control
- Technology design and programming
- Resilience, stress tolerance and flexibility
- Reasoning, problem-solving, and ideation (WEF, 2020) sorted like this.

These abilities make it clear that students in the twenty-first century are expected to be original, innovative, creative, and proficient users of technology. This generation wants schools to raise students with speed and practicality in mind. It is evident that many of the abilities covered in the 2018 social studies curriculum are comparable to those in the 2025 vision and coincide with the WEF's 2020 Report. The fundamental competencies covered in the social studies curriculum, such as media literacy, digital literacy, problem- solving, critical thinking, decision-making, self-control, entrepreneurship, social engagement, and innovative thinking, are aligned with the competencies of WEF.

Raising digitally literate children from an early age is essential in the 21st century, since digital technologies increasingly impact human existence. As a result of the growing popularity of wikis, blogs, instant messaging, and digital technologies, two million American youngsters between the ages of six and fourteen have their own websites (Pedro, 2007). It is possible to say that this number has increased even more in the last 17 years. In this context, it has an important place in raising 21st century people.

Social studies, which is based on human relations and society plays an important role in helping children, who are introduced to digital tools at an early age, acquire their rights and responsibilities in the use of these tools. It is believed that integrating Web 2.0 tools into social studies classroom settings will help students develop these abilities.

When the literature is examined, it can be seen that Web 2.0 tools are used in areas such as science (Açıkgül- Fırat, 2015; Akbaba, 2019; Gürleroğlu, 2019; Wright, 2017), foreign language teaching (Bozna, 2017; Daşkın, 2017; Gençtürk, 2017; Guksu, 2020; Kaynar, 2019; Kutlu- Demir, 2018). Social studies teaching (Balçın & Çalışkan, 2021; Keleş, 2019; Kantekin, 2023; Merç, 2017; Tünkler, 2021a, Tünkler, 2021b, Tünkler, 2022). When the literature is examined, it is seen that there are studies such as the following to determine the effect of the use of Web 2.0 tools in the social studies course on different skills and values. Historical inquiry skills (Bull, Hammond & Ferster, 2008), environmental sensitivity (Balçın & Çalışkan, 2021), social science research tool (Snee, 2008), critical thinking (Frisch, Jackson & Murray, 2013), digital citizenship (Richards, 2010). However, there appears to be a limited number of studies (Tepe & Çelik, 2021) to determine the effect of using web 2.0 tools on social studies for gaining digital literacy skills.

However, this research was also conducted on teacher candidates. On the other hand, no studies have been conducted regarding how employing Web 2.0 resources in social studies classes affects secondary school students' digital literacy. In this case, the research's aim is to include digital resources into the social studies curriculum and use Web 2.0 tools to educate students on pertinent course accomplishments. In conclusion, the goal of this study was to determine whether using Web 2.0 technologies in the classroom has an impact on students' digital literacy. The research's problem statement conducted for this purpose was presented as follows: “Does the seventh grade social studies course taught using Web 2.0 tools have an effect on students' digital literacy skills?” The following are the research's subproblems:

1. Is there a difference of statistical significance between the students in the experimental group and the students in the control group regarding their levels of digital literacy?

1.1. Is the difference between the students' digital literacy abilities and attitude sub-dimension in the experimental group and the students' sub-dimension in the control group statistically significant?

1.2. Does the technical sub-dimension of the learners' digital literacy abilities in the experimental group differ statistically significantly from the technical sub-dimension of the students' digital literacy skills in the control group in favour of the experimental group?

1.3. Do the students in the experimental group's cognitive sub-dimension of digital literacy skills differ from those in the control group's in a statistically significant way?

1.4. Is the social sub-dimension of students' digital literacy skills in the experimental group different from students' social sub-dimension in the control group in a statistically significant way?

2. Does the experimental group of students in the seventh grade social studies class show a statistically significant difference between the pre-test and post-test results on the digital literacy abilities scale?

2.1. Does the attitude sub-dimension of the digital literacy skills scale show a statistically significant difference between the pretest and posttest results of the students in the experimental group who created Web 2.0 tools in the seventh-grade social studies course?

2.2. Does the technical sub-dimension of the digital literacy skills scale show a statistically significant difference between the pretest and posttest results of the students in the experimental group who created Web 2.0 tools in the seventh-grade social studies course?

2.3. Does the cognitive sub-dimension of the digital literacy skills scale show a statistically significant difference between the pretest and posttest results of the students in the experimental group who created Web 2.0 tools in the seventh-grade social studies course?

2.4. Does the social sub-dimension of the digital literacy skills scale show a statistically significant difference between the pretest and posttest results of the students in the experimental group who created Web 2.0 tools in the seventh-grade social studies course?

Method

Research Model

The study employed the quantitative research approach with the purpose of determining the impact of the use of Web 2.0 technologies, which is the independent variable on digital literacy skill which is the dependent variable. A quasi-experimental design comprising experimental and control, groups were used to carry out this methodology. The application of the quasi-experimental design is carried out by making measurements depending on the dependent variable both prior to and following the experimental research (Karasar, 2014, p. 99). In quasi-experimental research, participants are divided into groups before starting the research and independent of the researcher's influence (Balcı, 2015; Gliner, Morgan & Leech, 2015; Karagöz, 2017).

Data Collection and Experimental Process

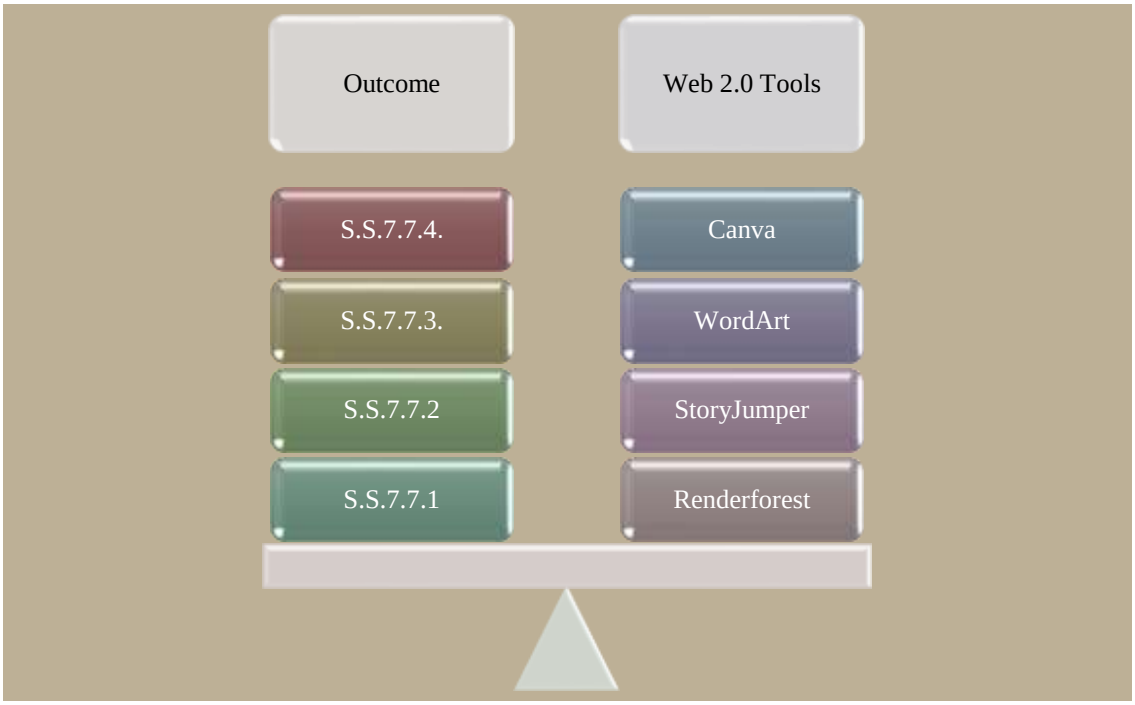
The "digital literacy scale" used in the research was developed by Ng (2012). It was adapted to Turkish by Hamutoğlu, Güngören, Kaya-Uyanık and Gür-Erdoğan (2017), and a measurement invariance study was conducted for secondary school students by Eroğlu, Güngören, Kaya-Uyanık and Gür-Erdoğan (2019). The scale is in a five-point likert format. This scale consists of attitude, technical, cognitive and social factors and 17 items. The Cronbach alpha coefficient of the scale was calculated as .93. In this study, the Cronbach alpha coefficient of the scale was calculated as .86.

Before starting the implementation process of the research, the school principal, parents and students were informed about the research process. Edmodo 7/A class was created with the experimental group students. Students were also shown how to use additional Web 2.0 capabilities through demonstration applications. Facebook and Edmodo both operate on similar principles. Students who are familiar with Facebook

from their adult social circles have been shown to transition to Edmodo with ease. Students were introduced to more Web 2.0 tools like Renderforest, StoryJumper, WordArt, Canva, YouTube and prototype applications were created. Figure 2 displays the research's accomplishments as well as the Web 2.0 tools that were employed.

Figure 2

Outcomes and Web 2.0 Tools Used



The Web 2.0 tool Renderforest was used for the outcome of "S.S.7.7.1. S/he gives examples to the organizations of which Türkiye is a member" (MoNE, 2018). Renderforest, with the slogan "The only limit is your imagination", is a tool that helps students create video animations based on what they have learned. Students contributed to the creation of the animation by sharing their thoughts on Türkiye's geopolitical position and place in the world, its significance, its contribution to world peace with the international organizations it is a member of, its role in solving problems, and the organizations they are members of.

Web 2.0 tool StoryJumper was used for the outcome of "S.S.7.7.2. S/he recognizes the economic regions and institutions that Türkiye has relations with" (MoNE, 2018). Offering collaborative learning, StoryJumper is a tool that helps students create e-books. Students in the course talked about how the global economy, economic activity, and international economic institutions affect international relations. The organizations Türkiye belongs to and the roles Türkiye has played in the global economy are described. In light of the information that they obtained in the session, the students used the interactive whiteboard to write their electronic book.

It was discussed with the students that prejudices, stereotypes, and stereotypes are impressions developed against a community and nation for the acquisition of "S.S.7.7.3. Questioning stereotypes about various cultures"(MoNE, 2018). Videos on the topic were viewed on YouTube. A Web 2.0 tool called WordArt was employed in the application procedure. With the help of the application WordArt, students were able

to turn the keywords they had developed in their cognitive memories for the acquisition into a word cloud. On the word cloud, it was shown that the pupils articulated the pre-existing stereotypes about various countries and ethnicities. The children had the chance to compose their own statements and the stereotypes they proposed with their friends as part of the application procedure.

Web 2.0 tool Canva was used for the outcome of " S.S.7.7.4. Develops ideas and suggestions for the solution of global problems with his friends" (MoNE, 2018). Global problems such as terrorism, migration, hunger, climate change, wars, hunger were discussed with the students, and the subject was discussed with examples from Türkiye's close geography and the world. Videos on international issues were watched on YouTube. During the application process, posters from Canva were designed with students. With Canva, an infographic tool, students designed posters for learning outcomes about problems that threaten the world. Student products were shared on the Edmodo tool and it was aimed that students stay in touch with each other outside the classroom.

Data Analyses

Analyses were carried out using the data gathered from the digital literacy test used in the research. A normality test was applied to determine whether the data showed normal distribution. First, the results of the Shapiro-Wilk test were examined because the sample size for the normality tests was less than thirty. After examining the histogram graph, the distribution was determined to be normal based on the values of Skewness and Kurtosis. The normality test results of the test group and control group are given in Table 1 and Table 2 below.

Table 1

Experimental Group Normality Test Results

	Kolmogorov-Smirnov	Shapiro-Wilk	Skewness	Z Score	Kurtosis	Z Score
Digital Literacy Scale Pre-Test	.124	.366	.024	0.044	-1.012	-0.974
Digital Literacy Scale Post-Test	.088	.095	.334	0.623	-1.087	-1.047

Table 2

Control Group Normality Test Results

	Kolmogorov-Smirnov	Shapiro-Wilk	Skewness	Z Score	Kurtosis	Z Score
Digital Literacy Scale Pre-Test	.200	.500	.005	0.009	-.676	-.651
Digital Literacy Scale Post-Test	.200	.310	.161	0.300	-.981	-0.945

When the tables are evaluated, it means that the Shapiro-Wilk test results ($p>0.05$), which is one of the normality values of the test and control groups provide normality (Can, 2018, p. 89). When the skewness values are examined, the fact that the distribution's z score which is calculated by dividing its skewness coefficient by the standard deviation, ranges from +1.96 to -1.96, can be interpreted as not deviating too much from the normal (Büyüköztürk, 2017, p. 42). It can be accepted that the data are normally distributed in the tests performed within the context of these findings.

The test and control groups were compared using an independent samples t-test, and the test group's pre- and post-test results were analysed using a dependent samples t-test, once the normality tests had confirmed that the data had a normal distribution. The t-test for independent samples is utilized to determine whether a significant difference exists between the means of two independent samples (Büyüköztürk, 2017, p. 39). If more than two related measurement sets have mean scores that differ noticeably from one another, the related samples t-test is employed to find out. (Büyüköztürk, 2017, p. 40). In order to control the effect of the independent variable on the dependent variable d values, the standardized effect size index formulated by Cohen were calculated. Accordingly, d values of .2, .5 and .8 are interpreted as small, medium and large, respectively (Büyüköztürk, Çokluk, & Köklü, 2017).

Ethical Procedures

The researchers were contacted in order to get the appropriate rights for the using the digital literacy scale. Prior to initiating the implementation phase, Afyon Kocatepe University's ethics committee approved the research (date: May 13, 2022; number: 2022/173), and the Aydın Provincial Directorate of National Education granted research permission.

Results

Normality tests revealed that the data displayed a normal distribution. The results of the independent samples t-test and the data of the related samples t-test for the pre-test and post-test results of the experimental group are presented in tables in this context, in this section of the research, in the comparison of the data gathered from the control and experimental groups, and they are interpreted.

Digital Literacy Levels of Students

Is there a difference of statistical significance between the students in the experimental group and the students in the control group regarding their levels of digital literacy that works in favor of the experimental group? Results relevant to this sub-problem are displayed in Table 3.

Table 3

Digital Literacy Scale Post-Test Results

Groups	n	$\bar{x}$	s	t	sd	p	cohen d
Experimental	20	4.02	0.52	3.960	25.96	0.001	1.29
Control	18	3.02	0.95				

*p< .05

An independent sample t-test was performed, as indicated in Table 3, to see whether using Web 2.0 technologies in the social studies course significantly differed in terms of digital literacy skills. There was a significant difference between the post-test mean score of the students in the experimental group, where the courses were conducted with Web 2.0 tools ($\bar{x}$= 4.02), and the test score average of the students in the control group, which was conducted with the course books and activities $\bar{x}$= 3.02; t= 3.960, p<0.05. Accordingly, it is seen that the calculated effect size is at a high level (d = 1.29). Therefore, it can be said that using Web 2.0 tools in social studies course has a significant effect on digital literacy skills.

Is the difference between the students' digital literacy abilities and attitude sub-dimension in the experimental group and the students' sub-dimension in the control group statistically significant? Findings related to this sub-problem are shown in Table 4.

Table 4

Results of the Digital Literacy Scale Attitude Sub-dimension

Groups	n	$\bar{x}$	s	t	sd	p	cohen d
Experimental	20	3.88	0.71	3.346	36	0.002	1.07
Control	18	3.00	0.91				

*p< .05

As can be seen in Table 4, there was a significant difference between the test score average of the attitude sub-dimension of the students in the test group in which the

courses were conducted with Web 2.0 tools ($\bar{x}$= 3.88) and the test point average of the students in the control group where the course was taught in accordance with the current curriculum $\bar{x}$= 3.00; t= 3.346, p<0.05. Accordingly, it is seen that the calculated effect size is at a high level (d = 1.07). In this case, it is seen that using Web 2.0 tools in the social studies course contributed positively to the scores obtained from the attitude sub-dimension of the digital literacy scale.

Does the technical sub-dimension of the learners' digital literacy abilities in the experimental group differ statistically significantly from the technical sub-dimension of the students' digital literacy skills in the control group? Findings related to this sub-problem are shown in Table 5.

Table 5

Digital Literacy Scale Technical Sub-Dimension Results

Groups	n	$\bar{x}$	s	t	sd	p	cohen d
Experimental	20	4.20	0.50	3.988	23.81	0.001	1.31
Control	18	3.12	1.04				

*p< .05

As seen in Table 5, there was a significant difference between the technical sub-dimension test score average of the students in the test group in which the courses were conducted with Web 2.0 tools ($\bar{x}$= 4.20) and the test point average of the students in the control group where the course was taught in accordance with the current curriculum $\bar{x}$= 3.12; t= 3.988, p<0.05. Accordingly, it is seen that the calculated effect size is at a high level (d = 1.31). Therefore, it can be concluded that utilizing Web 2.0 tools in the social studies course improved the experimental group's students' scores on the technical sub-dimension of the digital literacy scale.

Do the students in the experimental group's cognitive sub-dimension of digital literacy skills differ from those in the control groups in a way that is statistically significant in favor of the experimental group? Findings related to this sub-problem are shown in Table 6.

Table 6

Digital Literacy Scale Cognitive Sub-Dimension Results

Groups	n	$\bar{x}$	s	t	sd	p	cohen d
Experimental	20	4.07	0.79				

				3.480	28.6	0.002	1.14
Control	18	2.88	1.23				

*p< .05

As shown in Table 6, there was a significant difference between the cognitive sub-dimension test average score of the students in the test group in which the courses were conducted with Web 2.0 tools ($\bar{x}$= 4.07) and the test point average of the students in the control group, where the course was taught in accordance with the current curriculum $\bar{x}$= 2.88; t= 3.480, p<0.05. Accordingly, it is seen that the calculated effect size is at a high level (d = 1.14). In this case, it can be concluded that integrating Web 2.0 tools into the social studies curriculum had a positive impact on the experimental group students' scores on the digital literacy scale's cognitive sub-dimension.

Is the social sub-dimension of students' digital literacy skills in the experimental group different from students' social sub-dimension in the control group in a statistically significant way that and favors the experimental group? The findings related to this sub-problem are shown in Table 7.

Table 7

Results of the Social Sub-Dimension of the Digital Literacy Scale

Groups	n	$\bar{x}$	s	t	sd	p	cohen d
Experimental	20	4.30	0.63	4.598	36	0.000	1.47
Control	18	2.94	1.13				

*p< .05

As seen in Table 7, there was a significant difference between the social sub-dimension test average score of the students in the test group in which the courses were conducted with Web 2.0 tools ($\bar{x}$= 4.30) and the test point average of the students in the control group where the course was taught in accordance with the current curriculum $\bar{x}$= 2.94; t= 4.598, p<0.05. Accordingly, it is seen that the calculated effect size is high (d=1.47). In this case, it can be said that using Web 2.0 tools in the social studies course contributed positively to the scores of the experimental group students in the social sub-dimension of the digital literacy scale.

Digital Literacy Abilities of Students

Does the experimental group of students in the seventh grade social studies class show a statistically significant difference between the pretest and posttest results on the digital literacy abilities scale? Findings relevant to this sub-problem are displayed in Table 8.

Table 8

Experimental Group Digital Literacy Scale Pre-Test Post-Test Results

Test	n	$\bar{x}$	s	t	sd	p	cohen d
Pre-test	20	3.33	0.91				
				3.030	19	0.007	0.9
Post-test	20	4.02	0.52				

As shown in Table 8, there was a significant difference between the experimental group students' pre-test mean score ($\bar{x}$= 3.33) and post-test mean score ($\bar{x}$= 4.02) when the courses were done using Web 2.0 tools (t= 3.030, p<0.05). Accordingly, it is seen that the calculated effect size is at a high level (d = 0.9). In this case, it is seen that using Web 2.0 tools in the social studies course has a positive effect on students' digital literacy skills.

Does the attitude sub-dimension of the digital literacy skills scale show a statistically significant difference between the pre-test and post-test results of the students in the experimental group who created Web 2.0 tools in the seventh-grade social studies course? Findings relevant to this sub-problem are displayed in Table 9.

Table 9

Experimental Group Digital Literacy Scale Attitude Sub-Dimension Results

Test	n	$\bar{x}$	s	t	sd	p	cohen d
Pre-test	20	3.17	0.96				
				2.690	19	0.015	0.8
Post-test	20	3.88	0.71				

As can be seen in Table 9, there was a significant difference between the attitude sub-dimension pre-test mean score ($\bar{x}$= 3.17) and the post-test mean score ($\bar{x}$= 3.88) of the students in the experimental group in which the courses were conducted using Web 2.0 tools (t= 2.690, p<0.05). Accordingly, it is seen that the calculated effect size is at a high level (d = 0.8). In this case, it can be said that using Web 2.0 tools in the social studies course contributed positively to the scores obtained from the attitude sub-dimension of the digital literacy scale.

Does the technical sub-dimension of the digital literacy skills scale show a statistically significant difference between the pretest and posttest results of the students in the experimental group who created Web 2.0 tools in the seventh-grade social studies course? Findings related to this sub-problem are shown in Table 10.

Table 10

Experimental Group Digital Literacy Scale Technical Sub-Dimension Results

Test	n	$\bar{x}$	s	t	sd	p	cohen d
Pre-test	20	3.50	0.87				
				3.137	19	0.005	0.9
Post-test	20	4.20	0.50				

As shown in Table 10, there was a significant difference between the technical sub-dimension pre-test mean score ($\bar{x}$ = 3.50) and the post-test mean score ($\bar{x}$= 4.20) of the students in the experimental group in which the courses were conducted using Web 2.0 tools (t= 3.137, p<0.05. Accordingly, it is seen that the calculated effect size is at a high level (d = 0.9). In this case, it can be said that using Web 2.0 tools in the social studies course contributed positively to the scores of the students in the technical sub-dimension of the digital literacy scale.

Does the cognitive sub-dimension of the digital literacy skills scale show a statistically significant difference between the pretest and posttest results of the students in the experimental group who created Web 2.0 tools in the seventh-grade social studies course? Findings related to this sub-problem are shown in Table 11.

Table 11

Experimental Group Digital Literacy Scale Cognitive Sub-Dimension Results

Test	n	$\bar{x}$	s	t	sd	p	cohen d
Pre-test	20	3.20	1.14				
				2.807	19	0.011	0.8
Post-test	20	4.07	0.79				

As given in Table 11, there was a significant difference between the cognitive sub-dimension pre-test mean score ($\bar{x}$= 3.20) and the post-test mean score ($\bar{x}$= 4.07) of the students in the experimental group in which the courses were conducted using Web 2.0 tools (t= 2.807, p<0.05). As a result, it can be observed that the estimated effect size (d = 0.8) is at a high level. In this case, it can be said that using Web 2.0 tools in the social studies course contributed positively to the students' scores in the cognitive sub-dimension of the digital literacy scale.

Does the social sub-dimension of the digital literacy skills scale show a statistically significant difference between the pretest and posttest results of the students in the experimental group who created Web 2.0 tools in the seventh-grade social studies course? Findings related to this sub-problem are shown in Table 12.

Table 12

Experimental Group Digital Literacy Scale Social Sub-Dimension Results

Test	n	$\bar{x}$	s	t	sd	p	cohen d
Pre-test	20	3.47	1.16				
				2.435	19	0.025	0.8
Post-test	20	4.30	0.63				

As shown in Table 12, there was a significant difference between the social sub-dimension pre-test mean score ($\bar{x}$= 3.47) and the post-test mean score ($\bar{x}$= 4.30) of the students in the experimental group, in which the courses were conducted using web 2.0 tools (t= 2.435, p<0.05). Accordingly, it is seen that the calculated effect size is at a high level (d = 0.8). In this case, it can be said that using Web 2.0 tools in the social studies course has a significant effect on the social sub-dimension of students' digital literacy skills.

Discussion and Conclusion

In the research, some Web 2.0 tools (Canva, Renderforest, Edmodo, WordArt, YouTube and StoryJumper) were used to process four achievements in the seventh grade social studies Global Connections learning field. In conclusion, it was shown that using Web 2.0 tools had a favorable impact on students' digital literacy abilities. This study examined how using Web 2.0 tools in social studies instruction in the seventh grade of a secondary school affected students' digital literacy skills. It was concluded that there was a statistically significant difference in favor of the experimental group, both in general and in each of the attitude, technique, cognitive and social sub-dimensions of the digital literacy scale, between the students in the experimental group and the students in the control group, where the social studies course supported by Web 2.0 tools was taught. The results of the pre-test and post-test for the students in the experimental group also showed a significant statistical difference favoring the post-test.

This research was conducted to determine the effects of using Web 2.0 tools in seventh grade social studies teaching on students' digital literacy skills. As seen in the findings of this study, employing Web 2.0 tools has been found to improve students' digital literacy skills. Both the experimental group and the control group's test scores on the digital literacy scale were compared. It was concluded that the experimental group significantly outperformed the control group in all four of the scale's subdimensions—attitude, technique, cognitive ability, and social ability—as well as the overall scale. Additionally, it was determined that the experimental group students' pre- and post-test results differed significantly.

A review of the literature reveals that research has been done on how Web 2.0 tools affect digital literacy. The findings of this study are consistent with studies that found that the employment of Web 2.0 tools and digital tools throughout the educational process significantly improves students' digital literacy skills (Baki, 2022; Cun, 2022).

Besides, in most of the studies (Colwell, Hunt- Baron, & Reinking, 2013; Ekemen, 2022; Gürleroğlu, 2019; Korkut, Özpir- Mantaş, & Yıldırım, 2021; Tsvetkova, Ushatikova, Antonova, Salimova, & Degtyarevskaya, 2021), it has been concluded that although the use of Web 2.0 tools in the teaching process improves students' digital literacy skills, it does not cause a statistically significant difference. Studies have shown that, in the absence of a large difference, technological infrastructure deficiencies, reliance on previously acquired superficial information, difficulty to adjust to using digital technologies, and issues with the implementation process are all effective. However, studies have found that the adoption of 21st century capabilities by students and the growth of their digital literacy skill levels are significantly influenced by the usage of Web 2.0 tools in the implementation process.

Studies (Efe, Turan, & Ünsal, 2022; Gündüzalp, 2021; Jose, 2021; Pürbudak, 2020) have determined that the teaching process carried out using Web 2.0 tools increases sharing among students and contributes to a collaborative learning environment. It was observed that the Web 2.0 tools used in the implementation process of this research improved cooperation among students and contributed to the creation of common products. It has been noted that Web 2.0 tools used in the processing of the Global Connections learning area of the seventh grade social studies course can also positively contribute to the development of students' digital citizenship skills. This supports the findings of the International Society for Technology in Education (ISTE), 2008 and Nebel, Jamison, & Bennet, 2009.

It was seen that the students did not have difficulty using Edmodo which is the main Web 2.0 tool of this research, it contributed to the socialization of the students and the development of their extracurricular communication, and the application process was the virtual classroom. In the literature, it has been reached that Edmodo is a social learning tool that supports social participation (Balasubramanian, Jaykumar, & Fukey, 2014), is reliable for students (Alemdağ, 2013; Weber, 2012), and creates a social learning environment with its easy use (Bicen, 2015; Shockney, 2013). Another result is that it is effective in ensuring the participation of students with low classroom participation in crowded classroom environments (Egüz, 2020; Rogers, 2011), and contributes to active participation and learning (Thongmak, 2013). The increase in scores derived from the social sub-dimension of the digital literacy scale utilized in the research is supported by both the research findings and studies in the literature.

It has been concluded that the Renderforest tool used for the acquisition of "S/he gives examples to the organizations of which Türkiye is a member" is an effective tool for the acquisition. The students demonstrated success in making video animations, communicating the material in short and creative ways, and developing collaboration and production skills. In the literature, it was reached that the Renderforest tool is suitable for my learning (Umar, 2022), it contributes to the development of students' thinking skills in creating educational video animations (Almelweth, 2022) and when used together with the problem-based learning method, it has a positive effect on the development of students' problem solving skills (Sari, & Fathoni, 2022). The findings confirm the improvement in the posttest scores on the study's digital literacy scale.

It has been noted that the StoryJumper tool which is used for the acquisition of "S/he recognizes the economic regions and institutions with which Türkiye has a relationship" supports the collaborative learning of the students and improves their

digital competencies. In the literature, StoryJumper is used to increase interaction, develop multiple skills (Fansa, 2020), improve students' digital competencies and self-confidence (binti Mohammad, & Yamat, 2020), and provide an innovative learning environment (Kulaca, 2023; Nurlaela, Ilham, & Lisabe, 2022; Shuguli, 2023) an effective tool, supporting the results of this research. It is thought that the results also support the increase in the scores obtained from the technical sub-dimension of the digital literacy scale.

It has been observed that the WordArt tool used to acquire "S/he questions the stereotypes s/he has towards various cultures" is an efficient tool in revealing students' perceptions of various cultures and groups, their thoughts in their cognitive structures, and improving their writing abilities. The two word cloud design tools, WordArt and WordCloud have been found to be helpful for summarizing the main idea of texts in a variety of studies (Calle-Alonso et al., 2018; Hearst et al., 2020; Zhu, Zang, & Tobita, 2020). Furthermore, it has been concluded that since the interfaces are easy, students can easily adapt to them and help create an eye-pleasing visual design. During the application process of this research, it was observed that students enjoyed using WordArt, that it was a useful tool for converting texts into keywords, and that WordArt contributed to summarizing the subject. In the same way, it has been observed that the Canva tool for the acquisition of ”S/he develops ideas for solving global problems together with friends" also contributes to revealing the thoughts formed in the cognitive structures of students, increasing motivation to class, developing sensitivity to global problems, developing empathy skills for world problems, during the implementation process. Studies in the literature (Erdal, 2021; Kulaca, 2023; Kyllonen, Lipnevich, Burrus, & Roberts, 2014; Le, Bo, & Nguyen, 2023; Ramadani, Arizal, & Rahayu, 2023; Utami, & Djamdjuri, 2021). Suggest that Canva tool helps students' writing skills, increasing motivation towards learning. It has been concluded that it supports users and offers practical solutions to users with its rich content. It was determined that the rise in the digital literacy scale's cognitive and affective sub-dimension scores, as well as the statistically significant difference, supported this claim.

Implications

Within the context of both the application procedure and the data gathered following the application of the research, some suggestions can be stated as follows:

- This research which was carried out for the seventh-grade social studies course "Global Connections" learning area can also be applied to other learning areas and acquisitions.
- This research which was conducted at the seventh-grade level can also be conducted at other grade levels and in different learning areas and the results of the use of Web 2.0 tools in social studies teaching can be evaluated.
- This research which is designed as a quantitative research method with a quasi-experimental design can be carried out as a mixed method research with qualitative research methods such as case study and action research.
- Web 2.0 tools can be used for gaining 21st century skills in both social studies courses and after-school activities.
- It is possible to implement activities that enhance students' digital literacy by incorporating various Web 2.0 tools into various subject areas.

Statement of Responsibility

While İlhan Kulaca conducted the application data collection and analysis of the study (%40), Hakkı Yazıcı contributed to the theoretical framework, the methods and results section (%30). Tuğba Selanik Ay participated in the discussion of results, the suggestions section, and the reporting process (%30).

Conflicts of Interest

The authors certify that they have no conflicts of interest.

Author Bios:

İlhan KULACA works as a social studies teacher at a public secondary school affiliated with the Turkish Ministry of National Education. He is interested in school-based applications for the use of digital technologies in social studies teaching.

Hakkı YAZICI is a lecturer at the Department of Social Studies Education, Faculty of Education at Afyon Kocatepe University. His studies focus on Human and Economic Geography, Geography teaching as well as Social Studies teaching.

Tuğba SELANİK AY is a lecturer at the Department of Social Studies Education, Faculty of Education at Afyon Kocatepe University. She lectures many courses at undergraduate, graduate and doctoral levels. Her research interests are contemporary approaches in social studies education, teacher training, and entrepreneurship.

References

Acikgoz, B., & Akman, O. (2023). The relationship between epistemological beliefs and technological, pedagogical, and content knowledge (TPACK). *International Journal of Technology in Education (IJTE), 6*(2), 326-348.

Açıkgül-Fırat, E. (2015). *Web 2.0 araçlarıyla desteklenen öğretimin öğretmen adaylarının biyoteknoloji okuryazarlıklarına etkisi* [Unpublished doctoral dissertation]. İnönü University, Institute of Educational Sciences.

Akbaba, K. (2019). *Fen öğretiminde web 2.0 uygulamalarının öğrencilerin fen bilimleri dersine ve teknoloji kullanıma yönelik tutumlarına etkisi* [Unpublished master's thesis]. Aksaray University, Institute of Sciences.

Akdağ, H. (2014). Sosyal bilgilerin tanımı, amacı, önemi ve Türkiye'deki yeri. In R. Turan, A. M. Sünbül, & H. Akdağ (Eds.), *Sosyal Bilgiler Öğretiminde Yeni Yaklaşımlar- 1 (*pp. 1-24*)*. Pegem Akademi.

Akdoğan-Mindivanli, E., & Öner, Ü. (2023). Opinions of social studies teachers and 7th-grade students regarding digital literacy skills. *Türk Akademik Yayınlar Dergisi (TAY Journal), 7(special issue),* 75-106.

Akman, O., & Guven, C. (2015). TPACK survey development study for social sciences teachers and teacher candidates. *International Journal of Research in Education and Science (IJRES), 1*(1), 1-10.

Aküzüm, C. (2013). Eğitim ve teknoloji ile ilgili temel kavramlar. In R. Sever & E. Koçoğlu (Eds.), S*osyal bilgiler öğretiminde eğitim teknolojileri ve materyal tasarımı* (pp. 1-19). Pegem Akademi.

Alemdağ, E. (2013). Edmodo: Eğitsel bir çevrimiçi sosyal öğrenme ortamı. *InetTr, 13*, 71-77.

Almelweth, H. (2022). The effectiveness of a proposed strategy for teaching geography through artificial intelligence applications in developing secondary school students' higher-order thinking skills and achievement. *Pegem Journal of Education and Instruction, 12*(3), 169-176.

Baki, Y. (2022). Web 2.0 araçlarının dijital okuryazarlık becerilerinin ve web pedagojik içerik bilgisinin gelişimine etkisi. *Ana Dili Eğitimi Dergisi, 10*(3), 671-695.

Balasubramanian, K., Jaykumar, V., & Fukey, L. N. (2014). A study on "Student preference towards the use of edmodo as a learning platform to create responsible learning environment". *Procedia-Social and Behavioral Sciences, 144*, 416-422.

Balçın, K., & Çalışkan, H. (2021). The effect of web 2.0 tools used in social studies course on environmental sensitivity of secondary school students. *Journal of Interdisciplinary Education: Theory and Practice, 3*(2), 128-141.

Barr, R., Barth, J. L., & Shermin, S. S. (2013). *Sosyal bilgilerin doğası* (Trans. C. Dönmez). Pegem Akademi.

Başaran, İ.E. (1972). *Eğitim psikolojisi*. Gül Yayınevi.

Bicen, H. (2015). The role of social learning networks in mobile assisted language learning: Edmodo as a case study. *J. Univers. Comput. Sci., 21*(10), 1297-1306.

Binti Mohammad, N. A., & Yamat, H. (2020). Students' perspectives and motivation towards story jumper on creative writing. *Jurnal Penyelidikan Sains Sosial (JOSSR), 3*(7), 1-11.

Blummer, B. (2008). Digital literacy practices among youth populations: A review of the literature. *Educational Libraries: Childrens Resources, 31*(3), 38-45.

Bozna, H.(2017). *Yabancı dil öğrenen dijital yerlilerin web 2.0 araçlarını kullanma düzeylerinin belirlenmesi* [Unpublished master's thesis]. Anadolu University, Institute of Social Sciences.

Bull, G., Hammond, T., & Ferster, B. (2008). Developing web 2.0 tools for support of historical inquiry in social studies. *Computers in the Schools, 25*(3-4), 275-287.

Büyüköztürk, Ş. (2017). *Sosyal bilimler için veri analizi el kitabı.* Pegem Akademi.

Büyüköztürk, Ş., Çokluk, Ö., & Köklü, N. (2017). *Sosyal bilimler için istatistik.* Pegem Akademi.

Byrne, R. (2009). The effect of web 2.0 on teaching and learning. *Teacher Librarian, 37*(2), 50-53.

Calvani, A., Cartelli, A., Fini, A., & Ranieri, M. (2008). Models and instruments for assessing digital competence at school. *Journal of Learning and Knowledge Society, 4*(3), 183-193.

Colwell, J., Hunt- Barron, S., & Reinking. D. (2013). Obstacles to developing digital literacy on the internet in middle school science instruction. *Journal of Literacy Research, 45*(3) 295–324.

Cun, A. (2022) Digital literacy practices and identities of two children with refugee backgrounds. *Bilingual Research Journal, 45*(2), 205-221.

Çenesiz, M. (2020). *Web 2.0 araçlarının ortaöğretim 10. sınıf coğrafya dersinde (topoğrafya ve kayaçlar) akademik başarı ve tutuma etkisi* [Unpublished master's thesis]. Afyon Kocatepe University, Institute of Social Sciences.

Çocuk, H. E. (2020). *Dijital öykü uygulamalarının Türkçe öğretmen adaylarının akademik başarılarına, dijital okuryazarlık ve Türkçe öğretimi özyeterlik algılarına etkisi* [Unpublished doctoral dissertation]. Mersin University, Institute of Educational Sciences.

Daşkın, Z. (2017). *Öğretim üyeleri ve okutmanların yabancı dil öğretiminde web 2.0 araçları farkındalıkları, rutinleri ve kullanımı* [Unpublished master's thesis]. Hacettepe University, Institute of Educational Sciences.

Davidson- Shivers, G. V., Rasmussen, K. R., & Lowenthal, P. R. (2018). *Web based learning.* Springer.

Efe, H., Turan, H., & Ünsal, Ü. U. (2022). Developing secondary school students' 21st century skills through online science education with web 2.0 tools. *Journal of Human and Social Sciences, 5*(2), 206-229.

Egüz, E. (2020). Using web 2.0 tools in and beyond the university classrooms: A Case study of edmodo. *International Online Journal of Education and Teaching (IOJET), 7*(3). 1205-1219.

Ekemen, M. (2022). *Web 2.0 araçları ile zenginleştirilmiş sosyal medya destekli fen öğretiminin 6. sınıf öğrencilerinin sosyal medya kullanım durumlarına, dijital okuryazarlık düzeylerine ve eleştirel düşünme becerilerine etkisinin incelenmesi* [Unpublished master's thesis]. Marmara University, Institute of Educational Sciences.

Erdal, B. B. 2021). Infografik tasarımında kullanılan web teknolojilerinin karşılaştırılması. *Turkish Online Journal of Design Art and Communication, 11*(3), 797-812.

Erstad, O. (2008). Changing assessment practice and the role of IT. In. J. Voogt, G. Knezek (Eds.), *International handbook of information technology in primaryand secondary education (*pp. 181-194*)*. Part One, New York.

Eshet- Alkalai, Y. (2004). Digital literacy: A conceptual framework for survival skills in the digital era. *Journal of Educational Multimedya and Hypermedia, 13*(1), 93-106.

Eshet- Alkalai, Y., & Chajut, E. (2009). Changes over time in digital literacy. *Cyper Psychology & Behavior, 12*(6), 713-715.

Fansa, M. (2020). Geçici eğitim merkezindeki Suriye uyruklu öğrencilerin ve Türkçe öğreticilerin storyjumper deneyimleri: "Yamen Okulda". *Türkiye Bilimsel Araştırmalar Dergisi, 5*(2), 360-376.

Frisch, J. K., Jackson, P. C., & Murray, M. C. (2013). WikiED: Using web 2.0 tools to teach content and critical thinking. *Journal of College Science Teaching, 43*(1), 70-80.

Gliner, J.A., Morgan, G.A., & Leech, N.L. (2015). *Uygulamada araştırma yöntemleri desen ve analizi bütünleştirme yaklaşımı*. Nobel Yayıncılık.

Guksu, O. (2020). *Web 2.0 araçlarının yabancı dil olarak ingilizce öğrenen Türk öğrencilerinin verdikleri dönüt türleri, tutumları ve yazma becerilerinin gelişimine*

etkisi [Unpublished master's thesis]. Bahçeşehir University, Institute of Educational Sciences.

Gündüzalp, C. (2021). Web 2.0 araçları ile zenginleştirilmiş çevrimiçi öğrenmenin öğrencilerin üst bilişsel ve yaratıcı düşünme becerilerine etkisi. *Uluslararası Türkçe Edebiyat Kültür Eğitim (TEKE) Dergisi, 10* (3), 1158-1177.

Gürleroğlu, L. (2019). *5E modeline uygun web 2.0 uygulamaları ile gerçekleştirilen fen bilimleri öğretiminin öğrenci başarısına motivasyonuna tutumuna ve dijital okuryazarlığına etkisinin incelenmesi* [Unpublished master's thesis]. Marmara University, Institute of Educational Sciences.

Hamutoğlu, N. B., Güngören, Ö. C., Kaya- Uyanık, G., & Gür- Erdoğan, D. (2017). Dijital okuryazarlık ölçeği: Türkçeye uyarlama çalışması. *Ege Eğitim Dergisi, 18*(1), 408-429.

Hearst M. A., Pedersen, E., Patil, L., Lee, E., Laskowski P., & Franconeri, S. (2020). An Evaluation of Semantically Grouped Word Cloud Designs. In *IEEE Transactions on Visualization and Computer Graphics, 26*(9), pp. 2748-2761.

Huang, W- H. D., Hood, D. W., & Yoo, S. J. (2013). Motivational support in web 2.0 learning environments: A regression analysis based on the integrative theory of motivation, volition and performance. *Innovation in Education and Teaching International, 51*(6), 631-641.

International Society for Technology in Education (ISTE) (2008). *ISTE standards: Teachers*. Retrieved from http://www.iste.org/docs/pdfs/20-14_ISTE_Standards-T_PDF.pdf. 13.07.2020.

Jose, K. (2021). Conversations through web 2.0 tools: Nurturing 21st century values in the classroom. *Rupkatha Journal of Interdisciplinary Studies in Humanities, 13*(2), 1-16.

Kantekin, M. (2023). *6. sınıf sosyal bilgiler dersinde kültürel miras konularının öğretiminde web 2.0 araçlarının kullanımı* [Unpublished doctoral dissertation]. Anadolu University, Institute of Educational Sciences.

Karagöz, Y. (2017). *SPPS ve amos uygulamalı nitel- nicel- karma bilimsel araştırma yöntemleri ve yayın etiği.* Nobel Akademi Yayıncılık.

Karasar, N. (2014). *Bilimsel araştırma yöntemi*. Nobel Akademi Yayıncılık.

Kaynar, T. (2019). *Web 2.0 araçlarının yabancı dil öğretiminde kullanımı* [Unpublished master's thesis]. Marmara University, Institute of Educational Sciences.

Keleş, H. (2019). *Sosyal bilgiler öğretmenlerinin teknopedagojik alan bilgisi yeterlilikleri ve web 2.0 teknolojileri hakkında görüşlerinin incelenmesi* [Unpublished master's thesis]. Aksaray University, Institute of Social Sciences.

Korkut, M. H., Özpir- Mantaş, H. C., & Yıldırım, M. (2021). Analysis of the effect of use of web 2.0 tools in online course on students achivements and digital literacy. *Journal of Science and Mathematics Education in Southeast Asia, 44*, 148-168.

Kottler, E., & Gallavan, N. (2013). *Sosyal bilgiler öğretiminde başarının sırları. (*Transl. Ed.: S. B. Demir). Eğiten Kitap.

Kulaca, İ. (2023). Sosyal bilgiler öğretiminde web 2.0 araçlarının kullanımı [Unpublished doctoral dissertation]. Afyon Kocatepe University, Institute of Social Sciences.

Kutlu- Demir, Ö. (2018). *21st century learning: Integration of web 2.0 tools in Turkish Adult language classrooms* [Unpublished doctoral dissertation] Çağ University, Institute of Social Sciences.

Kyllonen, P. C., Lipnevich, A. A., Burrus, J., & Roberts, R. D. (2014). Personality, motivation, and college readiness: A Prospectus for assessment and development. *ETS Research Report Series, 2014*(1), 1-48.

Le, A. N. N., Bo, L. K., & Nguyen, N. M. T. (2023). Canva-based e-portfolio in L2 writing instructions: Investigating the effects and students' attitudes. *Computer Assisted Language Learning, 42*(1), 41-62.

Merç, A. (2017). *Sosyal bilgiler dersinde mekân algılama becerisinin kazandırılmasında google earth uygulamasının etkililiği* [Unpublished doctoral dissertation]. Anadolu University, Institute of Educational Sciences.

MoNE (2004). *Sosyal bilgiler 4.-5. sınıf programı.* Devlet Kitapları Müdürlüğü Basımevi.

MoNE (2018). *Sosyal bilgiler dersi öğretim programı.* MEB Yayınları.

Musser, J., & O' Relly, The O' Relly Radar Team (2007). *Web 2.0 principle and best practices.*O' Relly Media.

Nebel, M., Jamison, B., & Bennett, L. (2009). Students as digital citizens on web 2.0. *Social Studies and The Young Learner, 21*(4), 5-7.

Nerse, B. N. (2021). *Online eğitim sürecinde web 2.0 araçlarıyla zenginleştirilmiş probleme dayalı öğrenme yaklaşımının öğrencilerin akademik başarılarına, üstbilişsel farkındalıklarına, teknolojiyle kendi kendine öğrenmelerine ve dijital okuryazarlıklarına etkisinin incelenmesi* [Unpublished master's thesis]. Kocaeli University, Institute of Sciences.

Nurlaela, N., Ilham, M. J., & Lisabe, C. M. (2022). The effects of storyjumper on narrative writing ability of EFL learners in higher education. *Jurnal Educatio FKIP UNMA, 8*(4), 1641-1647.

Olaniran, B. A. (2009). Culture, learning styles and web 2.0. *Interactive Learning Environments, 17*(4), 261-271.

Öztürk, C., & Dilek, D. (2004). *Hayat bilgisi ve sosyal bilgiler öğretimi*. Pegem Akademi.

Payton, S., & Hague, C. (2010, April). *Digital literacy in practice.* https://www.nfer.ac.uk/publications/FUTL06/FUTL06casestudies.pdf.

Pedro, F. (2007). The new millennium learners: Challenging our views on digital technologies and learning. *Digital Kompetanse, 4*(2), 244-264.

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon MCB University Press, 9* (5), 1-5.

Pürbudak, A. (2020). *Web 2.0 temelli işbirlikli grup etkinliklerinin öğrenme stilleri bağlamında deneysel olarak incelenmesi* [Unpublished master's thesis]. Necmettin Erbakan University, Institute of Educational Sciences.

Ramadani, A. H., Arizal, H., & Rahayu, I. A. T. (2023). Penerapan modul pembelajaran interaktıf berbasıs web menggunakan canva pada matakulıah teknologı mekanık. *Journal of Vocational and Technical Education (JVTE), 5*(1), 1-8.

Richards, R. (2010). Digital citizenship and web 2.0 tools. *MERLOT Journal of Online Learning and Teaching, 6*(2), 516-522.

Rodriguez-de-Dios, I., Igartua, J.J., Gonzales, & Vaquez, A. (2016, November). Development and validation of a digital literacy scale for teenenagers. *Proceedings of the Fourth International Conference on Technological Ecosystems for Enhancing Multiculturality* (TEEM'16). Salamanca, Spain.

Rogers, A. (2011). Using edmodo to extend literacy learning: Grade 6 novel study. *Learning, Literacies, & Libraries, 4*(1), 28.

Sari, I. P., & Fathoni, A. (2022). Problem based learning model assisted by renderforest video animation on mathematics learning outcomes. *International Journal of Elementary Education 6*(3), 648-656.

Shockney, R. (2013). *Measuring effectiveness of a social networking site in a middle school* [Unpublished master's thesis]. California State University.

Shuguli, A. N. B. (2023). Storyjumper como herramienta digital para desarrollar la escritura creativa en educación general básica. *Revista Científica UISRAEL, 10*(2), 129-142.

Snee, H. (2008). Web 2.0 as a social science research tool. *British Library, 4*(November), 1-34.

Tepe, T., & Çelik, T. (2021, April). Farklı web 2.0 araçları kullanımının sosyal bilgiler öğretmen adaylarının dijital okuryazarlık ve bit kullanım yeterlilikleri üzerine etkisi. *International Symposium on Current Developments in Science, Technology and Social Sciences*. Gaziantep, Türkiye.

Thongmak, M. (2013). Social network system in classroom: Antecedents of edmodo© adoption. *Journal of E-learning and Higher Education, 2013*(1), 1-15.

Tsvetkova, M., Ushatikova, I., Antonova, N., Salimova, S., & Degtyarevskaya, T. (2021). The use of social media for the development of digital literacy of students: From adequate use to cognition tools. *International Journal of Emerging Technologies in Learning (iJET), 16*(2), 65-78. Retrieved from: https://www.learntechlib.org/p/218939/. (25 February 2023).

Tünkler, V. (2021a). Sosyal bilgilerde kavram öğretiminde web 2.0 araçları: öğretmen adaylarının görüşleri. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi*, (53), 234-260.

Tünkler, V. (2021b). Concept learning and teaching in social studies. In Ö. Akman, F. O. Atasoy, & T. Gür, (Eds.), *Education, social, health and political developments in Turkey between 2000-2020* (pp. 175-193). ISRES Publishing.

Tünkler, V. (2022). Web 2.0 technologies for 21st century learners. In Ö. Akman, & V. Tünkler (Eds.), *Social studies teaching 1* (pp. 109-125). ISTES Organization.

Umar, M. R. (2022). Wasilah renderforest fi tadris al-mufrodat li thalabah as-shaf ats-tsamin fi al-medrese al-tsanawiyah al-hukumiyah 1 payakumbuh. lisaanuna talim al-lughah al-arabiyah. *Jurnal Pendidikan Bahasa Arab,5*(2), 230-244.

Utami, Y., & Djamdjuri, D. S. (2021, December). Students' motivation in writing class using of canva: Students'perception. In *Bogor English Student And Teacher (BEST) Conference* pp. 153-159.

Weber, A. (2012). Considerations for social network site (SNS) use in education. *International Journal of Digital Information and Wireless Communications, 2*(4), 37-52.

WEF (2020). *The future of jobs report, october 2020*. Retrieved from http://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf 11.11.2020.

Zhu, W.,Zang, J., & Tobita, H. (2020). Wordy: Interactive Word Cloud to Summarize and browse online videos to enhance eLearning," *2020 IEEE/SICE International Symposium on System Integration* (SII), Honolulu, HI, USA, 2020, pp. 879-884.

Appendices

Appendix 1

Sample Photos of the Work of the Experimental Group Students

Journal of Theoretical Educational Science, 17(3), 563-591, July 2024
Kuramsal Eğitimbilim Dergisi, 17(3), 563-591, Temmuz 2024
[Online]: http://dergipark.org.tr/akukeg
DOI number: http://doi.org/10.30831/akukeg.1323295

Examining the Process of Middle School Math Teachers Diagnosing and Eliminating Student Misconceptions in Algebra*

Ortaokul Matematik Öğretmenlerinin Öğrencilerin Cebirdeki Kavram Yanılgılarını Tespit Etme ve Giderme Süreçlerinin İncelenmesi

Hüseyin KABADAŞ** **Hayal YAVUZ MUMCU*****

Received: 05 July 2023 **Research Article** **Accepted:** 15 April 2024

ABSTRACT: The aim of this study is to examine how middle school mathematics teachers diagnose and attempt to eliminate students' misconceptions in algebra. The study employed a case study method and embedded single-case design. The research was conducted with three mathematics teachers working in different state schools and having different professional experiences, as well as ten students from the eighth-grade classes of the same schools. The data collection instruments used in the study included the Diagnostic Test developed by researchers to identify students with misconceptions, the Assessment Framework prepared for the evaluation of teacher performances in diagnosing and eliminating student misconceptions, and Semi-Structured Interviews conducted between students and teachers, which were recorded and made available in audio/video format. The study revealed that teachers generally resorted to conventional methods in the process of diagnosing and eliminating students' misconceptions. In most cases, teachers superficially addressed students' errors and did not fully focus on students' thinking. Regarding the processes aimed at eliminating student misconceptions, teachers preferred to directly inform students that their answers were incorrect, rather than facilitating students in recognizing their own mistakes. The findings highlight the need to increase teachers' awareness and student knowledge regarding misconceptions in algebra.

Keywords: Misconceptions in algebra, middle school math teachers, knowledge of student thinking, pedagogical content knowledge.

ÖZ: Bu çalışmanın amacı ortaokul matematik öğretmenlerinin öğrencilerin cebirdeki kavram yanılgılarını tespit etme ve giderme süreçlerinin incelenmesidir. Çalışma kapsamında durum çalışması yöntemi ve iç içe geçmiş tek durum deseni kullanılmıştır. Çalışma farklı devlet okullarında görev yapan ve farklı mesleki deneyimlere sahip üç matematik öğretmeni ve aynı okulların sekizinci sınıf şubelerinde öğrenim gören on öğrenci ile yürütülmüştür. Veri toplama aracı olarak kavram yanılgısına sahip öğrencilerin belirlenmesine yönelik araştırmacılar tarafından geliştirilmiş olan Teşhis Testi, öğretmenlerin kavram yanılgılarını tespit etme ve giderme süreçlerinin değerlendirilmesine yönelik olarak hazırlanmış olan Değerlendirme Çerçevesi ile öğrenci ve öğretmenler arasında yürütülmüş olan ve ekran/ ses kaydı alınarak saklanabilir hale getirilmiş olan Yarı Yapılandırılmış Görüşmeler kullanılmıştır. Çalışma sonucunda öğretmenlerin öğrencilerin kavram yanılgılarını tespit etme ve giderme süreçlerinde geleneksel yöntemlere başvurdukları görülmüştür. Öğretmenler çoğu durumda öğrencilerin hatalarını yüzeysel olarak ele almış ve öğrenci düşüncesine tam olarak odaklanamamışlardır. Öğrenci yanılgısının giderilmesine yönelik olarak yürütülen süreçlerde ise öğretmenlerin, öğrencilerin kendi hatalarını fark etmelerini sağlamak yerine, onlara cevaplarının yanlış olduğunu doğrudan söylemeyi tercih ettikleri gözlenmiştir. Bu çalışmanın sonuçları, cebirdeki kavram yanılgıları konusunda öğretmenlerin farkındalıklarının ve öğrenci bilgilerinin arttırılması gerektiğini ortaya koymaktadır.

Anahtar kelimeler: Cebirdeki kavram yanılgıları, ortaokul matematik öğretmenleri, öğrenci düşüncesi bilgisi, pedagojik alan bilgisi.

* This study was produced from the first author's master thesis titled 'Investigation of Secondary School Mathematics Teachers' Prediction and Elimination Processes of Students' Possible Misconceptions in Algebra' under the supervision of the second author.

** M.Sc, Ministry of National Education, Ordu, Turkey, huseyinkabadas@hotmail.com, https://orcid.org/0000-0002-1679-6088.
***Corresponding Author: Assoc. Prof. Dr., Ordu University, Ordu, Turkey, hayalym52@gmail.com, https://orcid.org/0000-0002-6720-509X.

Citation Information
Kabadaş, H., Yavuz Mumcu, H. (202?). Examining the process of middle school math teachers diagnosing and eliminating student misconceptions in algebra. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 17*(3), 563-591.

ISSN: 1308-1659

From past to present, mathematics has generally been perceived as a difficult and complex subject, and one of the reasons for this perception is its abstract nature (Baykul, 2014; Martino et al., 2023; O'Leary et al., 2017; Reyes et al., 2019; Yang et al., 2020). Students often have difficulties in abstract thinking processes when trying to understand mathematical concepts without having the opportunity to observe them concretely. In particular, algebra stands out as one of the areas in school mathematics that students have difficulty in understanding due to its abstract nature (NCTM, 2000).

The field of algebra employs functions as a means of illustrating mathematical relationships, analyzing change, and highlighting connections between quantities. These functional relationships are conveyed and abstracted through the use of mathematical symbols. Algebra, often described as generalized arithmetic, was defined by Kieran (1992) as a discipline that represents numerical relations and mathematical operations. It utilizes symbols and generalized numbers to solve equations, examine functional relationships, and establish a system of expressions and relations (Lew, 2004). As an integral component of the secondary school mathematics curriculum, algebra is functionally employed across all areas of mathematical learning, imparting a comprehensive structure to the subject. According to Moses (2000) and Strong and Cobb (2000), algebra should be included in the education of all students, as it serves as a critical gateway to advanced mathematics and to many respected professions.

In the realm of school mathematics, algebra is often perceived as the application of symbols, solving complex equations, and simplifying algebraic expressions. However, algebra encompasses much more than these aspects. It is crucial that students develop an in-depth understanding of the mathematical structures and algorithms underlying the use of algebraic concepts and symbols and gain insight into their application in a variety of situations (NCTM, 2000). In the absence of such an understanding, concepts are poorly understood and cannot be related to each other, symbols lose their meaning and algorithms are simply memorized without being understood. As a result, various learning difficulties and misconceptions may arise. Similarly, Suparno (2005) argues that when students have difficulty in understanding a new concept and cannot assimilate it into their mental schema, they develop their own incoherent conceptual framework that is different from the actual concept.

In mathematics learning processes, it is seen that students develop many misconceptions of different types, especially in algebra. Research on algebra teaching has been conducted over the years, and some of the problems have been solved in these studies, but many problems still persist (Baş et al., 2011; Dede & Peker, 2007). Among these studies, Barbieri et al., (2019), Demirören (2019), Lucariello et al., (2019) and Ralston and Li (2022) show that students still lack basic competencies to effectively handle variables, algebraic expressions and equations. Current studies conducted in Turkey (Birgin & Demirören, 2020; Çakmak Gürel & Okur, 2017; Demirören, 2019; Örnekçi, 2019; Şahiner, 2018; Şahin & Soylu, 2011) also report that there are still problems in teaching algebra. Accordingly, in Demirören's (2019) study, it was determined that some students had various misconceptions in visual and geometric representations of algebraic expressions, selection and priority of operations, and setting up and solving equations. In this study, different types of students' misconceptions about understanding algebraic expressions, writing them in different forms, performing operations with algebraic expressions and solving equations were reported. Birgin and

Demirören (2020) found that students who could not establish the algebra-geometry relationship had difficulty in understanding algebraic expressions and could not move from pattern to algebraic equation. It was also observed that students' errors in simple visual and algebraic expressions were caused by choosing the wrong algebraic operation, ignoring parenthesis in algebraic expressions, misinterpreting the shape pattern and arithmetic operation errors. Çakmak Gürel and Okur (2018) examined misconceptions about equality and equation in their study. In terms of misconceptions, it was determined that students had the misconception that 'variables are always different from each other' at the highest level and 'not considering the importance of parentheses in algebra' at the lowest level. In his thesis study, Örnekçi (2019) mentions different types of misconceptions that eighth grade students have about slope. According to the results of Şahiner (2018), it was determined that students had various misconceptions about algebraic expressions. It was determined that students could not mathematically structure identity expressions and had difficulty in modeling. In addition, it was found that they had misconceptions about factoring and simplifying rational algebraic expressions. Şahin and Soylu (2011) reported the misconceptions regarding the variable as overlooking the variables, processing the different units under the same unit, focusing on 'x', 'y' variables, not being able to find the connection between the verbal expressions and the variables, reducing the variables to constants, attributing digits to the variable in multiplication, confusing the 'x' unknown with the multiplication sign and not using parenthesis. In their study, Ralston and Li (2022) reported that students focused on the operational meaning of the equals sign rather than its relational meaning and saw the equals sign as a symbol expressing a result. Lucariello et al. (2019) revealed students' misconceptions about the concept of variable. These misconceptions include ignoring the variable, perceiving the variable as a label of an object, and seeing the variable as an unknown value.

Therefore, in order to solve this problem in algebra teaching, it is necessary to seek answers to two basic questions: How can students' algebra learning process be improved and how can misconceptions be corrected? Although there are many studies in the literature on improving algebra learning processes, the persistence of the existing problem led this study to focus on the answers to the second question. Accordingly, this study focuses on exploring strategies to eliminate students' misconceptions in algebra.

Knowledge of Student Thinking in Eliminating Misconceptions

Misconceptions are caused by students' constructing concepts in their minds in line with their own understanding and are generally defined as a phenomenon that is not scientifically correct but can be explained by students in their own way (Ebenezer & Fraser, 2001). According to Baki (1999) and Driver and Easley (1978), misconceptions arise as a result of individuals' experiences and false beliefs. If students have a misconception in their prior learning, it is highly likely that new concepts will also contain misconceptions because mathematics is learned in a relational way. However, since these misconceptions arise from students' incorrect coding of new information in their minds and are supported by the individual's experiences, these are constantly resistant to change (Tafara, 2015). In this context, Minstrell (1982) see misconceptions as permanent barriers to conceptual understanding. For this reason, as educators, we

need to know the underlying causes of these conceptions and take measures to create more efficient learning environments (Ojose, 2015).

In this context, teachers should be aware of their students' ways of thinking, anticipate scenarios in which students may form misconceptions, and organize their teaching accordingly. All these processes are associated with knowledge of student thinking (K-ST), as an important component of pedagogical content knowledge (An et al., 2004; Shulman, 1987). Pedagogical content knowledge, which is defined as the knowledge of how to teach a certain subject (An et al., 2004), is expressed in most studies with the components of subject knowledge, pedagogical knowledge, student knowledge, and curriculum knowledge (An et al., 2004; Morine-Dershimer & Kent 1999). One of these components, K-ST, is defined as knowing the characteristics of a particular group of students and planning the teaching accordingly by creating a classroom environment that meets the needs of these students (Fennema & Franke 1992). An et al. (2004) mention four components of K-ST. These are i) *building new knowledge on the student's existing ideas,* ii) *identifying students' misconceptions*, iii) *involving students in mathematics learning processes,* and iv) *encouraging students' thinking about mathematics*. In the same study, the authors stated that teachers should link students' prior knowledge with new ones through various representations, examples, and manipulatives, and focus on students' conceptual understanding rather than procedures or rules. Teachers also need to accurately identify students' misconceptions and eliminate such misconceptions by using appropriate questions or tasks. In this context, strong student knowledge enables teachers to measure how well students understand mathematical concepts, to understand possible misconceptions and their causes, and to develop clear strategies to correct these misconceptions (An & Wu, 2012; Even & Tirosh, 1995).

Purpose

Since it is not possible to completely prevent students' misconceptions (Ünlü, 2015), instructors in mathematics education will always encounter students with misconceptions. Based on this fact, it is important how to behave in these situations. Considering the misconceptions that students have in algebra, it is necessary for teachers to be aware of these misconceptions and to be able to use appropriate teaching methods and strategies to overcome these misconceptions. Therefore, in this study, knowledge of student thinking was used in the context of pedagogical content knowledge.

However, when the studies about student misconceptions in algebra are examined in the literature, most of them (Aydın-Güç & Aygün, 2021; Akhtar et al., 2020; Bush & Karp, 2013; Erdem & Aktaş, 2018; Rathnayake & Jayakody, 2022; Sarımanoğlu, 2019; Welder, 2012; Yasseen et al., 2020) focused on the current situation but practical studies on how to diagnose and eliminate existing misconceptions (Bingölbali, 2010; Chick & Baker, 2005; Erdem & Sarpkaya-Aktaş, 2018; Kılıç, 2011) were found to be quite limited. In one of these studies, Bingölbali (2010) investigated how mathematics teachers deal with student difficulties in their lessons. In this study, five primary school teachers' mathematics lessons were observed in order to reveal how they intervene in students' errors and misconceptions. Algebra activities were utilized in the study. Click and Baker's (2005) study with nine middle school teachers was based

on interview processes conducted through open-ended questions similar to this study. Teachers were compared with students' answers containing misconceptions and were asked the question ‘What would you say to a student with such a misconception?’. The questions used in this research are related to different subject areas of mathematics. Erdem and Sarpkaya Aktaş (2018) investigated the effectiveness of activity-based instruction in eliminating misconceptions in algebra. Kılıç (2011) examined student knowledge in the context of pedagogical content knowledge of the participants in his study with six pre-service teachers. In the study in which she participated as a participant observer, the author observed the pre-service teachers during their undergraduate course and used different sources such as interviews, observations, questionnaires and written documents to collect data.

Although the studies mentioned here so far differ in terms of purpose and methodology, it can be said that they generally try to observe how teachers or pre-service teachers intervene in students' errors or misconceptions in different learning areas. This study differs from other studies in that it focuses on mathematics teachers rather than pre-service teachers, focuses only on pre-defined possible misconceptions about algebra learning, and offers the opportunity to observe all the processes carried out by mathematics teachers and their students in detail. Within the scope of the study, it is aimed to obtain richer and more useful data on specific situations. In this context, the aim of the study is to examine how mathematics teachers use knowledge of student thinking in the process of identifying and eliminating students' misconceptions in algebra. The research problem can be expressed as ‘How do mathematics teachers use the knowledge of student thinking in the process of identifying and eliminating students' misconceptions about algebra?’.

Method

This study has a qualitative design, and the case study method was used to examine a specific phenomenon or situation in detail during the study process. Within the scope of the study, an embedded single case design from different types of case study was used. This type is often used to understand a complex event or situation, identify cause-effect relationships, or develop a theoretical framework. Besides, in this type of studies, there is the existence of more than one analysis unit in a single situation (Yin, 2018).

Each teacher involved in this study has been considered as a different unit of analysis, and a detailed analysis of these different cases has been conducted in an attempt to develop a theoretical framework for teachers' process of addressing student misconceptions. The results obtained from this study were interpreted on this axis. So, the relevant type appears to be suitable for this study.

Participants

The participants in the study consisted of three mathematics teachers and ten secondary school students who were selected from the classes taught by these teachers. In the determination of the participants, convenient and criterion sampling methods were used together. The teachers involved in the study were selected from individuals accessible to the researcher, and they volunteered to participate in the study. The criteria for selecting teachers included having more than 10 years of professional experience

and working in schools with an average level of academic performance in the city center. Gender diversity was also considered in the selection of teachers. Therefore, the teacher coded as T1 in the study was a male with 13 years of professional experience. The teacher coded as T2 was a female with 15 years of professional experience. Lastly, the teacher coded as T3 was also a female with 21 years of professional experience.

Additionally, ten secondary school students were selected from the classes taught by these teachers. In the selection of these students, criteria such as providing expected answers to questions in the diagnostic test prepared by the researchers and voluntary participation in the study have been taken into account. At this stage, the students who were predicted to have misconceptions were included in the study with the help of the answers they gave to the questions in the diagnostic test and the explanations including the reasons for their answers.

Ethical Procedures

This research was approved by University Social and Human Sciences Research Ethics Committee with its decision dated 27.01.2021 and numbered 2020-12. In addition, necessary permissions with the 20982064 and 20981990 numbered, were obtained from the provincial directorate of national education to carry out the study and the institutions of the participating teachers were informed about the study. However, parental consent was obtained from the students participating in the study, the participation of the students was completely voluntary, and it was stated that any participant could leave the study whenever they wanted. Confidentiality principles were also complied with within the framework of ethical rules.

Data Collection Procedures and Instruments

In the study process, a diagnostic test was first developed for the possible misconceptions that students may have and applied to a total of 94 eighth grade students selected from the classes of the participating teachers. Based on the answers they provided to the questions in the test, students who were likely to have misconceptions were identified. Since the students were asked to explain the reasons for their answers in writing in the diagnostic test, student expressions were used in this process. At the end of the process, students who were predicted to have misconceptions were paired with their teachers. Accordingly, three teachers were matched with a total of ten students and semi-structured interview processes were planned between teachers and students. At the end of the process, it was tried to reveal how the teachers used the knowledge of student thinking in eliminating misconceptions by utilizing the interview processes carried out by the teachers.

Diagnostic Test (DT)

In the preparation of the diagnostic test, a comprehensive content was created by conducting a literature review in the field, focusing on different types of misconceptions in algebra. The categories found in the studies of Sarpkaya-Aktaş (2019), Güler (2014), and Baki (2008) have been referenced in the final version of the diagnostic test. Accordingly, there are 14 questions in seven different categories in the test. These categories are i) *Misconceptions about the concept of algebraic expression and variable*, ii) *Misconceptions about the concept of equality*, iii) *Misconceptions about the*

concept of identity, iv) *Misconceptions about the concept of equation*, v) *Misconceptions about the concept of inequality*, vi) *Misconceptions about the concept of pattern*, vii) *Misconceptions about linear relations and equations*. Expert opinions were used for the validity of the test, and a pilot study was conducted for reliability. For the pilot study, the test was administered to 27 students from a different school in the same school district, and the questions were finalised accordingly. Each of the questions in the diagnostic test may contain misconceptions belonging to more than one category. Accordingly, the categories to which the 14 questions in the diagnostic test belong and questions 4, 5, 7, 9, 10 and 14 in the findings section are given in Appendix.

Semi-Structured Interviews (SSI)

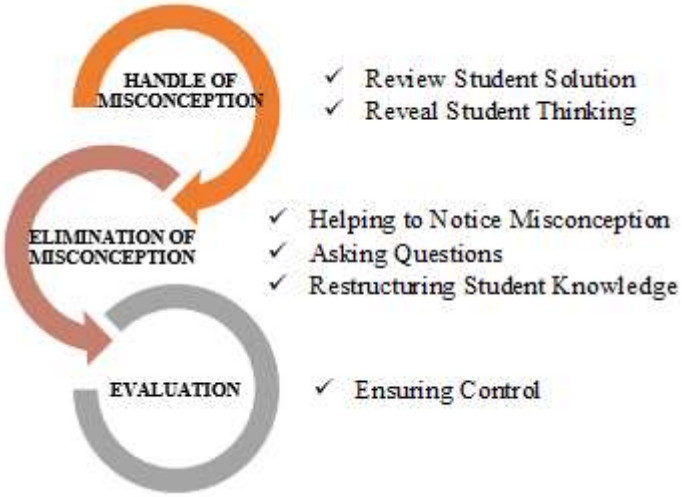
In this study, SSIs were conducted between students with misconceptions and teachers. Since this study was conducted during the pandemic period, the interview process was conducted online and recorded using screen and audio recordings to protect the data. No time constraints were imposed on the teachers during the interview sessions. Some of the questions in the semi-structured interview form can be exemplified by 'Can you explain to me what you did in this question?', 'Why do you think this answer is correct?', 'Can there be a different solution to this question?'.

In order to analyze the data obtained within the scope of the study and evaluate teacher performances, researchers conducted inductive coding processes. All of the data obtained from the interview processes were analysed inductively, and an attempt was made to develop a framework for how teachers deal with student misconceptions. In this process, teacher behaviours were associated with the indicators of K-ST by making use of the relevant literature (An et al., 2004; Özaltun, 2014) and an evaluation framework was created to outline the interview processes and to analyse teacher performances.

In the formation of the framework, the researchers acted together and created certain categories and stages for teacher behaviours, and then the views of a faculty member who had different studies in the field were consulted for the relevant framework. Accordingly, the components of the relevant framework are in Figure 1. At the stage of handle of misconception, which is the first stage of the process, the teacher examines the student's solution. At this stage, the teacher tries to understand student's thinking by using appropriate questions. In the second stage of the process, the teacher tries to help the student recognize the misconception and determine the source of his mistake. Then, the teacher tries to ensure that the student replaces the wrong knowledge with the correct one/ones by using appropriate methods and teaching strategies. During the evaluation stage, the teacher implements techniques to determine whether the student's misconception persists. Although this process has a hierarchical structure in basic stages, in fact all processes are intertwined. For example, in the stage of elimination of misconception, the teacher may ask the student to explain his/her solution (sub-solutions) with own sentences, in accordance with the indicators belong to the step of handle of misconception. Similarly, a teacher who tries to give the correct information to the student in the process of restructuring student knowledge, may apply the processes related to the evaluation stage and try to control whether the student understands the outputs of the pedagogical methods used in the process or not.

Figure 1

Components (Stages) of the Evaluation Framework



Therefore, although it is not possible to separate this intertwined process with definite boundaries, the relevant framework has been formed in general terms to carry out the data analysis process in the study and relevant indicators have been created for each step. Based on this structure, the indicators created for each stage of the process are as follows (Table 1).

Table 1

Assessment Framework and Relevant Indicators

	Inadequate (IA)	**Partially Adequate (PA)**	**Adequate (A)**
Handle of Misconception			
Review Student Solution	*Prevents the student from explaining their solution process in their own words, as the solution is read out to them without allowing them to express it in their own terms.*	*Provides the opportunity for the student to explain their solution but makes inducements during the process.*	*Allows the student to explain their solution process in their own words.*
Reveal Student Thinking	*Asks more information-based questions that require a single answer, where the answer is evident from the teacher's speed and tone of voice or the nature of the question itself.*	*The questions asked, provide partially evidence for the student's thinking.*	*Asks questions that allow the student to provide evidence for their thinking and elaborate on the given information.*
Elimination of Misconception			
Helping to Notice Misconception	*Does not provide any feedback to the student regarding the validity of their solution. Gives incorrect/incomplete feedback regarding*	*Provides clues for the student to recognize why their solution is incorrect/invalid and gives some guidance, but these clues and guidance mostly*	*Provides the student with clues to recognize why their solution is incorrect/invalid and enables them to identify the source of*

	whether the solution is valid or not. Does not facilitate any process for the student to recognize their misconception.	*remain at the procedural or rote knowledge level rather than addressing conceptual understanding.*	*their misconception/error.*
Asking Questions*			
Restructuring Student Knowledge	i) The teacher prompts the student to think and develop their ideas based on evidence. ii) The teacher utilizes different representations and models to facilitate conceptual understanding. iii) The teacher breaks down/simplifies the concept into sub-concepts in order to address student misconceptions. iv) The teacher aims to facilitate the construction of accurate knowledge by creating a discussion environment through a question/answer method.		
	The teacher does not use any of the above strategies and methods in the process of knowledge construction.	*The teacher partially utilizes the above strategies and methods in the process of knowledge construction.*	*The teacher appropriately utilizes the above strategies and methods in the process of knowledge construction.*
Evaluation			
Ensuring Control	*The teacher does not conduct any control process regarding the continuation of the misconception.*	*The teacher partially addresses the control of the misconception by asking questions like "Do you understand?"*	*The teacher ensures the continuation of the misconception by checking through similar situations.*

**Asking questions- Reveal student thinking stages have the same indicators.*

The framework and related indicators in Table 1 were used to evaluate teacher performances in interview processes. The encoder reliability for the coding processes of teacher behaviours was calculated in data analysis processes and in case of conflict, the relevant records were listened again, and the researcher codings were finalized.

Findings

In this study, the performance of three different teachers in diagnosing and eliminating student misconceptions can be summarized based on the processes included in the evaluation framework as follows. The data in the Table 2 are generated based on the high-frequency performances of the teachers.

Upon examining the data presented in Table 2, it can be observed that the teachers generally exhibited similar and inadequate performances throughout the entire process. However, it is evident that T3 coded teacher demonstrated significantly better performance compared to the other teachers. However, when considering different stages of the process, it can be said that the teachers exhibited better performances in ensuring control compared to other stages.

Table 2

Teacher Performances for Diagnosing and Eliminating Misconceptions

	Teacher Performances		
	T1	**T2**	**T3**
Handle of Misconception			
➢ *Review Student Solution*	IA	IA	IA
➢ *Reveal Student Thinking*	IA	IA	PA
Elimination of Misconception			
➢ *Helping to Notice Misconception*	IA	IA	PA
➢ *Asking Questions*	IA	IA	PA
➢ *Restructuring Student Knowledge*	IA	IA	PA
Evaluation			
➢ *Ensuring Control*	IA	PA	PA

In order to present the findings obtained from this research in more detail, in this section, the performances of the participating teachers will be exemplified with selected direct quotations. The exemplification aims to highlight crucial aspects of their performance. The quoted questions in this section are provided in appendix.

Findings Obtained from Teacher Coded T1

The teacher with the code T1, showed inadequate performance in the majority of the interview processes. This teacher read and solved all the questions himself throughout the process and did not pay much attention to the students' solutions. This teacher, who used totally traditional methods, received feedback from his students solely to validate himself, and did not include questions that attempted to disclose how they thought. It was observed that the teacher in question attempted to explain the correct answers to the students (without revealing the reasons) rather than correct the students' misconceptions. The interview process conducted by the T1 coded teacher regarding the 5th, 9th and 10th questions in the diagnostic test is given below respectively.

Example Case 1: T1 for the 5th question. Some excerpts from the interview between the T1 and the student who stated that the given problem solution is correct, are provided below. This student accepted the solution with 96-69/(7-a) written as 27/ (7-a).

> T1: Any idea how to solve this question? (The teacher writes the question again as)
>
> Student: …. (She cannot give an answer).
>
> T1: Because the unknown is the denominator of this expression, we can answer this question as follows. What number is subtracted from 96 to yield 9?
>
> Student: 87
>
> T1: So, we can say that this expression is equal to 87, right? Can we now imagine that the number 1 is under 87 here and perform the cross multiplication?
>
> Student: Yes.

> T1: (The teacher equated the given expression to 87 and discovered the value of 'a' as 180/29 by conducting the whole process herself). Equalizing the denominator was a bit of a challenge here because it was in the unknown denominator. So, whatever I subtract from 96 equals 9, we found the answer. Ok?
>
> Student: Yes.

The teacher does not implement any method to reveal the reasons of the student's wrong answer and addressing the student's mistake, instead, he solves the supplied problem himself. However, this student thinks that the equation of 96-69/(7-a) =9 can be written as 27/(7-a) =9. It is likely that the learner did not grasp the division operation in the given expression, or that the operation priority rule was violated. The teacher was content to show the student the correct solution for the question instead of focusing on the wrong solution.

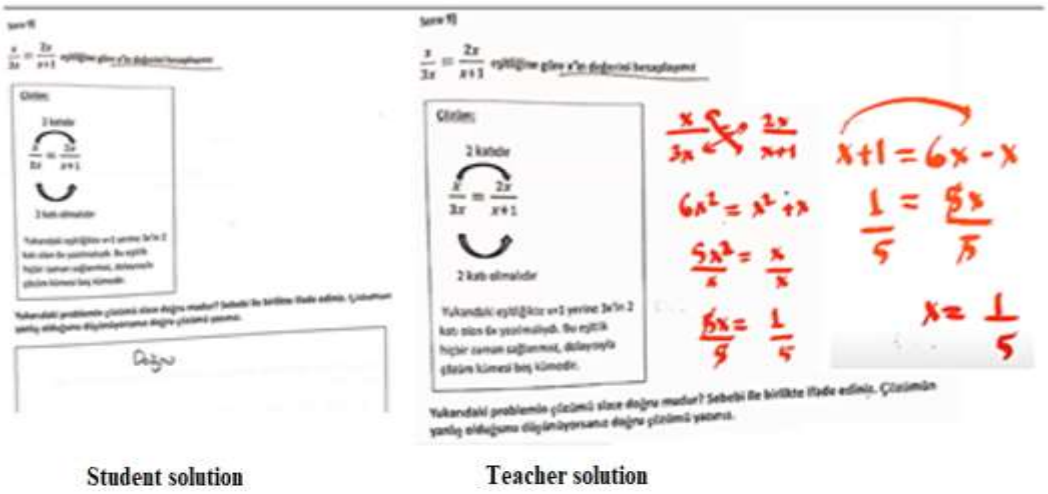
During the phase of 'review student solution' for the 'handle of misconception process', this process was coded as inadequate because the teacher read the student's solution himself and did not give the student the opportunity to explain her solution. Since the teacher did not take any action to elicit student thinking, the process of 'reveal student thinking' was also coded as inadequate. For the process of 'elimination of misconception', the process was coded as inadequate because the teacher did not take any action to make the student realize that the solution was wrong during the phase of 'helping to notice misconception'. Regarding the 'asking questions' phase, it was accepted that the teacher performed inadequately because he asked such questions that the answer was generally given by him and only wanted to be confirmed. In the process of 'restructuring student knowledge', the teacher's performance was coded as inadequate because he did not use any strategies or methods in this process. Finally, since the teacher did not carry out any process to determine whether the student's misconception continued during the 'ensuring control' phase of the 'evaluation' process, his performance was coded as inadequate.

Example Case 2: T1 for the 9th question. In question 9, the student stated that the solution given was correct. Some parts of the interview process between this student and the teacher coded T1 are given in Figure 2. This student believes that the equation has no solution. The reason for the student's thinking may be due to a misconception designed by the researchers or it may be because the student has a different perspective. If the student has a misconception, she may claim that since the numerator is doubled in the given expression, the denominator should also be doubled and therefore the expression should be written as '6x' instead of 'x+1'. Although this claim is true, the fact that the student thinks that 'x+1' and '6x' are different from each other constitutes the reason for the student's thinking that the given equation does not have a solution. Therefore, the process and questions that the teacher will ask in order to reveal the student's thinking are of great importance.

In this process, the teacher solved the equation himself and reached the solution x=1/5. Here, the operations performed by the teacher without taking into account the student's thoughts are noteworthy. The teacher ignores the student's mistake and accepts that 'x+1' is equal to '6x' and does not question the meaning of the result x=1/5. It is also noteworthy that at the end of the process, the teacher did not carry out any process to determine whether the student understood the solution of the problem or whether she had any questions.

Figure 2

Student and teacher solutions for the 9th question



T1: What is the first solution that comes to your mind to solve this question?

Student: …to equalise the denominators.

T1: Yes, it's possible, it can be done, and what about doing the cross multiplication here?

Student: Yes, maybe.

After that, the teacher reached the solution by performing the necessary mathematical operations for the solution of the problem and found the x value as 1/5. Then, the teacher handled the question in a different way.

T1: When you look at the solution to this question, what happened to x? Did it become 2x, doubling? So, what happens if I double 3x as well?

Student: 6x

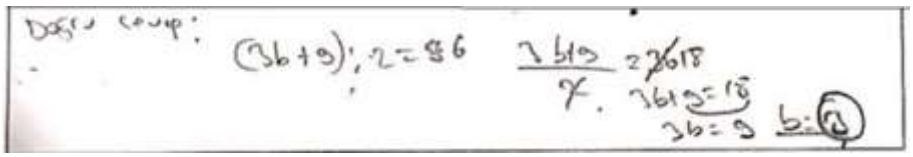
T1: It should be 6x. So, we can write x+1=6x.

Therefore, in this question, since the teacher coded T1 did not carry out any process to reveal the student thinking, to make her notice and eliminate her misconception, and to determine whether the student's misconception continued or not, all stages for the processes of 'handle of misconception', 'elimination of misconception' and 'evaluation' were coded as inadequate.

Example Case 3: T1 for the 10th question

Figure 3

Student solution for the 10th question



Below is the interview process conducted by the T1 coded teacher with the student who made the mistake in Figure 3 for the 10th question.

T1: Your answer is wrong, now let's look at your mistake. (3b + 9) /2 =36, now what did you do here? You simplified 36 and 2, but what were we doing in the rational equations?

Student: Don't know.

T1: (Teacher solves the question by equating the denominator). In rational equations, we solve the equation by equating the denominator, not by simplification.

In this question, it is seen that the teacher only uses rote knowledge to correct the student's mistake and continues the process without questioning the reason or source of the student's wrong answer. For this reason, the teacher's performances in all processes were coded as inadequate in this question as in the other questions.

Findings Obtained from Teacher Coded T2

When the interview processes conducted by the T2 coded teacher were examined, it was seen that this teacher read the student solutions throughout the process and conducted the process in a teacher-centered manner. This teacher generally used a rule-based approach when addressing students' misconceptions and asked them to remember the rules they had memorized while providing correct information. It was observed that the teacher did not focus much on why the student's solution was wrong. In addition, she did not check whether the students' misconceptions persisted, but only asked questions such as ‘Do you understand?’ and ‘Okay?’. Throughout the process, it was observed that the teacher displayed partially adequate and mostly inadequate performance. The interview process conducted by the teacher coded T2 regarding the 4th and 14th questions in the diagnostic test is given below, respectively.

Example case 1: T2 for the 4th question. Some parts of the interview process between the T2 and the student who said that the given solution of the problem is correct, are given below. This student considered the solution in which ‘13-7x’ is written as ‘6x’ to be correct.

T2: You answered this question wrong; would you like to have a look again?

Student: (he doesn’t say anything)

T2: What were we doing in such questions, were we grouping the known (variables) to one side and the unknown (variables) to the other in such questions?

Student: Yes.

T2: Well, you said that this solution is right, how did we get 6x?

Student: I don’t know.

T2: So, let's try it again. You tell me what you want, and I'll write it. Known variables on one side and unknowns on the other, correct?

Following that, the teacher solved the problem with the help of the student and arrived at the conclusion $x=1$.

T2: So, the answer given in the question is correct ($x=1$) but is the solution correct?

Student: No.

T2: In other words, the result is correct by chance, but this procedure was wrong from the beginning. You know what she did here, she subtracted 7x from 13 and said 6x, then I can subtract 3x from 9 as well. It's a bit of ridiculous solution. The answer is correct, but the solution is wrong, understand?

Student: Yes.

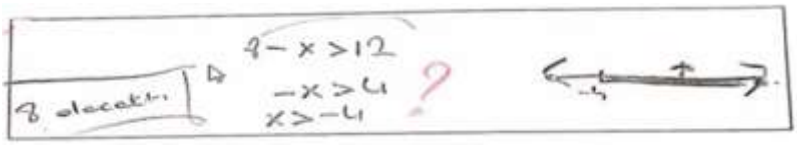
Here, it is seen that the teacher partially involved the student in the process but did not explain the reasons for the incorrect mathematical knowledge to the student. Therefore, it can be said that the teacher did not give the student enough opportunity to question the current situation.

In the process of 'handle of misconception', the stages of 'review student solution' and 'reveal student thinking' were coded as inadequate because the teacher directly told the student that she answered this question incorrectly and did not give the student the opportunity to explain her thinking. Since there was no teacher intervention in the 'helping to notice misconception' and 'asking questions' stages of 'elimination of misconception' stage, these stages were also coded as inadequate. However, since the teacher partially involved the student in the process at the 'restructuring student knowledge' and used her ideas in the solution process, this stage was coded as partially adequate. During the 'evaluation phase', although the teacher did not carry out a process to determine whether the student's misconceptions persisted or not, his performance at this stage was coded as partially adequate since he used questions such as 'did you understand' during the interview process.

Example Case 2: T2 for the 14th question

Figure 4

Student solution for the 14th question



The relevant part of the interview process conducted by the T2 coded teacher, regarding the student mistake (given above) is given below.

T2: Can our unknown be negative? (The teacher says for -x)

Student: It can't.

T2: What do we need to divide each side in order to make it (x) positive?

Student: -1.

T2: So, this side is x, and this one is -4? Ok? And do you remember inequalities, how we multiply or divide an inequality by a negative number? There was a rule, remember? Inequality was shifting. Do you remember this?

Student: I couldn't remember.

T2: If we divide or multiply by a negative number, the direction of our inequality changes.

In the interview process above, it is seen that the teacher tried to correct the student's misconception with rule-based knowledge. However, it can be said that the mathematical expressions used by the teacher in the process have the potential to lead the student to different misconceptions. Expressions such as 'Can our unknown be negative' and 'What do we need to divide each side in order to make it positive' may cause misconceptions in students because the minus sign in front of the variable 'x' does not mean that it is negative.

Although the above process was inadequate for all stages of the process, the stage of 'reconstructing student knowledge' was coded as partially adequate because the teacher included the student in the process, even if partially, and used her answers in the process.

Findings Obtained from Teacher Coded T3

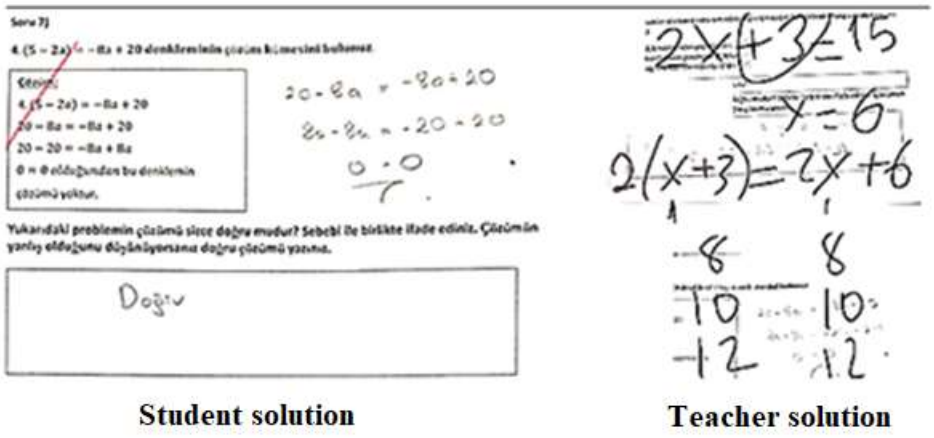
The teacher coded T3 focused on the student's thinking throughout the interview processes and tried to progress by relating new knowledge with the student's existing

knowledge in most cases. Although this teacher often allowed the student to express his own thoughts, question and explore the reasons for the student's misconception, it was observed that in some questions she made explanations such as 'this is not true', 'it cannot be written this way'. It was observed that the teacher who tried to explain the reasons for mathematical rules showed adequate and partially adequate performances in most of the interview processes.

Example Case 1: T3 for the 7th question. Some parts of the interview process between the T3 and the student who said that the given solution of the problem is correct, are given below. Based on the information given in Figure 5, it can be observed that the student, using the distributive property, arrives at the equation 0=0 and concludes that the equation has no solution.

Figure 5

Student solution for the 7th question



Student solution **Teacher solution**

T3: What if I told you that I found a=1, how would you check if this is the right solution?

Student: Do we assign value of 1 to ‘a’, and proceed accordingly?

T3: Yes, set a=1 and see what happens.

Student: Ok, 12=12.

T3: So, is the value of 1 for ‘a’ which I found, is wrong?

Student: Yes.

T3: Why, 12=12 is not a wrong situation?

Student: Oh, yes. (The student thinks a little here but cannot be sure). Is it correct?

After this conversation, the teacher changed the course of the interview and tried to clarify the underlying concepts to the student.

T3: Have you ever heard of something called ‘identity’ as a mathematical subject?

Student: Yes.

T3: Well, can you write an identity that you know for me?

Student: I saw the topic, but I can't remember right now.

T3: Ok, have you ever heard of something called ‘equation’ as a mathematical subject?

Student: Yes.

T3: Well, can you write an identity that you know for me?

Student: Ok, 2x+3=15.

T3: Well, if we look at the equation you wrote, 2x=12 and x=6 so the solution of the equation you wrote, is 6. So let me write you an expression like this, 2(x+3) =2x+6. Is this an equation or not, let's talk about it with you.

Student: That’s an identity.

T3: Oh, why?

Student: Because they are equal.

T3: Huh okay because the left side and the right side are equal. There is a ‘identity’ when the left and right sides are equal. Now you can substitute any value for ‘x’ in the expression we call identity, because the left side and the right side are equal. Now if we say x=1, we get 8=8. If we say x=2, we get 10=10. If we say x=3, we get 12=12. In other words, equality has already been attained and is known as ‘identity’ regardless of what we write in place of x (we don't say there is no solution). So, every number is a solution for identities. If the right and left sides are equal, we say that this equation is provided for each number.

Here, it is seen that the teacher tried to explain the concepts of 'equation' and 'identity' to the students. It was accepted that the teacher's explanations here were partially adequate in terms of reconstructing knowledge. The reason for this situation is that although the teacher tries to present the information with reasons, she cannot give up the approach of giving memorized knowledge and does not allow the student to construct the knowledge herself.

At the stage of ‘review student solution’ in the process of ‘handle of misconception’, it was observed that the teacher did not give the student the opportunity to explain her solution and focused directly on the process. Therefore, the related stage was coded as inadequate. However, since the teacher predicted how the student thought and gave the wrong answer to this question, the stage of ‘reveal student thinking’ was coded as adequate since the teacher asked questions which enabled the student to elaborate on the knowledge she had and provided evidence for her thinking. The 'helping to notice misconception' stage of the ‘elimination of misconception’ process was coded as partially adequate because even though the teacher provides guidance on why the student's thinking is wrong, these remain at the procedural level rather than the conceptual level due to the rote definitions used by the teacher regarding the concept of identity. The stage of ‘asking questions’ was coded as partially adequate because the questions asked by the teacher in this phase of the ‘elimination of misconception’ process partially provide sufficient evidence about the student's thinking. The stage of ‘restructuring student knowledge’ was coded as partially adequate because the teacher was able to partially develop it based on student ideas. Finally, since the teacher did not carry out a process to determine whether the student’s misconception persisted or not, the ‘ensuring control’ phase of the ‘evaluation’ process was coded as inadequate.

Discussion and Conclusion

This study aimes to observe how mathematics teachers diagnose and attempt to eliminate the misconceptions held by their students and examined the pedagogical methods and strategies used by the teachers throughout the process. Based on the theoretical foundation of the framework, the study aimed to reveal the extent to which teachers can benefit from student thinking in identifying and eliminating students' misconceptions.

As a general comment, it was observed that all teachers in this study focused on the result rather than the cause in student solutions and tried to explain only the correct solution to the students. Unfortunately, there was no teacher who questioned the reasons behind the students' answers sufficiently during the study. Although all of the teachers participating in the study had at least ten years of professional experience, it was

observed that all of them preferred to explain or retell the subject during the interview process. In general, these teachers tried to ensure that students were able to answer the questions correctly without focusing too much on students' mistakes or misconceptions. In this process, it was observed that teachers adhered to traditional methods and did not generally utilize different pedagogical methods. Related to this situation, studies conducted in the literature show that teachers believe that they will have more permanent learning and prevent time loss by lecturing themselves (Akpınar & Ergin, 2005; Erdem & Ersoy, 2009; Keser, 2003, as cited in Gür & Kobak Demir, 2019). Önen et al. (2008) show that the reason why teachers do not use teaching methods and techniques that allow students to construct their knowledge is that they do not have sufficient knowledge on this subject.

In traditional teaching practices, assessment is done around the axis of true-false, pass-fail and there is no opportunity to correct students' mistakes. In teaching practices based on the constructivist approach, on the other hand, assessment is carried out to reveal students' inadequacies and the reasons for their misunderstandings. The aim is to make a diagnosis. Students are given feedback about their deficiencies and misunderstandings. Thus, students have the opportunity to complete their deficiencies and correct their mistakes within the system (Baki, 2008). In this context, Gelbal and Kelecioğlu (2007) concluded that teachers saw themselves as more competent and preferred traditional measurement-evaluation methods. The results of the study show that teachers have problems using measurement methods due to the crowding of the classroom, lack of time and difficulty in preparation. Another reason for the failure to implement alternative assessment and evaluation techniques is the resistance of teachers to change stereotyped traditional assessment and evaluation approaches (Lambdin, 1993). Teachers' inability to strike a balance between alternative assessment and evaluation approaches and the expectations of traditional education and the incompatibility of alternative assessment approaches and traditional methods cause a dilemma (Suurtamm, 2004, as cited in Gür & Kobak Demir, 2019).

When the performances of different teachers are compared, it can be said that the teacher with the highest professional experience (T3) had the best performance in identifying the causes of students' misconceptions and eliminating them, while the teacher with the lowest experience (T1) had the lowest performance. It was observed that the teacher coded T3 allowed the students to express their answers in their own words during the process of handle of misconceptions and asked questions which provide evidence to reveal the students' thinking. During this process, it was discovered that the T1 coded teacher generally read the students’ solutions without letting them to re-express their thoughts, and even began the process by ignoring the student's incorrect solution, and he asked more knowledge-based and single-answer questions. The T2 coded teacher, on the other hand, followed a rule-based method by taking a more behavioural approach than the T3 coded teacher, emphasising on memorised knowledge, even if he carried out processes to allow students to express themselves and disclose their thinking. It can be said that the T2 coded teacher has a performance between the other two teachers' performances. In the last step of the interview processes, it was observed that T3 coded teacher asked his students ‘Did you understand?’ ‘Okay?’ questions to control student learnings. Furthermore, it was discovered that this teacher (T3) controlled whether or not the misconceptions continues

by having the student develop a solution again using similar examples in some cases. While the T2 coded teacher is trying to provide the control of student learning by asking questions such as ‘Do you understand?’, ‘Ok?’, it was observed that the teacher with the lowest professional experience (T1) did not carry out any control process to determine whether the mistakes/misconceptions continued or not in most cases, and after solving the subject problem, he went directly to answering other questions. So, it can be stated that as teachers' professional seniority grows, they apply their knowledge of student thinking more effectively in the context of pedagogical content knowledge for this study. Although there are not many studies examining the processes of eliminating students' misconceptions in the literature, there are studies examining teachers' pedagogical content knowledge in the context of student thinking knowledge. According to these studies' findings (Carpenter et al. 1988; Feiman-Nemser & Parker, 1990; Shulman, 1987; as cited in Cochran et al., 1993), novice teachers exhibit inadequate pedagogical content knowledge, which is consistent with the findings of the present study. A beginner teacher may also lack a logical framework for delivering information, according to Cochran et al., (1993), who also noted that novice teachers frequently rely on unmodified subject knowledge that is taken directly from the text or curriculum materials. According to Brown and Borko (1992), beginner teachers are not always ready to take on the tasks that are required of them as developmentally competent mathematics teachers. According to Grouws and Schultz (1996), teachers should be aware of their students' thinking styles so that they may address their students' present mathematical knowledge and misconceptions in the classroom.

When the findings obtained from this study are considered in terms of teacher performances, it is seen that there are different studies with similar results in the literature. Mulungye (2016) found in his research with fifteen mathematics teachers that, while teachers are aware of student mistakes and misconceptions, they are unable to apply their knowledge to eliminate these misconceptions. It was reported that the teachers in the study used teacher-centered instruction, so the weak students were identified and supported during classroom discussions. The analyses based on the statistical methods used in the study, revealed that the student errors did not occur by chance, but rather as a result of the teacher's methods. Therefore, teacher practices are very important in teaching algebra. Kimii and Declark (1985) suggests that teachers' focus should be on students' thinking rather than correct answers. We can say that this proposal, which was made years ago, still maintains its importance and up-to-dateness today. Because the teachers in this study generally focused on taking the students to the right solution rather than correcting their misconceptions.

In this part of the research, the discussion on teacher performances will continue to be carried out through the pedagogical methods used by teachers regarding the subject. As a result of this research, it was seen that the methods used by teachers in the process of eliminating misconceptions were traditional and limited. When the results of the studies in the literature are examined, it can be said that in parallel with the results obtained from this study, teachers generally prefer similar methods in the process of eliminating misconceptions, and they do not generally interfere with the student to recognise his mistake. In these processes, it is seen that the teachers directly tell the student their mistake or explain/tell the concepts/subjects again. Different studies in the literature (Bingölbali, 2010; Bursalı & Gökkurt-Özdemir, 2019; Chick & Baker, 2005;

Scleppenbach et al., 2007; Şahin et al., 2016; Şahin, 2011) state that teachers prefer to tell the students the correct answer, give the rule directly, or ignore the mistake. In this context, it's revealed that the instructional explanations of teachers and teacher candidates in eliminating misconceptions are inadequate. Although instructional explanations in which the knowledge of student thinking is used extensively, are one of the most important dimensions of pedagogical content knowledge and studies in the literature (Gökkurt-Özdemir & Soylu, 2017; Kılcan, 2006; Kinach, 2002a, 2002b; Şahin et al., 2016) show that the instructional explanations used by teachers and pre-service teachers are generally rote-based and rule-process-oriented rather than understanding. These situations, which were revealed in the literature, were also frequently observed on the data obtained from this study. Related to this, Borko and Putnam (1996) and Thompson (1992) stated that the explanations of a teacher without adequate conceptual knowledge, would not be at the conceptual level and that the explanations of a teacher who sees mathematics as a set of rules would be rule-based. According to Ersoy and Erbaş (2005), when it comes to teaching algebra, teachers frequently overlook the conceptual side of the idea of variable and emphasize its practical aspect. Therefore, as expressed in these research findings, the teachers in this study mostly focused on the correct response rather than student misconceptions, and on rule knowledge rather than concept knowledge. So, it is seen that the situations expressed in the literature are still valid today.

This research deals with misconceptions in algebra and shows that students still have a wide range of misconceptions in algebra. While this research focuses on the elimination of these misconceptions, there is no doubt that taking instructional measures to prevent the emergence of these misconceptions will contribute to the field. The teaching methods to be used in overcoming the difficulties experienced in the field of algebra learning are of great importance. Kaya (2015) states that different teaching methods used in the lessons provide meaningful and lifelong development of students' algebraic thinking skills. The transition from arithmetic to algebra can be facilitated when students have physical experiences in order to comprehend abstract algebraic knowledge (Tunç et al., 2012). Baykul (2014) suggests using models to concretize abstract concepts in algebra teaching and that these models help in the comprehension of algebraic expressions as well as the ability to perform operations with algebraic expressions and the concept of identity. Similarly, Bukova Güzel (2016) states that it is important to make use of real-life visuals or visualization, which we can use as concrete models in the construction of algebraic expressions, to conceptualize the subject and to increase student motivation in order to realize qualified understandings. Therefore, it can be said that the studies in the literature suggest using visualization to reduce student difficulties in algebra teaching.

All mathematical concepts are related to one another, and hence the teaching of any concept in teaching processes is dependent on other (premise) notions that are necessary for this concept. As a result, learning a concept wrongly, creates a barrier for all future concepts to be taught. Considering that one of the areas where misconceptions are observed most in mathematics education is algebra, it will not be possible to completely prevent these misconceptions, so ways to eliminate them should be found. In this context, it is important to present the results of this research and making suggestions for the future in the light of these results. According to Tafara (2015), the

literature indicates that student misconceptions are difficult to resolve. Even if the student's misconception is eliminated, it is common for the same misconception to resurface after a period. As a result, active participation by students in the process of overcoming misunderstandings is a key need in removing these misconceptions. However, the findings of this study demonstrate that teachers still utilise traditional ways to eliminate student misconceptions and focus on the outcome rather than the process. So, it appears to be a serious problem in mathematics instruction today.

Limitations and Recommendations

In order for teachers to be aware of student misconceptions and to acquire more effective methods to eliminate them, courses or activities to create awareness on the subject can be held in teacher training institutions. Teachers might attend in-service programmes to learn about misconceptions and how to overcome them. Collaborations on this topic might be created between schools and educational institutions. Academicians or professionals can create materials for teachers to use in identifying and correcting student misconceptions in this setting. It is thought that teachers who frequently encounter student difficulties and misconceptions in the classroom and having difficulties in teaching processes, will show great interest in these materials and resources.

This research was conducted with three mathematics teachers, so this can be considered as a limitation for the study. In addition, the time allocated to the interview processes for the teachers involved in this research is a limitation for them. Although there is no time limit for the relevant interviews, the number of questions can be considered as a limitation that prevents teachers from acting more flexible in the interview process. In different studies to be conducted on the subject, more participants can be studied by focusing more on the quantitative dimension of the subject.

Acknowledgement

We would like to thank all the teachers and students who participated in this study.

Statement of Responsibility

The authors of this study are responsible from all parts of the study such as conceptualization, methodology, software, validation, formal analysis, investigation, resources, data curation, writing-original draft, writing-review&editing together.

Conflicts of Interest

There is no conflict of interest in the research.

Author Bios:

Hüseyin Kabadaş was born in Ordu, Turkey in 1991. He graduated from the Primary School Mathematics Teaching program at Karadeniz Technical University in 2013. He completed his master's degree in the department of Mathematics Education at Ordu University in 2022. He conducted his master's thesis on misconception in the context of pedagogical content knowledge and established a theoretical framework that can be used in future studies aimed at addressing misconceptions. He has publications

indexed by H. W. Wilson and TR Dizin and presented papers at national/international conferences and symposiums. He has contributed as co-author to different books and book chapters. The author's current publications cover the subjects of multiple representations, misconceptions and fraction operations. He has been working as a mathematics teacher in state schools affiliated with the Ministry of National Education for 10 years, and currently, he is working in Ordu province. He has volunteered in many projects supported by the government to end child labor and he is an Ph. D. candidate today.

Hayal Yavuz Mumcu graduated from the mathematics department of Karadeniz Technical University in 2001 and started her master's degree in the Department of Secondary Science and Mathematics Education, at Karadeniz Technical University in 2002. She completed her master's degree in 2004 and her doctoral studies in the same program in 2011. After approximately 10 years of working in schools affiliated with the Ministry of National Education as a mathematics teacher, she started her career as an assistant professor in the Department of Mathematics Education at Ordu University in November-2012. She obtained the title of associate professor in December-2020. Today, she has several research articles published in national/international journals and papers at national/international conferences and symposiums. She has also served as an editor and contributed as an author to international books and book chapters. Furthermore, she has led scientific research projects and participated in various projects. Her research interests include the use of mathematics in real-life contexts, mathematical literacy, mathematical modeling, mathematical skills, and computational thinking.

References

Akhtar, Z., Rashid, A., & Hussain, S. (2020). Writing equations in algebra: Investigation of students' misconceptions. *Sir Syed Journal of Education & Social Research, 3*(4), 22-28. https://doi.org/10.36902/sjesr-vol3-iss4-2020(22-28)

An, S., & Wu, Z. (2012). Enhancing mathematics teachers' knowledge of students' thinking from assessing and analyzing misconceptions in homework. *International Journal of Science and Mathematics Education, 10*(3), 717-753. https://doi.org/doi:10.1007/s10763-011-9324-x

An, S., Kulm, G., & Wu, Z. (2004). The pedagogical content knowledge of middle school mathematics teachers in China and the U.S. *Journal of Mathematics Teacher Education, 7* (2), 145–172. https://doi.org/10.1023/B:JMTE.0000021943.35739.1c

Aydin-Güç, F., & Aygün, D. (2021). Errors and misconceptions of eighth-grade students regarding operations with algebraic expressions. *International Online Journal of Education and Teaching, 8*(2), 1106-1126.

Baki, A. (1999). Cebirle ilgili işlem yanılgılarının değerlendirilmesi [Evaluation of algebra-related computing misconceptions]. In *III. Ulusal Fen Eğitimi Sempozyumu Bildirileri Kitabı [National Science Education Symposium Proceedings Book]* (pp.46-49). MEB.

Baki, A. (2008). *Kuramdan uygulamaya matematik eğitimi* [*Mathematics education from theory to practice]*. Harf Eğitim.

Barbieri, C. A., Miller-Cotto, D., & Booth, J. L. (2019). Lessening the load of misconceptions: Design-based principles for algebra learning. *Journal of the Learning Sciences, 28*(3), 381-417. https://doi.org/10.1080/10508406.2019.1573428

Baş, S., Erbaş, A. K. & Çetinkaya, B. (2011). Öğretmenlerin dokuzuncu sınıf öğrencilerinin cebirsel düşünme yapılarıyla ilgili görüşleri [Teachers' knowledge about ninth grade students' ways of algebraic thinking]. *Education and Science, 36*(159), 41-55.

Baykul, Y. (2014). *Ortaokulda matematik öğretimi (5-8. sınıflar) [Teaching mathematics in secondary school (5th-8th grades)].* Pegem.

Bingölbali, F. (2010). *The causes of students' difficulties encountered during the task implementation in mathematics teaching and types of teachers' interventions* [Unpublished master thesis]. Gaziantep University, Gaziantep.

Birgin, O., & Demirören, K. (2020). Sekizinci sınıf öğrencilerinin basit görsel ve cebirsel ifadeler konusundaki hata ve kavram yanılgılarının incelenmesi [Investigation of the preservice science teachers' views and suggestions on the application of the cooperative learning model in distance education environments]. *International Journal of Social and Educational Sciences*, *7*(14), 233-247.

Borko, H., & Putnam, R. T. (1996). Learning to teach. In D.C. Berliner and R.C. Calfee (Eds.), *Handbook of educational psychology* (pp. 673–708). Simon and Schuster Macmillan.

Brown, C., & Borko, H. (1992). Becoming a mathematics teacher. In D.A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 209-239). Macmillan Publishing.

Bukova-Güzel, E. (2016). *Matematik eğitiminde matematiksel modelleme [Mathematical modeling in mathematics education]*. Pegem.

Bursali, G. G., & Gökkurt-Özdemir, B. (2019). Instructional explanations of mathematics teachers and preservice teachers on misconceptions: The subject of probability. *Journal of Computer and Education Research, 7*(14), 642-672. https://doi.org/ doi: 10.18009/jcer.639384

Bush, S. B., & Karp, K. S. (2013). Prerequisite algebra skills and associated misconceptions of middle grade students: a review. *The Journal of Mathematical Behavior, 32*(3), 613-632. https://doi.org/10.1016/j.jmathb.2013.07.002

Çakmak Gürel, Z., & Okur, M. (2018). 7. ve 8. sınıf öğrencilerinin eşitlik ve denklem konusundaki kavram yanılgıları [The misconceptions of 7^{th} and 8^{th} graders on the equality and equation topics]. *Cumhuriyet International Journal of Education, 6*(4), 479-507. https://doi.org/10.30703/cije.342074

Chick, H. L., & Baker, M. K. (2005). Investigating teachers' responses to student misconceptions. In H. L. Chick, and J. L. Vincent (Eds.), *Proceedings of the 29th Conference of the International Group for the Psychology of Mathematics Education* (pp. 249-256). PME.

Cochran, K. F., DeRuiter, J. A., & King, R. A. (1993). Pedagogical content knowing: An integrative model for teacher preparation. *Journal of Teacher Education, 44*(4), 263-272. https://doi.org/10.1177/002248719304400400

Dede, Y., & Peker, M. (2007). Students' errors and misunderstanding towards algebra: Pre-service mathematics teachers' prediction skills of error and misunderstanding and solution suggestions. *Elementary Education Online, 6*(1), 35-49.

Demirören, K. (2019). *Investigation of the 8th grade students' mistakes and misconceptions about algebrary expressions* [Unpublished master thesis]. Uşak University, Uşak.

Di Martino, P., Gregorio, F., & Iannone, P. (2023). The transition from school to university mathematics in different contexts: affective and sociocultural issues in students' crisis. *Educational Studies in Mathematics*, *113*(1), 79-106. https://doi.org/10.1007/s10649-022-10179-9

Driver, R., & Easley, J. (1978). Pupils and paradigms: A review of literature related to concept development in adolescent science students. *Studies in Science Education, 5*(1978), 61- 84. https://doi.org/10.1080/03057267808559857

Ebenezer, J. V., & Fraser, D. M. (2001). First year chemical engineering students' conceptions of energy in solution processes: Phenomenographic categories for common knowledge construction. *Science Education, 85*(5), 509-535. https://doi.org/10.1002/sce.1021

Erdem, Ö., & Sarpkaya Aktaş, G. (2018). Assessment of activity-based instruction in overcoming 7th grade middle school students' misconceptions in algebra. *Turkish Journal of Computer and Mathematics Education, 9*(2), 312-338. https://doi.org/ doi: 10.16949/turkbilmat.333612

Ersoy, Y., & Erbaş, A. K. (2005). Kassel projesi cebir testinde bir grup Türk öğrencinin genel başarısı ve öğrenme güçlükleri [General achievement and learning difficulties of a group of Turkish students in the Kassel project algebra test]. *Elementary Education Online, 4*(1), 18-39.

Even, R., & Tirosh, D. (1995). Subject matter knowledge and knowledge about students as sources of teacher presentations of the subject-matter. *Educational Studies in Mathematics, 29*(1), 1-20. https://doi.org/10.1007/BF01273897

Fennema, E., & Franke, M. L. (1992). Teachers' knowledge and its impact. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning: A project of the National Council of Teachers of Mathematics* (pp. 47–164). Macmillan.

Gelbal, S., & Kelecioğlu, H. (2007). Öğretmenlerin ölçme ve değerlendirme yöntemleri hakkındaki yeterlik algıları ve karşılaştıkları sorunlar [Teachers' proficiency perceptions of about the measurement and evaluation techniques and the problems they confront]. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi [Hacettepe University Journal of Education]*, 33, 135-145.

Gökkurt-Özdemir, B., & Soylu, Y. (2017). Examination of the pedagogical content knowledge of mathematics teachers. *International Online Journal of Primary Education, 6*(1), 26-39.

Grouws, D., & Schultz, K. (1996). Mathematics teacher education. In J. Sikula (Ed.), *Handbook of research on teacher education*. Macmillan.

Güler, M. (2014). *Investigating pre-service teachers' knowledge for teaching mathematics: the sample of algebra* [Unpublished master thesis]. Karadeniz Technical University, Trabzon.

Gür, H., & Kobak Demir, M. (2019). Matematik öğretmenlerinin öğretim profillerinin belirlenmesi [Determining teaching profiles of mathematics teachers]. *Uluslararası Eğitim Bilim ve Teknoloji Dergisi [International Journal of Education Science and Technology]*, *5*(2), 67-105.

Kaya, D. (2015). *A study on the effects of multiple representations-based instruction on students' algebraic reasoning skills, algebraic thinking levels and attitudes towards mathematics* [Unpublished master thesis]. Dokuz Eylül University, İzmir.

Kieran, C. (1992). The learning and teaching of school algebra. In D.A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp.390-419). Macmillan.

Kılcan, S. A. (2006). *The levels of elementary mathematics teachers' conceptual knowledge of the division with fractions* [Unpublished master thesis]. Abant İzzet Baysal University, Bolu.

Kılıç, H. (2011). Preservice secondary mathematics teachers' knowledge of students. *Turkish Online Journal of Qualitative Inquiry, 2*(2), 17-35. https://doi.org/10.17569/tojqi.93311

Kimii, C., & Declark. G. (1985). *Young children reinvent arithmetic: Implications of Piaget's theory.* Teachers College Press.

Kinach, B. M. (2002a). A cognitive strategy for developing pedagogical content knowledge in the secondary mathematics methods course: Toward a model of effective practice. *Teaching and Teacher Education, 18*(1), 51-71. https://doi.org/10.1016/S0742-051X(01)00050-6

Kinach, B. M. (2002b). Understanding and learning-to-explain by representing mathematics: Epistemological dilemmas facing teacher educators in the secondary mathematics "methods" course. *Journal of Mathematics Teacher Education, 5*(2), 153-186. https://doi.org/10.1023/A:1015822104536

Lambdin, D. V. (1993). The NCTM's 1989 evaluation standards. Recycled ideas whose time has come? In N. L. Webb (Eds.), *Assessment in the mathematics classroom: 1993 yearbook* (pp. 7-16). National Council of Teachers of Mathematics.

Lew, H. C. (2004). Developing algebraic thinking in early grades: case study of Korean elementary school mathematics. *The Mathematics Educator, 8*(1), 88-106.

Lucariello, J., Tine, M. T., & Ganley, C. M. (2014). A formative assessment of students' algebraic variable misconceptions. *The Journal of Mathematical Behavior, 33*, 30-41. https://doi.org/10.1016/j.jmathb.2013.09.001

Minstrell, J. (1982). Explaining the "at Rest" condition of an object. *The Physics Teacher, 20*(1), 10-14. https://doi.org/10.1119/1.2340924

Morine-Dershimer, G., & Kent, T. (1999). The complex nature and sources of teachers' pedagogical knowledge. In *Examining pedagogical content knowledge* (pp.21-50). Springer.

Moses, B. (2000). Exploring our world through algebraic thinking. In *Mathematics Education Dialogues, 3*(2), 1−17.

Mulungye, M. M. (2016). *Sources of students' errors and misconceptions in algebra and influence of classroom practice remediation in secondary schools Machakos sub-county, Kenya* [Unpublished Master thesis]. Kenyatta University, Kenya.

National Council of Teachers of Mathematics [NCTM]. (2000). *Principles and standards for school mathematics*. Author.

Ojose, B. (2015). Students' misconceptions in mathematics: Analysis of remedies and what research says. *Ohio Journal of School Mathematics, 72*, 30–35.

O'Leary, K., Fitzpatrick, C. L., & Hallett, D. (2017). Math anxiety is related to some, but not all, experiences with math. *Frontiers in Psychology, 8*, 2067. https://doi.org/10.3389/fpsyg.2017.02067

Önen, F., Saka, M., Erdem, A., Uzal, G., & Gürdal, A. (2008). Hizmet içi eğitime katılan fen bilgisi öğretmenlerinin öğretim tekniklerine ilişkin bilgilerindeki değişimin tespiti: Tekirdağ örneği [The knowledges about the methods and technics of teaching relating to teachers who attended to the in service education: sample of Tekirdağ]. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi [Ahi Evran University Faculty of Education]*, 9(1), 45-57.

Örnekçi, A. (2019). *Examination of 8th grade students' errors and misconceptions about the slope of mathematics lesson* [Unpublished master thesis]. Erzincan Binali Yıldırım University, Erzincan.

Özaltun, A. (2014). *Professional development of mathematics teachers: Reflection of knowledge of student thinking on teaching* [Unpublished master thesis]. Dokuz Eylül University, İzmir.

Ralston, N., & Li, M. (2022). Student conceptions of the equal sign: Knowledge trajectories across the elementary grades. *The Elementary School Journal, 122*(3), 411-432. https://doi.org/10.1086/717999

Rathnayake, R., & Jayakody, G. N. (2022). Diagnosing mathematics ability of technology students: misconceptions in algebra. *Advances in Technology, 2*(1), 31-37. https://doi.org/10.31357/ait.v2i1.5477

Reyes, J. D., Insorio, A. O., Ingreso, M. V., Hilario, F. F., & Gutierrez, C. (2019). Conception and application of contextualization in mathematics education. *International Journal of Educational Studies in Mathematics, 6*(1), 1-18.

Şahin, Ö., & Soylu, Y. (2019). Elementary mathematics teachers canditates' development of instructional strategies knowledge about algebra. *Cumhuriyet International Journal of Education, 8*(3), 887-912. https://doi.org/10.30703/cije.582921

Sahin, Ö., & Soylu. Y. (2011). Mistakes and misconceptions of elementary school students about the concept of variable. *Procedia-Social and Behavioral Sciences, 15*, 3322-3327. https://doi.org/10.1016/j.sbspro.2011.04.293

Şahin, Ö., Gökkurt, B., & Soylu, Y. (2016). Examining prospective mathematics teachers' pedagogical content knowledge on fractions in terms of students' mistakes. *International Journal of Mathematical Education in Science and Technology, 47*(4), 531-551. https://doi.org/10.1080/0020739X.2015.1092178

Şahin, S. (2011). *The influence of a professional development program related to students' mathematical difficulties on teachers' ways of handling difficulties* [Unpublished master thesis]. Gaziantep University, Gaziantep.

Şahiner, F. (2018). *Misconceptions on algebraic expressions in maths lesson for secondary school 8th grade students* [Unpublished master thesis]. Akdeniz University, Antalya.

Sarpkaya-Aktaş, G. (Ed.). (2019). *Uygulama örnekleriyle cebirsel düşünme ve öğretimi [Algebraic thinking and its teaching with application examples]*. Pegem.

Schleppenbach, M., Flevares, L. M., Sims, L. M., & Perry, M. (2007). Teachers' responses to student mistakes in Chinese and US mathematics classrooms. *The Elementary School Journal, 108*(2), 131-147. https://doi.org/10.1086/525551

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1-22. https://doi.org/10.17763/haer.57.1.j463w79r56455411

Strong, D. S., & Cobb., N. B. (2000). Algebra for all: It's a matter of equity, expectations, and effectiveness. In *Mathematics Education Dialogues*, *3*(2), 1-17. National Council of Teachers of Mathematics.

Suparno, P. (2005). *Miskonsepsi dan perubahan konsep dalam pendidikan fisika [Misconceptions and concept changes in physics education]*. Grasindo.

Tafara, C. (2015). *A study into secondary school students' misconceptions in algebraic expressions. A case of a secondary school in Bindura district* [Unpublished PhD thesis]. Bindura University, Zimbabwe.

Thompson, A. G. (1992). Teachers' beliefs and conceptions: a synthesis of research. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 127–146). Macmillan.

Tunç, M. P., Durmuş, S., & Akkaya, R. (2014). İlköğretim matematik öğretmen adaylarının matematik öğretiminde somut materyalleri ve sanal öğrenme nesnelerini kullanma yeterlikleri [Primary school mathematics teacher candidates' competencies in using concrete materials and virtual learning objects in teaching mathematics]. *MATDER Mathematics Education Journal*, (1), 13-20.

Uçar-Sarımanoğlu, N. (2019). The investigation of middle school students' misconceptions about algebra. *Studies in Educational Research and Development, 3*(1), 1-22.

Welder, R. M. (2012). Improving algebra preparation: implications from research on student misconceptions and difficulties. *School Science and Mathematics, 112*(4), 255-264. https://doi.org/10.1111/j.1949-8594.2012.00136.x

Yang, X., Kaiser, G., König, J., & Blömeke, S. (2020). Relationship between pre-service mathematics teachers' knowledge, beliefs and instructional practices in China. *ZDM, 52*, 281-294. https://doi.org/10.1007/s11858-020-01145-x

Yasseen, A. R., Yew, W. T., & Meng, C. C. (2020). Misconceptions in school algebra. *International Journal of Academic Research in Business and Social Sciences, 10*(5), 803-812. https://doi.org/10.6007/IJARBSS/v10-i5/7250

Yin, R. K. (2018). *Case study research: Design and methods* (6th ed.). SAGE.

Appendix

The Questions in DT

Question	Type of misconception
1	❖ Misconceptions about algebraic expression and variable concept • Failure to distinguish the purposes of letter symbols in arithmetic and algebra ❖ Misconceptions about the concept of equation • İnversion error
2	❖ Misconceptions about algebraic expression and variable concept • Inability to associate coefficient with terms
3	❖ Misconceptions about the concept of equality • Thinking that there should always be the same expressions on different sides of equality • Considering terms close to the equality sign
4	❖ Misconceptions about algebraic expression and variable concept • Always start on the left
	Question 4: **Find the value of x in the equation of** $13 - 7x = 9 - 3x$ **Solution:** $13 - 7x = 9 - 3x$ $6x = 9 - 3x$ $6x + 3x = 9$ $9x = 9$ $x = 1$ **Do you think the solution to the above problem is correct? Please state the reason. If you think the solution is wrong, write down the correct solution.**
5	❖ Misconceptions about algebraic expression and variable concept • Always start on the left
	Question 5: **Find the value of "a" in the equation of** $96 - 69/(7 - a) = 9$ **Solution:** $96 - 69/(7 - a) = 9$ $27/(7 - a) = 9$ **Since when we divide 27 by 3 it will equal 9** $7 - a = 3$ $a = 4$ **Do you think the solution to the above problem is correct? Please state the reason. If you think the solution is wrong, write down the correct solution.**
6	❖ Misconceptions about linear relationships and linear equations • Misconceptions related to interpreting the graph of linear equations
7	❖ Misconceptions about the concept of identity • Thinking that a given algebraic expression is either an identity or an equation
	Question 7: **Find the solution of the equation** $4.(5 - 2a) = -8a + 20$ **Solution:** $4.(5 - 2a) = -8a + 20$ $20 - 8a = -8a + 20$ $20 - 20 = -8a + 8a$ $0 = 0$ **so, this equation has no solution.** **Do you think the solution to the above problem is correct? Please state the reason. If you think the solution is wrong, write down the correct solution.**

8	❖ Misconceptions about the concept of pattern • Misconceptions about the concept of nth digit
9	❖ Misconceptions about the concept of equality • Thinking that there should always be the same expressions on different sides of equality
	Question 9: **Calculate the value of x according to the equation of** $\frac{x}{3x} = \frac{2x}{x+1}$ **Solution:** two times "x" $\frac{x}{3x} = \frac{2x}{x+1}$ should be two times "3x" **In the above equation, 6x, which is 2 times of "3x", should have been written instead of "x+1". This equality is never satisfied, so the solution set is the empty set.** **Do you think the solution to the above problem is correct? Please state the reason. If you think the solution is wrong, write down the correct solution.**
10	❖ Misconceptions about the concept of equation • Limited application of the reverse transaction ❖ Misconceptions about algebraic expression and variable concept • Using the constant term instead of the coefficient of the variable
	Question 10: **Calculate the value of "b" in the expression of** $(3b + 9) : 2 = 36$ **Solution:** $(3b + 9) : 2 = 48$ $12b = 48 : 2$ $12b = 24$ $b = 2$ **Do you think the solution to the above problem is correct? Please state the reason. If you think the solution is wrong, write down the correct solution.**
11	❖ Misconceptions about the concept of inequality • Not being able to determine the solution set while solving the inequality correctly
12	❖ Misconceptions about the concept of equation • Errors due to lack of understanding of the transfer method
13	❖ Misconceptions about the concept of identity • Misconceptions about the identity of a perfect square
14	❖ Misconceptions about the concept of equation • Inversion error ❖ Misconceptions about the concept of inequality • Not changing the direction of the inequality when the inequality is multiplied by a negative number

Question 14:

$4-\frac{x}{2}>6$

Find the solution set of the inequality and show it on the number line.

Solution:

$4-\frac{x}{2}>6$

$4-x>12$

$-x>12-4$

$-x>8$ **If we edit this expression**

$-8<x$ **The solution set is shown on the number line as follows.**

Do you think the solution to the above problem is correct? Please state the reason. If you think the solution is wrong, write down the correct solution.

Journal of Theoretical Educational Science, 17(3), 592-615, July 2024
Kuramsal Eğitimbilim Dergisi, 17(3), 592-615, Temmuz 2024
[Online]: http://dergipark.org.tr/akukeg
DOI number: http://doi.org/10.30831/akukeg.1386249

The Role of Word Decoding Speed and Accuracy on Reading Comprehension in a Highly Transparent and Morphologically Complex Orthography

Sözcük Çözümleme Hızı ve Doğruluğunun Saydam ve Morfolojik Olarak Karmaşık Ortografideki Okuduğunu Anlama Üzerindeki Rolü

Tevhide KARGIN* **Birkan GÜLDENOĞLU****
Hilal GENGEÇ*** **Reşat ALATLI******

Received: 5 November 2023 **Research Article** **Accepted:** 15 April 2024

ABSTRACT: This research aimed to investigate the impact of word decoding speed and accuracy on reading comprehension in Turkish, which is characterized by a highly transparent and morphologically complex orthographic system. The study involved 160 students, half of whom were identified as poor readers, while the other half were classified as good readers. These participants were selected from the second and fourth grades of public elementary schools. The assessment process involved evaluating participants' isolated word decoding skills using a task that measured their ability to decode both real words and pseudowords. Additionally, reading fluency and comprehension were measured using grade-level appropriate reading texts. The analysis included a series of MANOVAs as well as a mediation model (Model 7) employing Haye's PROCESS macro for SPSS. The findings indicated that the poor readers' limited reading comprehension abilities were primarily attributed to their overall deficiency in word decoding fluency, with a particular emphasis on their inadequate phonological decoding skills. These results are significant as they shed light on the challenges that children with reading comprehension difficulties may face in transparent orthographic systems. The attainment of proficient reading comprehension in such languages appears to be influenced by the specific aspects of word decoding fluency.

Keywords: Word decoding, reading fluency, reading comprehension, orthography, mediation model.

ÖZ: Bu araştırmanın amacı, oldukça saydam ve morfolojik olarak karmaşık bir ortografi sistemine sahip olan Türkçe'de kelime çözümleme hızı ve doğruluğunun okuduğunu anlama üzerindeki etkisini incelemektir. Çalışmaya, yarısı zayıf okuyucu, diğer yarısı ise iyi okuyucu olarak sınıflandırılan 160 öğrenci katılmıştır. Bu katılımcılar devlet ilkokullarının ikinci ve dördüncü sınıflarından seçilmiştir. Değerlendirme süreci, katılımcıların hem gerçek sözcükleri hem de sahte sözcükleri çözümleme becerilerini ölçen bir görev kullanarak sözcük çözümleme becerilerini değerlendirmeyi içermektedir. Ek olarak, okuma akıcılığı ve anlama, sınıf seviyesine uygun okuma metinleri kullanılarak ölçülmüştür. Analiz, bir dizi MANOVA'nın yanı sıra Haye'nin SPSS için PROCESS makrosunu kullanan bir aracılık modelini (Model 7) içermektedir. Bulgular, zayıf okuyucuların sınırlı okuduğunu anlama becerilerinin öncelikle sözcük çözümleme akıcılığındaki genel eksikliklerine atfedildiğini ve özellikle yetersiz fonolojik çözümleme becerilerine vurgu yapıldığını göstermiştir. Bu sonuçlar, okuduğunu anlama güçlüğü çeken çocukların saydam ortografik sistemlerde karşılaşabilecekleri zorluklara ışık tutması açısından önemlidir. Bu tür dillerde yeterli okuduğunu anlama becerisinin kazanılması, sözcük çözümleme akıcılığının belirli yönlerinden etkileniyor gibi görünmektedir.

Anahtar kelimeler: Sözcük çözümleme, okuma akıcılığı, okuduğunu anlama, ortografi, aracılık modeli.

* Prof. Dr., Ankara University, Ankara, Turkey, tkargin@gmail.com, https://orcid.org/0000-0002-1243-8486
** Prof. Dr, Ankara University, Ankara, Turkey, birkanguldenoglu@yahoo.com , https://orcid.org/0000-0002-9629-1505
*** *Corresponding Author*: Asst. Prof. Dr., Kırıkkale University, Kırıkkale, Turkey, gengechilal@gmail.com, https://orcid.org/0000-0001-8723-6857
**** Dr., Ankara University, Ankara, Turkey, resatalatli@gmail.com, https://orcid.org/0000-0001-7504-5746

Citation Information
Kargın, T., Güldenoğlu, B., Gengeç, H., & Alatlı, R. (2024). The role of word decoding speed and accuracy on reading comprehension in a highly transparent and morphologically complex orthography. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 17*(3), 592-615.

ISSN: 1308-1659

Reading is a multifaceted process that involves various cognitive and linguistic abilities (Tunmer, 2008). The Simple View of Reading (SVR-Gough & Tunmer, 1986) posits that reading comprehension relies on two essential components: decoding and oral language comprehension. Decoding, a crucial aspect of reading instruction, encompasses two dimensions: accuracy and fluency. Accuracy pertains to the ability to correctly produce the phonological representation of each word, while fluency concerns the speed of decoding. Extensive research emphasizes that the majority of young or inexperienced readers struggle primarily with word decoding speed and accuracy, which leads to significant difficulties in reading, including poor comprehension (e.g. Cutting & Scarborough, 2006; Kim et al.,2010; Price et al., 2016). These deficits can be attributed to insufficient grapheme-to-phoneme conversions or limitations in fluency, which refers to the inability to decode written materials at an appropriate pace.

The development of fluent decoding skills plays a vital role in the reading process. As decoding becomes automatic and more accurate, readers can allocate their cognitive resources toward understanding the meaning of the text (Fuchs et al., 2001; Wolf & Katzir-Cohen, 2001). Fuchs et al. (2001) emphasized the significance of word decoding fluency for proficient reading and suggested that instruction focused on fluency holds promise for enhancing the reading comprehension abilities of struggling readers. Overall, existing literature consistently agrees that fluent and automatic word decoding is a crucial factor in achieving reading comprehension. Various studies conducted in different orthographic systems have reported moderate to strong positive correlations between word decoding fluency and comprehension (e.g., Fernandes et al., 2017; Kim et al., 2014; Kuhn et al., 2010; Vaknin Nusbaum et al., 2020). For instance, a recent study investigating Hebrew found that reading fluency, assessed in terms of both speed and accuracy (excluding prosody), significantly related to the reading comprehension skills of second-grade students (Vaknin Nusbaum et al., 2020). Similarly, a study focusing on English-speaking students demonstrated a bidirectional positive relationship between word decoding fluency and reading comprehension skills (Klauda & Guthrie, 2008). Additionally, research conducted in a moderately deep orthography, Portuguese, indicated that efficiency in word decoding is foundational for the development of reading fluency (i.e., fast and accurate reading) and significantly contributes to reading comprehension (Fernandes et al., 2017). In a recent study conducted in Turkish, a highly transparent orthography, Turna and Guldenoglu (2019) investigated the phonological decoding and reading fluency of Turkish students across different grade levels (first, fourth, and eighth). They found a significant relationship between word decoding speed and accuracy and reading fluency, with deficits in this domain negatively impacting reading fluency across all grade levels. Taken together, these findings suggest that word decoding speed and accuracy are critical components of reading across orthographic systems, as they are closely associated with reading outcomes such as fluency and comprehension.

Various cognitive models have been developed to explain word decoding development, looking at the mechanistic routes by which efficient decoding is achieved (Coltheart, 2005; Frost 1998, 2006; Goswami &Ziegler, 2006; Ramus et al., 2003; Ziegler & Goswami, 2005). A widely accepted model for the principles of the word decoding mechanism is the Dual Route Cascaded (DRC) reading model (Coltheart, 2005; Coltheart et al., 2001). DRC assumes there are two distinct routes to get from a

primitive alphabetic-phonological stage to a more advanced orthographical one to decode words. The first is a phonological or non-lexical route that focuses on grapheme-to-phoneme conversions through phonological analysis, and the second route is known as the orthographical or lexical route, which involves the direct retrieval of written word forms from the reader's orthographic lexicon (Coltheart, 2005).The basic assumption of DRC is that the phonological route, mapping letters onto sounds, is the initial and causal mechanism of the word decoding procedure; it enables beginning readers to decode and blend sub-lexical parts of written words to build orthographic representations in their mental lexicons (Share, 2011). In this model, the orthographic route is often conceptualized in terms of automaticity (fluency) because it is rapid and requires minimal effort. As the automaticity approach also argues, an increased use of this route eventually increases the speed of decoding and allows the attention once required for the task of word decoding to be devoted to reading comprehension.

The Role of Orthographic Transparency in Reading

Extensive research has established that the orthographic transparency of a language significantly influences word decoding speed and accuracy (Seymour et al., 2003; Ziegler et al., 2010). Alphabetic orthographies vary widely in terms of the consistency of their grapheme-to-phoneme mappings. English, with its inconsistent grapheme-phoneme conversions, represents one end of the spectrum, while Turkish, characterized by perfect correspondence between graphemes and phonemes, exemplifies the other extreme. Seymour et al. (2003) conducted a study to illustrate these differences among orthographic systems. They developed a set of simple real words and non-words and administered them to first-grade students from 14 European countries. Readers of orthographically consistent languages (e.g., Greek, Finnish, German, Italian, Spanish) performed strongly in both real word and non-word reading, while English readers fared significantly worse, reflecting the inconsistency of the English language. Another cross-linguistic study comparing word decoding in English and Turkish yielded similar findings. Due to the orthographic transparency of the Turkish language, Turkish children demonstrated faster and more accurate word decoding skills than their English counterparts by the end of the first grade (Durgunoglu & Oney, 1999). These results underscore the impact of the orthographic characteristics of a language on word decoding speed and accuracy.

Turkish stands out as one of the few orthographic systems characterized by highly symmetric transparency in grapheme-to-phoneme conversions (Babayigit & Stainthorp, 2011; Durgunoglu, 2006; Durgunoglu & Oney, 1999, 2002; Oney & Goldman, 1984; Raman, 2006). The regular orthography of Turkish consistently produces one-to-one relationships between graphemes and their corresponding phonemes. Notably, a letter in the Turkish alphabet generally maintains the same pronunciation across all the words in which it appears (Babayigit & Stainthorp, 2010; Oney & Durgunoglu, 1997; Raman, 2006). However, it is important to recognize that while Turkish exhibits high orthographic transparency, it is also a morphologically complex agglutinative language, distinguishing it from other transparent languages such as German, Dutch, and Finnish. Turkish commonly employs suffixation, resulting in the formation of long words through the combination of numerous suffixes. This morphological complexity, with its iterative loops, allows for the potential creation of

words of infinite length through various combinations of suffixes. This intricate word formation process can impede the decoding process for readers, particularly those who are less experienced, and hinder their fluency in accessing decoded words from their orthographic lexicon. One can argue that this particular attribute of the Turkish language adds complexity to the word decoding process in reading, emphasizing the significance of proficient decoding abilities in facilitating reading comprehension.

In conclusion, the significance of word decoding speed and accuracy for reading comprehension may vary in highly transparent yet morphologically complex languages like Turkish compared to opaque languages like English. However, most studies have primarily focused on English-speaking children, and there is limited evidence from transparent orthographies. This restricts the generalizability of the findings, given that English possesses one of the most-opaque orthographic systems. Furthermore, the existing research on the association between word decoding speed and accuracy and reading comprehension in a language with unique linguistic characteristics, such as Turkish, has yielded inconclusive results. Since the relative importance of word decoding speed and accuracy may differ in impacting reading comprehension, it is important to investigate the relationship specifically in highly transparent orthographies that represent morphologically complex agglutinative languages like Turkish.

The Present Study

The objective of this research was to investigate the impact of word decoding speed and accuracy on reading comprehension in Turkish, an orthography characterized by high transparency and morphological complexity. The study aimed to provide valuable insights into the factors that contribute to reading comprehension difficulties in transparent orthographies in general, and to shed light on the relationship between word decoding speed and accuracy and reading comprehension in a highly transparent and morphologically complex orthography specifically. When the literature is examined, it is observed that there are studies investigating the relationship between word decoding speed and reading comprehension (Aytaç, 2017; Keskin, Baştuğ & Akyol, 2013; Baştuğ & Keskin, 2012; Güldenoğlu, Kargın & Miller, 2012; Kargın, Güldenoğlu, & Alatlı, 2023), as well as studies examining the relationship between word reading accuracy and reading comprehension (Arabacı, 2022; Güldenoğlu, et al., 2012). However, a study comparing the impact of word decoding speed and accuracy on reading comprehension between students with good and poor performance in reading could not be found. The study differs from other studies in the literature in that it examines the mediating effect of word reading speed and accuracy on reading comprehension.

Research Questions

1. Do deficiencies in word decoding speed and accuracy have a substantial association with the inability to comprehend text effectively in Turkish?

2. How are word decoding speed and accuracy related to reading comprehension in Turkish, a language characterized by high transparency and morphological complexity?

Method

This study, which aims to examine the mediating effect of word decoding speed and accuracy on reading comprehension of good and poor readers attending the 2nd and 4th grades, is in the relational screening model. Relational screening model is a screening approach that aims to determine the existence of co-variation between two or more variables. In the relational screening model, whether the variables change together or not; If there is a change, it is tried to determine how it happened (Karasar, 2006).

Participants

The participants consisted of 160 students (80of them were poor readers, 80 were good ones) recruited from the second and fourth grades in public elementary schools in Turkey (Table 1). The two samples were balanced with respect to grade levels and gender distribution. The participants in both samples came from socio-economically disadvantaged backgrounds and were enrolled in regular education classrooms. According to their school files:(a) poor readers consisted of students with lower reading comprehension performance in their classes, while good ones were average; (b) all participants included in the study were individuals who spoke Turkish as their native language, had normal vision or corrected-to-normal vision, and did not have any diagnosed cognitive disabilities (hearing impairments, intellectual disabilities, visual impairments, etc.); (c) good readers were educated in the same class as poor ones. In determining the participants, 2nd and 4th grade reading comprehension texts included in the Reading Skills Assessment Battery (RSAT) developed by Alatlı et all. (2022) were used.

Table 1

Demographic Distribution of Participants Based on Reader Profile, Gender, and Grade Level

Reader Profile	**Grade 2**		**Grade 4**		**Total**
	M	F	M	F	
Poor readers	23	17	26	14	80
Good readers	16	24	15	25	80
Total	39	41	41	39	160

To check the participants' reading profiles, we applied a reading comprehension assessment with grade level matched reading texts and multiple choice questions related to the texts (for details, see Measurements). We ran an ANOVA, with reader profile (poor readers (PR), good readers (TD)) and grade level (second and fourth grades) as between-subject factors. Results appear in Table 2.

Table 2

Means and Standard Deviations in Reading Comprehension Considering Reader Profile and Educational Level

Grade Level	PR	TD	Total
Grade 2	3.10 (1.31)	4.85 (.86)	3.97 (1.41)
Grade 4	3.42 (.98)	4.85 (.76)	4.13 (1.13)
All	3.26 (1.16)	4.85 (.81)	4.05 (1.27)

Note.(Maximum accuracy score= 6, PR : Poor readers, TD: Good readers)

The group comparison yielded a highly significant between-group effect, with TD readers demonstrating significantly higher reading comprehension rates compared to their poor reader counterparts ($F(1,159) = 99.79$, $p < .01$, $\eta 2 = .39$). The main effect of grade level was found to be statistically non-significant ($F(1,159) = 1.04$, $p > .05$, $\eta 2 = .00$), indicating that overall grade level did not have a significant impact on the classification of individuals as good or poor readers. Additionally, the interaction between grade level and reader profile was not statistically significant ($F(1,159) = 1.04$, $p > .05$, $\eta 2 = .00$), indicating that the reading comprehension differences between the two grade levels were similar for both groups (see Table 2).

Measurements

Isolated Word Decoding

We tested isolated word decoding performance using participants' reaction time and accuracy in an isolated word (a single word without a suffix) decoding task, with two different word statuses (real word and pseudoword). This task included 84 words (half were real words and the other half pseudowords) developed in a way that conformed to the Turkish language spelling rules and commonly used syllable structures (V, V+C, C+V, C+V+C, V+C+C, C+V+C+C), with one to four syllables. First, we determined if the real words were familiar to all participants. To test this issue, participants' teachers were asked to evaluate the relevance of the selected words to their students' level. They verified that each word used in the study fell within the active vocabulary of the youngest participants. Subsequently, they rearranged the letters of the real words to create pseudowords (e.g., the letters of “eldiven" (a real word) were displaced and “denilev” (a pseudoword/nonword) was created). We made sure the words were grammatically correct but had no meaning or use.

During the application of the paradigm, participants were asked to read aloud the words presented on a computer screen within five seconds. The items were presented one by one; if students gave no response within five seconds, the computer automatically passed to another word. We used D-MASTR software (http://www.u.arizona.edu/~kforster/dmastr/dmastr.htm)to present stimuli and collect data. This software is a computer-based application that enables the precise measurement of response latencies within the millisecond range. It records these latencies along with response accuracy, facilitating subsequent analysis.

Reading Fluency

The reading fluency of participants was calculated by the number of correct words read per minute (the formula of [total number of words read correctly X 60 / reading time (in seconds)]) from a grade level matched text. We used two narrative texts (one for second and the other for fourth graders). The texts used to determine the reading fluency of both 2nd grade and 4th grade participants are included in RSAT (Alatlı et al., 2022). The second-grade level text consists of 118 words and 14 sentences. The readability value is 57 (medium). The 4th grade level text consists of 267 words and 23 sentences. The readability value is 50 (medium).

Reading Comprehension

Reading comprehension was evaluated by the number of total correct responses to the multiple-choice questions on the text used to test reading fluency. Each text was accompanied by six multiple-choice questions (literal understanding (2 questions); reorganization (1); inference (1); prediction (1); evaluation (1); Day & Park, 2005) with one correct answer for each question. We performed an item analysis of the text questions and found the difficulty levels were average and the discrimination level was high.

Reliability

The reliability of the measurements was determined by Kuder Richardson (KR20) for word decoding and Cronbach Alpha reliability coefficient calculations for reading fluency and test-retest procedure for reading comprehension. To determine the reliability of the isolated word decoding task, we calculated the Kuder–Richardson Formula 20 (KR-20) on the basis of the grade levels; the results were.78 and .82 for the second and fourth grades, respectively. For reading fluency, we calculated the Cronbach Alpha coefficients and found .95 and .97 in each grade respectively. For the reliability analysis of the text questions, we applied the test-retest technique to 30 students in each grade with similar characteristics to our participants; the correlations between the two comprehension measurements were .80 and .70 for the second and fourth grade, respectively.

Procedure

Data were gathered during individual assessment sessions conducted in suitable settings within participants' schools. Prior to each session, participants received detailed information about the study's content, objectives, and procedures. The assessments were exclusively administered to participants who volunteered to take part. The duration of each session ranged from 25 to 30 minutes.

A standardized procedure was implemented across all assessment sessions, commencing with word decoding tasks and subsequently transitioning to text reading activities. Throughout the sessions, participants were instructed to read aloud, enabling the experimenter to record their audio. Upon completion of the applications, the total number of words read per minute was calculated for each participant using the appropriate formula. Following the completion of all independent tasks, the testing session concluded, and participants were expressively acknowledged for their participation.

Ethical Procedures

Participant recruitment adhered to the ethical guidelines outlined by the Turkish Academy of Sciences regarding research involving human subjects. This research was conducted with the permission of the ethics committee of Hasan Kalyoncu University, with the decision dated 20/07/2017.

Role of Researchers

In this study, where the relational screening method, one of the quantitative research methods, was used, the researchers have a doctorate degree in special education and have conducted research in the field of reading difficulties. Within the scope of this study, the role of researchers is limited to collecting data that can be expressed numerically using standardized measurement tools and explaining the results by analyzing these data statistically (Yıldırım & Şimşek, 2005; Walliman, 2017).

Results

Isolated Word Decoding

To examine the isolated word decoding abilities of the two groups, two multivariate analyses of variance (MANOVAs) were conducted. One MANOVA utilized reaction times (RT) as the dependent variable, while the other utilized decoding accuracy (accuracy rate). Both analyses incorporated the reader profile (poor readers (PR) and good readers (TD)) and grade level (second and fourth grades) as between-subject factors, and word status (WS) (real words and pseudowords) as a within-subject factor. The outcomes of these analyses are presented in Table 3 and visualized in Figures 1 and 2.

Reaction Time

The analysis revealed a significant effect of word status (WS) ($F(1,156) = 605.06$, $p < .01$, $\eta 2 = .79$), indicating that participants demonstrated faster decoding times for real words compared to pseudowords. Furthermore, there was a significant main effect of reader profile ($F(1,156) = 145.48$, $p < .01$, $\eta 2 = .48$), indicating that overall, TD readers exhibited faster word decoding abilities compared to their PR peers. Additionally, the main effect of grade level was statistically significant ($F(1,156) = 37.93$, $p < .01$, $\eta 2 = .19$), indicating that fourth graders demonstrated significantly faster word decoding times compared to second graders (see Table 3).

The observed significant interaction between grade level and reader profile ($F(1,156) = 5.54$, $p < .01$, $\eta 2 = .03$) indicated that the variations in word decoding speed between the two grade levels were not consistent for each group. To further elucidate this interaction, two separate ANOVAs were conducted, with word decoding speed as the dependent variable and grade level as the between-subject factor for each reader group. The analysis revealed a significant difference between the two groups in both the second and fourth grades ($p < .01$), but the disparities in word decoding speed between the two grade levels were more pronounced among PR participants compared to TD participants.

Table 3

Means and Standard Deviations in Word Decoding Considering Reader Profile and Educational Level

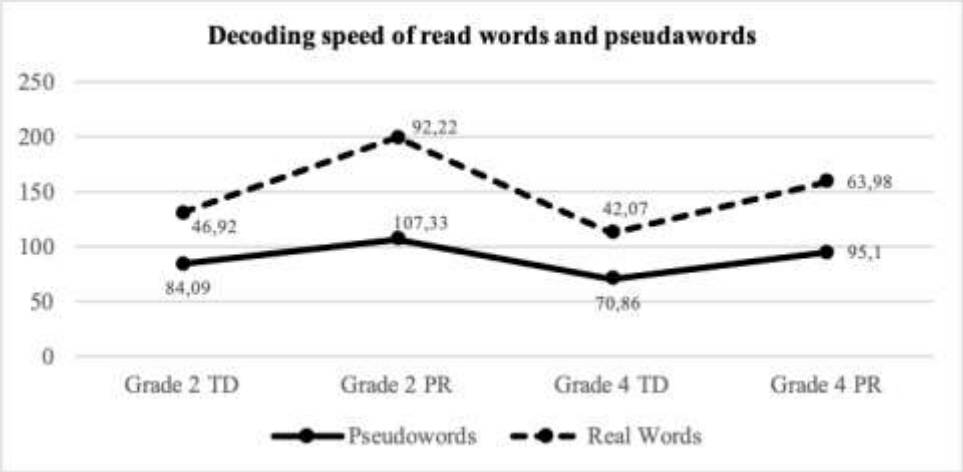
	Real words					
Grade Level	**Reaction Times**			**Accuracy Rates**		
	PR	**TD**	**Total**	**PR**	**TD**	**Total**
Grade 2	92.22 (27.71)	46.92 (9.99)	69.57 (30.79)	32.50 (9.28)	41.92 (.26)	37.21 (8.06)
Grade 4	63.98 (16.20)	42.07 (9.94)	53.02 (17.32)	41.12 (1.11)	41.92 (.47)	41.52 (.94)
All	78.10 (26.66)	44.49 (10.20)	61.30 (26.25)	36.81 (7.87)	41.92 (.38)	39.36 (6.11)
	Pseudowords					
Grade Level	**Reaction Times**			**Accuracy Rates**		
	PR	**TD**	**Total**	**PR**	**TD**	**Total**
Grade 2	107.33 (20.17)	84.09 (13.01)	95.71 (20.52)	22.42 (9.35)	39.27 (1.73)	30.85(10.79)
Grade 4	95.10 (14.51)	70.86 (14.39)	82.98 (18.84)	31.37 (6.31)	39.72 (2.51)	35.55 (6.36)
All	101.21 (18.51)	77.47 (15.17)	89.34 (20.65)	26.90 (9.12)	39.50 (2.15)	33.20 (9.14)
	Overall					
Grade Level	**Reaction Times**			**Accuracy Rates**		
	PR	**TD**	**Total**	**PR**	**TD**	**Total**
Grade 2	99.77 (22.48)	65.50 (10.11)	82.64 (24.44)	27.46 (8.74)	40.60 (.90)	34.03 (9.04)
Grade 4	79.54 (13.60)	56.46 (10.54)	68.00 (16.76)	36.25 (3.37)	40.82 (1.38)	38.53 (3.44)
All	89.66 (21.08)	60.98 (11.22)	75.32 (22.14)	31.85 (7.93)	40.71 (1.17)	36.28 (7.18)
	Word Status Effect					
Grade Level	**Reaction Times**			**Accuracy Rates**		
	PR	**TD**	**Total**	**PR**	**TD**	**Total**
Grade 2	15.10 (18.13)	37.17 (11.36)	26.13 (18.69)	10.07 (6.45)	2.65 (1.70)	6.36 (5.99)
Grade 4	31.11 (14.35)	28.9 (12.95)	29.95 (13.63)	9.75 (6.06)	2.20 (2.31)	5.97 (5.93)
All	23.11 (18.13)	32.98 (12.82)	28.04 (16.42)	9.91 (6.22)	2.42 (2.03)	6.16 (5.94)

Note. (RTs in seconds, Maximum accuracy score= 42 PR : Poor readers, TD: Good readers)

The analysis revealed a significant interaction between the word status (WS) effect and reader profile ($F(1,156) = 18.78$, $p < .01$, $\eta 2 = .10$), indicating that the reaction time differences related to word status were comparable for both reader groups. However, as presented in Table 3, the reaction time differences were more pronounced for TD readers compared to PR readers. The interaction between the WS effect and grade level was not statistically significant ($F(1,156) = 2.79$, $p > .05$, $\eta 2 = .01$), suggesting that the differences in word decoding speed between real words and pseudowords were similar across each grade level. Lastly, the three-way interaction between the WS effect, reader profile, and grade level was not statistically significant ($F(1,82) = .28$, $p > .05$, $\eta 2 = .00$), indicating that the reaction time differences resulting from word status disparities were not uniform for second and fourth graders (see Figure 1).

Figure 1

Reaction Time Means in Real Word and Pseudoword Decoding across Reader Profiles and Educational Levels



Accuracy

The analysis revealed a significant effect of word status (WS) ($F(1,156) = 281.19$, $p < .01$, $\eta 2 = .64$), indicating that participants demonstrated higher accuracy in decoding real words compared to pseudowords. Additionally, there was a significant main effect of reader profile ($F(1,156) = 138.48$, $p < .01$, $\eta 2 = .47$), suggesting that overall, TD readers exhibited greater accuracy in decoding words compared to PR readers. Furthermore, the main effect of grade level was statistically significant ($F(1,156) = 35.85$, $p < .01$, $\eta 2 = .18$), indicating that fourth graders demonstrated higher accuracy in decoding words compared to second graders (see Table 3).

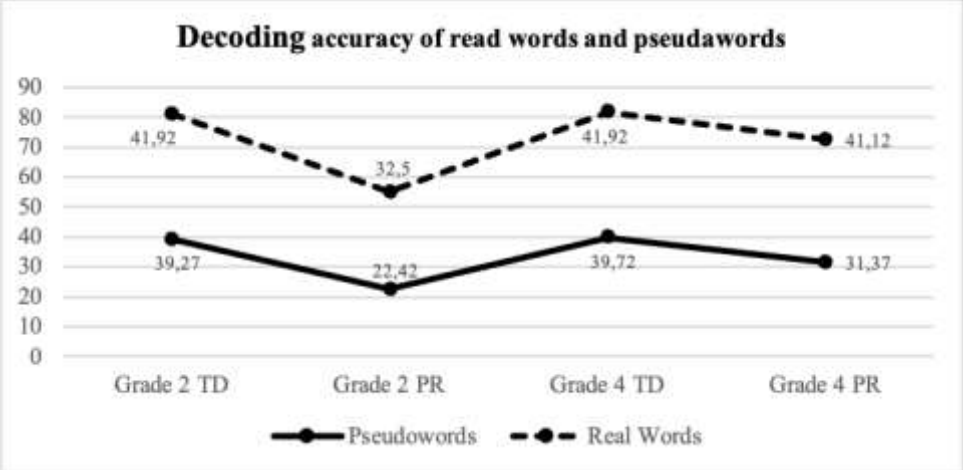
The observed significant interaction between grade level and reader profile ($F(1,156) = 32.36$, $p < .01$, $\eta 2 = .17$) indicated that the differences in word decoding accuracy between the two grade levels were not consistent for each group. To further elucidate this interaction, two separate ANOVAs were conducted, with word decoding accuracy as the dependent variable and grade level as the between-subject factor for each reader group. The analysis revealed a statistically significant difference between PRs in the second and fourth grades ($F(1,79) = 35.15$, $p < .01$), indicating a notable variation in word decoding accuracy. However, a similar difference did not emerge for

TDs (F(1,79) = .73, p > .05), suggesting a lack of significant variation in word decoding accuracy between the two grade levels within this group.

A significant interaction was observed between the word status (WS) effect and reader profile (F(1,156) = 103.56, p < .01, η2 = .39), indicating that the differences in accuracy rates for word decoding related to word status were comparable for both reader groups. The interaction between the WS effect and grade level was not statistically significant (F(1,156) = .27, p > .05, η2 = .00), suggesting that the disparities in word decoding accuracy rates between real words and pseudowords were similar across each grade level. Finally, the three-way interaction between the WS effect, reader profile, and grade level was not statistically significant (F(1,156) = .00, p > .05, η2 = .00), implying that the differences in accuracy rates between the two participant groups resulting from word status variations were consistent for both second and fourth graders (see Figure 2).

Figure 2

Accuracy Means in Real Word and Pseudoword Decoding across Reader Profiles and Educational Levels



Reading Fluency

To assess the reading fluency performance of the reader groups, a General Linear Model (GLM) ANOVA was employed, utilizing reader profile (poor readers (PR) and good readers (TD)) and grade level (second and fourth grades) as between-subject factors. The results of this analysis can be seen in Table 4.

Table 4

Means and Standard Deviations in Reading Fluency Considering Reader Profile and Educational Level

Number of words read per minute			
Grade Level	**PR**	**TD**	**Total**
Grade 2	43.74 (22.81)	108.31 (13.90)	76.02 (37.52)
Grade 4	62.41 (16.70)	110.00 (8.47)	86.21 (27.32)

All	53.07 (21.97)	109.15 (11.47)	81.11 (33.11)

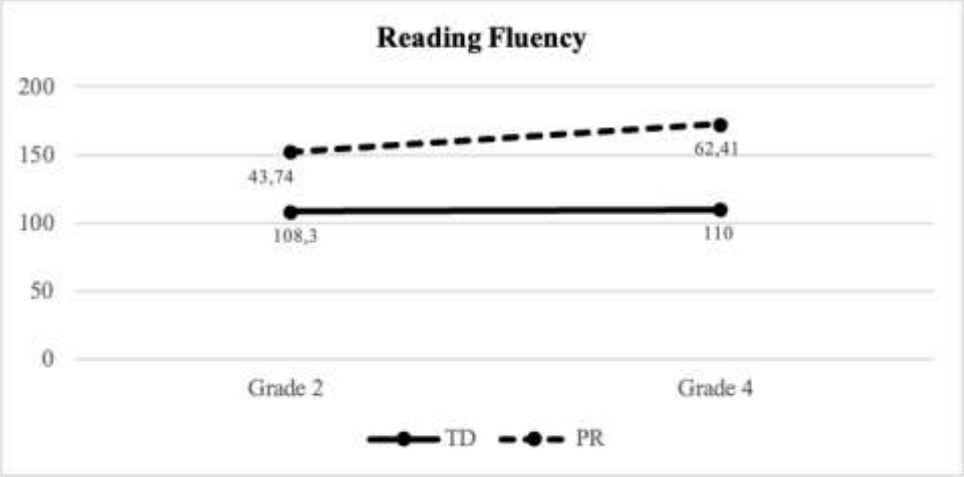
Note. (PR : Poor readers, TD: Good readers)

The main effect of reader profile was found to be statistically significant ($F(1,159) = 472.50$, $p < .01$, $\eta 2 = .75$), indicating that PR participants exhibited lower reading fluency rates compared to their TD peers. Additionally, the main effect of grade level was also statistically significant ($F(1,159) = 15.58$, $p < .01$, $\eta 2 = .09$), suggesting that fourth graders demonstrated higher reading fluency rates than third graders (see Table 4).

The observed significant interaction between grade level and reader profile ($F(1,159) = 10.83$, $p < .01$, $\eta 2 = .06$) indicated that the differences in fluency rates between the two grade levels were not consistent for each group. To further elucidate this interaction, two separate ANOVAs were conducted, with reading fluency as the dependent variable and grade level as the between-subject factor for each reader group. The analysis revealed a statistically significant difference between second- and fourth-grade PRs ($F(1,79) = 17.46$, $p < .01$), suggesting notable variations in reading fluency rates. However, a similar difference did not emerge between second- and fourth-grade TDs ($F(1,79) = .43$, $p > .05$), indicating a lack of significant variation in reading fluency rates between the two grade levels within this group (see Figure 3).

Figure 3

Means of Reading Fluency across Reader Profiles and Educational Levels

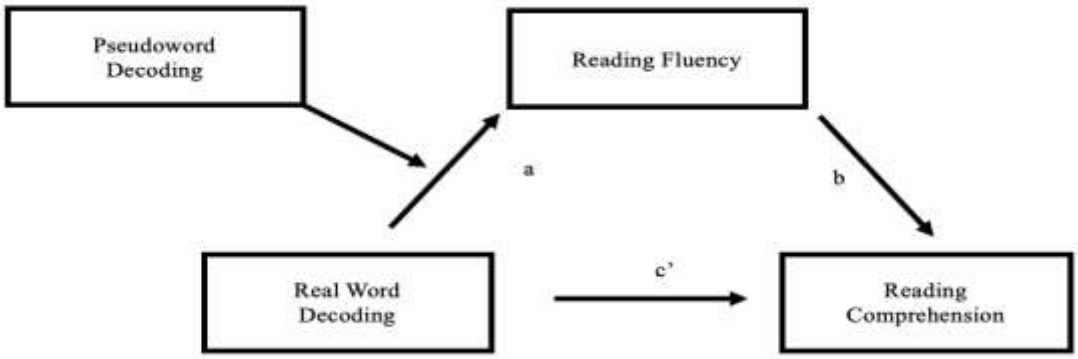


Relationship Between Word Decoding Fluency and Reading Comprehension

To clarify the relationship between word decoding fluency and reading comprehension in a highly transparent orthography, we tested the theoretical framework using a moderated mediation model (Figure 4).

Figure 4

Theoretical Framework for Moderated Mediation Analysis



Before conducting the moderated mediation analysis, we tested the interrelations of the measured variables via Pearson correlation coefficients. Findings revealed positive and significant relationships between all measured variables (Table 5).

Table 5

Correlations Between Variables

Variables	**RWD**	**PWD**	**RF**	**RC**
Real word decoding (RWD)	-			
Pseudoword decoding (PWD)	.766**	-		
Reading fluency (RF)	.652**	.808**	-	
Reading comprehension (RC)	.445**	.584**	.631**	-

The mediating role of reading fluency in the theoretical framework was evaluated with the help of a mediation model (Model 7) using Haye's PROCESS macro for SPSS. This model allows the assessment of the mediation effect with multiple regressions in a single analysis (Hayes, 2018). Results are visualized in Figure 5 and summarized in Table 6.

Figure 5

Multiple Moderated Mediation Analysis (Model 7 by Hayes, 2018)

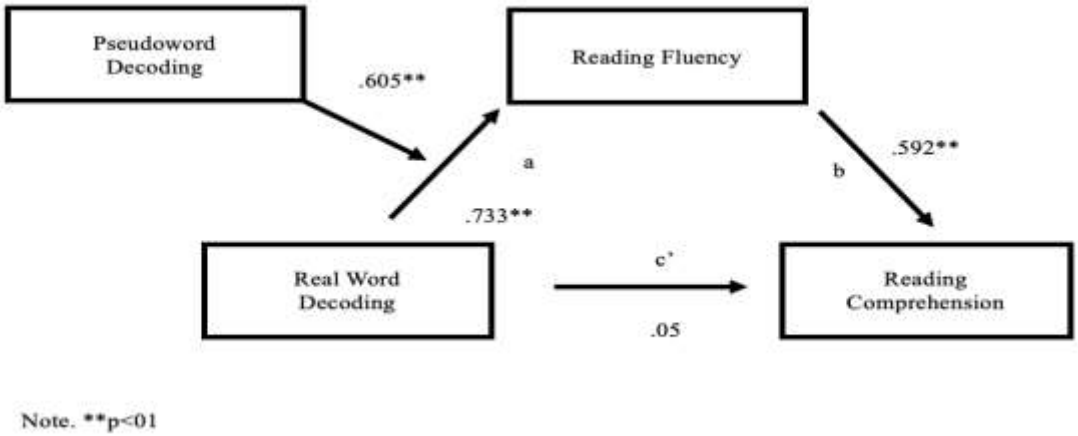


Table 6

Results for Moderated Mediation Analysis

	coeff	**se**	**t**	**p**	**LLCI**	**ULCI**
RWD on RF	.733	.176	4.150	.000	.384	1.082
PWD on RF	.605	.077	7.767	.000	.451	.759
Moderation of PWD	.287	.0714	4.025	.000	.146	.428
RF on RC	.592	.081	7.272	.000	.431	.753
RWD on RC	.058	.081	.714	.475	-.102	.219

Note. (LLCI = lower limit confidence interval; ULCI = upper limit confidence intervalRWD: real word decoding, PWD: pseudoword decoding, RF: reading fluency, RC: reading comprehension)

The direct effect of reading fluency on reading comprehension was also positive and significant (b=.592, s.e.=.081, p<.01), suggesting fluent readers were better comprehenders than non-fluent ones. Finally, when the mediator (reading fluency) was added to the model, a nonsignificant direct effect emerged for real word decoding on reading comprehension (b=.058, s.e.=.081, p>.01). Overall, this evidence suggests reading fluency fully mediates the relationship between phonological decoding and reading comprehension and supports pseudoword decoding as a moderator of the relationship between real word decoding and reading fluency (Table 6). In this model, we tested the mediation (indirect effect) using non-parametric bootstrapping. The lower and upper bound of the 95% confidence interval indicated that the indirect effect was statistically significant (Table 7). Finally, we tested the mediation effect using the Sobel test. Results were statistically significant (p<.01); reading fluency fully mediated the relationship between real word decoding and reading comprehension.

Table 7

Conditional Indirect Effects of Real Word Decoding on Reading Comprehension

Value group	**Effect**	**BootSE**	**BootLLCI**	**BootULCI**
Low	.264	.070	.139	.412
Medium	.434	.106	.250	.663
High	.598	.143	.353	.912
Index of moderated moderation				
Mediator	**Index**	**BootSE**	**BootLLCI**	**BootULCI**
Reading fluency	.170	.040	.104	.261

Note. (LLCI = lower level of confidence interval; ULCI = upper level of confidence interval.)

Discussion and Conclusion

This study aimed to investigate the impact of word decoding speed and accuracy on reading comprehension in Turkish, which possesses a highly transparent and morphologically complex orthography. To achieve this objective, a comparison was made between poor and good readers in a sample comprising second and fourth-grade students. Two tasks were utilized to evaluate word decoding speed and accuracy at both the isolated word and text levels. The isolated word decoding task focused on participants' ability to decode single real words and pseudowords, while the reading fluency task involved determining the number of words read correctly per minute in a grade-level reading text.

According to the Simple View of Reading (SVR - Tunmer & Greaney, 2010), reading comprehension relies on two key components: decoding and oral language comprehension. Decoding refers to the efficient extraction of meaning from printed text, encompassing accuracy and fluency in reading isolated words or nonwords (Lonigan et al., 2018). On the other hand, oral language comprehension involves understanding the linguistic aspects of written materials, such as vocabulary diversity, content, and linguistic structures (Tunmer & Chapman, 2012). These two dimensions are mutually dependent on successful reading, and achieving proficiency in both is crucial for the reading process. In this study, we tested the role of word decoding fluency in reading comprehension based on two research hypotheses by controlling the factors (e.g., vocabulary diversity and content; for details, see Measurements) affecting oral language comprehension.

Our initial hypothesis predicted that poor readers would demonstrate slower and less accurate performance in both isolated word decoding and reading fluency compared to their good reader counterparts. To test this hypothesis, we first evaluated the isolated word decoding abilities of all participants. The results revealed that poor readers exhibited significantly lower proficiency in isolated word decoding efficiency compared to the good readers. This pattern was also observed for decoding speed and accuracy. Consequently, our findings strongly support the first hypothesis, indicating a direct relationship between participants' performance in isolated word decoding speed and accuracy and their reading comprehension abilities.

Upon further examination of the analyses, it became evident that decoding the word stimulus took more time under the pseudoword condition. This observation suggests that participants employed distinct strategies to decode the words in the two experimental conditions. The extended reaction times observed in the pseudoword condition likely signify the engagement of phonological conversion processes in the absence of established orthographic representations. Because they were unknown sequences of letters for the readers, they had only one solution for decoding the pseudowords – to follow the phonological decoding route. However, when the word decoding reaction times are considered separately by group, we see each group took a different decoding route, especially in the decoding of real words. Specifically, the difference in word decoding speed for real words vs pseudowords with the same syllable structure and length in good readers suggested each grade level used different strategies for decoding each word category. Considering that they had only one way to decode the pseudowords, it is clear that the TD group decoded the real words using the orthographic route. This is an important finding; even the second graders had reached the orthographic decoding level when decoding the words. However, PRs were stuck on the phonological decoding route for both word statuses in the second grade; they reached the orthographic decoding level for real words only in the fourth grade but were still significantly slower than their TD peers. From these findings, at first glance, it seems PRs had some difficulties decoding words efficiently.

The results for word decoding speed only were not sufficient to determine isolated word decoding efficiency. Therefore, it was necessary to review them together with the results for the isolated word decoding accuracy. Results for accuracy rates suggested good readers were significantly more accurate (almost at the ceiling level) than PRs in all word categories. In contrast, the word decoding accuracy of PRs was as low as their word decoding speed. Taking the word decoding speed and accuracy results together, it seems PRs lacked a fundamental phonological decoding capacity. The main factor leading us to this conclusion was that PRs lagged significantly behind their TD peers in word decoding speed and accuracy in each grade level whenever they tried to use their phonological decoding skills.

In sum, findings on isolated word decoding speed and accuracy revealed that the word decoding capacity of readers was parallel to their reading comprehension. From this point of view, word decoding efficiency seemed to be a factor in reading comprehension. However, at this stage, the argument was a very preliminary one. For this reason, in the second analysis of the study, we examined the word decoding fluency in the context of the reading fluency performance of reader groups at the text level.

We tested reading fluency based on the number of correct words read per minute. Our findings revealed that having more skill in reading fluency had an impact on participants' reading comprehension skills. More specifically, regardless of the grade levels, good readers read approximately two times more correct words per minute than PRs. It is well established in the literature that efficient word decoding is one of the most important indicators of fluent reading, an important prerequisite for proper reading comprehension (Shaywitz & Shaywitz, 2005). From this perspective, the marked word decoding deficits in PRs may have caused them to perform much more poorly in reading comprehension. In addition, it should be noted that fluency needs to reach an acceptable level in order to contribute to reading comprehension; once the mechanics of

fluency (decoding speed and accuracy) reach a certain level of proficiency, they cease to constrain the comprehension processes (Babayiğit & Stainthorp, 2011; Vaknin-Nusbaum et al., 2020). Consider our PRs, although they increased their fluency rates by nearly 50 % from the second grade to the fourth grade, they were still only half as fluent as their good peers (see Figure 3), and the increase was not enough to contribute to their reading comprehension performance (see Table 2).

We should mention that the orthographical and morphological characteristics of Turkish may have influenced the participants' reading fluency results. As stated in the introduction, Turkish is an entirely shallow orthography. The consistency of grapheme-to-phoneme is perfect; readers only learn 29 correspondences and, in this way, they can decode all words. However, the most interesting aspect of Turkish is its morphological form, notably its agglutinative features. Turkish is characterized by a prevalent agglutinating structure, whereby word formation predominantly relies on suffixation. This linguistic feature leads to the generation of lengthy word forms in Turkish, which may pose challenges for decoding and hinder the transfer of the word into the reader's orthographic lexicon. Consequently, the complexity introduced by the agglutinating nature of Turkish compounds the decoding process and impedes its integration into the reader's existing orthographic knowledge. For this reason, even if they are experienced, in the course of fluent reading, readers frequently require the phonological route based on the process of converting graphemes to their corresponding phonemes. Although Turkish readers deal with an extremely transparent orthography, this situation reduces the reading fluency of those with poor phonological decoding skills, and this, in turn, negatively affects their reading comprehension performance. Thus, even if the entropy of letter to sound is minimum, fluent phonological decoding becomes denser. Nothing is arbitrary in Turkish orthography. The combination of extreme transparency and suffixation requires Turkish readers to have an optimal ratio of phonological decoding capacity to decode the written stimuli fluently.

An interesting question is how word decoding fluency and reading comprehension are affected by the relationship between the excessively agglutinative aspect of the Turkish language and the complete transparency of the orthographic system. Taking this point together with the previous results on isolated word decoding, the disadvantages of PRs in terms of reading fluency make more sense: their lower reading fluency and reading comprehension may have originated in their inefficient phonological word decoding fluency.

The general consensus in the reading literature is that success in reading comprehension depends on a reader’s ability to decode written words accurately and fluently (e.g., Garcia & Cain, 2014; Lonigan et al., 2018; Steensel et al., 2016; Tunmer, 2008; Tunmer & Hoover, 2019). Moreover, there is a reciprocal relationship between them, creating a “chicken and egg” situation, whereby better decoders comprehend the text better, and better comprehenders are more willing to read and thus increase their decoding efficiency. Recent research has also found that automaticity in word decoding has the largest share in reading comprehension performance (e.g., Alvarez-Canizo et al., 2020; Garcia & Cain, 2014; Vaknin-Nusbaum, et al., 2020; Roembke et al., 2019). Given these findings, to clarify the role of word decoding fluency in reading comprehension in a highly transparent orthography, our second hypothesis argued that

reading fluency would act as a bridge between isolated word decoding and reading comprehension.

The results of the regression analyses provided strong evidence supporting the significance of word decoding fluency as a predictor of reading comprehension in Turkish. Furthermore, reading fluency was found to fully mediate the relationship between isolated word decoding and reading comprehension, confirming our second hypothesis and highlighting the role of fluency as a bridge between decoding and comprehension levels. This finding aligns with previous research, which has consistently reported moderate to high positive correlations between word decoding fluency and comprehension in various studies (e.g.,Alvarez-Canizo et al., 2020; Vaknin-Nusbaum et al., 2020; Price et al.,2016; Roembke et al., 2019; Spear-Swerling, 2006; Stevens et al., 2017). The automaticity approach further supports this relationship, suggesting that as decoding fluency improves in terms of speed and accuracy, cognitive resources previously dedicated to decoding can be allocated to comprehension, leading to a more proficient understanding of the text. Importantly, our mediation analysis results align closely with the existing literature. It is worth noting the intriguing finding of the mediation role of phonological decoding, particularly in the context of pseudoword decoding, in real word decoding and reading fluency in Turkish, a highly transparent orthography known for its relatively straightforward phonological transformations. This finding suggests that the complex morphological structure of Turkish plays a crucial role in efficient word decoding, even in an orthography that is considered highly transparent.

Taking all the findings together, it seems the limited reading comprehension of PRs was due to their weakness in word decoding fluency in general and their impoverished phonological decoding abilities in particular. In summary, our findings indicate that word decoding fluency serves as a critical factor in reading fluency and ultimately contributes to reading comprehension, even in a highly transparent orthography like Turkish. This conclusion has implications for understanding the challenges faced by children with reading comprehension difficulties in transparent orthographies.

Based on the aforementioned perspectives, several practical implications can be drawn. Firstly, proficient phonological word decoding skills are crucial for reading comprehension, regardless of whether the orthography is transparent or opaque. Secondly, despite the comparatively easier and faster progress in decoding skills observed in transparent orthographies like Turkish, teachers should prioritize the development of word decoding fluency to enhance the reading comprehension abilities of students with reading difficulties. Thirdly, irrespective of the advantage offered by transparent orthographies, early implementation of a reading curriculum that emphasizes intensive phonological decoding knowledge would greatly benefit the long-term reading comprehension of students with reading difficulties in transparent orthographies.

The study acknowledged certain limitations. Firstly, its exploratory nature constrained the sample size to 160 elementary students, thereby limiting the generalizability of the findings. To enhance the validity and generalizability of the results, future research should aim to expand the sample size and adopt a longitudinal approach. Secondly, the study focused exclusively on the influence of word decoding

fluency on reading comprehension, neglecting other potential factors such as vocabulary, prosody, and cognitive abilities like working memory, rapid naming, and attention. It is recommended that future studies investigate the impacts of these factors across various levels of reading (e.g., word decoding, paragraph or text comprehension) to attain a comprehensive understanding of reading comprehension challenges and develop appropriate interventions.

Acknowledgements

This study was conducted as a component of a nationwide reading project funded by the Turkish Academy of Sciences (Project number: 117K976).

Statement of Responsibility

Therefore, we send an author contribution form to the authors, and authors are required to fill in this form. The form refers to a statement of responsibility in the manuscript that specifies the contribution of every author.

Conflicts of Interest

The authors declare no conflicts of interest to disclose in relation to this study.

Author Bios:

Tevhide Kargın completed her undergraduate education at Ankara University, Faculty of Educational Sciences, Psychological Services in Education Program, and completed her master's and doctoral studies in the field of Special Education at the same Faculty. In 2000, she became an assistant professor at Ankara University, Faculty of Educational Sciences, Department of Special Education, associate professor in 2005 and professor in 2010. Until 2017, Tevhide Kargın, who held many positions such as Center Directorate, Senator, Faculty Board Member, Department Head and Journal Editor at Ankara University, Faculty of Educational Sciences, started to work as a faculty member at Hasan Kalyoncu University Faculty of Education, Department of Special Education as of 2017-2018 academic year. Tevhide Kargın, who has published many articles in national and international journals and worked as an executive in many national and international projects, continues her studies on educational assessment, inclusion, learning disabilities, early literacy and reading.

Birkan Güldenoğlu completed his undergraduate education at Dokuz Eylül University, Classroom Teaching Program in 2004. In 2008, he completed his master's degree at Ankara University, Institute of Educational Sciences, Department of Special Education and in 2012, he completed his doctorate in the same department. In 2005, he started to work as a research assistant in Ankara University, Faculty of Educational Sciences, Department of Special Education as a professor as of 2023. Birkan Güldenoğlu, who has worked as a researcher in many national and international projects, continues to work on supporting academic skills, learning disabilities, early literacy, reading, reading difficulties, early mathematics and assessment and support of mathematics skills.

Hilal Gengeç graduated from Kafkas University, Faculty of Education, Classroom Teaching Program in 2009. In the same year, she started working as a classroom teacher at Bitlis 100th Year Atatürk Primary School. Gengeç, who worked as a classroom teacher at Gaziantep Latife Özmimar Primary School between 2012-2017,

left her classroom teaching position in 2017 and started working as a research assistant at Hasan Kalyoncu University Faculty of Education, Department of Special Education. Gengeç, who completed his doctorate education at Ankara University Institute of Educational Sciences, Department of Special Education in 2021, started to work as a doctor in Hasan Kalyoncu University Faculty of Education, Department of Special Education in the same year. He started to work as a Dr. Lecturer. Since 2022, she has been working at Kırıkkale University, Faculty of Education, Department of Special Education. She continues her studies on early literacy, reading difficulties, learning difficulties and educational assessment.

Reşat Alatlı completed his undergraduate education at Ankara University, Faculty of Educational Sciences, Department of Classroom Teaching in 2006. Reşat Alatlı, who held positions as a regular classroom teacher and a special education classroom teacher, successfully obtained his master's degree in 2014 and his PhD in 2020. He is presently employed as a lecturer at Ankara University, namely in the Faculty of Educational Sciences, Department of Special Education. He is actively engaged in doing scientific research and undertaking projects related to reading and learning disabilities. In addition, he instructs undergraduate courses on assessment and evaluaiton in special education, individualization of teaching, teaching mathematics in special education, and teaching practicum.

References

Alatlı, R., Güldenoğlu, B. & Kargın, T. (2022). Examination of the reading comprehension skills of good and poor readers in the dimension of reading components developed by a reading skills assessment tool. *Education and Science, 47*(211), 273-295.

Álvarez Cañizo, M., Cueva, E., Cuetos Vega, F., & Suárez Coalla, M. P. (2020). Reading fluency and reading comprehension in Spanish secondary students. *Psicothema, 32*(1), 75–83.

Arabacı, G. (2022). Öğrenme güçlüğü olan ve olmayan öğrencilerde akici okuma ve okuduğunu anlama becerileri arasindaki ilişkinin incelenmesi. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi, 23*(2), 365-388. https://doi.org/10.21565/ozelegitimdergisi.700711

Aytaç, A. (2017). Prozodi ile okuduğunu anlama arasındaki ilişki. *Ana Dili Eğitimi Dergisi, 5*(2), 102-113. https://doi.org/10.16916/aded.286282

Babayigit, S., & Stainthorp, R. (2010). Component processes of early reading, spelling, and narrative writing skills in Turkish: A longitudinal study. *Reading and Writing: An Interdisciplinary Journal, 23*(5), 539–568. https://doi.org/10.1007/s11145-009-9173-y

Babayiğit, S., & Stainthorp, R. (2011). Modeling the relationships between cognitivelinguistic skills and literacy skills: New insights from a transparent orthography. *Journal of Educational Psychology, 103*(1), 169–189. https://doi.org/10.1037/a0021671

Baştuğ, M., & Keskin, H. K. (2012). Akici okuma becerileri ile anlama düzeyleri basit ve çikarimsal arasindaki ilişki. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi, 13*(3), 227-244.

Coltheart, M. (2005). Modeling reading: The dual-route Approach. In M. J. Snowling & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 6–23). Blackwell Publishing. https://doi.org/10.1002/9780470757642.ch1

Coltheart, M., Rastle, K., Perry, C., Langdon, R., & Ziegler, J. (2001). DRC: A dual route cascaded model of visual word recognition and reading aloud. *Psychological Review, 108*(1), 204–256. https://doi.org/10.1037/0033-295X.108.1.204

Cutting, L. E., & Scarborough, H. S. (2006). Prediction of reading comprehension: Relative contributions of word recognition, language proficiency, and other cognitive skills can depend on how comprehension is measured. *Scientific Studies of Reading, 10*(3), 277 299.

Day, R. R., & Park, J. S. (2005). Developing reading comprehension questions. *Reading in a Foreign Language, 17*(1), 60-73.

Durgunoğlu, A. Y. (2006). Learning to read in Turkish. *Developmental Science, 9*(5), 437–439. https://doi.org/10.1111/j.1467-7687.2006.00522.x

Durgunoğlu, A. Y., & Öney, B. (2002). Phonological awareness in literacy acquisition: It's not only for children. *Scientific Studies of Reading, 6*(3), 245–266. https://doi.org/10.1207/S1532799XSSR0603_3

Durgunoğlu, A. Y., & Öney, B. (1999). A cross-linguistic comparison of phonological awareness and word recognition. *Reading and Writing: An Interdisciplinary Journal, 11*(4), 281–299. https://doi.org/10.1023/A:1008093232622

Fernandes, S., Querido, L., Verhaeghe, A., Marques, C., & Araújo, L. (2017). Reading development in European Portuguese: Relationships between oral reading fluency, vocabulary and reading comprehension. *Reading and Writing: An Interdisciplinary Journal, 30*(9), 1987–2007. https://doi.org/10.1007/s11145-017-9763-z

Frost, R. (1998). Toward a strong phonological theory of visual word recognition: True issues and false trials. *Psychological Bulletin, 123*(1), 71-99.

Frost, R. (2006). Becoming literate in Hebrew: The grain-size hypothesis and semitic orthographic systems. *Developmental Science, 9*(5), 439-440.

Fuchs, L. S., Fuchs, D., Hosp, M. K., & Jenkins, J. R. (2001). Oral reading fluency as an indicator of reading competence: A theoretical, empirical, and historical analysis. *Scientific Studies of Reading, 5*(3), 239–256.

García, J. R., & Cain, K. (2014). Decoding and reading comprehension: A meta-analysis to identify which reader and assessment characteristics influence the strength of the relationship in English. *Review of Educational Research, 84*(1), 74–111. https://doi.org/10.3102/0034654313499616

Gough, P. B., & Tunmer, W. E. (1986). Decoding, reading and reading disability. *Remedial and Special Education, 7,* 6-10.

Goswami, U., & Ziegler, J. C. (2006). Fluency, phonology and morphology: A response to the commentaries on becoming literate in different languages. *Developmental Science, 9*(5), 451–453. https://doi.org/10.1111/j.1467-7687.2006.00511.x

Güldenoğlu, B., Kargin, T., & Miller, P. (2012). İyi ve zayıf okuyucuların kelime işlemleme ve okuduğunu anlama becerilerinin karşılaştırılmalı olarak incelenmesi. *Kuram ve Uygulamada Eğitim Bilimleri (KUYEB), 12*(4), 2807-2828.

Karasar, N. (2006). Bilimsel araştırma yöntemi.Ankara: Nobel Yayınevi.

Kargın, T., Güldenoğlu, B., & Alatlı, R. (2023). Okuma güçlüğü olan ve olmayan okuyucuların okuma performanslarının okumanın bileşenleri açısından gelişimsel olarak incelenmesi. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi, 24*(1), 68-105. https://doi.org/10.29299/kefad.1177181

Keskin, H., Baştuğ, M., & Akyol, H. (2013). Sesli okuma ve konuşma prozodisi: İlişkisel bir çalışma. *Mersin Üniversitesi Eğitim Fakültesi Dergisi, 9*(2), 168-180. https://doi.org/10.17860/efd.92252

Kim, Y.S., Park, C., & Wagner, R.K. (2014). Is oral/text reading fluency a "bridge" to reading comprehension? *Reading and Writing, 27*(1), 79–99. https://doi:10.1007/s11145-013-9434-7

Kim, Y.-S., Petscher, Y., Foorman, B. R., & Zhou, C. (2010). The contributions of phonological awareness and letter-name knowledge to letter-sound acquisition—a cross-classified multilevel model approach. *Journal of Educational Psychology, 102*(2), 313–326.

Kuhn, M. R., Schwanenflugel, P. J., Meisinger, E. B., & Levy, B. A., & Rasinski, T. V. (Eds.). (2010). Aligning theory and assessment of reading fluency: Automaticity, prosody, and definitions of fluency. *Reading Research Quarterly, 45*(2), 230–251. https://doi.org/10.1598/RRQ.45.2.4

Lonigan, C. J., Burgess, S. R., & Schatschneider, C. (2018). Examining the simple view of reading with elementary school children: Still simple after all these years. *Remedial and Special Education, 39*(5), 260–273.

Oney, B., & Durgunoğlu, A. Y. (1997). Beginning to read in Turkish: A phonologically transparent orthography. *Applied Psycholinguistics, 18*(1), 1–15. https://doi.org/10.1017/S014271640000984X

Oney, B., & Goldman, S. R. (1984). Decoding and comprehension skills in Turkish and English: Effects of the regularity of grapheme-phoneme correspondences. *Journal of Educational Psychology, 76*(4), 557–568. https://doi.org/10.1037/0022-0663.76.4.557

Price, K. W., Meisinger, E. B., Louwerse, M. M., & D'Mello, S. K. (2012). Silent reading fluency using underlining: Evidence for an alternative method of assessment. *Psychology in the Schools, 49*(6), 606-618.

Raman, I. (2006). On the age-of-acquisition effects in word naming and orthographic transparency: Mapping specific or universal? *Visual Cognition, 13*(7-8), 1044–1053. https://doi.org/10.1080/13506280500153200

Ramus, F., Pidgeon, E. & Frith, U. (2003). The relationship between motor control and phonology in dyslexic children. *Journal of Child Psychology & Psychiatry, 44*(5), 712-722.

Roembke, T., Hazeltine, E., Reed, K. D. & McMurray, B. (2019). Automaticity of word recognition is a unique predictor of reading fluency in middle-school students. *Journal of Educational Psychology, 111*(2), 314.

Seymour, P. H. K., Aro, M., & Erskine, J. M. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology, 94*, 143-174. https://doi.org/10.1348/000712603321661859

Share, D. L. (2011). On the role of phonology in reading acquisition: The self-teaching hypothesis. In S. A. Brady, D. Braze, & C. A. Fowler (Eds.), *Explaining individual differences in reading: Theory and evidence* (pp. 45–68). Psychology Press.

Shaywitz, S. E., & Shaywitz, B. A. (2005). Dyslexia (specific reading disability). *Biological Psychiatry, 57*, 1301-1309. https://dx.doi.org/10.1016/j.biopsych.2005.01.043

Spear-Swerling, L. (2006). Children's reading comprehension and oral reading fluency in easy text. *Reading and Writing: An Interdisciplinary Journal*, *19*(2), 199–220. https://doi.org/10.1007/s11145-005-4114-x

Steensel, R., Oostdam, R., Gelderen, V. A., & Schooten ,V. A. (2016). The role of word decoding, vocabulary knowledge and metacognitive knowledge in monolingual and bilingual low achieving adolescents' reading comprehension. *Journal of Research in Reading, 39*(3), 312 329.

Stevens, E. A., Walker, M. A., & Vaughn, S. (2017). The effects of reading fluency interventions on the reading fluency and reading comprehension performance of elementary students with learning disabilities: A synthesis of the research from 2001 to 2014. *Journal of Learning Disabilities*, *50*(5), 576–590. https://doi.org/10.1177/0022219416638028

Tunmer, W. E. (2008). Recent developments in reading intervention research: Introduction to the special issue. *Reading and Writing: An Interdisciplinary Journal*, *21*(4), 299–316.

Tunmer, W. E., & Chapman, J. W. (2012). Does set for variability mediate the influence of vocabulary knowledge on the development of word recognition skills? *Scientific Studies of Reading, 16*(2), 122–140. https://doi.org/10.1080/10888438.2010.542527

Tunmer, W., & Greaney, K. (2010). Defining dyslexia. *Journal of Learning Disabilities*, *43*(3), 229–243. https://doi.org/10.1177/0022219409345009

Tunmer, W. E., & Hoover, W. A. (2019). The cognitive foundations of learning to read: a framework for preventing and remediating reading difficulties. *Australian Journal of Learning Difficulties*, 1–19. https://doi:10.1080/19404158.2019.16140

Turna, C. & Guldenoglu, B. (2019). Investigation of the relationship between phonological decoding and word reading speed and accuracy in developmental perspective. *Education & Science*, *44*(198), 413-433. https://doi:10.15390/EB.2019.7891

Vaknin-Nusbaum, V., Nevo, E., Brande, S., & Gambrell, L. (2019). Reading and writing motivation of third to sixth graders. *Reading Psychology*, *41*(1), 44–70. https://doi.org/10.1080/02702711.2019.1674435

Walliman, N. (2017). *Research methods: The basics*. New York: Routledge.

Wolf, M., & Katzir-Cohen, T. (2001). Reading fluency and its intervention. *Scientific Studies of Reading, 5*(3), 211–239. https://doi.org/10.1207/S1532799XSSR0503_2

Yıldırım A, Şimşek H. (2013). *Sosyal bilimlerde nitel araştırma yöntemleri*. (9. Baskı). Ankara: Seçkin Yayıncılık.

Ziegler, J. C., Bertrand, D., Tóth, D., Csépe, V., Reis, A., Faísca, L., Saine, N., Lyytinen, H., Vaessen, A., & Blomert, L. (2010). Orthographic depth and its impact

on universal predictors of reading: A cross-language investigation. *Psychological Science, 21*(4), 551–559. https://doi.org/10.1177/0956797610363406

Ziegler, J. C., & Goswami, U. (2005). Reading acquisition, developmental dyslexia, and skilled reading across languages: A psycholinguistic grain size theory. *Psychological Bulletin, 131*(1), 3–29. https://doi.org/10.1037/0033-2909.131.1.3

Journal of Theoretical Educational Science, 17(3), 616-642, July 2024
Kuramsal Eğitimbilim Dergisi, 17(3), 616-642, Temmuz 2024
[Online]: http://dergipark.org.tr/akukeg
DOI number: http://doi.org/10.30831/akukeg.1379716

The Impact of Interactive Reading Activities at Primary School Level on Language Skills: A Systematic Review

İlkokul Düzeyi Etkileşimli Okuma Uygulamalarının Dil Becerilerine Yansımaları: Sistematik Bir İnceleme

Ebru ERGÜL[*] **Nurhan AKTAŞ**[**]

Received: 22 October 2023 **Research Article** **Accepted:** 6 June 2024

ABSTRACT: The aim of this study is to examine the national and international studies on the combination of interactive reading with language skills at the primary school level through the content analysis method. Upon being accessed using multiple keywords and databases and then selected by the researchers in the light of the criteria determined according to the research purpose, a total of 33 studies -22 articles and 11 postgraduate theses- were analysed by covering the period between 1984 and 2023. The analysis was conducted based on the following criteria: "research methods used, grade levels, number of participants, data collection tools, types of data analysis, types of participants, language skills covered, advantages and disadvantages on the basis of results". The results show that most of the studies have been conducted in the quasi-experimental design of the quantitative method, and likewise, most of them have been conducted with second-grade students. Interactive reading activities appear to have been carried out mostly between teachers and students in the studies generally involving small groups. The data of the studies included were mostly obtained through tests through descriptive statistical analyses. Since for the language skills were selected as the subject of the studies, it seems that reading skills were the most common, and almost all of the research results emphasized the advantages of interactive reading activities for the development of language skills.

Keywords: Interactive reading, language skills, primary school.

ÖZ: Araştırmanın amacı, ilkokul düzeyinde etkileşimli okumanın dil beceriyle kombinasyonunu ele alan ulusal ve uluslararası alanda yapılan çalışmaları içerik analizi yöntemiyle incelemektir. Araştırmada, birden fazla anahtar kelime ve veri tabanı kullanılarak erişilen ve ardından araştırmacılar tarafından araştırma amacına göre belirlenen kriterler ışığında değerlendirilerek seçilmiş 22 makale ile 11 lisansüstü tez olmak üzere toplam 33 çalışma analiz edilmiştir. 1984-2023 yılları arasını kapsayan çalışmalar; "kullanılan araştırma yöntemleri, sınıf düzeyleri, katılımcı sayıları, veri toplama araçları, veri analiz türleri, katılımcı türleri, konu edilen dil becerileri, araştırma sonuçlarına göre avantajları ve dezavantajları" kriterlerine göre incelenmiştir. Elde edilen sonuçlara göre, araştırmaların en çok nicel yöntemin yarı deneysel deseninde yürütüldüğü ve en fazla ikinci sınıf öğrencileriyle çalışıldığı belirlenmiştir. Genellikle küçük gruplarla çalışılan araştırmalarda etkileşimli okuma etkinliklerinin daha çok öğretmen-öğrenci arasında gerçekleştirildiği sonucuna ulaşılmıştır. Araştırmaların verileri en çok testler ile elde edilmiş ve verilerin analizlerinde betimsel istatistiki analizler ağırlıkta olmuştur. Araştırmalara konu edilen dil becerilerine bakıldığında ise en fazla okuma becerisine yer verildiği ve araştırma sonuçlarının neredeyse tamamına yakınının etkileşimli okuma uygulamalarının dil becerilerinin geliştirilmesine yönelik avantajları ön plana çıkardığı görülmüştür.

Anahtar kelimeler: Etkileşimli okuma, dil becerileri, ilkokul.

[*] Res. Asst., Selcuk University, Konya, Türkiye, ebru.ergul@selcuk.edu.tr, https://orcid.org/0000-0002-0298-7035

[**] *Corresponding Author:* Assoc. Prof. Dr., Selcuk University, Konya, Türkiye, nurhan.aktas@selcuk.edu.tr, https://orcid.org/0000-0003-0264-5120

Citation Information
Ergül, E., & Aktaş, N. (2024). The impact of interactive reading activities at primary school level on language skills: A systematic review. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 17*(3), 616-642.

ISSN: 1308-1659

Developed by Whitehurst et al. (1988), dialogic reading is also called "interactive reading" in the literature. Interactive reading is an activity process in which the roles of the person reading the text and the child listening to it change over time (Whitehurst & Lonigan, 1998). In other words, it is a reading method where the roles of reader and listener change over time, with the reader pausing at intervals to involve the listeners in the reading process (Çetinkaya et al., 2018). It involves social interactions such as reading aloud to children and children reading aloud to others (Merga, 2017). This process can be carried out in small groups with parents, teachers, caregivers and peers, face-to-face or remotely, in a shared and iterative manner (Beschorner & Hutchison, 2014; Çelebi-Öncü, 2016; Elmonayer, 2013; Gladwin & Stepp-Greany, 2008; Vallly et al., 2015). Through the questions asked by the adult about the book while reading, the child takes an active role, thus gaining the responsibility of both reading the book and asking questions (Cohrssen et al., 2016; Whitehurst & Lonigan, 1998). In interactive reading, the child is also encouraged to participate in the reading process, and the excitement of reading is reinforced by giving continuous feedback to the child (Morgan & Meier, 2008; Pillinger & Wood, 2014). The aim here is to allow the child to develop the ability to comment on the story by discussing and comprehending it with adult guidance (Yopp & Yopp, 2006). Interactive book reading practices can be executed in a planned and systematic manner at the primary school level, starting from the preschool period (Ergül et al., 2016).

Research shows that all activities and practices during interactive reading boost children's language skills and enable them to use language actively (Anderson et al., 2005). Interactive reading activities are acknowledged as facilitating and improving students' accurate reading and comprehension skills and also contributing to fluent reading skills (Ceyhan & Yıldız, 2021; Hâkimi et al., 2014; Gutiérrez, 2016; Rosenhouse et al., 1997; Uğur & Tavşanlı, 2022; Yurtbakan, 2022). It is also known that the affective reading skills of students who actively participate in the interactive reading process are positively affected, thereby increasing their reading motivation (İlhan & Canbulat, 2021; Yurtbakan et al., 2021), as well as improving their attitudes towards reading (Karadoğan, 2020) and their reader self-perception (Çetinkaya et al., 2018). It can thus be assumed that interactive reading activities nurture children's/students' reading skills in many ways. Research also shows that interactive reading activities contribute to the development of children's speech skills, one of the expressive language skills (Durmaz, 2020; Kim & Hall, 2002; Thiede, 2019). The fact that children who participate in the interactive reading process with their family members, teachers, and peers are at the centre of the interactive reading process result in improving the communication between the child and the guide, besides boosting their skills such as asking questions, giving answers, and making comments (Whitehurst et al., 1994). In this way, it is also suggested that children who have the opportunity to express themselves (Hargvare & Senechal, 2000) develop a positive attitude towards speaking as a consequence of talking a lot and making detailed descriptions (Ganotice et al., 2017). The most basic principle of interactive reading is to transform children from passive listeners into active storytellers. In order for the child to be a good storyteller, it is necessary to follow the process carefully and be a good listener. A number research studies (Sezer, 2021; Şimşek 2017) have concluded that interactive reading improves children's listening comprehension skills to a great extent compared to other types of

reading. In interactive reading activities, social interaction with children during the reading activity contributes to their storytelling skills. As for the writing skill, which is another expressive language skill, it is stated that interactive reading activities also created considerable positive changes in children's writing skills (Sim et al., 2014), raised their awareness of language and spelling rules (Webster, 2001), and improved their written expression skills (Manak, 2009).

Research also reveals that interactive reading improves receptive and expressive language skills (Bucksar, 2022; Thiede, 2019; Uğur & Tavşanlı, 2022), increases vocabulary knowledge (Brayko, 2012; Ceyhan & Yıldız, 2019; Mitchell, 2015), contributes to affective development by generating positive attitudes and motivation towards reading (İlhan & Canbulat, 2022; Yurtbakan et al., 2020), and strengthens communication between family and child (Ganotice et al., 2017). When we examine the studies in the literature on the research topic, we see that the majority of them have been conducted as experimental studies. Although systematic review studies on interactive reading are limited, they generally cover the preschool period (Malani et al., 2010; Mol et al., 2009; Yurtbakan, 2020). In general, there is no systematic study in the literature that overlaps with the current study and examines interactive reading studies at the primary school level at the international level. Accordingly, this study aims to provide a framework for past studies in order to provide a basis for increasing interactive reading practices. The aims of the review are to determine the effectiveness of interactive reading practices in terms of language skills and to reveal the unstudied areas, to show the teaching methods, techniques and materials used in the practices, and thus to guide researchers interested in interactive reading practices at the primary school level to increase the effectiveness of their practices.The aim of this study is, therefore, to examine the primary school level studies on language skills in relation to interactive reading. Based on the purpose of the present study, the following research questions were sought:

1. What are the main characteristics of studies on interactive reading at the primary school level?
2. What are the language skills addressed in studies conducted on interactive reading at the primary school level?
3. What do the outcomes of the studies on interactive reading at the primary school level indicate?

Method

Model of the Research

Systematic reviews involve providing the upfront definition of a research question, clarity about the scope of the review, revealing the kind of studies which are appropriate for inclusion, making every effort to find all relevant studies, ensuring that bias issues are considered in the included studies, and analysing the included studies to draw conclusions in an unbiased and objective manner based on all identified studies (Lasserson et al., 2019). When conducted systematically, review studies can be useful in understanding the level of knowledge on a particular topic and how that subject matter

has changed over time (Gough et al., 2012). This study will present general trends in research studies conducted on interactive reading and language skills.

Data Sources and Search Strategies

This study drew upon the "Preferred Reporting Items for Systematic Reviews and Meta-Analysis" (PRISMA) checklist. The literature review was finalized on March 24, 2023. Systematic searches were conducted in the following electronic databases: (1) Web of Science Core Collection, (2) Google Academic, (3) National Thesis Centre at the Council of Higher Education (YÖK), (4) ProQuest Dissertations and Theses, (5) Networked Digital Library of Theses and Dissertations (NDLTD), and (6) Open Access Theses and Dissertations (OATD). These databases were used due to their high-quality indexing standards and good international reputation, and to retrieve research articles and theses on interactive reading and language skills. The search template in Table 1 was developed by the researchers to access the reviewed articles and theses.

Table 1

Search Strings

Database	Search Terms
Web of Science Core Collection	"Interactive reading" and "dialogical reading" and "dialogic reading" Refined by source types: Academic articles and Education Research. Language: English.
Google Academic	"Interactive reading" and "first grade" and "primary school" and "interactive reading" and "second grade" and "primary school" and "interactive reading" and "third grade" and "primary school "and "interactive reading" and "fourth grade" and "primary school". Language: English and Turkish
National Thesis Centre of Higher Education Institution (TÜRKİYE)	"Etkileşimli okuma" Language: Turkish
ProQuest Dissertations and Theses	"Interactive reading" and "dialogical reading" and "dialogic reading" Refined by: Scientific Reviews and Theses. Language: English
Networked Digital Library of Theses and Dissertations (NDLTD)	"Interactive reading" and "dialogical reading" and "dialogic reading". Language: English
Open Access Theses and Dissertations (OATD)	"Interactive reading" and "dialogical reading" and "dialogic reading" Language: English

Article and Theses Selection Criteria and Procedure

This study focuses on peer-reviewed research articles, Master's and Doctoral theses published in English and Turkish that address interactive reading and language skills. The article selection process consisted of PRISMA's main steps of identification, screening, and inclusion (Page et al., 2020). The inclusion criteria (IC) and exclusion criteria (EC) used are presented in Table 2 below.

Table 2

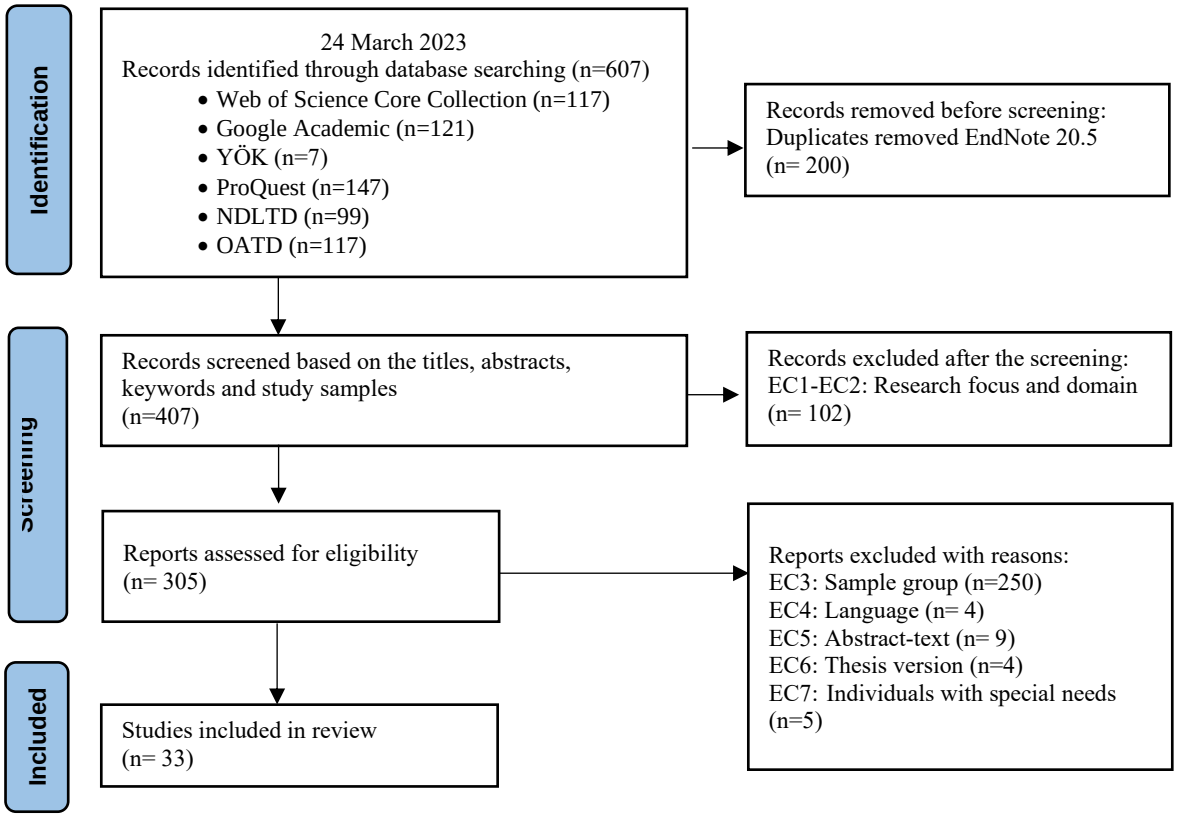
Selection Criteria

Criteria	
Inclusion criteria (IC)	Exclusion criteria (EC)
IC1: It deals with the relationship between interactive reading and one of the basic language skills (reading, writing, listening, and speaking).	EC1: It is in a discipline other than educational research.
IC2: The study group corresponds to one of the primary school grades (In Türkiye, primary school was reduced to 4 years in 2012, but 5th grade is included in this study so as to ensure equivalence with the primary school level in other countries.)	EC2: It does not deal with the relationship between interactive reading and one of the basic language skills (reading, writing, listening, and speaking).
IC3: The language is English or Turkish.	EC3: The study group is not in one of the primary school grade and age levels.
IC4: It has free full-text access.	EC4: The language is not English or Turkish.
IC5: It is open to free access from Web of Science Core Collection, Google Academic, Higher Education Institution National Thesis Centre, ProQuest Dissertations and Theses, Networked Digital Library of Theses and Dissertations (NDLTD), Open Access Theses and Dissertations (OATD) databases.	EC5: There is no free full-text access.
	EC6: The article generated from the same author's thesis.
	EC7: The study group consists of individuals with special needs.

At first, six databases were searched using the search strings in Table 1, and 607 studies were identified. After removing 200 duplicates with the help of EndNote 20.5 software, we proceeded to the screening step. Based on IC and EC, the titles, abstracts, keywords and sample group of 407 articles were carefully reviewed. A total of 305 potential studies were ultimately identified as suitable for preliminary review. Then, based on the same IC and EC, the full-text versions of 305 articles were analysed in depth. Finally, 33 studies were included in the systematic review. Figure 1 shows our article and thesis selection process based on the PRISMA checklist.

Figure 1

Flow Chart of The Study Selection Process



Note: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71. For more information, visit: http://www.prisma-statement.org/

Data Analysis and Reliability

For data analysis, the full texts of all eligible studies were coded based on qualitative content analysis guided by a review form developed by the researchers and presented in Table 3 in order to reach the results that would answer our research question (Miles & Huberman, 1994).

Table 3

Review Form

General Features	*Content Features*
Author(s):	Research Method:
Publication Year:	Design:
Publication Type (thesis code or article code):	Grade Level:
Information of University/Country:	Number of Participants:
Journal Indexing:	Data Collection Tools:
	Data Analysis Type:
	Interaction Type:
	Main Language Skills:

	Conclusion (advantages or disadvantages):

As can be seen from the headings presented in Table 3, the analysis was structured around our research question and codes focused on the following three main categories: (1) the main features of the studies (author information, year of publication, journal index information, university information, research method and design information, sample type, grade level, number of participants, data collection tools, types of data analysis, and type of interaction), (2) the language skills examined in the studies (reading, writing, speaking, and listening/viewing), and (3) the outcomes identified by the studies (advantages and disadvantages). The first category was supported with tables, and the other categories with graphs to facilitate understanding. Percentages of the data presented in tables and graphs were also calculated.

The data were coded by one researcher. During the coding process, another researcher closely observed the coding process as an observer. One month after the initial coding, the data were recoded as if no coding had been done previously. After the second coding, 25% of the studies (approximately n= 8) were randomly selected and cross-checked for consistency by an external coder. Coding reliability was calculated based on Miles and Huberman's (1994) reliability formula. The calculations revealed a satisfactory reliability rate (98.3%), as stated by Creswell & Poth (2016). Finally, the coders discussed any discrepancies and resolved them through consensus.

Results

In this section, the results obtained from the studies on the reflections of interactive reading activities on language skills at the primary school level are presented in tables and graphs and interpreted according to the headings in the graphs.

Main Features of the Studies

In this section, the question of "What are the main characteristics of studies on interactive reading at the primary school level?" addressed. Some information, including the general structures and code information of the 22 articles and 11 graduate theses, examined for the purposes of this study were listed in year order from past to present. The results are presented in Table 4.

Table 4

General Features of The Studies

No	**Code**	**Author(s)**	**Publication Year**	**Journal Index**					**Information of University**
				SSCI	**ESCI**	**ERIC**	**EBSCO**	**TR**	**Name of The University/ Country**
1	A1	Gemake	1984	+					
2	A2	Rosenhouse et al.	1997	+					
3	A3	Whitehurst	1999	+					
4	DT1	Webster	2001						Oakland University/USA

5	A4	Kim & Hall	2002	+				
6	A5	Morgan & Meier	2008			+		
7	DT2	Manak	2009					Florida University/USA
8	MT3	Ariaz	2010					University of Texas At El Paso /USA
9	A6	Ertem	2011			+		
10	DT4	Brayko	2012					University of Washington/USA
11	A7	Pillinger & Wood	2013			+		
12	A8	Hakimi et al.	2014		+			
13	MT5	Mitchell	2015					University of Wisconsin/USA
14	DT6	Bryant	2016					University of Missouri–St. Louis/USA
15	A9	Gutierrez	2016	+				
16	A10	Türkben & Temizyürek	2017				+	
17	A11	Merga	2017	+				
18	A12	Ergül et al.	2017			+		
19	A13	Çetinkaya, Öksüz & Öztürk	2018				+	
20	A14	Ceyhan & Yıldız	2019				+	
21	A16	Çetinkaya, Ateş & Yıldırım	2019			+		
22	A17	Thiede	2019		+			
23	A15	Yurtbakan	2020					+
24	MT7	Karadoğan	2020					Balıkesir University/ Türkiye
25	MT8	Durmaz	2020					Düzce University/ Türkiye
26	A18	İlhan & Canbulat	2021					+
27	A19	Yurtbakan, Erdoğan & Erdoğan	2021	+				
28	A20	Ceyhan & Yıldız	2021			+		
29	A21	Uğur & Tavşanlı	2022					+
30	DT9	Yurtbakan	2022					Trabzon

						University/ Türkiye
31	DT10	Bucksar	2022			Widener University/USA
32	A22	Chuang & Jamiat	2023	+		
33	MT11	Yıldırım	2023			İstanbul Aydın University/ Türkiye

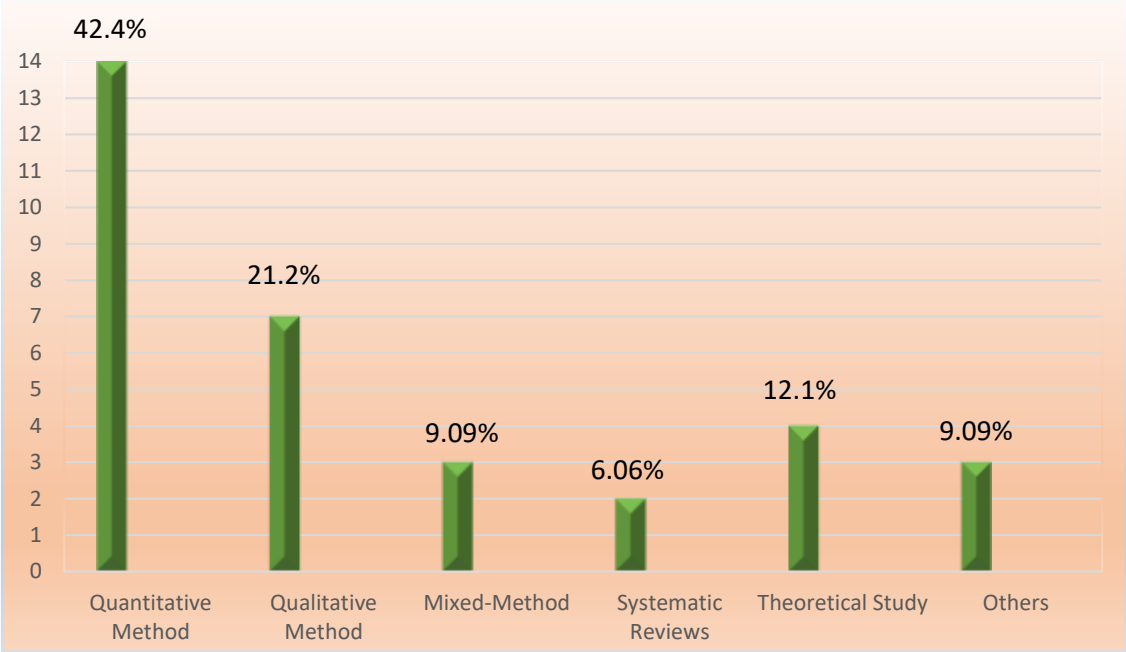
*A=Article **MT=Master thesis ***DT=Doctoral thesis ****USA=United State of America

As shown in Table 4, there are 33 studies on interactive reading conducted for the primary school level in the form of articles and theses. Of these studies, 22 of them are articles (66.66%), six are Doctoral studies (18.18%), and five are Master's studies (15.15%).

The articles and thesis studies on interactive reading at the primary school level were found to have been conducted in 1984, 1997, 1999, 2001, 2002, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, and 2018, and became the subject of research once in each year. Interactive reading was the subject of research twice in 2016 and 2023 and three times each in 2017, 2019, 2020, 2021, and 2022. When the journal indexes of the articles on interactive reading at the primary school level are examined, it appears that seven (21.21%) articles are included in the SSCI index, while the other seven (21.21%) articles are in the ERIC index. There are six articles, three of which are in TR-indexed and the other three in EBSCO-indexed journals. These articles individually account for 9.09% of the total percentage, and there are two other articles (6.06%) within the scope of the ESCI index. The literature review of postgraduate research on interactive reading conducted with students at the primary school level reveals that seven (21.21%) theses were conducted by researchers from universities in the United States of America, followed by four universities in Türkiye (12.12%). In the light of all these considerations, it can be concluded that research studies on interactive reading conducted at the primary school level has gained intensity in the last eight years and in the form of articles, which were found to have been published mostly in journals indexed in SSCI and ERIC indexes. It also appeared that the studies prepared in the thesis type were the studies of researchers in various universities in the United States of America. Figures were used in order to ensure better comprehensibility regarding the presentation of information about the content structures of 22 articles and 11 graduate theses examined within the scope of the present study. Figure 1 below presents the findings obtained from the analysed studies regarding the research methods:

Figure 2

Methodologies of the Research

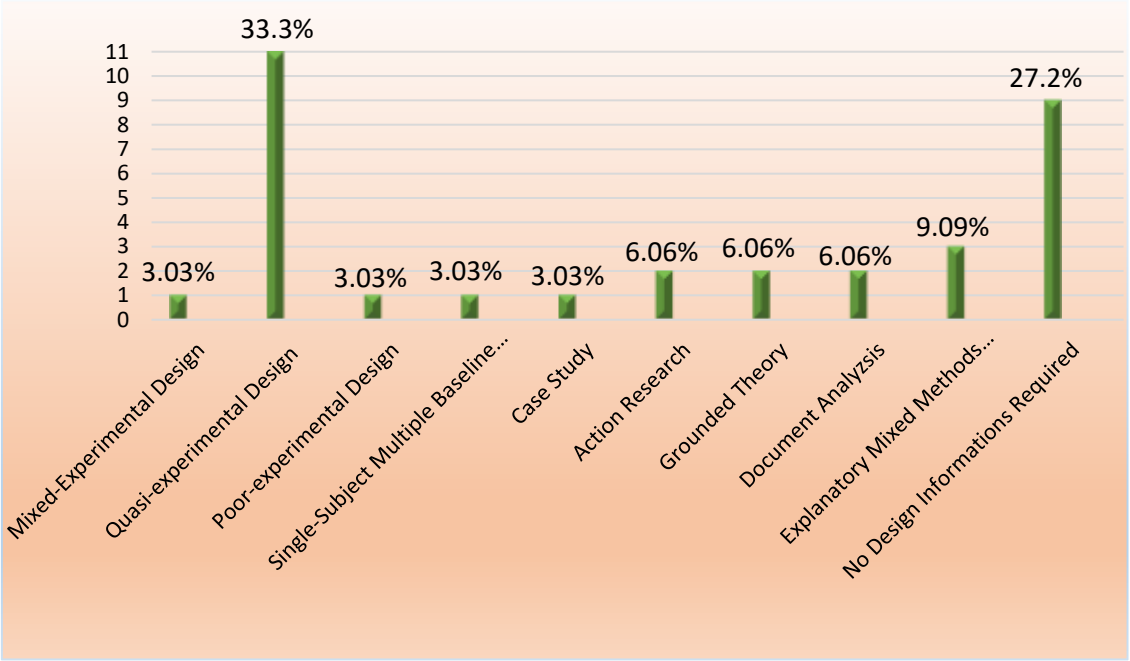


As can be seen in Figure 2, 14 (42.4%) of the studies focusing on interactive reading at the primary school level were conducted with quantitative method (A2, A3, A7, A9, A13, A14, A16, A18, A20, A21, MT3, MT7, MT8, and MT11). Qualitative method turned out to be the second most preferred research method, with which seven studies (21.2%) were found to have been conducted (A8, A10, A11, DT2, DT4, DT6, and MT5). The third most preferred method, on the other hand, consists of studies on theoretical ideas (A1, A5, A6, and A17), accounting for 4 (12.1%) of all studies. Mixed methods research (A19, DT9, and DT10) and other methods such as descriptive (DT1), micro-genetic (A4), and cohort studies (A12) were the fourth most used methods. Three of these studies (9.09%) were conducted with mixed methods, whereas the other three (9.09%) with other method designs. In addition, systematic reviews (A15, A22) took the last place. There were two studies (6.06%) in which this method was followed. Given these studies, it can be concluded that they were mainly conducted with the quantitative method paradigm.

The findings obtained related to the research designs of the studies analysed in the study are shown in Figure 3.

Figure 3

Methodological Designs of the Study

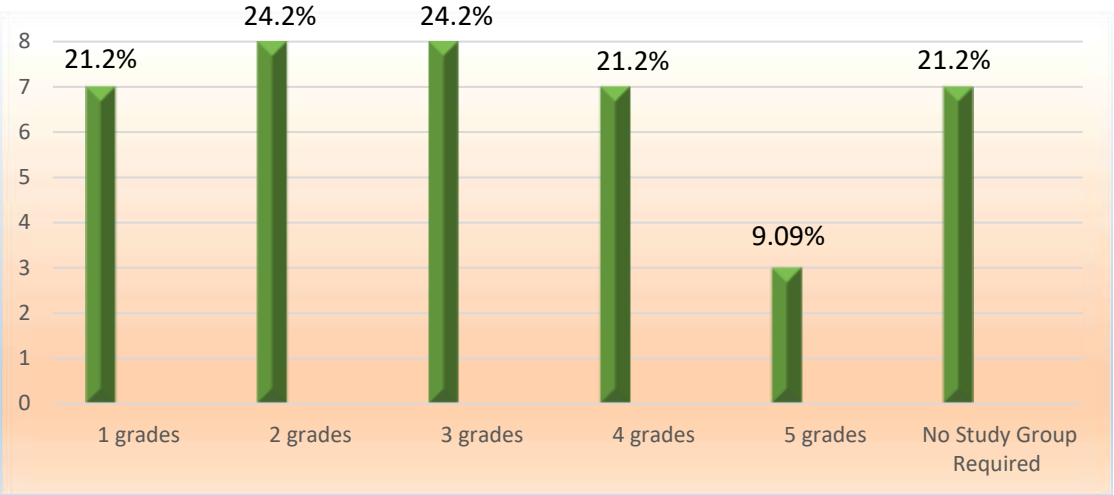


As seen in Figure 3 above, 11 (33.3%) of the studies conducted regarding interactive reading at the primary school level drew on the quasi-experimental design of quantitative method (A2, A3, A7, A9, A13, A16, A18, A21, MT7, MT8, and MT11). The second research design used was the explanatory design of mixed methods (A19, DT9, and DT10), and three other studies (9.09%) were conducted using the explanatory mixed methods design. There were two studies for each of the following methods included in the qualitative approach, which specified their research design as an action research (MT5, DT6), grounded theory (DT2, DT4), and document analysis (A10, A11). Each of these studies accounted for 6.06% of the total number of studies. Mixed experimental (A20), weak experimental (A14), and single-subject designs (MT3) of the quantitative method were used for one study each, and one study was conducted with a case study (A8) design of the qualitative method. The percentage of these research designs was calculated as 3.03%. Since nine studies (27.2%) were evaluated as systematic review (A15, A22), theoretical (A1, A5, A6, A17) and other (A4, A12, DT1), no direct research design information was available. It can be concluded that the studies were significantly concentrated in a quasi-experimental design.

Figure 4 shows the findings regarding the grade levels included in the relevant studies reviewed. Some studies included different grade levels in the same research study. For this reason, the values on the vertical axis of the graph show how many times the grade levels were selected in the studies.

Figure 4

Grade Levels of The Participants in The Study Samples

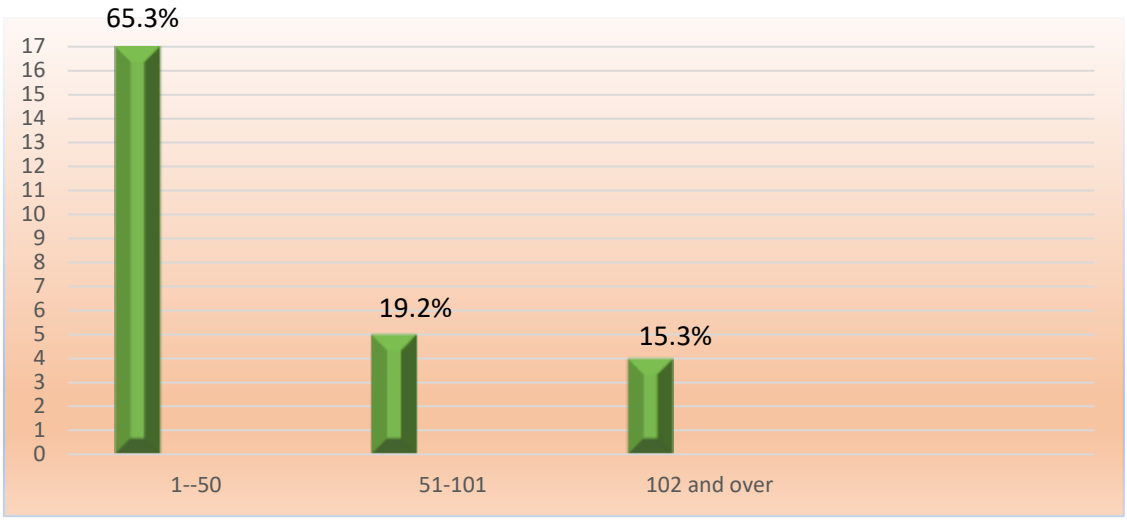


As shown in Figure 4 above, the studies conducted at the primary school level within the scope of interactive reading were mostly conducted with the participation of second (A3, A14, A16, A20, MT5, MT7, DT9, and DT10) and third (A4, A7, A11, A16, DT2, DT4, MT8, and M11) grade students. Eight studies were conducted at each of these grade levels, representing 24.2% of the overall total. The number of studies in which first grade (A1, A2, A12, A18, MT3, DT1, and DT6) and fourth grade (A9, A11, A13, A16, A19, A21, and DT4) students took part as participants and those in which there were no participants due to the methodology employed (A1, A5, A6, A10, A15, A17, and A22) were equal in number, i.e., seven (21.2%) each. In three studies (9.09%), fifth grade students were the participants (A8, A11, and DT4). From this standpoint, it could be stated that the studies on interactive reading at the primary school level mostly selected students studying in the second and third grades of primary school as participants.

Figure 5 presents the results reported of the studies examined in the present study (excluding seven articles as they lacked the information that could be considered as a sample) regarding the number of people in the study samples.

Figure 5

Number of Participants

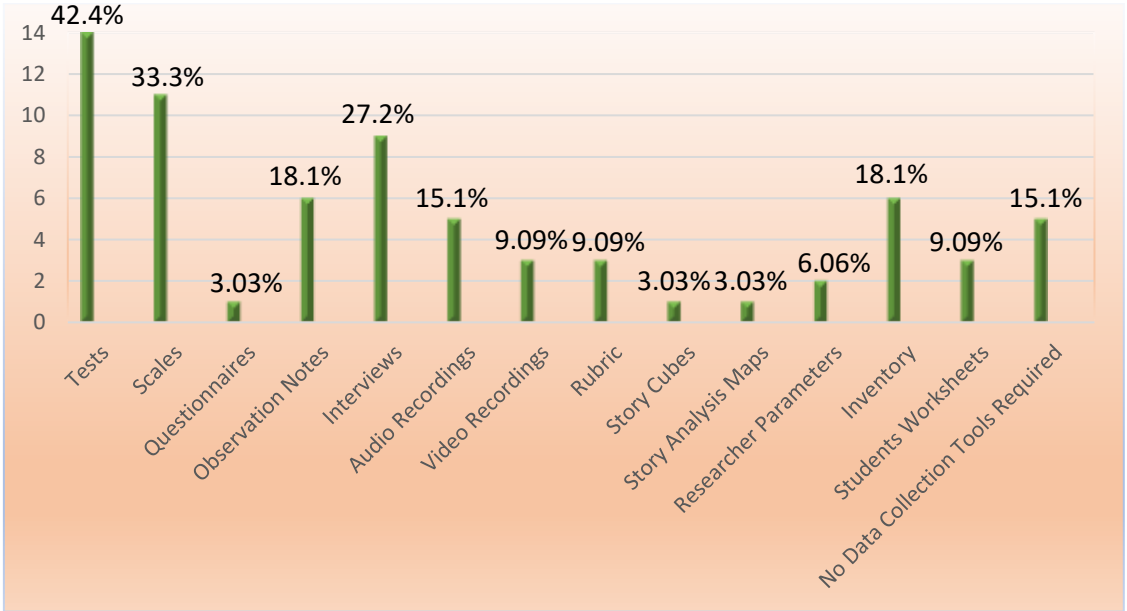


As seen in Figure 5, the number of studies with between 1 and 50 participants is 17 (65.3%) (A4, A7, A8, A11, A13, A18, A19, A21, DT1, DT2, MT3, DT4, MT5, DT6, MT7, MT8, and DT10), and there are five studies (19.2%) with 51-101 participants (A12, A14, A20, DT9, and MT11), four other studies (15.3%) with 102 or more participants (A2, A3, A9, and A16). In the light of all these, it can be asserted that the participants of the studies dealing with interactive reading at the primary school level consist of small groups of 1-50 people.

Figure 6 provides the findings of the data collection tools of the studies analysed. Since more than one data collection tool was used in the studies, the values on the vertical axis of the graph show how many times each data collection tool was repeatedly employed.

Figure 6

Data Collection Tools



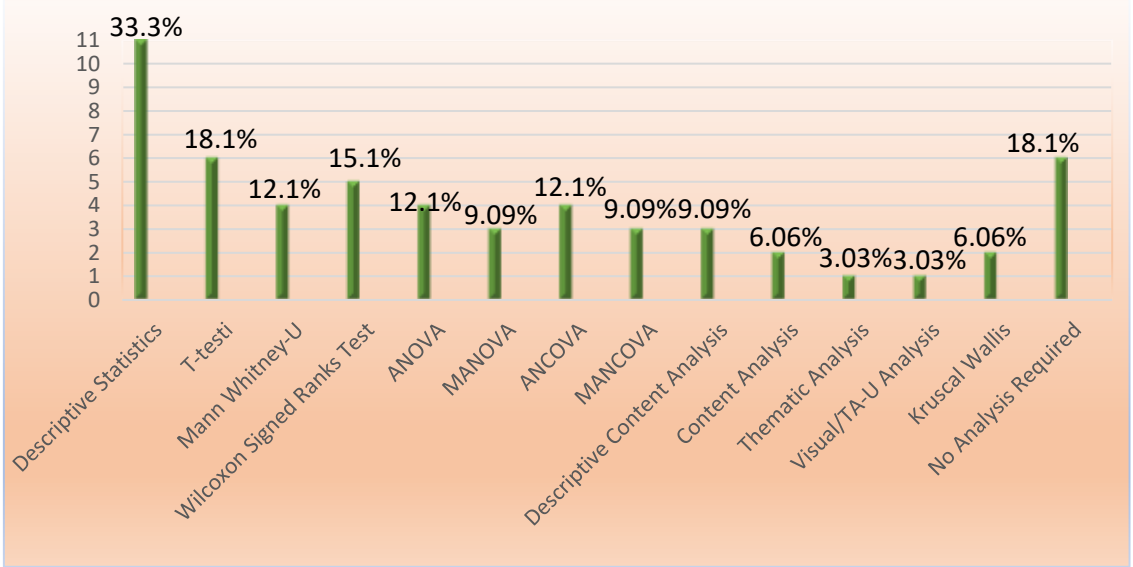
As given in Figure 6, it appears that various data collection tools were used to collect data on interactive reading practices conducted at the primary school level.

Among these tools, tests (A2, A3, A7, A8, A9, A12, A16, A18, A21, DT6, MT7, MT3, DT9, and MT11) were used 14 (42.4%) times as data collection tools in the studies, while surveys were used 11 (33.3%) times (A3, A7, A9, A14, A18, A19, A20, DT1, DT6, MT7, and DT9). The number of studies in which participants were interviewed and data were collected through interview forms is nine (27.2%) (A2, A11, A19, DT1, DT2, DT4, DT6, DT9, and DT10). The number of studies in which observation notes and word/vocabulary inventories etc. were used as data collection tools is equal, with each being six (18.1%), respectively. There are also five studies (15.1%) in which audio recordings were used as data collection tools (A4, DT1, DT4, DT6, and MT8). Video recordings (A4, MT3, and DT4), rubrics (A20, DT1, and DT10), and student work products (DT1, DT2, and DT4) seem to have been chosen as data collection tools three times each (9.09%). Furthermore, in 2 (6.06%) studies, the researchers determined their own parameters based on the relevant literature without using any data collection tools such as surveys or questionnaires (A15, A22). The number of studies in which tools such as questionnaires (DT6), story cubes (A13) and story analysis maps (MT5) were used during data collection is one (3.03%) each respectively. Finally, five studies (15.1%) did not require the use of data collection tools due to their methods (A1, A5, A6, A10, A17). Based on this information, it can be concluded that tests have more widely been used as data collection tools than others.

Figure 7 below shows the findings of the data analysis types used in the studies examined for the purpose of this study. Since more than one data analysis type was used simultaneously in the studies, the numbers on the vertical axis of the graph show how many times each data analysis name was repeated in the studies.

Figure 7

Data Analysis Types



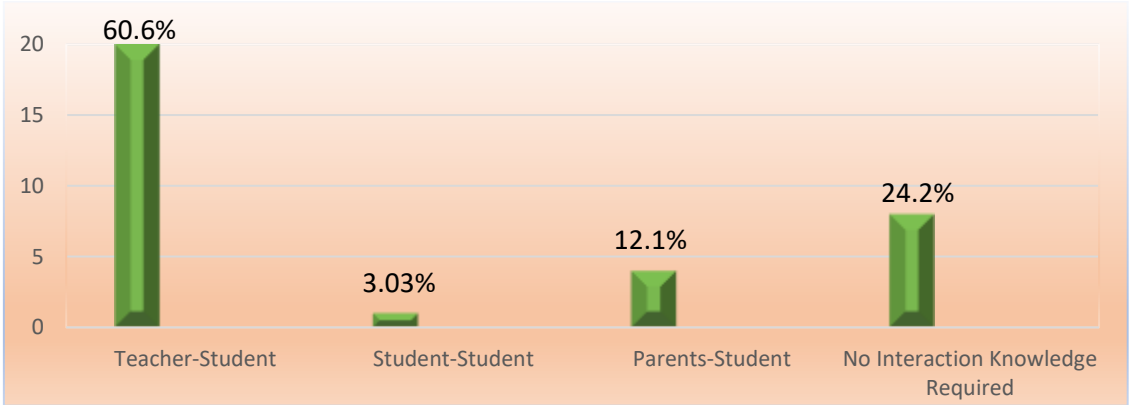
As can be seen in Figure 7 above, the studies on interactive reading at the primary school level seem to have examined the data obtained through various data collection tools by using different types of analysis together. Descriptive statistics (mean, standard deviation, percentage, frequency, etc.) were the type of analysis used a total of 11 (33.3%) times in the studies (A4, A8, A9, A12, A18, A19, DT1, MT3, DT4,

MT5, and DT9). There are six studies (18.1%) in which t-test analysis was used (A13, A16, A21, MT7, MT8, and MT11). The number of statistics used to compare group means using Wilcoxon signed-rank test (A4, A18, A19, MT3, and DT9) was five (15.1%), whereas Mann-Whitney U test (A13, A18, MT8, and DT9), ANOVA (A7, A9, A12, and A14) and ANCOVA (A3, A9, A20, and MT8) analyses were used four times each (12.1%). MANOVA (A2, A3, and A9), MANCOVA (A2, A3, and A9) and descriptive content analyses (A15, A9, and A22) were used three times each (9.09%) in different studies. Content analysis (DT2, DT6) and Kruskal-Wallis test (A14, DT9) were used twice (6.06%) in different studies. Thematic analysis and visual analysis were used in one (3.03%) study (DT10). Moreover, there were six studies (18.1%) that did not require any analysis process (A1, A5, A6, A10, A11, and A17). Based on all this information, it appears that descriptive statistics were used more than other types of data analysis.

Figure 8 below shows the findings regarding the participants who performed interactive reading practices together, in other words, who interacted with each other in the studies included.

Figure 8

Interaction Types



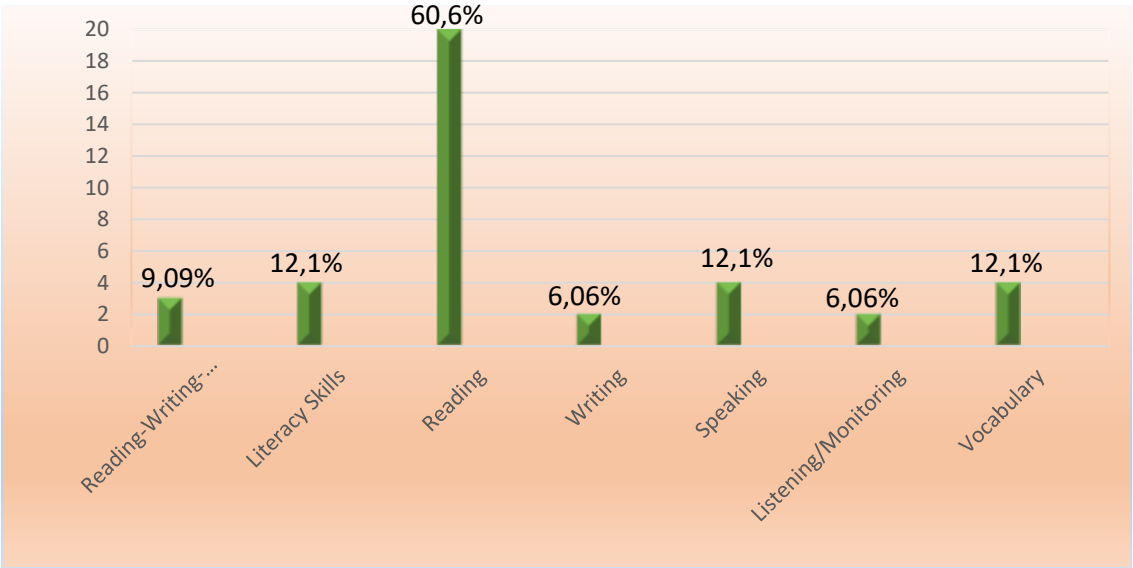
As demonstrated in Figure 8, the pairs that interacted during the reading sessions of the interactive reading-based studies conducted at primary school level consisted of teacher-student, student-student, and family member-student pairs. In total, there are 20 studies (60.6%) in which interactive reading studies were conducted through teacher-student interaction (A2, A3, A4, A8, A9, A12, A13, A14, A16, A18, A19, A20, A21, DT1, DT2, MT5, DT6, MT7, MT8, and MT11). There is only one study (3.03%) in which student-student interaction was established in reading sessions (DT4). The number of interactive reading sessions based on the interaction of a family member and a student is four (12.1%) (A7, MT3, DT9, and DT10). The number of studies that did not include information about any type of interaction due to their methods is eight (A1, A5, A6, A10, A11, A15, A17, and A22), accounting for 24.2% in total. As a consequence, it seems that the studies on interactive reading at the primary school level were mostly conducted based on the interaction between teachers and students.

Language Skills as the Subject Matter of the Studies

Under this heading, the question of 'What are the language skills addressed in studies conducted on interactive reading at the primary school level?' answered. Figure 9 below presents the distribution of language skills in relation to which the effects of interactive reading activities were observed in the studies analysed for the purposes of this study. Some studies examined more than one language skill in the same study. For this reason, the numbers on the vertical axis of the graph show how many times the relevant language skill was selected as the subject matter of the research study.

Figure 9

Distribution of The Main Language Skills



As shown in Figure 9, the interactive reading practices at the primary school level seem to have been conducted in order to contribute to reading-writing-speaking-listening/monitoring skills, besides literacy skills and vocabulary development. There are 20 studies (60.6%) examining the effects of interactive reading activities on reading. When the details of the interactive reading studies on reading skills were examined, it was revealed that 14 of these studies focused on the improvements in decoding, fluent reading, accurate reading and reading comprehension skills of the participants as a result of interactive reading activities (A2, A6, A8, A9, A10, A12, A16, A20, A21, A22, MT7, DT9, DT10, and MT11). Three studies focused on the effects of interactive reading on reading motivation (A19, A20, and A22), while two other studies included the effects of interactive reading on reader self-perception (A14, MT3) and one studied the impacts of interactive reading on reading attitude (MT7). Moreover, there are four studies each on the effects of interactive reading on literacy skills (A3, A5, A7, and DT6), speaking skills (A2, A4, A18, and MT8), and vocabulary development (A13, A22, DT4, and MT5), which all account for 12.1% of the total. There are three studies (9.09%) emphasizing that all reading, writing, speaking and listening/watching skills can be improved with the help of interactive reading (A1, A15, and DT6). Two studies (6.06%) were identified, with each focusing on writing (DT1, DT2) and listening (A11, DT1) skills. Generally speaking, the studies on writing skills tended to focus on how interactive reading affects writing skills. However, the studies on listening skills appear to have investigated how interactive reading practices affect listening comprehension, in

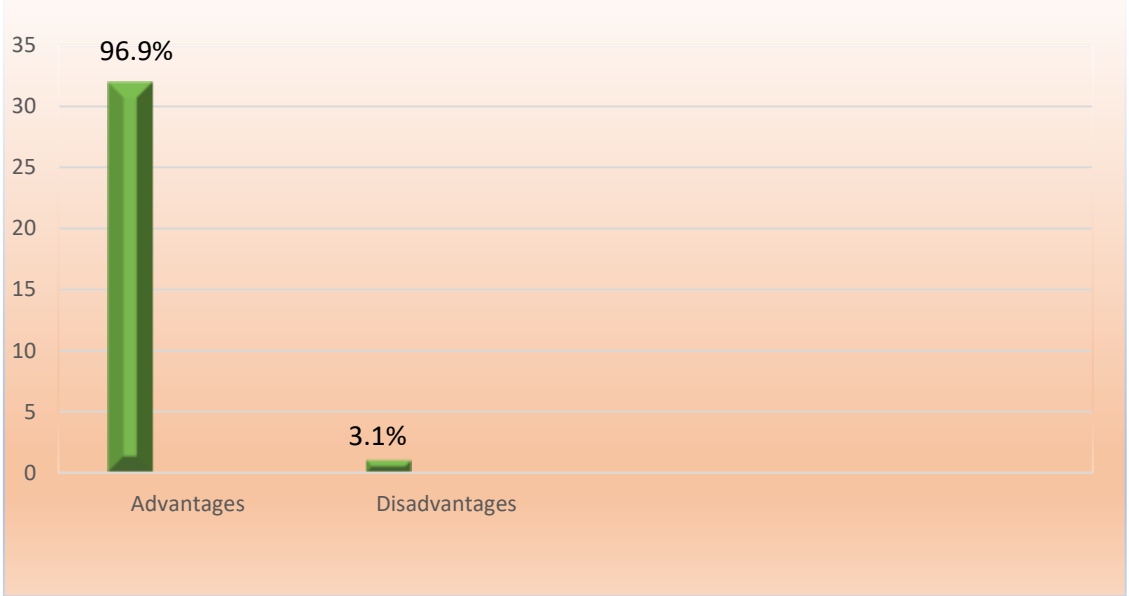
addition to the development of listening skills. To summarize, it can be considered that most of the studies on interactive reading at the primary school level have focused on reading skills.

Outcomes of the Studies

In this section, the question "What do the outcomes of the studies on interactive reading at the primary school level indicate?" answered, and presents the results of 33 studies analysed within the scope of the present study. The results of the studies were grouped under two categories according to the advantages and disadvantages combined of interactive reading on language skills. Figure 10 provides data about that distribution.

Figure 10

Distribution of Advantages and Disadvantages



As seen in Figure 10, 32 out of 33 studies (96.9%) in which interactive reading was addressed at the primary school level presented advantageous results (A1, A2, A3, A4, A5, A7, A8, A9, A10, A11, A12, A13, A14, A15, A16, A17, A18, A19, A20, A21, DT1, DT2, MT3, DT4, MT5, DT6, MT7, MT8, DT9, DT10, and MT11). Such results reveal that interactive reading provides significant advantages on the acquisition and development of language skills. The advantages identified according to the results of the studies begin with the emphasis that interactive reading is an important educational tool in the process of language development and acquisition (MT3). This is followed by another study arguing that interactive reading encourages children to transfer their experiences and knowledge into written texts and to express their feelings and ideas, in addition to helping them form their own ideas (A1). It is also believed that students learn how to use or develop some pragmatic skills in learning any language during interactive reading sessions (A4, A8). Besides that, it has been reported that ensuring the cognitive control and information management in the child's developing mind/brain can be achieved to a significant extent with interactive reading (A17). Interactive reading activities are also said to improve students' understanding of reorganization by increasing the ability to synthesize, summarize and reorder ideas from the information

obtained from the text, and similarly, contribute to the capacity to infer from the information in the given text, thereby boosting the reader's ability to obtain implicit meanings in the text by using his/her prior knowledge and grammar rules, as well as the ability to add information to the text, to create more meaning from it, and to better understand it (A9). The increase in students' listening comprehension skills with interactive reading has also been reported as another advantage (DT4).

The fact that interactive reading activities support literacy (A3, DT6) and improve students' vocabulary (A2, A7, A11, A13, A15, A17, DT4, MT5, and MT8) can be considered as other advantages of interaction-based reading. Additionally, the fact that the participants were more successful in decoding (A2, A3, A9, and DT1), accurate reading (A7, A3, A12, and DT9), reading comprehension (A2, A3, A9, A10, A12, A16, A20, A21, DT1, MT5, MT7, DT9, and DT10), as well as gaining reading fluency (A12, A16, A20, and DT9), and improving themselves in terms of pronouncing letters, syllables, words and sentences correctly (A11, DT9) with interactive reading activities are among the advantages of this approach. Some other advantages can be indicated as follows: interactive reading leads to positive attitude towards reading (A 14, MT7) and perception of self-efficacy, increases reading motivation (A14, A20, A22), makes the reading process more fun (A19, DT9), draws children more into reading (A1, A19) and increases reading participation (DT4). The positive effect of interactive reading on the development of children's receptive and expressive language skills (A5, A18, and MT8) and the success in storytelling (A2) are also cited as advantages. In like manner, the increased intensity of conversations regarding the text and the progress in oral language production (DT4), as well as the improvement of students' questioning skills (DT9) can be regarded among the important advantages of interactive reading activities on language skills. It has also been shown that, since interactive reading activities facilitate the understanding of story structure and grammar (A2), the inclusion of such factors as the sequence of events, main characters, invented and traditional spellings, as well as the use of book language, the awareness raised related to writing rules, and increased text length to include certain book features seem to result in desirable achievement in writing (A1, DT1). The progress in students' use of spelling rules and writing (DT1, DT2), their ability to make connections with more than one text and between texts in each sentence, and their development in writing like a writer (DT2) can be considered as advantages.

Furthermore, Figure 10 also shows that only one of the 33 studies (3.1%) in which interactive reading was discussed at the primary school level mentioned that the practices or ideas based on interactive reading did not show a significant effect. The study encoded as A6 discusses that there are no conclusive results on whether interactive reading activities clearly support, improve, hinder, or on the contrary, have no effect on children's comprehension skills.

Discussion and Conclusion

Within the scope of the present study, a total of 22 articles and 11 graduate theses were reviewed. Given the main characteristics of the analysed, it is clear that interactive reading-related studies have continued to be conducted since 1984, almost half of the published articles have been scanned in SSCI and ERIC indexes (42.42%), and 24.24% of them have been present in ESCI-, EBSCO-, and TR-indexed journals.

When it comes to the postgraduate theses, it appears that the studies on interactive reading at the primary school level have mostly been conducted by researchers from universities in the United States of America (Ariaz, 2010; Brayko, 2012; Bryant, 2016; Bucksar, 2022; Manak, 2009; Mitchell, 2015; Webster, 2001). The reason for this may be that the framework of the concept of "interactive reading" was introduced in the USA and research studies on interactive reading began long ago.

Our study shows that a significant number of studies have been aimed at determining the effects of interactive reading approach on various dimensions of reading skills (reading comprehension skills, literacy skills, reading motivation, reading attitude, vocabulary, early literacy skills, etc.). According to our findings, most studies appear to have been designed with quantitative methods, that is, the experimental designs (Ceyhan & Yıldız, 2021; Durmaz, 2020; Gutierrez, 2016; Karadoğan, 2020; Pilinger & Wood, 2013; Thiede, 2019; Whitehurst, 1999) and mixed methods (Bucksar, 2022; Yurtbakan et al., 2021; Yurtbakan, 2022). Moreover, this result is followed by those that have been conducted in conformity with qualitative research, action research (Bryant, 2016; Mitchell, 2015), grounded theory (Brayko, 2012; Manak, 2009), and document analysis (Merga, 2011; Türkben & Temizyürek, 2017) are the most common qualitative research designs. Yurtbakan (2020), for example, analysed the studies on interactive reading conducted between 2008 and 2018, stating that the majority of the studies were conducted with a focus on quantitative research and especially experimental design. Experimental studies may have been predominantly conducted due to the fact that interactive reading is used as a method and students' participation in the process is ensured through question-and-answer activities, and also that it is a method to be used to test its efficacy in many areas.

As another findings, it was also apparent that the studies on interactive reading were mostly conducted with students studying in the second and third grades of primary school (Bucksar, 2022; Çetinkaya et al., 2018; Karadoğan, 2020; Kim & Hall, 2002; Manak, 2009; Mitchell, 2015; Whitehurst, 1999; Yurtbakan, 2020; Yurtbakan et al., 2021; Yurtbakan, 2022). The fact that younger children show more interest in interactive reading than older ones (Malani et al., 2010) may constitute the reason for the concentration of studies at these grade level. It was also found that the number of participants in the relevant studies ranged between 1 and 50, while studies with a high number of participants were relatively few. By its nature, interactive reading approach involves performing such tasks as asking students questions, giving feedback, enabling students to be active in the process (Justice & Pullen, 2003), and allocating enough time for each student (Yaman, 2010), which may be the reason why smaller sample groups have been preferred.

Another finding is that the reading sessions conducted in the studies examined within the scope of the present study were mostly based on teacher-student interaction (Durmaz, 2020; Hakimi et al., 2014; Karadoğan, 2020; Mitchell, 2015). Since the primary school level was taken as a criterion in the studies examined and teachers, in general, carry out such interactive reading practices more effectively in this age group (Waterhouse, 2014), such studies may have been conducted mostly with teachers. It is known that interactive reading activities are commonly conducted between an adult and a child. this information may have led to the limitation of the type of interaction as teacher and student (Cohrssen et.al, 2016; Yopp & Yopp, 2006). And also in school

settings it is not always easy to find people to lead interactive reading sessions in a professional way. At this point, teachers were seen as the most reliable source (Kim & Hall, 2002; Whitehurst, 1999; Yıldırım, 2023).

The results of the research showed that tests and then questionnaires were widely used as data collection tools, as the studies were conducted in the school environment and within a certain systematic framework (Bryant, 2016; Karadoğan, 2020; Pilinger & Wood, 2013; Rosenhouse et al., 1997; Whitehurst, 1999). In parallel with this, not only descriptive statistics, but also t-tests and Wilcoxon signed-rank tests have been used for data analysis in most of the studies (İlhan & Canbulat, 2021; Kim & Hall, 2002; Yıldırım, 2023; Yurtbakan et al., 2020). It is also seen that inferential (predictive) analysis methods have mostly been used to analyse the data obtained. These methods allow for easier explanation and interpretation of the characteristics analysed between variables (Bektaş, Dündar & Ceylan, 2013). This may be a possible reason why inferential (predictive) analysis methods have been preferred more than others.

Another result of the study shows that reading skill ranks first among the language skills covered by interactive reading approach (Bucksar, 2022; Ceyhan & Yıldız, 2021; Ertem, 2011; Gutierrez, 2016; Hakimi et al., 2014; Karadoğan, 2020; Merga, 2017; Uğur & Tavşanlı, 2022; Yurtbakan, 2020; Yurtbakan et al., 2020; Yurtbakan, 2022). Since interactive reading approach includes activities, such as vocabulary building, between adults and children (Brannon & Dauksas, 2012), explaining words whose meaning is unknown (Ergül et al., 2016), and providing a more accurate understanding of the material read, they may have been aimed to see the impact on the development of reading skills. In terms of reading skills, in particular, skills such as fluent reading, reading comprehension and accurate reading have been studied the most. As a matter of fact, looking at the relationship between interactive reading applications and reading skills; it is known that it increases students' vocabulary (Noble et.al, 2019), improves reading comprehension and fluent reading skills (Ceyhan & Yıldız, 2021), increases students' active participation in the reading process and positively improves affective processes such as attitude and motivation (İlhan & Canbulat, 2021; Yurtbakan et. al, 2021). Besides that, studies conducted to determine the effect of the interactive reading approach on literacy skills (Morgan & Meier, 2008; Pilinger & Wood, 2013; Whitehurst, 1999), speaking skills (Durmaz, 2020; Kim & Hall, 2002; Rosenhouse et al., 1997) and vocabulary acquisition (Ariaz, 2010; Chuang & Jamiat, 2023; Çetinkaya et al., 2018) all come in second place in terms of possible consequences. Interactive reading practices for speaking skills ranked second (Kim & Hall, 2002; Rosenhouse, 1997). Speaking is a natural requirement for the interaction between individuals in interactive reading practices (Cohrssen et al., 2016). Therefore, interactive reading applications can become an attractive method for developing speaking skills. In the interactive reading process, students' development of speaking skills while answering questions about the book (Blom-Hoffman et. al, 2006) and having a positive attitude towards speaking due to their detailed descriptions of the events in the book (Ganotice et. al, 2017) reflect the relationship between interactive reading practices and speaking skills. The studies on other language skills, such as writing and listening/watching, have been conducted less frequently. In the studies dealing with the writing dimension of interactive reading; while there is a relationship in the form of increasing awareness of language and spelling rules (Webster, 2001) and

improving written expression skills (Manak, 2009); in terms of listening skills, it is emphasized that the child's participation as an active listener in the process improves listening comprehension skills (Sezer, 2021). However, the fact that the number of these studies is quite small shows that there is a need for studies to determine the effect and relationship of interactive reading activities on other language skills other than reading.

Finally, the results of the studies on interactive reading reveal that 96.9% of the studies have reported the positive effect of interactive reading approach on language skills. In this context, the advantages of this approach include that it significantly improves children's cognitive skills (Çetinkaya et al., 2019; Uğur & Tavşanlı, 2022), boosts vocabulary (Brayko, 2012; Ceyhan & Yıldız, 2019; Çetinkaya et al., 2019; Durmaz, 2020; Ergül et al., 2017; Mitchell, 2015; Pilinger & Wood, 2013; Rosenhouse et al., 1997; Türkben & Temizyürek, 2017; Uğur & Tavşanlı, 2022), enhances reading comprehension (Bucksar, 2022; Webster, 2001; Yurtbakan, 2022), improves reading fluency (Merga, 2017; Yurtbakan, 2020; Yurtbakan et al., 2020; Yurtbakan, 2022), helps children pronounce letters, syllables, words and sentences correctly (Türkben & Temizyürek, 2017), increases motivation (Çetinkaya et al., 2018; Uğur & Tavşanlı, 2022), and improves speaking skills (Brayko, 2012), writing skills (Manak, 2009), and listening skills (Webster, 2001). These results are similar to those reported by other studies (Yurtbakan, 2020) in the literature conducted in previous years. It is also stated that the effect of interactive reading on the development or acquisition of language skills is not yet clear, in other words, that it shows a variable effect. We considered this as a disadvantage in our study because, the study we examined emphasized that more research was needed to determine the effect of interactive reading on language skills. Even if research shows that there are more advantages, such an emphasis can create mistrust for interactive reading.

Implications

This study analysed interactive reading-based studies conducted at primary school level from a comprehensive and holistic point of view, in terms of language skills, thereby ensuring to determine the trend in the field and to create a road map for future studies. The results obtained from the study can guide researchers in noticing the gap in the literature and planning their studies in this regard. Based on the results of the study, what can contribute to the literature include conducting further studies on language skills in speaking and listening and more studies in accordance with qualitative research methods, as well as planning longitudinal studies and resorting to diversification at many stages of such research studies.

Limitations

The research contained publications until the end of March 2023. In addition, the analyzed studies are limited to being written in English and Turkish. We recommend that new research should conduct a more up-to-date review and also access research in different languages.

Acknowledgements

The study was not supported by any institution.

Statement of Responsibility

The authors contributed equally to the study.

Conflicts of Interest

The authors declare that there is no conflict of interest.

Author Bios:

Ebru ERGÜL works as a research assistant at Selcuk University, Faculty of Education. She continues her doctoral studies in basic education at Gazi University. She conduct teacher education, mathematics education for primary school, maths game, mathematical modelling.

Nurhan Aktaş is associate professor in the department of Primary Teacher Education at Selcuk University. She has a PhD degree in basic education at Gazi University. Her field of research is in elementary reading and writing, story writing, reading comprehension, motivation in reading and writing, digital writing and screen reading.

References

Anderson, A., Anderson, J., & Shapiro, J. (2005). Supporting multiliteracies: Parents' and children's talk within shared storybook reading. *Mathematics Education Research Journal, 16,* 5-26. https://doi.org/10.1007/BF03217399

*Ariaz, S. K. (2010). *Vocabulary acquisition of bilingual students through the implementation of dialogic shared storybook reading techniques* [Master's thesis]. The University of Texas at El Paso.

Bektaş, M., Dündar, H., & Ceylan, A. (2013). Ulusal sınıf öğretmenliği eğitimi sempozyumu (USOS) bildirilerinin çeşitli değişkenler açısından incelenmesi. *Uşak Üniversitesi Sosyal Bilimler Dergisi, 6(*2), 201-226.

Beschorner, B., & Hutchison, A. (2014). Parent education for dialogic reading: Online and face-toface delivery methods. *Journal of Research in Childhood Education, 30*(3), 374-388. https://doi.org/10.1080/02568543.2016.1178197

Blom-Hoffman, J., O'neil Pirozzi, T. M., & Cutting, J. (2006). Read together, talk together: The acceptability of teaching parents to use dialogic reading strategies via videotaped instruction. *Psychology in the Schools, 43*(1), 71-78. https://doi.org/10.1002/pits.20130

*Brayko, K. (2013). *Reading and relationships: leveraging community strengths in a cross-age, bilingual, dialogic reading intervention* [Doctoral dissertation]. University of Washington.

Brannon, D., & Dauksas, L. (2012). Studying the effect dialogic reading has on family members' verbal interactions during shared storybook reading. *SRATE Journal, 21*(2), 9-20.

*Bryant, J. D. S. (2016). *Let's give them something to talk about: Supporting primary African American students' language through dialogic reading* [Doctoral dissertation]. University of Missouri-Saint Louis.

*Bucksar, A. V. (2022). *The impact of digital dialogic reading intervention on the primary school age at-risk readers' comprehension* [Doctoral dissertation]. Widener University.

*Ceyhan, S., & Yıldız, M. (2021). The effect of interactive reading aloud on student reading comprehension, reading motivation, and reading fluency. *International Electronic Journal of Elementary Education, 13*(4), 421-431. https://doi.org/10.26822/iejee.2021.201

*Chuang, C., & Jamiat, N. (2023). A systematic review on the effectiveness of children's interactive reading applications for promoting their emergent literacy in the multimedia context. *Contemporary Educational Technology, 15*(2), ep412. https://doi.org/10.30935/cedtech/12941

Cohrssen, C., Niklas, F., & Tayler, C. (2016). 'Is that what we do?' Using a conversation analytic approach to highlight the contribution of dialogic reading strategies to educator– child interactions during storybook reading in two early childhood settings. *Journal of Early Childhood Literacy, 16*(3), 361–382. https://doi.org/10.1177/1468798415592008

Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

*Çetinkaya, F. Ç., Öksüz, H. İ., & Öztürk, M. (2018). Etkileşimli okuma ve kelime hazinesi. *Journal of International Social Research, 11*(60), 705-715. http://dx.doi.org/10.17719/jisr.2018.2825

*Çetinkaya, F.C., Ates, S. & Yildirim, K. (2019). Effects of interactive book reading activities on improvement of elementary school students' reading skills. *International Journal of Progressive Education, 15*(3), 180-193. https://doi.org/ 10.29329/ijpe.2019.193.13.

Çelebi-Öncü, E. (2016). Etkileşimli kitap okumanın beş-altı yaş çocuklarının sosyal durumlara yaklaşımlarına etkisinin incelenmesi. *Ana Dili Eğitimi Dergisi, 4*(4), 489-503.

*Durmaz, M. (2020). *Etkileşimli okumanın hikâye anlatma becerisine etkisi*. [Master Thesis], Düzce University.

Elmonayer, R. A. (2013). Promoting phonological awareness skills of Egyptian kindergarteners through dialogic reading. *Early Child Development and Care, 183*(9), 1229–1241. https://doi.org/10.1080/03004430.2012.703183

Ergül, C., Sarıca, A. D., & Akoğlu, G. (2016). Etkileşimli kitap okuma: Dil ve erken okuryazarlık becerilerinin geliştirilmesinde etkili bir yöntem. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi, 17*(2), 193-204. https://doi.org/10.21565/ozelegitimdergisi.246307

*Ergül, C., Akoğlu, G., Karaman, G., & Sarıca, A. D. (2017). Anasınıfında uygulanan etkileşimli kitap okuma programının sonraki okuma becerilerine etkisi: İzleme çalışması. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 10(2),* 191-219. http://dx.doi.org/10.5578/keg.27611

*Ertem, İ. S. (2011). Understanding interactive CD-ROM storybooks and their functions in reading comprehension: A critical review. *International Journal of Progressive Education, 7*(1), 28-44.

Ganotice Jr, F. A., Downing, K., Mak, T., Chan, B., & Lee, W. Y. (2017). Enhancing parent-child relationship through dialogic reading. *Educational Studies, 43*(1), 51-66. https://doi.org/10.1080/03055698.2016.1238340

*Gemake, J. (1984). Interactive reading: How to make children active readers. *The Reading Teacher, 37*(6), 462–466.

Gladwin, R. F., & Stepp-Greany, J. (2008). Reading approach vs. traditional an interactive. instructor-supported reading instruction in Spanish. *Foreign Language Annals, 41*(4), 687-701. https://doi.org/10.1111/j.1944-9720.2008.tb03325.x

*Gutiérrez, R. (2016). Effects of dialogic reading in the improvement of reading comprehension in students of primary education/Efectos de la lectura dialógica en la mejora de la comprensión lectora de estudiantes de Educación Primaria. *Revista de Psicodidáctica, 21*(2), 303-320.

Gough, D., Thomas, J., & Oliver, S. (2012). Clarifying differences between review designs and methods. *Systematic reviews, 1*(1), 1-9.

*Hakimi, Z., Abdorahimzadeh, S. J., & Kargar, A. A. (2014). Implementing English study in primary education: Investing in early interactive reading and children literature. *Modern Journal of Language Teaching Methods, 4*(3), 100.

*İlhan, E., & Canbulat, T. (2021). Etkileşimli kitap okuma programının (ekop) ilkokul birinci sınıf öğrencilerinin temel dil becerilerine etkisi. *Başkent University Journal of Education, 8*(1), 40-56.

Justice, L. M. & Pullen, P. C. (2003). Promising interventions for promoting emergent literacy skills: Three evidence-based approaches. *Topics in Early Childhood Special Education, 23*, 99-113. https://doi.org/10.1177/02711214030230030l0

*Karadoğan, Z. (2020). *Etkileşimli kitap okuma uygulamalarının okuduğunu anlama becerisi ve tutuma etkisi* [Master's dissertation]. Balıkesir Üniversitesi.

*Kim, D., & Hall, J. K. (2002). The role of an interactive book reading program in the development of second language pragmatic competence. *The Modern Language Journal, 86*(3), 332–348. https://doi.org/10.1111/1540-4781.00153

Lasserson, T. J., Thomas, J., & Higgins, J. P. (2019). Starting a review. In J.P.T. Higgins, J. Thomas, J. Chandler, M. Cumpston, T. Li, M.J. Page and V.A. Welch (Eds.), *Cochrane handbook for systematic reviews of interventions*. https://doi.org/10.1002/9781119536604.index

Malani, M. D., Barina, A., Kludjian, K., Perkowski, J., Nye, C. & Schwartz, C. (Commentary authors). (2010). Added value of dialogic book reading for young children's vocabulary development. *Evidence-Based Communication Assessment and Intervention, 4*(4), 178-182. https://doi.org/10.1080/17489539.2011.567891

*Manak, J. A. (2009). *Intertextual connections: The impact of interactive read alouds on the writing of third graders during writing workshop* [Doctoral dissertation]. University of Florida.

*Merga, M. K. (2017). Interactive reading opportunities beyond the early years: What educators need to consider. *Australian Journal of Education, 61*(3), 328-343. https://doi.org/10.1177/0004944117727749

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

*Mitchell, A. (2015). *Effect of interactive read-alouds on student comprehension* [Master thesis]. University of Wisconsin.

Mol, S. E., Bus, A. G. & Jong, M. T. (2009). Interactive book reading in early education: A tool to stimulate print knowledge as well as oral language. *Review of Educational Research, 79*(2), 979-1007. https://doi.org/10.3102/0034654309332561

*Morgan P. L. & Meier C. R. (2008) Dialogic reading's potential to improve children's emergent literacy skills and behaviour, *Preventing School Failure: Alternative Education for Children and Youth, 52*(4), 11-16. https://doi.org/10.3200/PSFL.52.4.11-16

Noble, C., Sala, G., Peter, M., Lingwood, J., Rowland, C., Gobet, F., & Pine, J. (2019). The impact of shared book reading on children's language skills: A meta-analysis. *Educational Research Review, 28*, 100290. https://doi.org/10.1016/j.edurev.2019.100290

Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ 372*(71), 1-9. https://doi.org/10.1016/j.ijsu.2021.105906

*Pillinger, C., & Wood, C. (2013). A small-scale comparison of the relative impact of dialogic and shared book reading with an adult male on boys' literacy skills. *Journal of Early Childhood Literacy, 13*(4), 555–572. https://doi.org/10.1177/1468798413491975

*Rosenhouse, J., Feitelson, D., Kita, B., & Goldstein, Z. (1997). Interactive reading aloud to Israeli first graders: Its contribution to literacy development. *Reading Research Quarterly, 32*(2), 168–183. http://www.jstor.org/stable/748104

Sezer, B. B. (2021). *Farklı sesli okuma yöntemlerinin ilkokul 3. sınıf öğrencilerinin dinlediğini anlama düzeylerine etkisi*. [Master's dissertation]. Düzce Üniversitesi.

Sim, S. S. H., Berthelsen, D., Walker, S. Nicholson, J. M., & Fielding-Barnsley, R. (2014). A shared reading intervention with parents to enhance young children's early literacy skills. *Early Child Development and Care, 184*(11), 1531-1549. https://doi.org/10.1080/03004430.2013.862532

Şimşek, Z. C. (2017). *Farklı kitap okuma tekniklerinin 48-66 ay grubu çocuklarının dil gelişimine olan etkileri* [Doctoral dissertation]. Pamukkale Üniversitesi.

*Thiede, R. (2019). Synesthetic entrainment in interactive reading sessions of children's books. *Children's Literature Association Quarterly 44*(4), 381-400.

*Türkben, T., & Temizyürek, F. (2017). Okuduğunu anlama becerisinin geliştirilmesinde etkileşimsel okuma öğretiminin rolü. *Kesit Akademi Dergisi*, (7), 374-388.

*Uğur, S. & Tavşanlı, Ö. F. (2022). Öğretmen rolüyle etkileşimli okuma uygulamalarının dördüncü sınıf öğrencilerinin okuduğunu anlama başarısına etkisi. *TEBD, 20*(2), 655-678. https://doi.org/10.37217/tebd.1086345

Vallly, Z., Murray, L., Tomlison, M., & Cooper, P. J. (2015). The impact of dialogic book-sharing training on infant language and attention: a randomized controlled trial in a deprived South African community. *Journal of Child Psychology and Psychiatry, 56*(8), 865–873. https://doi.org/10.1111/jcpp.12352

Waterhouse, N. L. (2014). *Changing participation in guided interactive shared reading: A study of early childhood teachers' implementation and children's engagement*. [Unpublished doctorate thesis]. Montana University.

*Webster, P. P. S. (2001). *The influence of interactive storybook read-alouds on first graders' literacy development* [Doctoral dissertation]. Oakland University.

Whitehurst, G. J., Falco, F. L., Lonigan, C., Fischel, J. E., DeBaryshe, B. D., Valdez-Menchaca, M. C. … Caulfield, M. (1988). Accelerating language development through picture book reading. *Developmental Psychology, 24*, 552-558.

Whitehurst, G. J., Arnold, D. S., Epstein, J. N., Angell, A. L., Smith, M., & Fischel, J. E. (1994). A picture book reading intervention in day care and home for children from low-income families. *Developmental Psychology, 30*, 679-689. https://doi.org/10.1037/0012-1649.30.5.679

Whitehurst, G. J. & Lonigan, C. J. (1998). Child development and emergent literacy. *Child Development, 69*(3), 848-872. https://doi.org/10.1111/j.1467-8624.1998.tb06247.x

*Whitehurst, G. J., Zevenbergen, A. A., Crone, D. A., Schultz, M. D., Velting, O. N., & Fischel, J. E. (1999). Outcomes of an emergent literacy intervention from Head Start through second grade. *Journal of Educational Psychology, 91*(2), 261-272. https://doi.org/10.1037/0022-0663.91.2.261

Yaman, E. (2010). Kalabalık sınıfların etkileri: Öğrenciler ne düşünüyor? *Kastamonu Eğitim Dergisi, 18*(2), 403-414.

*Yıldırım, S. (2023). *Etkileşimli okuma yönteminde Barrett taksonomisi ile ilkokul 3. sınıf öğrencilerinin okuduğunu anlama becerilerinin geliştirilmesi* [Master's Dissertation]. İstanbul Aydın Üniversitesi.

*Yıldız, M., & Ceyhan, S. (2019). The Effect of interactive reading aloud activities on the reader self-perception of primary school students. *Universal Journal of Educational Research, 7*(4), 1007-1013. https://doi.org/10.13189/ujer.2019.070412

Yopp, R. H., &Yopp, H. K. (2006). Informational texts as read alouds in school and home. *Journal of Literacy Research, 38,* 37-51. https://doi.org/10.1207/s15548430jlr3801_2

*Yurtbakan, E. (2020). Etkileşimli okuma: Bir içerik analizi. *Ana Dili Eğitimi Dergisi, 8*(1), 135-156.

*Yurtbakan, E., Erdoğan, Ö., & Erdoğan, T. (2020). Etkileşimli okumanın okuma motivasyonuna etkisi. *Eğitim ve Bilim, 46*(206), 161-18. http://dx.doi.org/10.15390/EB.2020.9258

*Yurtbakan, E. (2022). *Öğretmen ve ebeveyn rehberliğinde yapılan etkileşimli okuma uygulamalarının ilkokul 2. sınıf öğrencilerinin okuma becerilerine etkisi* [Doctoral dissertation]. Trabzon University.

**The research studies reviewed for the purposes of this study.*

Journal of Theoretical Educational Science, 17(3), 643-675, July 2024
Kuramsal Eğitimbilim Dergisi, 17(3), 643-675, Temmuz 2024
[Online]: http://dergipark.org.tr/akukeg
DOI number: http://doi.org/10.30831/akukeg.1365907

The Effect of Lesson Study on Preservice Teachers' Noticing Skills Towards Misconceptions*

Ders İmecesinin Öğretmen Adaylarının Kavram Yanılgılarına Yönelik Farkındalık Becerilerine Etkisi

Yasemin TÜRK ** **Adnan BAKİ** ***

Received: 25 September 2023 **Research Article** **Accepted:** 30 June 2024

ABSTRACT: The aim of the study is to examine how lesson study activities affect primary school preservice teachers' noticing of students' misconceptions. A qualitative research approach was adopted and action research method was used. The study was conducted with 9 primary school preservice teachers. The data were obtained from the observation form, video recordings, reflection reports and field notes in order to reveal how the lesson study model affected the noticing development of preservice teachers. In addition to these, the "video exam" at the end of the Teaching Practicum-II course also constituted one of the data collection tools. Descriptive analysis was used in the study. The data obtained were analyzed by adapting the theoretical framework of "Levels of Noticing of Students' Mathematical Thinking" developed by van Es (2011) as "Levels of Noticing of Students' Misconceptions" in order to reveal preservice teachers' noticing of students' mathematical thinking. As a result of the research, it was concluded that noticing skills of the lesson study group preservice teachers were mostly at the level of reasoning and justifying their reasons (level 3) and offering alternative pedagogical solution suggestions based on comments (level 4). It was concluded that the noticing skills of the comparison group preservice teachers were mostly descriptive (level 1) and at the level of identifying important events but being insufficient to expand their interpretations (level 2).

Keywords: Noticing, lesson study, teacher education, misconception.

ÖZ: Araştırmanın amacı, ders imecesi çalışmalarının, sınıf öğretmeni adaylarının, öğrencilerin kavram yanılgısı ile ilgili farkındalık becerilerini nasıl etkilediğinin incelenmesidir. Çalışmada nitel araştırma yaklaşımı benimsenmiş ve aksiyon araştırması yöntemi kullanılmıştır. Çalışma 9 sınıf öğretmeni adayı yürütülmüştür. Ders imecesi modelinin öğretmen adaylarının farkındalık gelişimini nasıl etkilediğini ortaya koyabilmek için veriler, gözlem formundan, video kayıtlarından, yansıma raporlarından ve alan notlarından elde edilmiştir. Bunlara ek olarak Öğretmenlik Uygulaması-II dersinin sonunda yapılan "video sınavı" da veri toplama araçlardan bir tanesini oluşturmuştur. Çalışmada betimsel analiz yapılmıştır. Elde edilen veriler, öğretmen adaylarının öğrencilerin matematiksel düşünmeleri farkındalık becerisini ortaya koyabilmek için van Es (2011) tarafından geliştirilmiş olan "Öğrencilerin Matematiksel Düşünmelerini Fark Etme Düzeyleri" teorik çerçevesi araştırmacı tarafından "Öğrencilerin Kavram Yanılgısını Fark Etme Düzeyleri" şeklinde uyarlanarak analiz edilmiştir. Oluşturulan bu çerçeve verilerin analizinde kullanılmıştır. Çalışmanın sonucunda ders imecesi grubu öğretmen adaylarının farkındalık becerilerinin ağırlıklı olarak düzey 3 veya düzey 4, karşılaştırma grubu öğretmen adaylarının farkındalık becerilerinin ise ağırlıklı olarak düzey 1 ve düzey 2 olduğu sonucuna varılmıştır.

Anahtar kelimeler: Farkındalık, ders imecesi, öğretmen eğitimi, kavram yanılgısı.

* This study was prepared based on the doctoral thesis, titled "The effect of lesson study on the noticing skills of preservice teachers regarding student learning", which we completed in February 2020.

** *Corresponding Author:* Instructor., Karadeniz Technical University, Trabzon, Türkiye, yaseminturk3010@gmail.com, https://orcid.org/ 0000-0002-2680-3149

*** Prof. Dr., Trabzon University, Trabzon, Türkiye, adnanbaki@gmail.com, https://orcid.org/0000-0002-1331-053X

Citation Information
Türk, Y., & Baki, A. (2024). The effect of lesson study on preservice teachers' noticing skills towards misconceptions. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 17*(3), 615-640.

ISSN: 1308-1659

The knowledge of "content education", which is included in the general competencies of teaching profession determined in our country (MEB, 2017), appears as "knowledge of teaching the content" among the knowledge that teachers should have in the international literature (Cochran, 1997; Magnusson, Borko, & Krajcik, 1999; Mohr & Townsend, 2002; Sulman, 1986; Van Driel, Verloop, & de Vos, 1998). Content area teaching knowledge includes the knowledge that teachers should have in order to realize effective learning in students (Baki, 2019; Ball, Thames, & Phelps, 2008; Fennema & Franke, 1992; Marks, 1990; Shulman, 1986). Shulman (1986) gave the answers to the questions of what a teacher considers when preparing a lesson, what knowledge he mobilizes in the preparation phase of the lesson, how he determines the most accurate and effective technique that can be used in the implementation of a plan, how he behaves in order to teach a knowledge that he has not encountered in his own learning process, and how he transforms his content knowledge into a form that students can understand with the concept of " teaching knowledge". In the studies, there are professional development models that have been put forward to improve the knowledge of teaching the content. In this way, there are many professional development models that support teacher professional development (Darling-Hammond, 2003; Garet, Porter, Desimone, Birman, & Yoon, 2001; Hawley & Valli, 1999; Kennedy, 1999). One professional development model that supports the development of the teacher's knowledge of teaching the required content area (Fernandez & Yoshida, 2004; Takahashi & Yoshida, 2004) is lesson study. Lesson study is a model for developing teachers' content knowledge and it starts with setting goals for student learning and development (Lewis, Perry, & Murata, 2006). The lesson study model includes successive stages such as setting goals, planning the lesson, implementing the plan, observing the lesson, discussing and evaluating the lesson, reviewing and reorganizing the lesson, re-teaching the lesson and re- evaluating the lesson (Fernadez & Yoshida, 2004; Lewis & Tsuchida, 1998). In this model, in the planning phase, teachers prepare the lesson plan together. In the implementation phase, one teacher in the group implements the plan prepared together and this lesson is recorded. In the observation phase, the other teachers observe the implementing teacher, in the discussion phase, all teachers, first the teacher who taught the lesson, share their observations and suggestions about the lesson, and in the evaluation phase, the lesson is evaluated and the lesson plan prepared together is revised. The new revised plan can be reapplied or not, depending on demand. Studies in the literature suggest that the lesson study model as a professional development model can be used by teachers (Gözel, 2016; Lewis, 2016; Meyer & Wilkerson, 2011; Sudejamnong, Robsouk, Loipha, & Inprasitha, 2014; Verhoef & Tall, 2011); Yoshida & Jackson, 2011) and preservice teachers (Akbaba-Dağ, 2014; Baki, 2012; Bütün, 2012; Corcoran, 2008; Fernandez, 2010; Özdemir-Baki, 2017) positively support the development of mathematics teaching knowledge. One of the concepts that has gained importance in teacher education in recent years and makes it necessary to focus on practices in teaching is the concept of teacher noticing (Philipp, 2014). van Es and Sherin (2002) and Sherin and van Es (2009) defined teacher noticing as a teacher's ability to recognize important situations that occur in complex classroom environments and to interpret these complex situations. van Es (2011) suggests that teachers need to learn this noticing, given the emphasis in current mathematics education reform proposals (Ball & Cohen, 1999; NCTM, 2000) on teachers adopting a

flexible teaching approach that is responsive to student ideas. Some research results have shown that to teach mathematics effectively, teachers need to recognize students' thinking and use it to adjust their lessons to support students' learning (Ainley & Luntley, 2007; Lee, 2018; Lee & Cross Francis, 2018). According to Sherin and van Es (2005), noticing skills should be included in teacher training programs and preservice teachers should be given the opportunity to do practices that can develop these skills. Noticing skill is one of the basic professional skills that preservice teachers should have (Mason 2002; Sherin, Jacobs, & Philipp, 2011). van Es (2011) argues that teachers' noticing expertise "What did teachers notice? How did teachers notice?". The first category focuses on "to whom" (e.g. classroom environment, whole class, groups of students, individual students, individual teachers) and "what issues" (e.g. teaching strategies, students' behavior, students' mathematical thinking, classroom management) teachers attend to. The second category is concerned with how teachers analyze their observations (e.g., describing, interpreting, and evaluating), the depth of their analysis (e.g., giving few details or basing their interpretations on evidence), and making connections to pedagogical knowledge about teaching and learning. van Es (2011) presented a developmental trajectory for these dimensions within both categories, from level 1 to level 4, which reveals the development of noticing. Studies in the literature indicate that preservice teachers' noticing skills are at a low level compared to experienced teachers and that it is necessary to develop noticing skills in preservice teachers and ensure that they start to work (Jacobs, Lamb, & Philipp, 2010; Sherin & van Es., 2005; Star & Strickland, 2008; van Es et al., 2002). When the studies in the literature are examined, it is seen that the studies on lesson study (Budak, Budak, Bozkurt, & Kaygın, 2011; Fernandez, 2005; Meyer, 2005; Özdemir-Baki, 2017; Özen, 2015; Özen & Köse, 2013; Özen & Köse 2014; Verhoef et al, 2011) and teacher noticing studies were conducted with mathematics teachers or preservice mathematics teachers (Erdik, 2014; Güner, 2017; Osmanoğlu, 2010; Osmanoğlu, Işıksal, & Koç, 2012; Tataroğlu-Taşdan, 2018; Temel-Doğan, Özgeldi, 2018). Considering that primary school teachers plan and conduct mathematics lessons until the 4th grade of primary school, it is clear that these studies conducted with primary school mathematics teachers and preservice mathematics teachers should also be conducted with primary school teachers and preservice primary school teachers. It has been a matter of curiosity whether it would be an opportunity for primary teachers to practice with a professional development model that supports the development of knowledge of teaching the content such as lesson study before service, and to gain noticing skills. As a result, it is aimed to investigate how the lesson study model affects the noticing development of primary school preservice teachers regarding misconceptions. In addition, there are different research topics in the literature on teacher noticing that researchers have focused on and one of them is teacher noticing of student learning (Santagata, Zannoni, & Stigler, 2007). In this study, under the title of student learning, the focus was on the preservice teachers' ability to recognize students' misconceptions or prevent them from falling into misconceptions. According to Baki (2006), misconceptions are the behaviors of students as a result of their wrong beliefs and wrong experiences. Since misconception of a concept may lead to misperception of many subsequent concepts and learning difficulties in this regard, it is important for the teacher to be aware of the situations that may cause students to have misconceptions in the process of teaching concepts (Zembat, 2010). Prioritizing students' misconceptions and then planning teaching

activities by taking them into consideration is very important in terms of increasing the quality of teaching (Ayyıldız & Altun, 2013; Gilbert, Osborne, & Fensham, 1982). In this study, what is meant by "taking students' misconceptions into consideration" are as follows; Recognizing the student's systematic mistakes, recognizing the student's comprehension skill and ability, taking into account the student's prior knowledge and readiness level for teaching, giving appropriate feedback to the student in order to prevent the student from falling into misconceptions, showing appropriate behavior or behaviors to prevent the student's misconceptions, determining what or what may cause misconceptions, avoiding overgeneralization or over-specialization, taking into account the pedagogical reasons that may cause misconceptions, in other words, using the correct method technique appropriate to the subject, organizing the content appropriately. When the noticing studies in the literature are examined, it is seen that video is used as a tool to improve teacher noticing (Barnhart et al., 2015; Benedict-Chambers, 2016; Christ et al., 2017; Huang et al., 2012; Kleinknecht et al., 2016; Lee, 2019; Mitchell et al., 2014; Osmanoğlu, 2010; Osmanoğlu, Işıksal, & Koç; 2012; Stockero et al., 2017; van Es et al., 2002; 2006; 2008; Vrikki et al., 2017). However, this study aimed to expand the existing literature not only with the use of video, but also with the use of video in the context of content through lesson study. In addition, there are studies in the literature that examine teachers' noticing development in the lesson study process (Güner, 2017; Güner & Akyüz, 2017; Lee, 2019). However, when these studies were examined, it was seen that the focus was on teachers' noticing of students' mathematical thinking. However, this study aims to examine the misconception noticing process of preservice teachers. It is thought that the study will contribute to the literature in this sense. In this direction, the problem of the study was determined as "How do lesson study studies affect the noticing skills of primary school preservice teachers about students' misconceptions? In the light of all this information, the aim of this study is to reveal how preservice primary school teachers' noticing develops with the lesson study model and the development process that occurs in preservice teachers during the lesson study process. For this purpose, the study investigated in detail the primary school preservice teachers' ability to recognize students' misconceptions. As a result, it is aimed to investigate how the lesson study model affects the noticing development of primary school preservice teachers regarding misconceptions.

Theoretical Framework

Lesson Study

Lesson study is a professional development model originating from Japan, which was put forward to improve the knowledge of teaching the field in the process of knowledge research that the teacher should have (Fernandez et al., 2004; Takahashi et al., 2004). Lesson study; In primary education, it is a process that includes the development of teaching and structuring of knowledge (Cerbin and Kopp, 2006) and the stages of lesson planning, lesson implementation, lesson observation, lesson discussion, lesson evaluation, lesson revision, lesson re-implementation and lesson re-evaluation (Lewis, 2002; Lewis and Tsuchida, 1998).

Noticing

van Es and Sherin (2002) stated that "the teacher's ability to see and interpret important situations that occur in complex classroom environments is the teacher's noticing." van Es (2011) developed a theoretical framework consisting of four levels (Level1 - Level2 -Level3 -Level4) to reveal teachers' noticing development regarding students' mathematical thinking. van Es (2011) developed two categories for noticing: "what do teachers notice" and "how do teachers notice" and evaluated these two categories by dividing them into four dimensions. He divided these categories into dimensions to reveal the nature of the group's noticing. The first category is "what teachers notice" and includes the dimensions "Whose" and "Subject". The "whose" dimension is the teacher to the student, the teacher to himself, or to someone else. It is the dimension that expresses who is focused on. The "subject" dimension focuses on defined topics such as mathematical thinking, pedagogical strategies, classroom management, and environment. The second category of the framework concerns teachers' analysis of what they notice and includes the dimensions "Situation and Specificity". The "specificity" dimension indicates the level of detail in the teacher's discourse and focuses on the teacher talking about his general impressions while expressing his thoughts or expressing his thoughts in detail by justifying them. The "situation" dimension is the teacher's analytical approach in interpreting what he notices (van Es, 2011). It indicates whether the group's inquiry into teaching and learning is qualified or not, and how it interprets and evaluates its observations. The "situation" dimension is divided into three: definition, evaluation and interpretation. "Description" is a restatement of the events that occurred. "Evaluation" refers to the teacher deciding what is good or bad and expressing it or making conscious decisions about how to do it. "Interpreting" refers to the group's efforts to reason about what they observe, to understand the roots of an idea, and to explain what is meant by a particular idiom, drawing, action, or expression, or it includes expressions in which the teacher infers from his observations and tries to explain the reasons why events occur. van Es (2011) has put forward a framework consisting of four levels that will reveal the development of noticing for these four dimensions of both categories. These four levels are; They are presented as level 1, level 2, level 3 and level 4. Level 1 of students' noticing of mathematical thinking; It involves the teacher talking about his general impressions, expressing his observations in a simplistic manner, and not providing evidence or any interpretive explanations. level 2; It involves the teacher continuing to talk about his general impressions but also mentioning specific students and moments to support his statements but failing to elaborate on his comments and observations. level 3; It involves the teacher reasoning about his observations and trying to justify them; level 4 ; It involves the teacher trying to establish a connection between teaching and learning principles, as well as offering alternative pedagogical solutions based on interpretation.

Considering Misconceptions

In this study, what is meant by "taking into account the student's misconceptions" is as follows; Noticing the mistakes made systematically by the student, noticing the student's comprehension skills and abilities, taking into account the student's previous knowledge and readiness level for teaching, giving appropriate feedback to the student in order to prevent the student from falling into misconceptions,

showing appropriate behavior or behaviors to prevent the student from misconceptions, Determining what or what may cause misconceptions, avoiding overgeneralization or overspecification, taking into account the pedagogical reasons that will cause misconceptions, in other words, using the right method and technique appropriate to the subject, arranging the content appropriately, etc.

Method

Approach of the research

In the study, a qualitative research approach was adopted and action research method was used. Qualitative research approach is a research approach in which qualitative data collection techniques such as observation, interview, and document analysis are used and a qualitative process is followed to reveal perceptions and events in a realistic and holistic way in a natural environment (Yıldırım & Şimşek, 2013). One of the reasons why the qualitative research approach is preferred in research is to systematically examine the meanings arising from the experiences of the people to be researched (Ekiz, 2009). For this reason, in this research, a qualitative research approach was adopted as it was aimed to examine the change in the noticing of preservice teachers with their lesson study experience. Action research is defined as a research that aims to determine the necessary measures to improve the situation by making an analytical evaluation of the existing practice, conducted by expert researchers, with the participation of practitioners and parties to the problem (Karasar, 2009). This study was conducted as an action research with the aim of raising noticing among preservice teachers by improving the existing process through lesson study. In accordance with the nature of action research, the practitioner took an active role in this process as both a teacher and a researcher.

Research process

The research was conducted in Teaching Practicum-I and Teaching Practicum-II courses. In the Teaching Practicum-I course, eight lesson study cycles were carried out with 3 primary school preservice teachers. Each of the preservice teachers taught a mathematics lesson for 2 class hours for each cycle, making a total of 8 lesson study cycles. Before each lesson study cycle, the lesson plan was prepared jointly by the 3 preservice teachers and the researcher during the planning phase of the lesson. In the implementation phase of the lesson, one of the preservice teachers implemented the lesson plan prepared together in the classroom. At the end of the lesson, the primary school teacher was also asked to share her observations about the lesson. The lesson observation form was filled in by the preservice teachers participating in the lesson study during the implementation lesson. The items in the observation form focused on preventing students from falling into misconceptions. In the third stage, the discussion of the lesson and reflections stage, the implementation lesson was evaluated by watching the video of the implementation lesson recorded by the researcher, and by considering the observation form, lesson plan and video recordings together. After these meetings, each preservice teacher wrote reflection reports by considering the items related to misconceptions in the observation form. The plan was revised again, but the revised lesson plan was not applied again. The Teaching Practicum-I course, which was conducted with the lesson study group preservice teachers through lesson study cycles,

was conducted with the comparison group preservice teachers by adhering to the content and methodology specified in the undergraduate program. The comparison group preservice teachers also attended one-hour meetings once a week in the researcher's room, during which the lesson plan for Teaching Practicum was reviewed and discussed. In the Teaching Practicum-II course, 3 preservice teachers who had participated in the lesson study in the first semester and 6 preservice teachers who had never participated in a different lesson study were selected as the comparison group and observed each other's lessons in three groups of three for eight lessons consisting of two hours each. Video recordings and observation forms, which were used as part of the lesson study in the process of lesson study in the Teaching Practicum-I course, were used by the researcher as data collection tools in the second semester. The observation forms, reflection reports, video recordings, video exams and the researcher's field notes of the preservice teachers in the Teaching Practicum-II course were analyzed to reveal the noticing development of the preservice teachers.

Study group

The study was conducted with 9 preservice teachers studying in the 4th grade of Karadeniz Technical University Fatih Faculty of Education, Department of Elementary Education, Classroom Teaching Program in the Teaching Practicum-I and Teaching Practicum-II courses. Typical case sampling from purposeful sampling method was used to determine the primary school preservice teachers participating in the study. In order to reveal the noticing of preservice teachers, a typical group of preservice teachers whose academic achievement was neither very high nor very low was determined. Eight lesson study cycles were conducted with 3 preservice teachers in the Teaching Practicum-I course. In the Teaching Practicum-II course, 3 preservice teachers who participated in lesson study were selected as the lesson study group and 6 preservice teachers who had never participated in a different lesson study were selected as the comparison group and they were allowed to observe each other's mathematics lessons in three groups. The Teaching Practicum-I course was carried out with the 6 primary school preservice teachers in the comparison group in accordance with the content and methodology specified in the undergraduate program. In the second semester of the academic year, in the Teaching Practicum-II course, two groups of primary school preservice teachers were compared in order to reveal more clearly whether the lesson study model contributed to the noticing of preservice teachers.

Data collection tool

In order to reveal how the lesson study model affected preservice teachers' noticing development, data were obtained from the observation form developed by the researcher, video recordings, reflection reports and field notes. The reason for using more than one data collection tool in the study was to obtain more in-depth data. Video recordings, observation forms and reflection reports used as part of the lesson study were used as data collection tools in the second semester. In addition to these, the "video exam" at the end of the Teaching Practicum-II course was also one of the data collection tools. The video exam consisted of 3 preservice teachers who participated in the lesson study process and 6 preservice teachers who did not participate in the lesson study process watching a two-hour mathematics lesson of the mentor teacher, which was videotaped, and filling in the observation form simultaneously. A video exam

rubric was created by the researcher for the analysis of the video exam and used in the analysis of the data. Descriptive analysis, one of the qualitative data analysis types, was used in the study.

Data analysis process

The data obtained were analyzed by adapting the theoretical framework of van Es (2011) as "Students' Levels of Recognizing Misconceptions" by the researcher in order to determine preservice teachers' noticing of students' misconceptions. This framework was used to analyze the data. In order to determine the misconception noticing skills of preservice teachers, the levels adapted by the researcher using van Es (2011)'s theoretical framework are as follows: Level 1 (Baseline Noticing): Talks about general impressions about the misconception. They state what they observe with simple expressions. Makes descriptive and general comments. Does not provide evidence to support his/her explanations or gives very few details. Level 2 (Mixed Noticing): Although he/she continues to talk about his/her general impressions about the misconception, he/she also tries to describe important events. He/she mentions specific students and moments to support his/her explanations, but is unable to expand his/her comments and elaborate on his/her observations. Level 3 (Focused Noticing): Reason about what they observe about misconceptions and try to justify the reasons for them. Analyzes important situations observed in the classroom. Uses the details of observations to make inferences about students' misconceptions. His/her explanations based on his/her observations are interpretative and he/she tries to elaborate these explanations. Level 4 (Extended Noticing): Analyzes student comments and explanations in detail to determine whether students have misconceptions. Highlights noteworthy events related to misconceptions. Cites specific events and interactions as evidence. Provides detailed information on the interactions they observe and provides details to support their thinking as a result of their observations. Interpret and articulate what they observe, taking into account the relationship between the student's misconception and the teacher's pedagogy. Makes connections between what they observe and the principles of teaching and learning. Suggests alternative pedagogical solutions based on interpretations. In the Teaching Practicum-I course, preservice teachers in the lesson study group analyzed each other's lessons as part of the lesson study model. In the Teaching Practicum-II course, the Lesson Study group and the comparison group were allowed to analyze each other's lessons in their own groups in order to reveal their noticing, and the researcher analyzed the lessons of both groups. Studies conducted for the validity (Creswell & Miller, 2000) and reliability (Merriam, 1998) of the study; triangulation, long-term application, purposive sampling, detailed description, participants' consent to the data, defining the research method and stages of the research, detailed description of the sample, consistency review.The research is limited to the practices carried out with 9 preservice teachers in the Teaching Practicum-I and Teaching Practicum-II courses in the Department of Primary Education, Karadeniz Technical University. The research is limited to misconceptions from student learning. It is limited to 8 lesson study cycles conducted with primary school preservice teachers in Teaching Practicum-I course.

Ethical Procedures

Ethical committee date: 09.12.2021 and number: E-81614018-000-2100005124.

Findings

The noticing skills of T1, T2, T3, C1, C2, C3, C4 and C6 preservice teachers in the Teaching Practicum-II course are summarized in Table 1, Table 2 and Table 3 below. Group1 consisted of T2 Preservice Teacher, C1 Preservice Teacher, C2 Preservice Teacher, Group2 consisted of T3 Preservice Teacher, C3 Preservice Teacher, C4 Preservice Teacher, Group3 consisted of T1 Preservice Teacher, C5 Preservice Teacher, C6 Preservice Teacher. Table 1 below shows the noticing skills of T2, C1 and C2, preservice teachers in the Teaching Practicum-II course, which were obtained as a result of the analysis of the data obtained from the observation form and reflection reports.

Table 1

Noticing Skills of the Preservice Teachers in Group 1 (T2 Preservice Teacher, C1 Preservice Teacher, C2 Preservice Teacher)

	Misconception noticing levels		
	T2 Preservice Teacher	C1 Preservice Teacher	C2 Preservice Teacher
Lesson 1 Group 1	Level 3	Level 1	Level 2
Lesson 2 Group 1	Level 4	Level 1	Level 1
Lesson 3 Group 1	Level 4	Level 1	Level 2
Lesson 4 Group 1	Level 3	Level 1	Level 2
Lesson 5 Group 1	Level 4	Level 2	Level 2
Lesson 6 Group 1	Level 3	Level 1	Level 1
Lesson 7 Group 1	Level 4	Level 1	Level 1
Lesson 8 Group 1	Level 3	Level 1	Level 1

When Table 1 is examined, it is seen that the noticing skills of the preservice teachers in the lesson study group in group 1 are predominantly level 3 and level 4, while the noticing skills of the comparison group preservice teachers are predominantly level 1 and level 2. From this point of view, it was concluded that the lesson study group preservice teachers gained noticing skills as a result of the development of knowledge of teaching the content with the lesson study model. When the contents of the courses in which the preservice teachers' noticing levels were determined as level 4 were examined, it was concluded that there were topics that overlapped with the topics of the courses carried out in the Teaching Practicum-I course. As a result of this, it is thought that the focus of the lesson study activities caused the preservice teachers to gain competence in these subjects and thus to have high noticing skills.

In Table 2 below, the noticing skills of T3, C3 and C4 preservice teachers in the Teaching Practicum-II course are given as a result of the analysis of the data obtained from the observation form and reflection reports.

Table 2

Noticing Skills of the Preservice Teachers in Group 2 (T3 Preservice Teacher, C3 Preservice Teacher, C4 Preservice Teacher)

	Misconception noticing levels		
	T3 Preservice Teacher	C3 Preservice Teacher	C4 Preservice Teacher
Lesson 1 Group 2	Level 3	Level 1	Level 2
Lesson 2 Group 2	Level 4	Level 1	Level 1
Lesson 3 Group 2	Level 3	Level 1	Level 2
Lesson 4 Group 2	Level 4	Level 2	Level 1
Lesson 5 Group 2	Level 4	Level 2	Level 1
Lesson 6 Group 2	Level 3	Level 1	Level 2
Lesson 7 Group 2	Level 4	Level 1	Level 2
Lesson 8 Group 2	Level 3	Level 1	Level 1

When Table 2 is examined, it is seen that the noticing skills of the lesson study group of pre- service teachers in group 2 are predominantly level 3 and level 4, while the noticing skills of the comparison group preservice teachers are predominantly level 1 and level 2. From this point of view, it was concluded that the lesson study group preservice teachers gained noticing skills as a result of the development of knowledge of teaching the content with the lesson study model. When the contents of the courses in which the preservice teachers' noticing levels were determined as level 4 were examined, it was concluded that there were overlapping subjects with the subjects of the courses carried out in the Teaching Practicum-I course. As a result of this, it is thought that the focus in the lesson study activities caused the preservice teacher to gain competence in these subjects and thus to have high noticing skills.

Table 3 shows the noticing skills of T1, C5 and C6, preservice teachers in the Teaching Practicum-II course, which were obtained as a result of the analysis of the data obtained from the observation form and reflection reports.

Table 3

Noticing Skills of the Preservice Teachers in Group 3 (T1 Preservice Teacher, C5 Preservice Teacher, C6 Preservice Teacher)

	Misconception noticing levels		
	T1 preservice teacher	C5 preservice teacher	C6 preservice teacher
Lesson 1 Group 3	Level 4	Level 1	Level 1
Lesson 2 Group 3	Level 4	Level 2	Level 1
Lesson 3 Group 3	Level 3	Level 1	Level 1
Lesson 4 Group 3	Level 4	Level 2	Level 1
Lesson 5 Group 3	Level 3	Level 1	Level 1

Lesson 6 Group 3	Level 4	Level 2	Level 2
Lesson 7 Group 3	Level 4	Level 1	Level 1
Lesson 8 Group 3	Level 4	Level 1	Level 1

When Table 3 is examined, it is seen that the noticing skills of the lesson study group of pre- service teachers in group 3 are predominantly level 3 and level 4, while the noticing skills of the comparison group preservice teachers are predominantly level 1 and level 2. From this point of view, it was concluded that the lesson study group preservice teachers gained noticing skills as a result of the development of knowledge of teaching the content with the lesson study model. When the contents of the courses in which the preservice teachers' noticing levels were determined as level 4 were examined, it was concluded that there were overlapping subjects with the subjects of the courses carried out in the Teaching Practicum-I course. As a result of this, it is thought that the focus of the lesson study activities caused the preservice teachers to gain competence in these subjects and thus to have high noticing skills.

Noticing Skills of the Lesson Study Group and Comparison Group Preservice Teachers at the End of the Video Exam (Last Lesson)

At the end of the whole process, a math lesson of the mentor teacher was video recorded. Then, 9 preservice teachers were asked to watch this video-recorded lesson and they were asked to fill in the observation form. This application was done in the form of an exam. The data obtained from the observation forms were analyzed descriptively according to the scaled framework prepared in accordance with van Es's (2011) theoretical framework.

Observation Forms in the Video Examination

The implementation of this lesson was carried out by the practice teacher and the outcome of the lesson was "Solves problems requiring at least one division operation with natural numbers" in Grade 4.

Observation Form of Preservice Teacher T1

When the data obtained from the observation form of preservice teacher T1 were analyzed, it was seen that she stated that an incorrect explanation she made in division caused misconceptions in students. Preservice teacher T1 explained this observation about misconception as follows; *The teacher explained that in the division 150÷5, we put the zero in the ones place of 150 next to 3. In 170÷5 division, two of the students did 170÷5=30 on the board and found the remainder 2. In other words, they made a mistake by applying the teacher's explanation that we put the "0" here. They left the operation unfinished. The teacher did not explain why we put the "0" there. The teacher gave a wrong explanation. What the student should understand here is that the number 150 consists of 1 hundred, 5 tens and 0 ones. Let's first divide 1 hundred by 5, here they can do it using rhythmic counting, let them find 20. Then let's divide 5 tens by 5 and find 10, again using rhythmic counting. Add the two together and the result is 30. The student will generalize the explanation that we are throwing away the "0" here and in any case will throw away the "0" from the ones digit in the division to the ones digit in the quotient. This created a misconception.* In addition to this thought, preservice

teacher T1 stated that she realized that students could not perform division when there was 0 in the tens digit in 3-digit numbers and that this was also a misconception. She explained this observation as follows; *Students often incorrectly divided 3-digit numbers if there was 0 in the tens digit. For example, they did 307÷3=12. I think the teacher's explanations were too little here. She should have emphasized how many times 3 is in "0" and how many times "0" is in "0", so she should write this in the division.* When these explanations of T1 Preservice teacher are analyzed, it is seen that she identified important situations related to students' misconceptions and presented details from her observations to support her thoughts. While interpreting her observations, she considered the relationship between the students' misconceptions and the teacher's pedagogy. She offered a pedagogical solution based on interpretation. For this reason, T1 preservice teacher's misconception noticing skill was determined as level 4.

Observation Form of Preservice Teacher T2

When the data obtained from the observation form of preservice teacher T2 were analyzed, she stated that in the problems, the students performed the operations by understanding the question "how many times" as "how many more" and that this was a misconception. She expressed this observation in the observation form as follows; *The teacher asked the following problem: Ali reads 150 books a day, Ayşe reads 3 books a day. How many times more books does Ali read in 1 day than Ayşe read in 1 day? One of the students found 150-3=147. There is a misconception here, the student thought "is a multiple" as "is more" and did subtraction. The teacher said, "You made a mistake, who else wants to do it?". However, the teacher should have asked this student why he/she thought this way and found out the reason for his/her mistake. He should have explained that a multiple of a number is a number that can be divided without remainder. He could have modeled the concepts of "more" and "solid". For example, how many times the number 20 is the number 5? How many more than 5 is the number 20? Draw two figures and show these two operations on the board. The students would have seen that the first operation was a repeated division grouping, while the second was a subtraction operation.* When these explanations of preservice teacher S2 are analyzed, it is seen that she identified important situations related to students' misconceptions and presented details from her observations to support her thoughts. While interpreting her observations, she considered the relationship between students' misconceptions and the teacher's pedagogy. She offered a pedagogical solution based on interpretation. For this reason, the misconception noticing skill of T2 was determined as level 4.

Observation Form of Preservice Teacher T3

When the data obtained from the observation form of preservice teacher S3 were analyzed, he stated that he thought that the teacher's explanation that "the divisor should be more and the divisor should be less" could cause misconceptions in students. He expressed this observation as follows; *The teacher made an explanation about division as "in division, the divisor should be more and the dividend should be less". This explanation caused misconceptions in students. Why should the divisor be a large number, the student thought that a small number cannot be divided by a large number. Then the number 1 cannot be divided by 2. In future grades, the student will not understand fractions and decimals. This explanation of the teacher caused the student*

to overgeneralize and create a misconception that the larger number should always be divided by the smaller number. I can give an example like this: 1 apple cannot be divided by two people because 1 is less than 2. In addition, he explained that in division, for example, in the 124÷3 operation, 1 is not divided by 3, so we divide 12 by 3. This explanation was wrong. First, 1 is divisible by 3. But there, 1 is actually 1 100. When the 100s were divided equally by 3, 30 units would fall, 10 units would remain, and so on, he could have continued the division and prevented the students from falling into misconceptions. When these explanations of the preservice teacher S3 are examined, it is seen that he identified important situations related to students' misconceptions and presented details from his observations to support his thoughts. While interpreting his observations, he considered the relationship between the students' misconceptions and the teacher's pedagogy. He offered a pedagogical solution based on interpretation. For this reason, the misconception noticing skill of T3 was determined as level 4.

Observation Form of Preservice Teacher C1

When the data obtained from the observation form of preservice teacher C1 were examined, she stated that she realized the students made many mistakes in division and that these mistakes were misconceptions. She expressed this thought as follows;

Students made many errors in division in the problems and these were misconceptions. I realized that students had a lot of misconceptions in division. This explanation of preservice teacher C1 was very general and expressed her observation in a simplified way. Her explanation was descriptive and she did not provide any evidence to support this explanation. For this reason, preservice teacher C1's misconception noticing skill was determined as level 1.

Observation Form of Preservice Teacher C2

When the data obtained from the observation form of preservice teacher C2 were examined, she stated that she realized the students had misconceptions about the concepts of "being solid" and "being more". She expressed this observation with her explanation; *Students confused the concepts of "is solid" and "is more" in the problems and performed the operations accordingly. They tried to solve the problems by thinking "How many solids" as "How many more". This was a misconception.* This explanation of misconception made by C2 Preservice teacher was very general and she gave very few details to support her explanation. Her explanation is descriptive. For this reason, preservice teacher C2's misconception noticing skill was determined as level 1.

Observation Form of Preservice Teacher C3

When the data obtained from the observation form of preservice teacher C3 were examined, she stated that she realized the students had misconceptions but the teacher did not take this into consideration. She explained this thought as follows; *I realized that the students had misconceptions in the problems, but the teacher did not take this into account.* This explanation of preservice teacher C3 was very general and expressed her observation in a simplified way. Her explanation was descriptive and he did not provide any evidence to support this explanation. For this reason, preservice teacher C3's misconception noticing skill was determined as level 1.

Observation Form of Preservice Teacher C4

When the data obtained from the observation form of preservice teacher C4 were examined, she stated that she realized an explanation made by the teacher was wrong and that she thought this would cause misconceptions in students. She expressed this observation as follows; *One of the students set up a division problem, but in the problem the smaller number had to be divided by the larger number, and the teacher said "the divisor should be more and the divisor less". He may have wanted them to do this for this lesson, but he said it like a rule or as if it had to be, which may have caused misconceptions in the students.* This explanation made by C4 shows that she tried to define an event that she considered important. Although she mentions a specific student and moment to support her explanation, she fails to expand her interpretation and elaborate her observation. For this reason, preservice teacher C4's misconception noticing skill was determined as level 2.

Observation Form of Preservice Teacher C5

When the data obtained from the observation form of preservice teacher C5 were analyzed, she stated that she observed the teacher did not check the students' prior knowledge at the beginning of the lesson. She expressed this observation as follows;

The teacher did not check students' prior knowledge at the beginning of the lesson. They need to have a certain level of readiness before they can do division correctly. For example, the multiplication table. This explanation made by C5 shows that she tried to define an event that she considered important. Although she mentions a specific situation to support her explanation, she is insufficient in expanding her interpretation and elaborating her observation. For this reason, preservice teacher C5's misconception noticing skill was determined as level 2.

Observation Form of Preservice Teacher C6

When the data obtained from the observation form of preservice teacher C6 were examined, she stated that she thought that she realized that students had a misconception about division. She expressed this observation as follows; *While doing the operations, students say "Is the number 1 divisible by 3? It is not divisible. Then, is 12 divisible by 3, it is divisible by 3, we get 4..." This shows that they have a misconception, I think the statement "the number 1 is not divisible by 3" is a misconception.* This explanation made by C6 shows that she tried to define an event that she considered important. Although she mentions a specific situation and a specific student to support her explanation, she fails to expand her interpretation and elaborate her observation. For this reason, pre- service teacher C6's misconception noticing skill was determined as level 2.

As a result, the noticing skills of preservice teachers at the end of the video exam can be summarized as follows; the misconception noticing skills of preservice teachers T1, T2 and T3 were determined as level 4, the misconception noticing skills of preservice teachers C1, C2 and C3 were determined as level 1, and the noticing skills of preservice teachers C4, C5 and C6 were determined as level 2.

Table 4 below shows the noticing skills of preservice teachers T1, T2, T3, C1, C2, C3, C4, C5 and C6 as a result of the analysis of the data obtained at the end of the video exam.

Table 4

Noticing Skills of Lesson Study Group and Comparison Group Preservice Teachers at the End of the Video Exam (Last Lesson)

Preservice Teacher	Misconception Noticing Skills
T1	Level 4
T2	Level 4
T3	Level 4
C1	Level 1
C2	Level 1
C3	Level 1
C4	Level 2
C5	Level 2
C6	Level 2

Table 4 shows that, as a result of the video exam, the noticing skills of the lesson study group preservice teachers were determined as level 4, while the noticing skills of the comparison group preservice teachers were predominantly determined as level 1 and level 2. As a result of the video exam, it was concluded that the lesson study group preservice teachers gained noticing skills with the lesson study model. In addition, when all the data obtained from these two data sources were analyzed throughout the Teaching Practicum-II process and at the end of the video exam at the end of the process, the final noticing levels of the preservice teachers were determined as follows; T1 teacher's misconception noticing level is level 4, T2 preservice teacher's misconception noticing level is level 4, T3 preservice teacher's misconception noticing level is level 4, C1 preservice teacher's misconception noticing level is level 1, C2 preservice teacher's misconception noticing level is level 1, Misconception noticing level of preservice teacher C3 was determined as level 1, misconception noticing level of preservice teacher C4 as level 2, misconception noticing level of pre- service teacher C5 as level 2, misconception noticing level of preservice teacher C6 as level 1.

Discussion

Misconception Noticing Skills of Preservice Teachers

In the Teaching Practicum-II course, the misconception noticing skills of T1 preservice teacher from the lesson study group were determined as level 4 and level 3 for eight lessons. From this point of view, it was concluded that the lesson study model improved T1 preservice teacher's ability to recognize students' misconceptions. This result of the study is in parallel with the result of Mostofo's (2013) study. In his study, Mostofo (2013) found that the lesson study model improved preservice mathematics

teachers' ability to recognize students' misconceptions and responses. Although the misconception noticing skill of T1 was determined as level 4 in six lessons, it was determined as level 3 in the third and fifth lessons. The reason for this may be the lack of subject matter knowledge of T1 preservice teacher. As a result, it can be said that noticing varies according to content knowledge. According to Shulman (1987), teachers with inadequate subject matter knowledge are generally inadequate in defining concepts and relationships by making incomplete definitions. Similarly, Liu (2014) argued that teachers' knowledge, beliefs and goals affect their noticing of student thinking. Here, it can be said that the inadequate content knowledge of the pre- service teacher T1 prevented her from making correct determinations and definitions about misconceptions, interpreting important situations after defining them, and making suggestions about them. The teacher's content knowledge directly affected the teacher's noticing and will indirectly affect the success of the students. In the literature, there are studies showing that teachers' content knowledge affects students' achievement (Jacob, John & Gwany, 2020; Lee, Capraro & Capraro, 2018). When the contents of the courses in which the misconception noticing skill of preservice teacher T1 was determined as level 3, the subject of the third course and the subject of the fifth course overlapped. The outcome of the third lesson is "Makes conversions between meters and centimeters that do not require writing decimal fractions." and the outcome of the fifth lesson is "Solves and constructs problems using units of meters and centimeters." From this point of view, it is thought that it is not a coincidence that T1 preservice teacher's misconception noticing skill was level 3 in both lessons. This situation may be an evidence that it may be due to the lack of subject area knowledge that he/ she has about the subject. In both lessons, T1 preservice teacher could not establish a connection between what she observed and the principles of teaching and learning and could not offer alternative pedagogical solutions based on interpretation. Ma (1999) stated that teachers cannot show a behavior beyond their own understanding of the subject matter in order to guide students' understanding. Here, it can be said that T1 preservice teacher could not show a behavior beyond his/her own understanding of students' misconceptions in the lessons on meters and centimeters. To summarize, in general, the misconception noticing skill of preservice teacher T1 was determined as level 4 in terms of weight. T1 preservice teacher's noticing skill in any lesson was not determined as level 1 or level 2.From this point of view, it can be said that the lesson study model positively affected the development of preservice teacher's misconception noticing skills. The reason for this is thought to be the fact that the preservice teachers made video reflections by watching the teaching of both themselves and other preservice teachers in the lesson study. Similarly, studies in the literature suggest that video reflections with peers provide an important opportunity for a teacher to receive feedback, learn about specific teaching needs and strengths, and generate ideas to improve their pedagogy (Arya et al., 2013; Arya et al., 2015; Christ et al., 2012, 2014; Eröz-Tuga, 2013; Harford et al., 2008; Shanahan et al., 2014; Tripp et al., 2012; van Es et al., 2010; Yaffe, 2010).

It was concluded that the misconception noticing skills of T2, one of the preservice teachers in the Lesson Study group in the Teaching Practicum-II course, were at level 3 and level 4 for eight lessons. It was concluded that although the misconception noticing skill of T2 preservice teacher was determined as level 3 in four lessons, it was level 4 in the other four lessons. The misconception noticing skill of T2

preservice teacher was in the form of level 3-4-4-4-3-4-3-4-3-4-3 for eight lessons. The objectives of the fifth lesson, in which the noticing of the preservice teacher was determined as level 4, were "Divides a whole into equal parts and states that each of the equal parts is the unit of the fraction. Obtains fractions whose numerator is less than the denominator and whose denominator is at most a two-digit natural number."In this lesson, which includes the objectives related to fractions, the preservice teacher T2 reasoned about the observations she made about the misconceptions of the students and tried to explain the reasons. She addressed the situations she considered important and presented details from her observations to support her thoughts. While interpreting her observations, she considered the relationship between students' misconceptions and the teacher's pedagogy. C1 tried to offer alternative solutions to the preservice teacher about the misconceptions that she thought might occur in students. The concept of fraction is one of the difficult subjects in mathematics (Brown & Quinn, 2006; Ergöl& Memnun, 2020; Işık, 2011; Önal & Yorulmaz, 2017; Sartono& Karso, 2020), and it can be said that it is also one of the subjects that teachers find difficult to teach.Nevertheless, it was observed that T2 preservice teacher had the highest level of misconception noticing (level 4). There are many studies on misconceptions about fractions in the literature (Alacacı, 2012; Biber, Tuna, & Aktaş, 2013; Hansen, 2014; Haser, Ubuz, 2003; Işık & Kar, 2012; Kocaoğlu & Yenilmez, 2010; Ojose, 2015; Önal & Yorulmaz, 2017; Steffe & Olive, 2010; Taşkın & Yıldız, 2011; Yetim & Alkan 2010; Yılmaz & Yenilmez, 2007). While planning the lesson on fractions during the lesson planning process, discussing the misconceptions related to the subject of that lesson by focusing on the mathematics curriculum, discussing what should be done to prevent these misconceptions, discussing what should be done by taking into account the results of these misconceptions studies (Hart, 1993; Haser & Ubuz, 2003; Steffe & Olive, 2010) or the researcher's guidance on what should be done by taking into account the results of these misconceptions studies (Hart, 1993; Haser & Ubuz, 2003; Steffe & Olive, 2010) or the meetings held during the discussion and reflections phase of the lesson may have caused the preservice teacher to gain a competence on the subject to be covered. It was concluded that the misconception noticing skill of T3, one of the preservice teachers in the Lesson Study group in the Teaching Practicum-II course, was at level 3 and level 4 for eight lessons.

Although the misconception noticing skill of T3 preservice teacher was determined as level 3 in four lessons, it was concluded that it was level 4 in the other four lessons.The misconception noticing skill of T3 preservice teacher was in the form of level 3-4-3-3-4-4-4-3-4-3-3 for eight lessons. In the first and second lessons, preservice teacher T3 identified important situations related to decimal fractions, and in the second lesson, she offered pedagogical solutions for these situations and therefore her noticing was determined as level 4. The comments made by preservice teacher T3 as a result of her observations about decimal fractions in the second lesson show that she is aware of some misconceptions about decimals in the literature. For example, preservice teacher T3 stated that she realized that students had a misconception that the longer decimal number was larger and that preservice teacher C4 did not realize this and therefore did not intervene. When the literature is examined, Steinle and Stacey (1998) concluded in their study that students have a misconception that the decimal number with more digits in the fraction part is larger. Gür and Seyhan (2004) concluded that

students had misconceptions such as ignoring the decimal comma and thinking that multi-digit decimal numbers are larger. In other words, it was seen that the misconception that T3 preservice teacher realized about decimal numbers, that the longer decimal number is larger, is in line with the studies in the literature (Nesher & Peled, 1986; Resnick, Nesher, Leonard, Magone, Omanson, & Peled, 1986; Sackur-Grisvard & Leonard, 1985; Stacey & Steinle, 1998). In this way, it was determined that students with overgeneralization type misconceptions generalized a property of the set of natural numbers to the set of decimal numbers. From this point of view, it is thought that the preservice teacher may have read about misconceptions in the subject of that course before the lesson. As a result, it is thought that the lesson study process may have provided the preservice teacher with the behavior of focusing on misconceptions related to the subject of that lesson before the lesson.

In the Teaching Practicum-II course, it was concluded that the misconception noticing skill of C1, one of the comparison group preservice teachers, was level 1 for seven lessons, except for the fifth lesson. The misconception noticing skill in the fifth lesson was determined as level 2. As a result, it can be said that C1 preservice teacher's misconception noticing skill was level 1. Because the determination of noticing as level 1 in seven lessons out of eight lessons shows that the noticing of the preservice teacher is predominantly level 1. When the misconception noticing skills of pre- service teacher C1 were compared with the misconception noticing skills of preservice teacher T2 in his group, the misconception noticing skills of preservice teacher T2 were determined as level 3 or level 4. It is thought that the reason why preservice teacher C1's misconception noticing skills remained at the first stage of van Es' noticing framework, unlike preservice teacher T2's misconception noticing skills, is that she did not participate in the lesson study process. It was observed that C1 was only able to define what is important or noteworthy about a lesson situation, which is one of the three basic aspects of the noticing proposed by van Es and Sherin (2002). In the lesson study group, preservice teacher T2 tried to use what she knew about the content or what she knew about the sources of justification for her classroom interactions to reason about the situation she identified. For this reason, the noticing skills of preservice teacher T2 were determined as level 3 or level 4.According to Sherin and van Es (2005), preservice teachers should be given the opportunity to do practices in which they can develop their noticing skills, and in this study, it is thought that the environment that provided the opportunity for preservice teacher T2 to develop noticing skills, like the other lesson study group preservice teachers, was the lesson study process. In the Teaching Practicum-II course, it was concluded that the misconception noticing skill of C2, one of the comparison group preservice teachers, was in the form of level 2-1-2-2-2-2-1-1-1-1 for eight lessons. The misconception noticing skills of preservice teacher C2 were lower than pre- service teacher T2 but higher than preservice teacher C1. Because, although preservice teacher C1's misconception noticing skill was determined as level 1, preservice teacher C2's misconception noticing skill was determined as level 1 in four of the eight lessons and level 2 in the other four lessons. Even if preservice teacher C2's noticing skill was level 2, unlike preservice teacher C1, it was determined that preservice teacher C2 could not make inferences about students' misconceptions, elaborate her explanations, or offer pedagogical solutions for the student misconceptions she identified, as shown by preservice teacher T2. It is thought that the

reason why preservice teacher T2 was able to show these behaviors, unlike preservice teacher C2, is the noticing that preservice teacher T2 gained during the lesson study process about what can be done to recognize and eliminate students' misconceptions. According to Zembat (2013), it is important for the teacher to be aware of misconceptions and to analyze these misconceptions well.The reason for the preservice teacher T2, unlike the preservice teacher C2, to show this behavior or to gain this noticing before analyzing the misconceptions may be the lesson study activities carried out during a semester.

In the Teaching Practicum-II course, it was concluded that the misconception noticing skill of C3, one of the comparison group preservice teachers, was in the form of level 1-1-1-1-2-2-1-1-1-1 for eight lessons. From this point of view, it can be said that the misconception noticing skill of pre- service teacher C3 is predominantly level 1. On the other hand, the misconception noticing skill of the lesson study group Preservice Teacher T3, who was in the group of C3 Preservice Teacher, was determined as level 3 or level 4 for eight lessons. In lessons 2 and 7, this difference is much more obvious. Because while C3 preservice teacher's noticing was level 1, that of T3 preservice teacher was determined as level 4. When the subjects of these two lessons were analyzed, it was seen that the subject of the seventh lesson was "symmetry". The reason for this difference in noticing skills is thought to be a result of the fact that the subject of the 8th lesson, which the preservice teacher T3 practiced in the lesson study carried out in the first semester, was the subject of "symmetry". Because in the 8th lesson study in the first semester, T3 Preservice teacher could not show the symmetry axes of the star shape to the students and in addition to this, she caused the students to have a misconception that "every geometric shape has only one axis of symmetry". Both during the implementation phase of the plan by other preservice teachers (T1 and T2) in the observation forms and during the discussions during the discussion and reflections phase of the lesson, the teaching of preservice teacher T3 was discussed a lot about misconceptions. It can be said that this situation positively affected the noticing skill of T3 preservice teacher. According to Sherin and van Es (2005), teacher training programs should include noticing skills and preservice teachers should be given the opportunity to do practices that can develop these skills, and it is thought that the lesson study conducted in this study is a suitable environment in which the preservice teacher can develop noticing skills. In summary, it was concluded that in the lesson study process, T3 preservice teacher gained noticing skills differently from C3 preservice teacher.

In the Teaching Practicum-II course, it was concluded that the misconception noticing skill of C4, one of the comparison group preservice teachers, was 2-1-2-1-1-1-1-2-2-2-1 for eight lessons. From this point of view, it can be said that C4 preservice teacher's misconception noticing skill varied between level 1 and level 2. When the misconception noticing skills of preservice teacher C4 were compared with the misconception noticing skills of preservice teacher T3, the most significant difference emerged in the 2nd, 4th and 5th lessons. Because in these lessons, while the misconception noticing skills of T3 preservice teacher was determined as level 4, the misconception noticing skills of C4 preservice teacher could not go above level 1. This difference is very significant. It is thought that the reason for this is that the lesson study group focused on a special topic in mathematics. Decimal fractions and fractions are

two of the topics in mathematics where students, preservice teachers or teachers have misconceptions (Baki & Güç, 2014; Biber, Tuna, & Aktaş, 2013; Pesen, 2007).It is thought that focusing on such difficult mathematics topics in the lesson study and drawing the attention of the preservice teachers to important situations during the lesson study and discussing the misconceptions of the students and themselves, as well as their fellow teachers, may have caused the preservice teacher to focus on a specific area - in this case, decimal fractions and fractions - and to gain an noticing about it.

In the Teaching Practicum-II course, it was concluded that the misconception noticing skill of C5, one of the comparison group preservice teachers, was in the form of level 1-2-1-2-1-2-1-1-1-1 for eight lessons. From this point of view, it can be said that C5 preservice teacher's misconception noticing skill is level 1 in general. When C5 preservice teacher's misconception noticing skill was compared with the misconception noticing skill of T1 preservice teacher who participated in the lesson study, besides being low and different from each lesson, the biggest difference determined as level 1 and level 4 emerged in the 1st, 2nd, 4th, 7th and 8th lessons. When the contents of these lessons were analyzed, it was determined that there was an overlap in two lessons on "multiplication" and in the other two lessons on "fractions". It is thought that the overlaps identified in this way are not coincidental. This situation suggests that the noticing of the preservice teacher is related to his / her content knowledge. The fact that the misconception noticing of the comparison group pre- service teachers was different and lower than that of the lesson study group preservice teachers in the lessons where the subject matter of the lesson was the same can be shown as evidence that it may be related to subject matter knowledge. It is thought that the lesson study activities that the pre- service teacher in the lesson study group participated in caused her to be aware of her deficiencies in subject matter knowledge, to make more detailed observations and to make determinations about her or the other preservice teacher's teaching. As a result of this, it is thought that the noticing of the preservice teacher in the lesson study group, T1, was high. According to experienced teachers, pre- service teachers tend to notice more superficial classroom characteristics (Wise, Padmanabhan, & Duffy, 2009).Although both of the two preservice teachers compared here had the same experience, the fact that the noticing of the lesson study group preservice teacher T1 was high shows that she noticed more detailed situations instead of superficial classroom features, which can be said to have gained this experience through lesson study activities.

In the Teaching Practicum-II course, it was concluded that the misconception noticing skill of C6, one of the comparison group preservice teachers, was level 1 for seven lessons except the sixth lesson. The misconception noticing skill in the sixth lesson was determined as level 2. Unlike the preservice teachers in the lesson study group, the noticing skill of preservice teacher C6 was very low. It is thought that the reason for this is that the preservice teachers in the lesson study group gained the ability to focus on misconceptions through lesson study activities. According to Sadi (2007), teachers should focus more on misconceptions that are realized through study. Lesson study activities conducted with the preservice teachers in the lesson study group provided them with the opportunity to study more, see more examples, increase their noticing and focus on their misconceptions. For this reason, it is thought that the fact that preservice teacher C6 did not participate in the lesson study process caused her to

be inadequate in focusing on misconceptions and recognizing important situations related to misconceptions.

Misconception Noticing Skills of Preservice Teachers at the End of the Video Exam (Last Lesson)

At the end of the whole process, when the noticing skills of the preservice teachers who watched the video of this lesson of the mentor teacher, whose one mathematics lesson was videotaped from the practice school, and filled in the observation form, were examined at the end of this video exam, it was concluded that the noticing skills of the lesson study group preservice teachers were at level 4, while the noticing skills of the comparison group preservice teachers were mainly at level 1 and level 2. When the observation results of the lesson study group preservice teachers about this lesson whose outcome was "Solves problems requiring at least one division operation with natural numbers" were analyzed, it was found that the misconception noticing skills of C1 and C3 preservice teachers were determined as level 4 for each of them. It is thought that this difference in the noticing skills of the lesson study group and comparison group preservice teachers was caused by the fact that the lesson study group pre- service teachers were able to focus on the events occurring in the classroom. Stigler and Hiebert (1999) argue in their study that the lesson study model provides a different perspective on classroom practices. It is thought that the participation of the preservice teachers in the lesson study group in the lesson study process caused them to look at the practices in the classroom with a different perspective, to notice the events, and as a result of this, to develop their noticing skills. In addition, in the light of the findings of the study, it is thought that as a result of the development of knowledge of teaching the content through lesson study, preservice teachers' noticing skills also developed. Studies in the literature suggest that lesson study supports the development of teachers' or preservice teachers' content knowledge (Akbaba-Dağ, 2014; Baki, 2012; Budak, Bozkurt, & Kaygın, 2011; Bütün, 2012; Corcoran, 2008; Fernandez, 2010; Gözel, 2016; Lewis, 2016; Meyer et al., 2011; Sudejamnongvd., 2014; Verhoef et al., 2011; Yoshida et al., 2011). From this point of view, it can be said that preservice teachers gained noticing skills as a result of the development of knowledge of teaching the content with the lesson study model.

To summarize at the end of the whole research process, in the most general terms, when the noticing skills of the preservice teachers were examined, it was concluded that the noticing skills of the lesson study group preservice teachers were mainly at level 4, while the noticing skills of the comparison group preservice teachers were mostly at level 1 and level 2. In other words, when the noticing skills of the lesson study group preservice teachers were compared with the noticing skills of the comparison group preservice teachers, the misconception noticing skills of the lesson study group preservice teachers were determined as level 4, different from the noticing skills of the comparison group preservice teachers. The misconception noticing skills of the comparison group preservice teachers, unlike the lesson study group pre- service teachers, did not go above level 1 or level 2 in any lesson.From this point of view, it can be said that the lesson study professional development model positively affected preservice teachers' noticing skills. Similar to this result of the study, some studies in the literature also state that professional development models positively affect noticing

(Franke, Carpenter, Levi, Fennema, 2001; Lee, 2019; Lewis, Friedkin, Baker, & Perry, 2011).

In the lessons where the misconception noticing skills of the lesson study group preservice teachers were determined as level 4, it was determined that they generally made suggestions on how to prevent misconceptions before they occur and gave examples from the meetings in the lesson study process. To give an example from the findings, the preservice teachers stated that they realized that "0" was a problem for students in every subject and suggested that the appropriate teaching method should be chosen and more attention should be paid to teaching "0". It is thought that this situation is caused by the fact that while planning the lessons in the lesson study process, there was a lot of focus on the need to choose appropriate teaching methods to prevent misconceptions, or the misconceptions that students were thought to have or the teacher behaviors that caused these misconceptions were discussed in the discussion meetings. As a result, it was determined that the preservice teachers had a high level of noticing about the subjects where misconceptions were more expected, as well as making suggestions about the selection of appropriate teaching methods in this regard. In support of this result, Zembat (2010) also stated in his study that it is important for teachers to adopt approaches to prevent misconceptions before they occur by choosing appropriate teaching methods and techniques in subjects where misconceptions are more likely to occur. As a result, it is thought that the reason for the development of the misconception noticing skills of the preservice teachers in the lesson study group in this way is that the lessons recorded during the lesson study process were monitored by focusing on misconceptions. It can be said that discussing the misconceptions of the students observed in the video recordings, discussing the contribution of the preservice teacher in the formation of these misconceptions or discussing what should be done to prevent the emergence of these misconceptions positively affected the noticing development of the preservice teachers. Studies conducted in the literature on video-based lessons have also shown that preservice teachers' noticing skills improve when they analyze and discuss videos in a systematic and structured way (Barnett, 2006; Barnhart et al., 2015; Brouwer et al., 2015; Calandra, 2015; Fadde et al., 2013; Kleinknecht et al., 2016; Seidel et al., 2013; Star et al., 2008). In addition, noticining studies in the literature show that teachers who analyze their lessons using video recordings pay more attention to student behavior, subject teaching and activities (Bozkuş, 2020; Hollingsworth & Clarke, 2017; Özdemir Baki, 2020), have the opportunity to observe their classes and notice classroom events, ıt was concluded that they had the opportunity to improve their interpretation skills (Santagata et al., 2018; Türker Biber, 2017). When the noticing of the lesson study group preservice teachers and the comparison group preservice teachers were compared by taking van Es's (2011) noticing framework into consideration, it was concluded that the lesson study group preservice teachers reasoned about their observations as a result of their lesson observations and as a result, they were able to make informed instructional decisions. It was observed that the preservice teachers in the lesson study group generally showed behaviors in the third stage, which is the third stage of the three parts of noticing characterized in the literature (Hiebert et al., 2007; Jacobs et al., 2010; Richert, 2005; Santagata et al., 2007; Sherin, 2007; van Es et al., 2002). It is thought that the lesson study process was effective in these behaviors. Because it was observed that in the

lessons in which teachers were involved in the lesson planning stage, they started to notice students' mathematical thinking by focusing on issues such as determining the mathematical purpose of the lesson, associating prior knowledge with the subject of the lesson, anticipating possible student responses and waiting for these responses, and showed improvement in this regard (Fernandez et al., 2005). The improvement in teacher behaviors in these issues during the lesson study process may have contributed to the development of teacher noticing in direct proportion to this progress. It is thought that the lesson study group Preservice teachers gained the behavior of looking at the lessons they observed with a different perspective than the comparison group Preservice teachers. Similarly, Stigler and Hiebert (1999) defined lesson study as a professional development model that enables teachers to look at classroom practices with a different perspective.

As a result, the misconception noticing skills of preservice teachers in the lesson study group were determined as level 4, while the noticing skills of preservice teachers in the comparison group were predominantly determined as level 1 or level 2. It is thought that the reason why the noticing skills of the comparison group preservice teachers were lower than the noticing skills of the lesson study group preservice teachers was the implementation of the lesson study professional development model with the lesson study group preservice teachers for one semester. Because teachers do not possess noticing skills spontaneously or noticing skills are not a skill that can be developed through experience without any support (Sherin, Jacobs, & Philipp, 2011). For this reason, it was concluded that the noticing skills of the Preservice teachers in the lesson study group supported by the lesson study professional development model showed a positive development different from the noticing skills of the Preservice teachers in the comparison group.

Conclusion

As a result of the study, it was concluded that the misconception noticing skills of the lesson study group preservice teachers (T1, T2, T3) were level 4, while the misconception noticing skills of the comparison group preservice teachers (C1, C2, C3, C4, C5, C6) were mainly level 1 and level 2. It was concluded that the misconception noticing skills of the comparison group preservice teachers, unlike the lesson study group preservice teachers who were involved in the lesson study process, could not go above level 1 or level 2 in any lesson. When the misconception noticing skills of T2, C1 and C2 preservice primary school teachers in Group 1 were compared, it was concluded that the biggest difference between level 4 and level 1 emerged in the 2nd and 7th lessons. When the misconception noticing skills of T3, C3 and C4 preservice primary school teachers in Group 2 were compared, it was concluded that the biggest difference between level 4 and level 1 emerged in the 2nd lesson. When the misconception noticing skills of T1, C5 and C6 preservice primary school teachers in Group 3 were compared, it was concluded that the biggest difference between level 4 and level 1 emerged in the 1st, 7th and 8th lessons. When the results of the video exam at the end of the study were analyzed, it was concluded that the misconception noticing skills of the lesson study group preservice teachers who were involved in the lesson study process were level 4, while the noticing skills of the comparison group preservice teachers were mainly level 1 and level 2. It was concluded that the misconception noticing skills of the

comparison group preservice teachers could not go above level 1 or level 2. It was concluded that lesson study activities positively affected primary school preservice teachers' ability to recognize students' misconceptions.

Implications

In order to support preservice teachers noticing development through lesson study studies, course contents can be arranged in this direction by including such practices in undergraduate courses and teaching practice courses. By carrying out this study longitudinally, it can be investigated whether the development in preservice teachers noticing turns into behavior or, in other words, the permanence of their noticing development.

Acknowledgements

No financial support was received for this research.

Statement of Responsibility

All data generated and analyzed during this study are included in this published article.

Conflicts of Interest

None of the authors have potential conflicts of interest to be disclosed.

Author Bios:

Yasemin TÜRK graduated from Karadeniz Technical University, Department of Primary Education, Department of Classroom Teaching in 2005. In the same year, she started working as an instructor at Karadeniz Technical University, Fatih Faculty of Education, Department of Primary Education. She successfully completed her master's degree in Mathematics Education at Karadeniz Technical University in 2010 and her doctorate education in 2020. She worked as a lecturer at Trabzon University, Fatih Faculty of Education, Department of Basic Education until 06.10.2021. As of 06.10.2021, she has been working as a lecturer doctor at Karadeniz Technical University, Rectorate Corporate Communications Coordinator. The researcher's research areas are Education, Teacher Education, Mathematics Education.

Adnan BAKİ graduated from Karadeniz Technical University, Department of Secondary Education Science and Mathematics Education Mathematics Education in 1982. He completed his master's degree at the University of New Brunswick Faculty of Education Curriculum and Instruction in Canada in 1990. In 1994, he successfully completed his doctorate education at the University of London-Institute of Education, Mathematics, Statistics and Computing, United Kingdom. The researcher has been working at Karadeniz Technical University, Fatih Faculty of Education, Department of Secondary Education Science and Mathematics Education since 2004. The researcher's research areas are Social and Human Sciences, Education, Computer and Instructional Technology Education, Secondary Education Science and Mathematics Teaching.

References

Ainley, J., & Luntley, M. (2007). The role of attention in expert classroom practice. *Journal of Mathematics Teacher Education*, *10*(1), 3-22.

Akbaba-Dağ, S. (2014). *Mikroöğretim ders imecesi modeli ile sınıf öğretmeni adaylarının kesir öğretim bilgilerinin geliştirilmesine yönelik bir uygulama.* [Unpublished Doctoral Dissertation]. Dumlupınar Üniversitesi.

Alacacı, C. (2012). Öğrencilerin kesirler konusundaki kavram yanılgıları. E. Bingölbali ve M.F. Özmantar (Ed.*), Matematiksel zorluklar ve çözüm önerileri* (ss. 63-95), Ankara: PegemA Yayıncılık.

Arya, P., Christ, T., & Chiu, M. M. (2015). Links between characteristics of collaborative peer video analysis events and literacy teachers' outcomes. *Journal of Technology and Teacher Education, 23*(2), 159-183.

Arya, P., & Christ, T. (2013). An exploration of how professors' facilitation is related to literacy teachers' meaning construction process during video-case discussions. *Journal of Reading Education, 39*, 15-22.

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

Baki, A. (2006). *Kuramdan uygulamaya matematik eğitimi.* Ankara: Harf Eğitim Yayıncılık.

Baki, A. (2019). *Matematiği öğretme bilgisi*. Ankara: Pegem Akademi Yayıncılık.

Baki, A., & Aydın Güç, F. (2014). Dokuzuncu sınıf öğrencilerinin devirli ondalık gösterimle ilgili kavram yanılgıları. *Turkish Journal of Computer and Mathematics Education, 5*(2), 176-206.

Baki, M. (2012). *Sınıf öğretmeni adaylarının matematiği öğretme bilgilerinin gelişiminin incelenmesi: Bir ders imecesi (lesson study) çalışması* [Unpublished Doctoral Dissertation]. Karadeniz Teknik Üniversitesi.

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

Ball, D. L., & Cohen, D. K. (1999). Developing practice, developing practitioners: Toward a practice-based theory of Professional education. In G. Sykes and L. Darling-Hammond (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (pp. 3-32). San Francisco: Jossey-Bass.

Barnett, M. (2006). Using a web-based professional development system to support preservice teachers in examining authentic classroom practice. *Journal of Technology and Teacher Education, 14*(4), 701-729.

Barnhart, T., & van Es, E. (2015). Studying teacher noticing: Examining the relationship among preservice science teachers' ability to attend, analyze and respond to student thinking. *Teaching and Teacher Education,* 45, 83-93.

Benedict-Chambers, A. (2016). Using tools to promote novice teacher noticing of science teaching practices in post-rehearsal discussions. *Teaching and Teacher Education, 59*, 28-44.

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.

Bozkuş, F. (2020). *Ortaokul matematik öğretmenlerinin öğrencilerin matematiksel düşüncelerini fark etme becerilerinin incelenmesi* [Unpublished Doctoral Dissertation]. Bolu Abant İzzet Baysal Üniversitesi.

Brouwer, N., & Robijns, F. (2015). Insearch of effective guidance for preservice teachers' viewing of classroom video. In B. Calandra and P. J. Rich (Eds.), *Digital video for teacher education e research and practice* (pp.54-67). New York: Routledge.

Brown, G., & Quinn, R. (2006). Algebra students' difficulty with fractions: An error analysis. *Australian Mathematics Teacher, 62*(4), 28-40.

Budak, G., Budak, A., Bozkurt, I., & Kaygın, B. (2011). Matematik öğretmen adaylarıyla bir ders araştırması uygulaması. *e-Journal of New World Sciences Academy, 6*(2), 1606-1617.

Bütün, M. (2012). *İlköğretim matematik öğretmeni adaylarının uygulanan zenginleştirilmiş program sürecinde matematiği öğretme bilgilerinin gelişimi* [Unpublished Doctoral Dissertation, Karadeniz Teknik Üniversitesi]. YÖK Tez Merkezi.

Calandra, B. (2015). A process of guided, video-based reflection. In B. Calandra, and P. J. Rich (Eds.), *Digital video for teacher education e research and practice* (pp. 36-53). New York: Routledge.

Christ, T., Arya, P., & Chiu, M. M. (2012). Collaborative peer video analysis: Insights about literacy assessment ve instruction. *Journal of Literacy Research, 44*, 171-199.

Christ, T., Arya, P., & Chiu, M. M. (2014). Teachers' reports of learning and application to pedagogy based on engagement in collaborative peer video analysis. *Teaching Education, 25*(4), 349-374.

Christ, T., Arya, P., & Chiu, M. M. (2017). Video use in teacher education: An international survey of practices. *Teaching and Teacher Education, 63*, 22-35.

Cochran, K.F. (1997). Pedagogical content knowledge: Teachers' integration of subject matter, pedagogy, students, and learning environments. In R. Sherwood (Ed.), *Research matters... To the science teacher* (2nd ed.) (pp. 3-18). Manhattan, KS: NARST.

Corcoran, D. (2008). *Developing mathematical knowlege for teaching: A three-tiered study of irishpreservice primary teachers* [Unpublished doctoral dissertation]. University of Cambridge.

Creswell, J.W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into practice, 39*(3), 124-131.

Darling-Hammond, L. (2003). Teacher learning that supports student learning. In A. Ornstein, L. S. Behar Horenstein and E. Pajak (Eds.), *Contemporary issues in curriculum* (pp. 277-282). Boston: Pearson Education.

Erdik, E. (2014). *A comparative analysis of noticing of mathematics teachers with varying teaching experience* [Yüksek lisans tezi, Boğaziçi Üniversitesi]. YÖK Tez Merkezi.

Ergöl, H., & Memnun, D. S. (2020). Ortaokul öğrencilerinin kesir kavramına ilişkin ürettikleri metaforlar. *OPUS International Journal of Society Researches, 15*(23), 1920-1939.

Eröz-Tuga, P. B. (2013). Reflective feedback session using video recordings. *English Language Teaching, 67*(2), 175-183.

Fadde, P., & Sullivan, P. (2013). Using interactive video to develop preservice teachers' classroom awareness. *Contemporary Issues in Technology and Teacher Education, 13*(2), 156-174.

Fennema, E., & 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.

Fernandez, C., & Yoshida, M. (2004). *Lesson study: A Japanese approach to improving mathematics teaching and learning*. Mahwah: Lawrance Erlbaum Associates.

Fernandez, C. (2005). Lesson study: A means of elementary teachers to develop the knowledge of mathematics needed for reform minded teaching? *Mathematical Thinking and Learning, 7*(4), 265-289.

Fernandez, C., Cannon, J., & Chokshi, S. (2003). A US-Japan lesson study collaboration reveals critical lenses for examining practice. *Teaching and Teacher Education, 19*(2), 171-185.

Fernandez, M. L. (2010). Investigating how and what prospective teachers learn through microteaching lesson study. *Teaching and Teacher Education, 26*(2), 351-562.

Franke, M. L., Carpenter, T. P., Levi, L., & Fennema, E. (2001). Capturing teachers' generative change: A follow-up study of professional development in mathematics. *American Educational Research Journal, 38*(3), 653-689.

Garet, M., Porter, A., Desimone, L., Birman, B., & Yoon, K. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*(3), 915-945.

Gilbert, J.K., Osborne, R.J., & Fensham, P.J. (1982). Children's science and its consequences for teaching. *Science Education. 66*(4), 623-633.

Gözel, E. (2016). *Ders imecesi çalışmalarıyla sınıf öğretmenlerinin problem çözmeye dayalı matematiği öğretme bilgilerinin gelişiminin incelenmesi* [Unpublished Doctoral Dissertation]. Pamukkale Üniversitesi.

Güner, P. (2017). *Investigating preservice middle school mathematics teachers noticing of students mathematical thinking in the context of lesson study* [Unpublished Doctoral Dissertation]. Middle East Technical University.

Güner, P., & Akyüz, D. (2017). Ders imecesi mesleki gelişim modeli: Öğretmen adaylarının fark etme becerilerinin incelenmesi. *İlköğretim Online, 16*(2), 428-452.

Gür, H., & Seyhan, G. (2004). İlköğretim 7 ve 8. sınıf öğrencilerinin ondalık sayılar konusundaki hataları ve kavram yanılgıları.

http://citeseerx.ist.psu.edu/showciting?cid=61957684 adresinden 14 Nisan 2019 tarihinde erişilmiştir.

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

Harford, J., & MacRuairc, G. (2008). Engaging student inservice-teachers in meaningful reflective practice. *Teaching and Inservice-Teacher Education, 24*, 1884-1892.

Hart, K.M. (1993) Fractions. In K. M. Hart (Ed.), *Children's understanding of mathematics* (pp. 66-81). London: John Murray.

Haser, Ç., & Ubuz, B. (2003). Students' conception of fractions: A study of 5th grade students. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 24*, 64-69.

Hawley, D. W., & Valli, L. (1999). The essentials of effective professional development: A newconsensus. In D. L. Hammond ve H. G. Sykes (Eds.), *Teaching as the learning profession: Handbook o f policy and practice* (Chapter 5, pp. 127-150). San Francisco, CA: Jossey-Bass.

Hiebert, J., Morris, A. K., Berk, D., & Jansen, A. (2007). Preparing teachers to learn from teaching. *Journal of Teacher Education, 58*(1), 47-61.

Hollingsworth, H., & Clarke, D. (2017). Video as a tool for focusing teacher self-reflection: Supporting and provoking teacher learning. *Journal of Mathematics Teacher Education*, *20*(5), 457-475.

Huang, R., & Li, Y. (2012). What matters most: A comparison of expert and novice teachers' noticing of mathematics classroom events. *School Science and Mathematics, 112*(7), 420-432.

Işık, C. (2011). İlköğretim matematik öğretmeni adaylarının kesirlerde çarpma ve bölmeye yönelik kurdukları problemlerin kavramsal analizi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 41,* 231-243.

Işık, C., & Kar, T. (2012). Analyzing problems posed by 7th-grade students for addition operation with fractions. *Elementary Education Online*, 11(4), 1021-1035.

Jacob, F., John, S.& Gwany, D. M. (2020). Teachers' pedagogical content knowledge and students' academic achievement: a theoretical overview, Journal of *Global Research in Education and Social Science, 14(2), 14-44.*

Jacobs, V.R., Lamb, L.C., & Philipp, R. A. (2010). Professional noticing of children's mathematical thinking. *Journal for Research in Mathematics Education, 41*(2), 169-202.

Kennedy, M. M. (1999). The role of preservice teacher education. In l. Darling hammond and G. Sykes (Eds.), *Teaching as the learning profession: Handbook of teaching and policy* (pp. 54-86). San Francisco: Jossey Bass.

Kleinknecht, M., & Gröschner, A. (2016). Fostering preservice teachers' noticing with structured video feedback: Results of an online- and video-based intervention study. *Teaching and Teacher Education, 59*, 45-56.

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

Lee, M. Y. (2018). Further investigation into the quality of teachers' noticing expertise: A proposed framework fore valuating teachers' models of students'

mathematical thinking. *EURASIA Journal of Mathematics, Science, and Technology Education, 14*(9), 1-15.

Lee, Y., Capraro, R.M. & Capraro, M.M. (2018). Mathematics Teachers' Subject Matter Knowledge and Pedagogical Content Knowledge in Problem Posing, *International Electronic Journal of Mathematics Education*, 13(2), 75-90.

Lee, M. Y., & Cross Francis, D. (2018). Investigating the relationship among elementary teachers' perception about the use of students' thinking, their professional noticing skills and their teaching practice. *Journal of Mathematical Behavior, 51*, 118-128.

Lee, M.Y. (2019). The development of elementary preservice teachers' professional noticing of students' thinking through adapted lesson study. *Asia-Pacific Journal of Teacher Education, 47*(4), 383-398.

Lewis, C. (2016). How does lesson study improve mathematics instruction? *ZDM: The International Journal on Mathematics Education, 48*(4), 571-580.

Lewis, C., & Tsuchida, I. (1998). A lesson is like a swiftly flowing river. *American Educator*, (Winter) (pp. 12-17, 50-52).

Lewis, C., Friedkin, S., Baker, E., & Perry, R. (2011). Learning from the key tasks of lesson study. In O. Zaslavsky and P. Sullivan (Eds), *Constructing knowledge for teaching secondary mathematics* (pp. 161-176). US: Springer.

Lewis, C., Perry, R., & Murata, A. (2006). How should research contribute to instructional improvement? The case of lesson study. *Educational Researcher*, *35*(3), 3-14.

Liu, Y. (2014). *Teachers' in-the-moment noticing of students' mathematical thinking: A case study of two teachers* [Unpublished doctoral dissertation]. University of North Carolina.

Ma, L. (1999). *Knowing and teaching elementary mathematics: Teachers' understanding of fundamental mathematics in China and the United States*. Mahwah, NJ: Lawrence Erlbaum Associates Press.

Magnusson, S., Borko, H., & Krajcik, J. (1999). Nature, sources and development of pedagogical content knowledge for science teaching. In Gress-Newsome, J., and Ledermen, N.G. (Eds.), *Examining pedagogical content knowledge* (pp. 95-132). Boston: Kluwer Akademic Publishers.

Marks, R. (1990). Pedagogical content knowledge: From a mathematical case to modified conception. *Journal of Teacher Education, 41*, 3-11.

Mason, J. (2002). *Researching your own practice: The discipline of noticing*. New York: Springer.

MEB, (2017). *Öğretmenlik mesleği genel yeterlikleri, öğretmen yetiştirme ve geliştirme genel müdürlüğü*, Ankara.

MEB, (2018). *Matematik dersi öğretim programı, ilkokul ve ortaokul 1, 2, 3, 4, 5, 6, 7 ve 8. sınıflar*, Ankara.

Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco, CA: Jossey-Bass Publishers.

Merriam, S.B. (2013). *Nitel araştırma desen ve uygulama için bir rehber*. (Çev.Editörü: Selahattin Turan), Ankara: Nobel Yayınları.

Meyer, R. (2005). *Lesson study: The effects on teachers and students in urban middleschools* [Unpublished doctoral dissertation]. Baylor University.

Meyer, R. D., & Wilkerson, T. L. (2011). Lesson Study: The impact on teachers' knowledge for teaching mathematics. In L. C. Hart, A. S. Alston and A. Murata, (Eds.), *Lesson study research and practice in mathematic seducation: Learning together* (pp. 15-26). New York: Springer.

Mitchell, R. N., & Marin, K. A. (2014). Examining the use of a structured analysis framework to support prospective teacher noticing. *Journal of Mathematics Teacher Education*, *18*(6), 551-575.

Mohr, D. J., & Townsend, J. S. (2002). Research to practice: Using comrehensive teaching models to enhance pedagogical content knowledge. *Teaching Elementary Physical Education*, *13*(4), 36-37.

Mostofo, J. (2013). *Using lesson study with preservice secondary mathematics teachers: Effects on instruction, planning, and efficacy to teach mathematics* [Unpublished doctoral dissertation]. Arizona State University.

National Council of Teachers of Mathematics (NCTM). (2000). *Learning mathematics for a new century* (2000 Yearbook). Reston, VA: Author.

Nesher, P., & Peled, I. (1986). Shifts in reasoning: The case of extending number concepts. *Educational Studies in Mathematics*, *17*, 67-79.

Osmanoğlu, A. (2010). *Preparing preservice teachers for reform-minded teaching through online video case discussions: Change innoticing* [Unpublished doctoral dissertation]. Middle East Technical University.

Osmanoğlu, A., Işıksal, M., & Koç, Y. (2012). Prospective teachers' noticing with respect to the student roles underlined in the elementary mathematics program: Use of video-cases. *Eğitim ve Bilim, 37*(165), 336-347.

Ojose, B. (2015). Students' misconceptions in mathematics: analysis of remedies and what research says. *Ohio Journal of School Mathematics,* 72, 30-34.

Halil, Ö. N. A. L., & Yorulmaz, A. (2017). İlkokul dördüncü sinif öğrencilerinin kesirler konusunda yaptiklari hatalar. *Eğitim ve Toplum Araştırmaları Dergisi*, *4*(1), 98-113.

Özdemir-Baki, G. (2017) *Ortaokul matematik öğretmenlerinin matematiği öğretme bilgilerinin gelişim sürecinin incelenmesi: Ders imecesi modeli* [Unpublished Doctoral Dissertation]. Atatürk Üniversitesi.

Özdemir-Baki, G. (2020). Video kulüp sürecine katılan öğretmenlerin deneyimlerini yansıtan bir fenomenografi araştırması. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi*, 14(2), 1142-1188.

Özen, D. (2015). *Ortaokul matematik öğretmenlerinin geometrik düşünmelerinin geliştirilmesi: Bir ders imecesi* [Unpublished Doctoral Dissertation]. Anadolu Üniversitesi.

Özen, D., & Köse, N. (2013, Haziran). Geometrik cisimler konusunda bir ders imecesi örneği. *1. Türk Bilgisayar ve Matematik Eğitimi Sempozyumunda* sunulan bildiri, Karadeniz Teknik Üniversitesi, Trabzon.

Özen, D., & Köse, N. Y. (2014, Eylül). Ortaokul matematik öğretmenlerinin geometrik düşünmeyi geliştirme üzerine gerçekleştirdikleri ders imecesinin bireysel öğretimlerine yansımaları. *XI. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresinde* sunulan bildiri, Çukurova Üniversitesi, Adana.

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

Philipp R. A. (2014). Commentary on section 3: Research on teachers' focusing on children's thinking in learning to teach: Teacher noticing and learning trajectories. In J. Cai and J. Middleton (Eds.), *Research trends in mathematics teacher education* (pp. 285-293). Newyork: Springer.

Resnick, L. B., Nesher, P., Leonard, F., Magone, M., Omanson, S., & Peled, I. (1989). Conceptual bases of arithmetic errors: The case of decimal fractions. *Journal for Research in Mathematics Education, 20*(1), 8-27.

Richert, A. (2005). Inquiring about practice: Using web-based materials to develop teacher inquiry. *Teaching Education, 16*, 297-310.

Sackur-Grisvard, C., Leonard, F. (1985). Intermediate cognitive organization in the process of learning a mathematical concept: The order of positive decimal numbers. *Cognition and Instruction, 2*, 157-174.

Sadi, A. (2007), Misconceptions in numbers. *UGRU Journal, 5*, 1-7.

Santagata, R., Yeh, C., & Mercado, J. (2018). Preparing elementary school teachers to learn from teaching: A comparison of two approaches to mathematics methods instruction. *Journal of the Learning Sciences, 27*(3), 474-516.

Santagata, R., Zannoni, C., & Stigler, J.W. (2007). The role of lesson analysis in preservice teacher education: An empirical investigation of teacher learning from a virtual video-based field experience. *Journal of Mathematics Teacher Education, 10*, 123-140.

Sartono, S. & Karso, K. (2020). Are the fractions difficult? A case study at Elementary School 033 Asmi. *In International Conference on Elementary Education, 2*(1), 1029-1043.

Seidel, T., Blomberg, G., & Renkl, A. (2013). Instructional strategies for using video in teacher education. *Teaching and Teacher Education, 34*(1), 56-65.

Shanahan, L. E., & Tochelli, A. L. (2014). Examining the use of video study groups for developing literacy pedagogical content knowledge for critical elements of strategy instruction with elementary teachers. *Literacy Research and Instruction, 53*(1), 1-24.

Sherin, M. G. (2007). The development of teachers' professional vision in video clubs. In R. Goldman, R. Pea, B. Barron and S. J. Derry (Eds.), *Video research in the learning sciences* (pp. 383-396). Mahwah, NJ: Erlbaum.

Sherin, M. G., Jacobs, V. R., & Philipp, R. A. (Eds.). (2011). *Mathematics teacher noticing: Seeing through teachers' eyes* (pp. 3-15). New York: Taylor and Francis.

Sherin, M. G., & van Es, E. A. (2005). Using video to support teachers' ability to notice classroom interactions. *Journal of Technology and Teacher Education, 13*(3), 475-491.

Sherin, M. G., & van Es, E. A. (2009). Effects of video club participation on teachers' professional vision. *Journal of Teacher Education, 60*(1), 20-37.

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

Stacey, K., & Steinle, V. (1998). Refining the classification of students' interpretations of decimal notation. *Hiroshima Journal of Mathematics Education, 6*, 1-21.

Star, J. R., & Strickland, S. K. (2008). Learning to observe: Using video to improve preservice mathematics teachers' ability to notice. *Journal of Mathematics Teacher Education, 11*(2), 107-125.

Steffe, L. P., & Olive, J. (2010). The construction of fraction schemes using the generalized number sequence. *Children's Fractional Knowledge* (pp. 277-314), Springer US.

Steinle, V., & Stacey, K. (1998). The incidence of misconceptions of decimal notation amongst students in Grades 5 to 10. Retrieved April, 15, 2019 from https://extranet.education.unimelb.edu.au/SME/TNMY/Decimals/Decimals/backinfo/refs/merga98stst.pdf.

Stigler, J., & Hiebert, J. (1999). *The teaching gap: Best ideas from the world's teachers for improving education in the classroom*. New York: The Free Press.

Stockero, S. L. Rupnow, R L., & Pascoe A. E. (2017). Learning to notice important student mathematical thinking in complex classroom interactions. *Teaching and Teacher Education, 63*, 384-395.

Sudejamnong, A., Robsouk, K., Loipha, S., & Inprasitha, M. (2014). Development of teachers' mathematical knowledge for teaching by using the innovation of lesson study and open approach. *Sociology Mind, 4*, 317-327.

Takahashi, A., & Yoshida, M. (2004). Ideas for establishing lesson study communities. *Teaching Children Mathematics, 10*(9), 436-443.

Taşkın, D., & Yıldız, C. (2011, Nisan). Kesirlerde toplama ve çıkarma işlemlerinin öğretiminde common knowledge construction modele uygun materyal geliştirme. *2. International Conference on New Trends in Education and Their Implications* kongresinde sunulan bildiri, Antalya, Turkey.

Tripp, T. R., & Rich, P. J. (2012). The influence of video analysis on the process of teacher change. *Teaching and Teacher Education, 28*(5), 728-739.

Türker Biber, B. (2017). İstatistikle ilgili modelleme etkinlikleri bağlamında öğretmen farkındalığı: Bir durum çalışması [Unpublished Doctoral Dissertation]. Hacettepe Üniversitesi.

Van Driel, J. H., Verloop, N., & de Vos, w. (1998). Developing science teachers' pedagogical content knowledge. *Journal of Research in Science Teaching, 35*, 673-695.

van Es, E. A. (2011). A framework for learning to notice student thinking. In M. G. Sherin, V. R. Jacobs, and R. A. Philipp (Eds.), *Mathematics teacher noticing*: *Seeing through teachers' eyes* (pp. 134-151). New York, NY: Routledge.

van Es, E. A., Sherin, M. G. (2002). Learning to notice: Scaffolding new teachers' interpretations of classroom interactions. *Journal of Technology and Teacher Education, 10*, 571-576.

van Es, E. A., & Sherin, M. G. (2006). How different video club designs support teachers in "learning to notice". *Journal of Computing in Teacher Education, 22*(4), 125-135.

van Es, E. A., & Sherin, M. G. (2008). Mathematics teachers "learning to notice" in the context of a video club. *Teaching and Teacher Education, 24*, 244-276.

van Es, E. A., & Sherin, M. G. (2010). The influence of video clubs on teachers' thinking and practice. *Journal of Mathematics Teacher Education, 13*(2), 155-176.

Verhoef, N.C., Tall, D.O. (2011). Lesson study: The effect on teacher's professional development. In B. Ubuz (Ed.), *Proceedings of the 35th conference of the international for the psychology of mathematics education* (Vol. 4, pp. 297-304). Ankara: PME.

Vrikki, M. Warwick, P. Vermunt, J. D. Mercer, N., & Van Halem, N. (2017). Teacher learning in the context of Lesson Study: A video-based analysis of teacher discussions. *Teaching and Teacher Education, 61*, 211-224.

Wise, A. F., Padmanabhan, P., & Duffy, T. M. (2009). Connecting online learners with diverse local practices: The design of effective common reference points for conversation. *Distance Education, 30*(3), 317-338.

Yaffe, E. (2010). The reflective beginner: Using theory and practice to facilitate reflection among newly qualified teachers. *Reflective Practice: International and Multidisciplinary Perspectives, 11*(3), 381-391.

Yetim, S., & Alkan R. (2010). İlköğretim 7. sınıf öğrencilerinin rasyonel sayılar ve bu sayıların sayı doğrusundaki gösterimleri konusundaki yaygın yanlışları ve kavram yanılgıları. *Kırgızistan-Türkiye Manas Üniversitesi Fen Bilimleri Dergisi*, *11*, 87-109.

Yılmaz, Z., & Yenilmez, K. (2007). İlköğretim 7. ve 8. sınıf öğrencilerinin ondalık sayılar konusundaki kavram yanılgıları. *Afyon Kocatepe Üniversitesi Fen Bilimleri Dergisi, 8*(1), 269-290.

Yoshida, M., & Jackson, W., C. (2011). Ideas for developing mathematical pedagogical content knowledge through lesson study. In L, C, Hart., A., Alston and A. Murata (Eds.), *Lesson study research and practice in mathematics education* (pp. 279-288). Dordrecht, The Netherlands: Springer.

Zembat, İ, Ö. (2010). Kavram yanılgısı nedir? M.F. Özmantar, E. Bingölbali ve H. Akkoç (Ed.), *Matematiksel kavram yanılgıları ve çözüm önerileri,* Ankara: PegemA Yayıncılık.

Zembat, İ. Ö. (2013). Sayıların farklı algılanması-sorun sayılarda mı, öğrencilerde mi? M. F. Özmantar, E. Bingölbali, ve H. Akkoç (Ed.), *Matematiksel kavram yanılgıları ve çözüm önerileri* (s. 41-60) (3. baskı), Ankara: Pegem Akademi.

Journal of Theoretical Educational Science, 17(3), 676-697, July 2024
Kuramsal Eğitimbilim Dergisi, 17(3), 676-697, Temmuz 2024
[Online]: http://dergipark.org.tr/akukeg
DOI number: http://doi.org/10.30831/akukeg.1407619

The Impacts of School Climate on Teachers' Job Satisfaction: An Analysis of Teaching and Learning International Survey (TALIS) 2018 National Data

Okul İkliminin Öğretmenlerin İş Tatmini Üzerindeki Etkileri: Uluslararası Öğretme ve Öğrenme Analizi Araştırması (TALIS) 2018 Ulusal Verileri

Hnin Yu SOE* **Paul John Edrada ALEGADO** **

Received: 21 December 2023 **Research Article** **Accepted:** 06 June 2024

ABSTRACT: This study aims to assess and examine secondary school teachers' perceptions of school climate and job satisfaction in five diverse countries: Japan, Korea, Finland, the United States of America (USA), and Australia. It explores the impact of school climate on teachers' job satisfaction, a pivotal factor influencing teacher retention, mobility, and professional development. In order to improve teachers' skills and abilities in the classroom, improving teachers' job satisfaction and understanding the factors that influence it is highly critical. Utilizing secondary data from the Teaching and Learning International Survey (TALIS) 2018, this study provides valuable insights. The findings reveal that teachers in all five countries generally hold positive perceptions of school climates and report high job satisfaction. However, teachers in Japan and Korea express comparatively lower job satisfaction levels when contrasted with their counterparts in Finland, the USA, and Australia. Furthermore, their perceptions of school climate also rank lower. Consequently, this study concludes that a positive correlation exists between favorable perceptions of school climate and elevated job satisfaction. This assertion is supported by regression analyses, individual country data, and aggregate data from all five countries.

Keywords: School climate, teacher's job satisfaction, TALIS 2018.

ÖZ: Bu çalışma beş farklı ülkede (Japonya, Kore, Finlandiya, Amerika Birleşik Devletleri (ABD) ve Avustralya) ortaöğretim öğretmenlerinin okul iklimi ve iş tatmini algılarını değerlendirmeyi ve incelemeyi amaçlamaktadır. Bu çalışma, okul ikliminin öğretmenlerin işte kalma, hareketlilik ve mesleki gelişimini etkileyen önemli bir faktör olan öğretmenlerin iş tatmini üzerindeki etkisini araştırmaktadır. Öğretmenlerin sınıftaki beceri ve yeteneklerini geliştirmek için öğretmenlerin iş doyumunu artırmak ve buna etki eden faktörleri anlamak son derece önemlidir. Uluslararası Öğretme ve Öğrenme Araştırması'nın (TALIS) 2018 ikincil verilerini kullanan bu çalışma, değerli bilgiler sunmaktadır. Bulgular, beş ülkenin tamamındaki öğretmenlerin genel olarak okul iklimi konusunda olumlu algılara sahip olduklarını ve yüksek iş tatmini bildirdiklerini ortaya koymaktadır. Ancak Japonya ve Kore'deki öğretmenler, Finlandiya, ABD ve Avustralya'daki meslektaşlarıyla karşılaştırıldığında nispeten daha düşük iş tatmini düzeylerine sahiptir. Ayrıca okul iklimine ilişkin algıları da daha alt sıralarda yer almaktadır. Sonuç olarak bu çalışma, olumlu okul iklimi algısı ile yüksek iş tatmini arasında pozitif bir ilişkinin var olduğu sonucuna varmaktadır. Bu iddia, regresyon analizleri, bireysel ülke verileri ve beş ülkenin tamamından elde edilen toplu verilerle desteklenmektedir.

Anahtar kelimeler: Okul iklimi, öğremenlerin iş tatmini, TALIS 2018.

* Corresponding author: Dr., Thazin Community Development Institute, Yangon, Myanmar, mshninyusoe@gmail.com, https://orcid.org/0009-0005-4433-7232
** Dr., University of Worcester, Worcester, United Kingdom, p.alegado@worc.ac.uk, https://orcid.org/0000-0002-2913-6089

Citation Information
Soe, H. Y., & Alegado, P. J. E. (2024). The impacts of school climate on teachers' job satisfaction: An analysis of Teaching and Learning International Survey (TALIS) 2018 national data. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 17*(3), 676-697.

ISSN: 1308-1659

Teachers' job satisfaction is one of the factors for teacher retention, teacher mobility, and teacher professional development (Borman & Dowling, 2008; Colwell, 2022; Klassen & Chiu, 2011; Zhou, Padrón, Waxman, Baek, & Acosta, 2023). Improving teachers' job satisfaction is essential in retaining quality teachers (Ghavifekr & Pillai, 2016). Similarly, teachers' job satisfaction can increase teacher retention, an indicator of an effective school system regarding teacher management (Shann, 1998). According to Holland (1996), vocational satisfaction depends on the relationship between one's personality and the environment in which one works. In other words, people's satisfaction with their work is related to the conditions and the work climate. This paper investigates this crucial relationship between working conditions and school climate vis-a-vis teachers' job satisfaction.

Many factors have an effect on teachers' job satisfaction. Among them, school climate is becoming critical for teachers' job satisfaction and students' learning outcomes (Bascia & Rottmann, 2011; Chen, Bellibaş, & Gümüş, 2023). In the Teaching and Learning International Survey (TALIS), Sims (2017, 2018) used teacher data in 35 countries from TALIS (2013) to explore the school learning environments and working conditions. In this research, students' discipline and teacher cooperation were positively related to teacher job satisfaction in all countries.

Previous researches showed that school climate is critically important to becoming an effective school (Freiberg & Stein, 1999; Collie, Shapka, & Perry, 2012; Zakariya, 2020). Therefore, school climate is essential for school effectiveness because it may cause a negative and positive effect on the school performance, teachers' motivation, teachers' self-efficacy and well-being in general, and, in turn, students' motivation and learning outcomes (Collie, Shapka & Perry, 2011). However, the research on the comparative analysis of different countries using international data such as TALIS has been relatively limited. In this study, data on lower secondary teachers from Japan, Korea, Finland, the United States, and Australia were included. These countries were chosen to represent different contexts—Japan and Korea to demonstrate nuances in an Asian context, whilst Finland, the United States and Australia to represent Western complexities. Significant cross-cultural differences in job satisfaction and self-efficacy among teachers suggest that contextual factors and cultural settings play a vital role in how school climate impacts teacher satisfaction (Diagne, 2023). This paper aims to support such literature and provide quantitative evidence of the significance of school climate on teachers' job satisfaction in different cultural contexts using the data from the 2018 Teaching and Learning International Survey (TALIS) by conducting a comparative study among selected five countries.

Theoretical Framework

In this study, Bronfenbrenner's' ecological theory is employed to support this study. According to Bronfenbrenner's revised bioecological theory, human development is specifically connected to four properties: (1) person, (2) context, (3) process, and (4) time. Simply put, the 'person' is associated with the characteristics of individual age, gender, skill and ability and their interaction with the environment. 'Context' refers to home, school, peer group and community. The third factor, 'process', refers to the relationships with people or objects. And lastly, 'time' pertains to the process of change (Ettekal & Mahoney 2017).

In the education setting, teachers' job satisfaction is one of the factors that contribute to their professional development. There are many factors influencing teachers' job satisfaction, such as school environment (context), teacher-student interaction (process), and teacher empowerment (person) etc. In this study, teacher cooperation (process) and student-teacher relationship (process) were considered for school climate (context).

Figure 1

Bronfenbrenner's Revised Bioecological Theory

Note: Adapted from Ettekal & Mahoney (2017)

Moreover, job satisfaction is one of the indicators of teachers' effectiveness as well as school performance. Many factors affect the teachers' job satisfaction in their workplace. Among them, school climate is also an essential factor to be considered. Job satisfaction is a sense of accomplishment, satisfaction, and gratification from the environment and occupation in which the people work (Locke, 1969). It can also refer to the degree of individual feeling of the satisfaction of their job-related needs (Evans, 1997). Therefore, teachers' job satisfaction is related to their motivation, psychological well-being, and performance (Barnabe & Burns, 1994; Feather & Rauter, 2004; Vansteenkiste et al., 2007). Previous studies proved that the individual's sense and level of job satisfaction are influenced by internal or individual and external or environmental factors such as organizational occupational factors (Tandon & Tyagi, 2012; Lopes & Oliveira, 2020). Many types of research showed that teachers are satisfied with their teaching performance, professional growth, and work, but they are dissatisfied with their working conditions, salary, school climate, and other factors (Butt et al., 2005; Crossman & Harris, 2006; Dinham & Scott, 1998; Kim & Loadman, 1994).

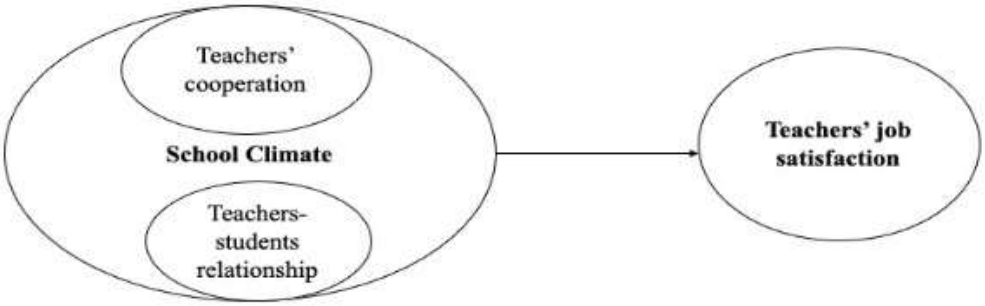
School climate has been a topic of research for many decades. Several studies show that the school climate can influence the students' and teachers' performance (Hoy & Woolfolk, 1993; Pas, Bradshaw, & Hershfeldt, 2012). School climate can be defined in different ways. The school climate can be defined as the feelings and attitudes that come from the school environment. School climate is one of the critical factors for providing a healthy and effective school environment and atmosphere. According to Freiberg (1998), "*the interaction of various school and classroom climate factors can create a fabric of support that enables all members of the school community*

to teach and learn at optimum levels" (p. 22). It can then be established that positive perceptions of school climate can give positive educational, physical, and mental outcomes for students and teachers, and adverse school climate can cause low student and teacher performance. (Cohen et al., 2009; Freiberg, 1998; Kuperminc et al., 1997; Lopes & Oliveira, 2020; Pepper & Thomas, 2001; Simin & Pillai, 2018).

Bastia and Rottmann (2011) conducted a study to explore the importance of working conditions in schools not only for teacher motivation, effectiveness, and job satisfaction but also for student opportunities to learn. They found that collegial support, administrator support, and student discipline were positively related to the teachers' job satisfaction. In addition, Toropova, Myrberg, and Johansson (2020) also conducted similar research in the Swedish context. They also found that school-working conditions such as teachers' cooperation, students' discipline, and a feasible workload were positively related to teachers' job satisfaction.

Figure 2

Relationship between School Climate and Teachers' job satisfaction



Note; Adapted from: Bascia and Rottmann (2011), Toropova, Myrberg & Johansson (2020).

In the Japanese context, school conditions can affect teacher job satisfaction. Shen, Leslie, Spybrook, and Ma (2012) researched school conditions and teachers' job satisfaction. They found that school processes, particularly career and working conditions, staff collegiality, and administrator support, are positively associated with teacher job satisfaction. You, Kim, and Lim (2015) examined the effects of teachers' sense of efficacy and school culture on job satisfaction among secondary teachers in Korea. At the institutional level, they found that school characteristics, academic climate, and support from colleagues and principals positively impacted teachers' job satisfaction. Malinen and Savolainen (2016) conducted a longitudinal study of school-working conditions on teacher job satisfaction and burnout in Finland with 642 Finnish middle school teachers. They found that teachers with higher teacher collaboration and student behavior were more satisfied with their jobs. In Australia, Aldridge and Fraser (2016) tested a research model of the relationships between the school climate, teachers' self-efficacy, and teacher job satisfaction with 781 Western Australian high school teachers. They found that school climate is related to teachers' efficacy and job satisfaction. Johnson, Kraft, and Papay (2012) conducted a study on the impact of school climates on teacher job satisfaction and career intentions in the US context. They found that teachers' working conditions were the most important. Therefore, the support of the school leadership, collegial support, and teacher-student relationships affect the teachers' job satisfaction and students' performance.

Based on the systematic research review, most of the research on school climate and teachers' job satisfaction were conducted in different countries with individual data. More research focused on one country, and less research focused on different countries with comparative data. In addition, there is also a need to examine the relationship between school climate and job satisfaction. Therefore, this research will be carried out to fill this research gap by using TALIS individual national data.

Research Objectives

This research aims:

1. To study and compare the teachers' perception of school climate and teachers' job satisfaction in Japan, Korea, Australia, Finland, and the United States.
2. To study the impact of school climate on teachers' job satisfaction in Finland, Korea, Japan, the United States of America, and Australia.

Method

Secondary data was used for this study. Data from the third teaching and learning international survey (TALIS 2018) was used. TALIS 2018, international survey is based on the cross-sectional survey. The procedures for the development of the questionnaire and how the data collection has been carried out are reported in the OECD technical report 2019 (OECD, 2019). TALIS began in 2008 with 24 participating countries and economies, focusing on lower secondary education. TALIS has since started conducting surveys in primary and upper-secondary schools. In 2013, the data we acquired from the OECD on mentoring were from 32 countries. 2018 it increased to 48 (total participating countries is 48). TALIS data aims to offer opportunities for teachers and principals to provide input into education analysis and policy development. TALIS was conducted by the Organization for Economic Co-operation and Development (OECD), and they are primarily cross-sectional surveys (OECD, 2019).

This study used five data sets for five countries: Japan, Korea, Australia, Finland, and the United States. The names of the data sets are BTGJPNT3 for Japan, BTGKORT3 for Korea, BTGAUST3 for Australia, BTGFINT3 for Finland, and BTGUSAT3 for the United States.

"B": lower secondary education (ISCED level.

"T": teacher-level data file.

"G" is used for general questionnaire data.

"T3" is used for the third round of TALIS, which was conducted in 2018.

All information about TALIS 2018 (framework underlying the questionnaires, technical report on the data collection and analysis plan for the variables) can be accessed via the OECD website (https://www.oecd.org/education/talis/talis-2018-data.htm).

Participants

The total population for this study was calculated from the TALIS (2018) data sets for lower secondary teachers in Japan, Korea, Finland, Australia, and the United States. The total population which completed the questionnaire is 15470 participants (2851 from Finland, 2931 from Korea, 3555 from Japan, 2560 from the United States and 3573 from Australia). According to the participants' background information, 90

percent of lower secondary teachers are full-time teachers in all countries. Among them, 2578 lower secondary school teachers, of a total of 2849, are master's or equivalent degree holders in Finland. Female teachers are generally more than male teachers in most countries' education systems. In the background table, it can be seen that there are more male teachers than female teachers at the lower secondary level in Japan. Other background information of the participants is shown in Table 1.

Table 1

Background Information of the Participants

Gender	Finland	Korea	Japan	United StateS	Australia
Male	866	906	2025	837	1327
Female	1985	2025	1510	1317	2264
Education Background	Finland	Korea	Japan	United State	Australia
Below ISCED 2011 Level 3	1	-	-	-	-
ISCED 2011 Level 3	34	-	-	2	-
ISCED 2011 Level 4	8	-	1	-	-
ISCED 2011 Level 5	27	1	116	5	131
ISCED 2011 Level 6	164	1790	2982	972	2776
ISCED 2011 Level 7	2578	1099	367	1524	607
ISCED 2011 Level 8	37	36	8	48	50
Total	2849	2926	3474	2551	3564
Missing	2	5	81	9	9
Total	2851	2931	3555	2560	3573
Employment status at current School	Finland	Korea	Japan	United State	Australia
Full-time (>90%)	2482	2828	3175	2455	2950
Part-time (71-80%)	134	43	80	17	284
Part-time (50-70%)	93	15	101	29	201
Part-time (< 50%)	176	11	161	22	60
Total Employment	Finland	Korea	Japan	United State	Australia
Full-time (>90%)	2562	2752	3012	2382	2843
Part-time (71-80%)	130	93	126	61	348
Part-time (50-70%)	49	21	97	26	147

Part-time (< 50%)	51	10	120	27	47
Primary Subject Category	Finland	Korea	Japan	United States	Australia
Reading, Writing, Literature	275	455	350	446	561
Mathematics	284	323	434	350	473
Science	274	330	318	278	376
Social Studies	219	321	301	240	345
Modern Foreign Languages	430	337	443	100	118
Technology	45	190	87	83	173
Ancient Greek or Latin				3	2
Art	276	216	237	194	261
Physical Education	246	236	276	167	281
Religion or Ethics	120	62	18	13	51
Practical or Vocational Skill	174	96	100	55	138
Other	64	113	47	63	48

Data Collection Instrument

According to the TALIS (2018) teachers' questionnaire framework, item number 49 (a, b, c, d, e) were used to assess the school climate, and item number 53 (b, e, g, h, i, j) were used for job satisfaction. The items are constructed with a four-point Likert scale identified as strongly disagree, disagree, agree, and strongly agree. The values of Cronbach's alpha for the internal consistency of these items are shown in Table 2.

Items for School Climate:

How strongly do you agree or disagree with the following statements about what happened in this school?

1. Teachers and students in this school usually get on well with each other. (TT3G49A)

2. Most teachers in this school believe that the student's well-being is important. (TT3G49B)

3. Most teachers in this school are interested in what the students have to say. (TT3G49C)

4. If a student needs an extra assistance, the school provides it. (TT3G49D)

5. Teachers in this school can rely on each other. (TT3G49E)

Items for Job Satisfaction:

We would like to know how you generally feel about your job. How strongly do you agree or disagree with the following statements.?

1. If I could decide again, I would still choose to work as a teacher. (TT3G53B)

2. I enjoy working at this school. (TT3G53E)
3. I would recommend my school as good place to work. (TT3G53G)
4. I think that the teaching profession is valued in society. (TT3G53H)
5. I am satisfied with my performance in this school. (TT353I)
6. All in all, I am satisfied with my job. (TT3G53J)

Method of Analysis

SPSS software (22) was used to analyze the data. Descriptive analysis, correlation, and regression analyses were conducted for data analysis. Mean scores were used for the description and comparison of the indices for each country. Correlation and regression were used to test how school climate influences the teachers' job satisfaction. To test the reliability of the items for each dimension, the reliability was calculated in terms of Cronbach's alpha, which is shown in Table 2. According to the value of Cronbach's alpha of two variables for each country, the internal consistencies of the items are acceptable.

Table 2

Reliability of the Scales in Terms of Cronbach's α

Measures	Finland	Korea	Japan	United States	Australia
School Climate	0.836	0.890	0.856	0.847	0.846
Job Satisfaction	0.793	0.838	0.759	0.772	0.787

Results

The Comparison of the Teachers' Perception of School Climate and Teachers' Job Satisfaction in Japan, Korea, Finland, the United States and Australia

Table 3 shows the mean scores for teachers' perceptions of school climate and job satisfaction in Japan, Korea, the United States and Australia. According to the result, teachers in all countries have positive perceptions of school climate and job satisfaction because all the values mean scores are greater than two. Among them, teachers in Finland, the United States, and Australia have little more positive perceptions of school climate and high job satisfaction than those in Japan and Korea. However, in order to test whether the school climate can influence teachers' job satisfaction, correlation and regression analysis were conducted. The following sections show each country's correlation and regression results and aggregate data of all five countries.

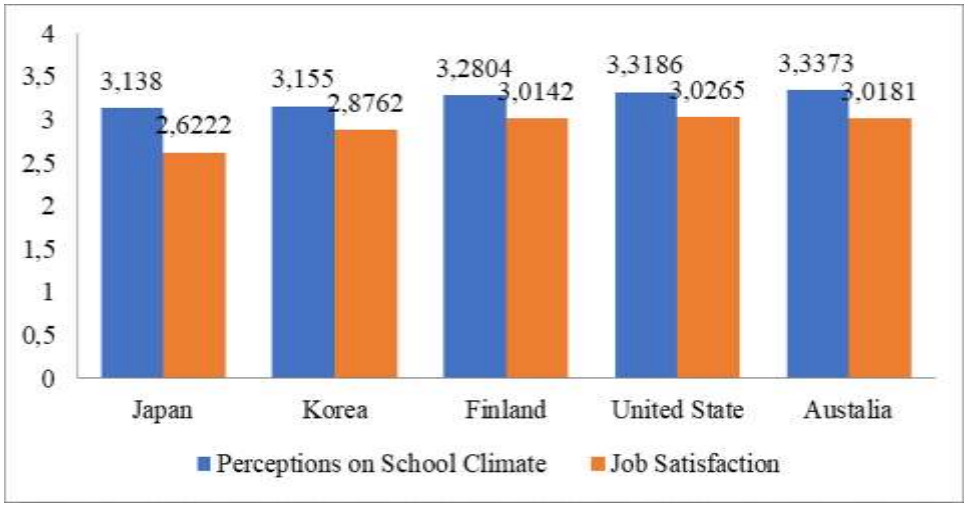
Table 3

Mean Scores for the Perceptions of School Climate and Job Satisfaction in Japan, Korea, Finland, the United States, and Australia

Country	Perceptions on School Climate	Job Satisfaction
Japan	3.138	2.6222
Korea	3.155	2.8762
Finland	3.2804	3.0142
United States	3.3186	3.0265
Australia	3.3373	3.0181

Figure 3

Comparison of Mean Scores for the Perceptions of School Climate and Job Satisfaction in Japan, Korea, Finland, United States and Australia



The Impact of School Climate on Teachers' Job Satisfaction

In order to answer the research question two, the linear regression was used. Before doing regression analysis, scatter plots and correlations were conducted for all data sets. In order to assess the effect size of the regression model, Cohen's f value was also calculated. Cohen's f value can be divided into three groups: Cohen's f =0.01: small effect size, Cohen's f =0.25: medium effect size and Cohen's f =0.40: large effect size. In this section, the result was shown for each of the five countries.

The Impact of School Climate on Teachers' Job Satisfaction in Japan

For the data set of Japan, according to the scatter plot diagram, the X-axis shows the school climate (predictor), and the Y-axis shows teachers' job satisfaction (predicted or dependent variable). According to the scatter plot result, there is a positive linear relationship between school climate and teachers' job satisfaction because the data shows an uphill pattern as it moves from left to right; this indicates a positive relationship between school climate and job satisfaction. This means that the teachers who work in a positive school climate will have more job satisfaction. However, the scatter plot does not give us definitive answers. We need to calculate the appropriate statistics. Therefore, correlation and linear regression analysis were also used. The correlation result of data from Japan is shown in Table 4. As shown in the table, the school climate is positively correlated with teachers' job satisfaction (r=.379, p>.01).

Figure 4

Scatter Plot Result for Japan

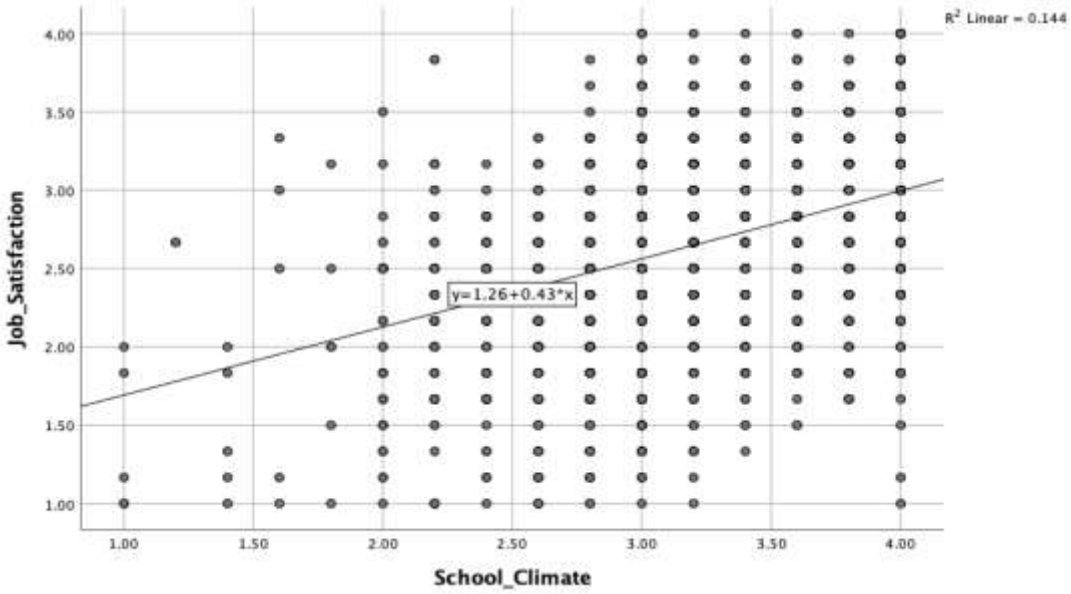


Table 4

Correlation between School Climate and Job Satisfaction in Japan

	School Climate	Job Satisfaction
School Climate	1	.379**
Job Satisfaction	.379**	1

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

Table 5

Impact of School Climate on Teachers' Job Satisfaction in Japan

Predictors	Predicted variables (Teachers' job satisfaction)
School Climate	.379***
R^2	.144

Adjusted R^2	.144
F Value	580.399***

*Note: ***sig at p<.001, **sig at p<.01, * sig at p<.05*

The overall regression model is significant (F (1) =580.399, P < .001); school climate is a variable which could be used to predict teachers' job satisfaction (t =24.091, P <.001). The correlation between the true Y and the predicted Y is .379, and the coefficient of the determinant is .144, which indicates that the regression model could explain 14.4% of the total variance in teachers' job satisfaction. The Cohen's f value is 0.41. Therefore, it has a large effect size because the value is greater than 0.4. The following equation is for the impact of school climate on the teachers' job satisfaction in Japan.

- School climate= 1.258+ .0.435* teachers' job satisfaction

The Impact of School Climate on Teachers' Job Satisfaction in Korea

In the case of the scatter plot result of the data from Korea, there is a positive linear relationship between school climate and teachers' job satisfaction because the regression line has a positive slope. It means a positive relationship between X and Y, and teachers with a positive working environment will have more satisfaction in their teaching job. In order to obtain definitive answers, correlation and linear regression analysis were also conducted. Table 6 shows the correlation results between school climate and job satisfaction in Korea. According to the results, there was a positive relationship between school climate and job satisfaction (r=.369, p>.01).

Figure 5

Scatter Plot Result for Korea

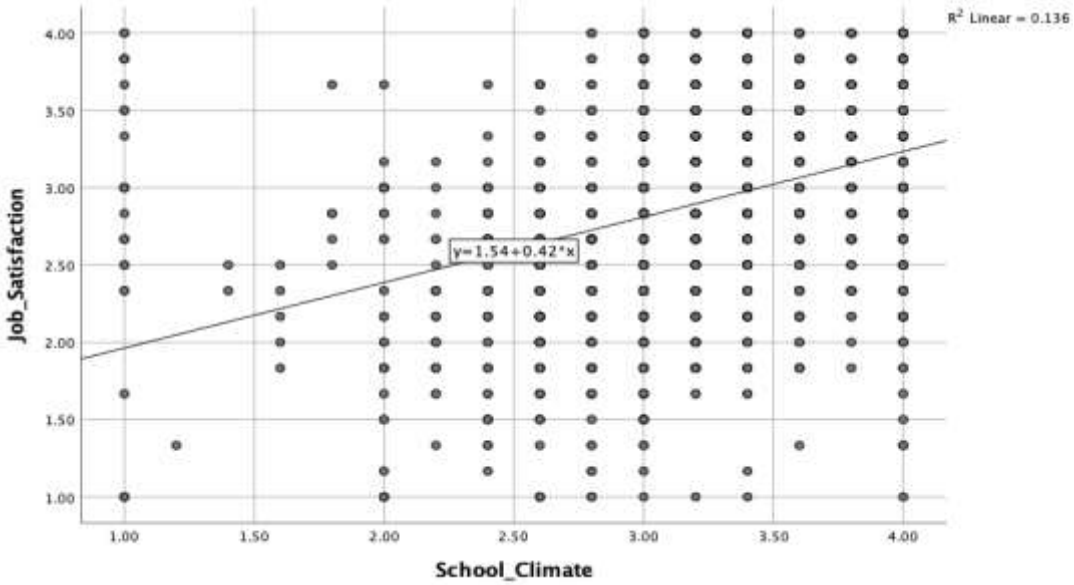


Table 6

Correlation between School Climate and Job Satisfaction in Korea

	School Climate	Job Satisfaction
School Climate	1	.369**
Job Satisfaction	.369**	1

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

Table 7

Impact of School Climate on Teachers' Job Satisfaction in Korea

Predictors	Predicted variables (Teachers' job satisfaction)
School Climate	.369***
R^2	.136
Adjusted R^2	.136
F Value	439.485***

****sig at p<.001, **sig at p<.01, * sig at p<.05*

Table 7 shows the results of the regression analysis in Korea. The overall regression model is significant (F (1) =439.485, P < .001); school climate is a variable that could be used to predict teachers' job satisfaction (t =20.964, P <.001). The correlation between the true Y and the predicted Y is .369, and the determinant coefficient is .136, which indicates that the regression model could explain 13.6% of the total variance in teachers' job satisfaction. Since the value of Cohen's f is 0.39, it has a medium effect size. The equation for the Korean context is as follows.

- School climate= 1.539+ 0.424* teachers' job satisfaction

The Impact of School Climate on Teachers' Job Satisfaction in Finland

As with the data for Korea, there is much overlap in the results of the lower secondary teachers in Finland. According to the scatter plot result, there is a positive linear relationship between school climate and teachers' job satisfaction because of the positive slope on the regression line. Therefore, working in a positive school climate is an important element of satisfaction with the teaching profession. The following tables show correlation and regression analysis to test the linear relationship. Table 8 shows the positive correlation between school climate and job satisfaction of teachers in Finland (r=.429, p<.01*).*

Figure 6

Scatter Plot Result for Finland

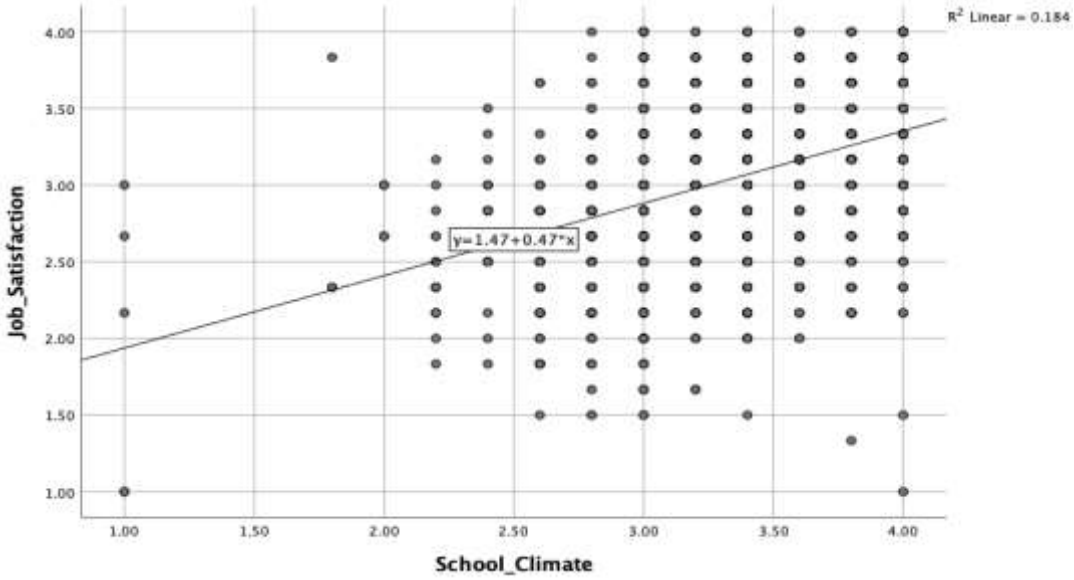


Table 8

Correlation between School Climate and Job Satisfaction in Finland

	School Climate	Job Satisfaction
School Climate	1	.429**
Job Satisfaction	.429**	1

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

Table 9

Impact of School Climate on Teachers' Job Satisfaction in Finland

Predictors	Predicted variables (Teachers' job satisfaction)
School Climate	.429***
R^2	.184
Adjusted R^2	.184
F Value	619.441***

*Note: ***sig at p<.001, **sig at p<.01, * sig at p<.05*

The overall regression model is significant (F (1) =619.441, P < .001); school climate is a variable which could be used to predict the teachers' job satisfaction (t =24.889, P <.001). The correlation between the true Y and the predicted Y is .429, and the coefficient of the determinant is .184, which indicates that the regression model could explain 18.4% of the total variance in teachers' job satisfaction. According to Cohen's f value (Cohen's f = 0.47), it has a large effect size. The equation result for Finland is as follows.

- School climate= 1.465+ .472* teachers' job satisfaction

The Impact of School Climate on Teachers' Job Satisfaction in the United States of America

As shown in Figure (6), as the regression line in the scatter plot result shows an uphill pattern, there is a positive linear relationship between school climate and teachers' job satisfaction. Based on the scatter plot result, teachers working in positive school environments have more satisfaction in their teaching profession. In order to have definitive answers, the correlation and regression analysis calculations are shown in Tables 10 and 11. According to the correlation result, there was a positive correlation between school climate and teachers' job satisfaction (r=.389, p<.01*)*

Figure 7

Scatter Plot Result for United States of America

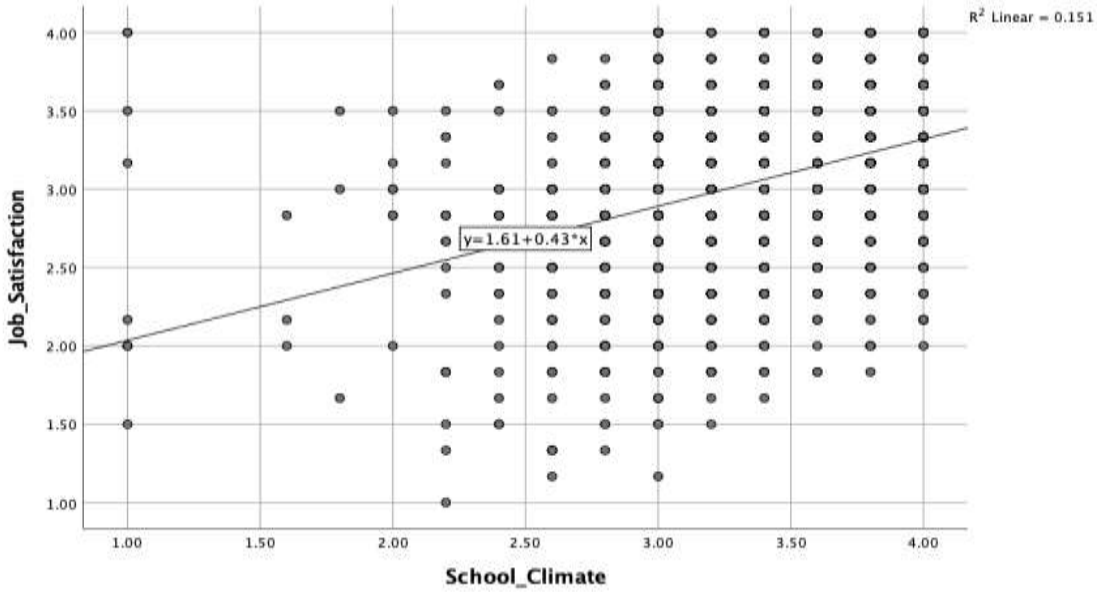


Table 10

Correlation between School Climate and Job Satisfaction in the United States

	School Climate	Job Satisfaction
School Climate	1	.389**
Job Satisfaction	.389**	1

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

Table 11

Impact of School Climate on Teachers' Job Satisfaction in United States

Predictors	Predicted variables (Teachers' job satisfaction)
School Climate	.389***
R^2	.151

Adjusted R^2	.151
F Value	419.390***

*Note: ***sig at p<.001, **sig at p<.01, * sig at p<.05*

The overall regression model is significant (F (1)=419.390, P < .001); school climate is a variable that could be used to predict the teachers' job satisfaction (t =20.479, P <.001). The correlation between the true Y and the predicted Y is .389, and the coefficient of the determinant is .151, which indicates that the regression model could explain 15.1% of the total variance in teachers' job satisfaction. Cohen's f is 0.42, which has a large effect size. The following equation is the impact of school climate on teachers' job satisfaction in the United States.

- School climate= 1.608+ .428* teachers' job satisfaction

The Impact of School Climate on Teachers' Job Satisfaction in Australia

In the case of data for Australia, according to the scatter plot result, there is a positive linear relationship between school climate and teachers' job satisfaction. The following tables show correlation and regression analysis to test the linear relationship.

Figure 8

Scatter Plot Result for Australia

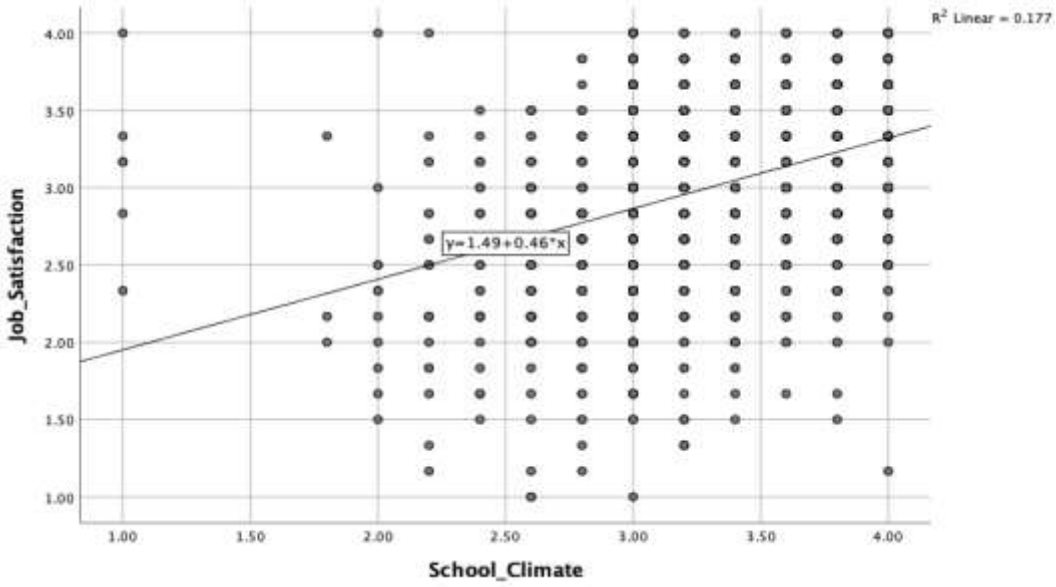


Table 12

Correlation between School Climate and Job Satisfaction in Australia

	School Climate	Job Satisfaction
School Climate	1	.421**
Job Satisfaction	.421**	1

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

Table 13

Impact of School Climate on Teachers' Job Satisfaction in Australia

Predictors	Predicted variables (Teachers' job satisfaction)
School Climate	.421***
R^2	.177
Adjusted R^2	.177
F Value	677.651***

*Note:****sig at p<.001, **sig at p<.01, * sig at p<.05*

The overall regression model is significant (F (1) =677.651, P < .001); school climate is a variable which could be used to predict the teachers' job satisfaction (t =26.032, P <.001). The correlation between the true Y and the predicted Y is .421, and the coefficient of the determinant is .177, which indicates that the regression model could explain 17.7% of the total variance in teachers' job satisfaction. According to Cohen's f value (Cohen's f = 0.46), this regression model for Australia also has a large effect size. The equation for Australia is as follows.

- School climate= 1.494+ .457* teachers' job satisfaction

The Impact of School Climate on the Teachers' Job Satisfaction in Japan, Korea, Finland, United States and Australia

As shown in Figure 9, the Scatter Plot result for Japan, Korea, Finland, the United States and Australia also shows a positive linear relationship between school climate and teachers' job satisfaction because of the positive slope on the regression line in the scatter plot. This means that teachers working in a positive school climate will have more satisfaction in the teaching profession. Tables 14 and 15 show the calculation of correction and regression analysis of all five countries' data sets.

Figure 9

Scatter Plot Result for Japan, Korea, Finland, United States and Australia

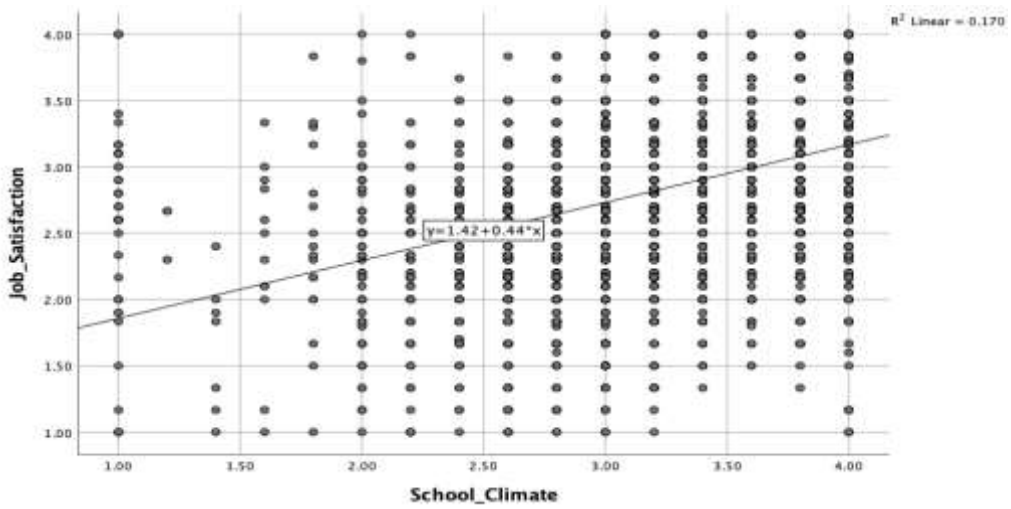


Table 14

Correlation between School Climate and Job Satisfaction in Japan, Korea, Finland, United States and Australia

	School Climate	Job Satisfaction
School Climate	1	.412**
Job Satisfaction	.412**	1

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

Table 15

Impact of School Climate on Teachers' Job Satisfaction in Japan, Korea, Finland, United States and Australia

Predictors	Predicted variables (Teachers' job satisfaction)
School Climate	. 412***
R^2	.170
Adjusted R^2	.169
F Value	619.441***

*Note: ***sig at p<.001, **sig at p<.01, * sig at p<.05*

The overall regression model is significant (F (1) =2.535E3, P < .001); school climate is a variable that could be used to predict teachers' job satisfaction (t =50.345, P <.001). The correlation between the true Y and the predicted Y is .412, and the coefficient of the determinant is .170, which indicates that the regression model could explain 17% of the total variance in teachers' job satisfaction. This regression model also has a large effect size because Cohen's f value is 0.45.

- School climate= 1.422+ .436* teachers' job satisfaction

Discussion and Conclusion

This paper aims to study the perceptions of secondary teachers on school climate and job satisfaction in Japan, Korea, Finland, the United States, and Australia and the impact of school climate on teachers' job satisfaction. The data from the third teaching and learning survey (2018) was used for this study. The data sets for Japan, Korea, Finland, the United States, and Australia were used in this study. There were two parts to the research findings: descriptive and inferential (regression) results. According to the descriptive findings, teachers from all countries have positive perceptions of school climates and high job satisfaction. However, teachers from Japan and Korea have slightly lower job satisfaction than teachers from Finland, the United States, and Australia, and their perceptions of school climate are also low.

In the second section, the relationship of these two variables was presented. Regression analysis was used to test how these two continuous variables are related. Before regression analysis, the scatter plot and correlation calculations were conducted as preliminary analyses. The correlation results of each country data set and combined

of all data sets show a positive correlation between the school climate and job satisfaction (r=.379, p>.01 in Japan, r=.369, p>.01 in Korea, r=.429, p<.01in Finland, r=.389, p<.01 in United State, r=.421, p<.01 in Australia, and r=.412, p<.01 in combined data respectively). Effect sizes for all country data sets were also calculated. According to the results of the regression analysis, teachers' perception of school climate can predict their job satisfaction in all five countries: Japan, Korea, Finland, the United States, and Australia. Based on the individual data and overall data for all countries (Japan, Korea, Finland, United States and Australia), research findings can be summarized as the more positive teachers' perception of the school climate, the higher teachers' job satisfaction. This research provides practical implications for improving school climate and conditions and ways to create better education policies. However, this current research included only five countries: Japan, Korea, Finland, Australia, and the United States.

The study finding is consistent with previous studies (Chen, Bellibaş, & Gümüş, 2023; Johnson, Kraft, and Papay, 2012; Zakariya, 2020), which showed the influence of school climate on teachers' job satisfaction. This current research aligns with the previous research (Sims, 2017; Toropova, Myrberg, & Johansson, 2020) based on TALIS (2013) international data. In addition, this study is consistent with previous researches in Japan, Korea, Finland, Australia, and the United States (Aldridge & Fraser, 2016; Johnson, Kraft, & Papay, 2012; Malinen & Savolainen, 2016; Shen, Leslie, Spybrook & Ma 2012; You, Kim & Lim 2015).

According to Bronfenbrenner's revised bioecological theory, human development is precisely connected to four properties: (1) person, (2) context, (3) process, and (4) time. In the school setting, many factors influence teachers' job satisfaction, such as teachers' professional qualifications, the context of school working conditions, the process of teachers' collaboration, students and teachers relationships, and global changes. Among them, the process of teachers' cooperation and student-teacher relationship were considered in this study. Sims (2017) conducted research to explore the school learning environments and working conditions based on the TALIS (international) 2013 data. In this research, students' discipline and teacher cooperation were positively related to teacher job satisfaction in all countries. Concerning the school climate, teacher cooperation and student-teacher relationship were included in the current research. Based on the current results, all these aspects of school climate influence the teacher's job satisfaction. Therefore, school principals, policymakers and educators should emphasize teacher collaboration by providing community learning and lesson study groups.

In addition, to create positive and better student-teacher relationships, different school activities and counselling programs should be provided within the school. A safe learning and working climate, in which students and teachers show mutual respect, shows a strong relationship with teachers' job satisfaction. Other TALIS studies based on TALIS 2013 and 2018 data showed the association between teachers' job satisfaction and teachers' participation in decision-making, collaboration and collaborative cultures in school (Wang & Zhang 2020: Liu., & Sui, 2023). Therefore, the factors of teacher-student relationships, providing students' well-being, and providing a collaborative environment for teachers should be considered for delivering positive school

environments. If policymakers and school principals can consider these factors, the teachers will value their profession and be more satisfied with their teaching profession.

Limitations and Suggestions for Future Research

The current study has several limitations. First, although the TALIS questionnaire included a few aspects of school climate, some of the aspects included in the literature in the field are not thoroughly considered, including multi-level influences on teacher level, such as motivation and disciplinary climate and the school level, such as violence, bullying discrimination (Liu, Keeley & Sui, 2020). Secondly, the data is secondary data and may need qualitative aspects to encapsulate specific nuances in terms of cultural contexts, hierarchical structure, level of students and experience. Third, this study is based on the cross-sectional survey of TALIS data and could not provide a causal relationship. Therefore, the longitudinal study should be conducted based on the trend of school climate and teacher job satisfaction. Another suggestion is to explore other factors, such as teacher professional development activities and job demands, to improve teachers' job satisfaction and use more advanced statistical analysis. These aspects of this research could be employed to further this study.

Statement of Responsibility

Hnin Yu Soe: Literature review for analysis, data analysis and interpretation, and writing the conclusion. Paul John Edrada Alegado: Literature review for analysis, analysis of expert opinions, and writing the conclusion.

Conflicts of Interest

This research has no financial, commercial, legal or professional relationship with other organizations or those working with them. There is no conflict of interest that would affect the research.

Author Bios:

Dr. Hnin Yu Soe is a professional educational consultant at a non-government organization (NGO) in Myanmar. She completed her doctoral degree at Beijing Normal University in China, majoring in comparative education. She earned PhD credits at Yangon University of Education and received her master's in teacher education from Sagaing University of Education. She has extensive experience in education and academia, which spans over 15 years, and her research interests include mathematics and science education and teacher education policy.

Dr. Paul John Edrada Alegado is a senior lecturer at the University of Worcester, UK. He received a scholarship from the China Scholarship Council and completed his Ph.D. in Comparative Education from Beijing Normal University. He previously held posts as a research fellow at the International Network on Gender, Health and Social Justice (University of Newcastle, Australia) and as a lecturing professor at Beijing University of Technology (Beijing, China). His research interests include adult nursing, gender and health, comparative education and transcultural communication and nursing.

References

Aldridge, J. M., & Fraser, B. J (2016). Teachers' views of their school climate and its relationship with teacher self-efficacy and job satisfaction. *Learning Environment Research*, *19*(2), 102-140.

Barnabe´, C., & Burns, M. (1994). Teachers' job characteristics and motivation. *Educational Research, 36,* 171–185. https://doi.org/10.1080/ 0013188940360206.

Bascia, N., & Rottmann, C. (2011). What's so important about teachers' working conditions? The fatal flaw in North American educational reform. *Journal of Education Policy*, *26*(6), 787–802.

Borman, G. D., & Dowling, N. M. (2008). Teacher attrition and retention: A meta-analytic and narrative review of the research. *Review of Educational Research, 78*(3), 367–409.

Butt, G., Lance, A., Fielding, A., Gunter, H., Rayner, S., & Thomas, H. (2005). Teacher job satisfaction: Lessons from the TSW pathfinder project. *School Leadership and Management, 25,* 455–471. https://doi.org/10.1080/ 13634230500340807

Chen, J., Bellibaş, M. Ş., & Gümüş, S. (2023). Impact of school climate and resources on principal workload stress and job satisfaction: Multinational evidence from TALIS 2018 data. *Journal of Educational Administration, 61*(5), 476-494. https://doi.org/10.1108/JEA-08-2022-0128

Cohen, J., McCabe, L., Michelli, N. M., & Pickeral, T. (2009). School climate: Research, policy, practice, and teacher education. *Teachers College Record, 111*, 180-213.

Collie, R. J., Shapka, J. D., & Perry, N. E. (2011). Predicting teacher commitment: The impact of school climate and social-emotional learning. *Psychology in the Schools, 48*, 1034-1048.

Colwell, M.G.B. (2022). Job Satisfaction and Retention of remote admissions professionals (Publication No. 29168398) [Doctoral dissertation]. California State University, Sacramento. ProQuest Dissertations Publishing.

Crossman, A., & Harris, P. (2006). Job satisfaction of secondary school teachers. *Educational Management Administration and Leadership, 34,* 29–46. https://doi.org/10.1177/174114320605953

Diagne, D. (2023). Factors associated with teacher job satisfaction: An investigation using TALIS 2018 Data. *Swiss Journal of Educational Research*, *45*(3), 265–277. https://doi.org/10.24452/sjer.45.3.4

Dinham, S., & Scott, C. (1998). A three-domain model of teacher and school executive career satisfaction. *Journal of Educational Administration, 36,* 362–378. https://doi.org/10.1108/09578239810211545.

Ettekal AV & Mahoney JL. (2017). Ecological systems theory. In *SAGE encyclopedia of out-of-school learning* [Internet] (pp. 239–41*)*. Thousand Oaks: *SAGE Publications, Inc.*

Evans, L. (1997). Understanding teacher morale and job satisfaction. *Teaching and Teacher Education, 13,* 831–845. https://doi.org/10.1016/S0742-051X(97)00027-9.

Feather, N. T., & Rauter, K. A. (2004). Organizational citizenship behaviors in relation to job status, job insecurity, organizational commitment and identification, job satisfaction, and work values. *Journal of Occupational and Organizational Psychology, 77,* 81–94. https://doi.org/10.1348/096317904322915928.

Freiberg, H. J. & Stein, T. A. (1999). Measuring, improving, and sustaining healthy learning environments. In H. J. Freiberg (Ed.), *School climate: measuring, improving, and sustaining learning environments* (pp. 11-29). Philadelphia: Falmer Press.

Holland, J. L. (1996). Exploring careers with typology: What we have learned and some new directions. *American Psychologist*, *51*, 397-406.

Hoy, W. K., & Woolfolk, A. E. (1993). Teachers' sense of efficacy and the organizational health of schools. *Elementary School Journal, 93,* 355. https://doi.org/10.1086/461729

Johnson, S. M., Kraft, M. A., & Papay, J. P. (2012). How context matters in high-need schools: The effects of teachers' working conditions on their professional satisfaction and their students' achievement. *Teachers College Record, 114*(10), 1–39.

Kim, I., & Loadman, W. E. (1994). *Predicting teacher job satisfaction.* Columbus: Ohio State University.

Klassen, R. M., & Chiu, M. M. (2011). The occupational commitment and intention to quit of practicing and pre-service teachers: Influence of self-efficacy, job stress, and teaching context. *Contemporary Educational Psychology*, *36*(2), 114–129.

Kuperminc, G. P., Leadbeater, B. J., Emmons, C., & Blatt, S. J. (1997). Perceived school climate and difficulties in the social adjustment of middle school students. *Applied Developmental Science, 1*, 76-88.

Liu, S., Keeley, J. W., & Sui, Y. (2023). Multi-level analysis of factors influencing teacher job satisfaction in China: Evidence from the TALIS 2018. *Educational Studies, 49*(2), 239–259. https://doi.org/10.1080/03055698.2020.1837615

Locke, E. (1969). What is job satisfaction? *Organizational Behavior & Human Performance, 4,* 309–336. https://doi.org/10.1016/0030-5073(69)90013-0.

Lopes, J., & Oliveira, C. (2020). Teacher and school determinants of teacher job satisfaction: A multilevel analysis. *School Effectiveness and School Improvement*, *31*(4), 641-659.

OECD. (2019). TALIS 2018 Technical Report. Parijs: *OECD Publishing*. Retrieved on 20 June 2022 from https://www.oecd.org/education/talis/talis-2018-data.htm.

OECD (2019). *Creating effective teaching and learning environments*: First results from TALIS. Berlin, Germany.

Pas, E. T., Brashaw, C. P., & Hershfeldt, P. A. (2012). Teacher- and school-level predictors of teacher efficacy and burnout: Identifying potential areas for support. *Journal of School Psychology*, *50*, 129-145. https://doi.org/10.1016/j.jsp.2011.07.003

Pepper, K. & Thomas, L. (2001). Making a change: The effects of the leadership role on school climate. *Learning Environments Research, 5*, 155-166.

Shann, M. H. (1998). Professional commitment and satisfaction among teachers in urban middle schools. *The Journal of Educational Research*, *92*(2), 67–73.

Shen, J., Leslie, J. M. Spybrook, J. K., & Ma, X. (2012). Are principal background and school process related to teacher job satisfaction? A multilevel study using schools and staffing survey. *American Educational Research Journal, 49*(2), 200-230 https://doi.org/10.3102/0002831211419949

Simin, G & Pillai, N. S., (2018). The relationship between school's organizational climate and teacher's job satisfaction: Malaysian experience. *Asia Pacific Educ. Rev*. (2016) 17:87–106. DOI 10.1007/s12564-015-9411-8

Sims, S. (2017). TALIS 2013: Working conditions, teacher job satisfaction and retention (Department for Education Statistical Working Paper). London: Department of Education.

Tandon, J. K. & Tyagi, P. (2012). The concept of job satisfaction and its organizational implications. *Educational Quest, 3*(1), 57-66.

Teaching and Learning International Survey TALIS (2018). Conceptual framework. Organization for Economic Co-operation and Development.

Toropova A, Myrberg E, & Johansson S. (2020). Teacher job satisfaction: The importance of school working conditions and teacher characteristics. *Educational Review, 8,* 127–128. https://doi.org/10.1080/00131911.2019.1705247

Vansteenkiste, M., Neyrinck, B., Niemiec, C. P., Soenens, B., De Witte, H., & Van, D. B. (2007). On the relations among work value orientations, psychological need satisfaction and job outcomes: A self-determination theory approach. *Journal of Occupational & Organizational Psychology, 80,* 251–277.

Wang, K., Li, Y., Luo, W., & Zhang, S. (2020). Selected factors contributing to teacher job satisfaction: A quantitative investigation using 2013 TALIS data. *Leadership and Policy in Schools, 19,* 512-532.

You, S., Kim, A. Y., & Lim, S. A. (2017). Job satisfaction among secondary teachers in Korea: Effects of teachers' sense of efficacy and school culture. *Educational Management Administration & Leadership*, *45*(2), 284-297. https://doi.org/10.1177/1741143215587311

Zakariya, Y.F. (2020). Effects of school climate and teacher self-efficacy on job satisfaction of mostly STEM teachers: a structural multigroup invariance approach. *International Journal of STEM Education 7*(1), 1-12. https://doi.org/10.1186/s40594-020-00209-4

Zhou, X., Padrón, Y., Waxman, H. C., Baek, E., & Acosta, S. (2023). How do school climate and professional development in multicultural education impact job satisfaction and teaching efficacy for STEM teachers of English learners? A path-analysis. *International Journal of Science and Mathematics Education*, *22*(2), 447–468. https://doi.org/10.1007/s10763-023-10381-y

Journal of Theoretical Educational Science, 17(3), 698-718, July 2024
Kuramsal Eğitimbilim Dergisi, 17(3), 698-718, Temmuz 2024
[Online]: http://dergipark.org.tr/akukeg
DOI number: http://doi.org/10.30831/akukeg.1321356

The Mediating Role of Moral Courage in the Relationship Between Authentic Leadership and Teachers' Positive Psychological Capital*

Otantik Liderlik ile Öğretmelerin Pozitif Psikolojik Sermayesi Arasındaki İlişkide Ahlaki Cesaretin Aracılık Rolü

Sami YOLLU ** **Mehmet KORKMAZ** ***

Received: 01 July 2023 **Research Article** **Accepted:** 06 June 2024

ABSTRACT: This study aims to reveal the mediating role of teachers' moral courage (MC) behaviours in the relationship between school principals' authentic leadership (AL) behaviours and teachers' positive psychological capital (PPC) according to the views of teachers working in primary and secondary schools. In this study "AL Questionnaire", "PC Scale" and "PMC (Professional Moral Courage) Scale" were used. 8665 teachers working in primary and secondary schools in Antalya city centre comprise the population of this study. The sample of the study consists of 474 teachers reached by using the convenient sampling method. Confirmatory Factor Analysis (CFA) and (Cronbach Alpha Coefficient) alpha coefficients were benefited from the validity and reliability analysis of the scales, and Spearman's Correlation Coefficient, which was used for data that were not normally distributed, was used to determine the relationships between the variables, and structural equation modelling (SEM) was used for mediating analysis. A low-level positive and significant relationship was found between school principals' authentic leadership behaviours and teachers' psychological capital and moral courage behaviours. Following the results of the Structural equation modelling (SEM) analysis, it has been determined that the moral courage behaviours of the teachers have a mediating role in the relationship between the authentic leadership behaviours of the school principals and the positive psychological capital of the teachers.

Keywords: Authentic leadership, positive psychological capital, moral courage.

ÖZ: Araştırmanın temel amacı okul müdürlerinin otantik liderlik davranışları ile öğretmenlerin pozitif psikolojik sermayeleri arasındaki ilişkide öğretmenlerin ahlaki cesaret davranışlarının aracılık rolünü ortaya koymaktır. Araştırmada "Otantik Liderlik Ölçeği", "Psikolojik Sermaye Ölçeği" ve "Ahlaki Cesaret Ölçeği" kullanılmıştır. Araştırmanın evrenini Antalya il merkezinde ilk ve ortaokullarda çalışmakta olan 8665 öğretmen oluşturmaktadır. Çalışmanın örneklemini uygun örneklem metodu yolu ile ulaşılan 474 öğretmen oluşturmaktadır. Doğrulayıcı Faktör Analizi (DFA) ve (Cronbach Alpha Coefficient) alfa kat sayısı, değişkenler arasındaki ilişkileri belirlemek için ise normal dağılmayan veriler için kullanılan Spearman Korelasyon Katsayısı ve aracılık analizi için yapısal eşitlik modeli (YEM) kullanılmıştır. Okul müdürlerin otantik liderlik davranışları ile öğretmenlerin psikolojik sermayeleri ve ahlaki cesaret davranışları arasında düşük düzeyde olumlu ve anlamlı bir ilişki bulunmuştur. Yapısal eşitlik modellemesi (YEM) analizi sonucuna göre okul müdürlerin otantik liderlik davranışları ile öğretmenlerin pozitif psikolojik sermayeleri arasındaki ilişkide öğretmenlerin ahlaki cesaret davranışlarının tam aracılık rolünün olduğu tespit edilmiştir.

Anahtar kelimeler: Otantik liderlik, pozitif psikolojik sermaye, ahlaki cesaret.

* This study was produced from the Ph.D. dissertation entitled "An Examination of the Relationship between the Authentic Leadership Behaviors of School Administrators and Positive Psychological Capital and Moral Courage Behaviors of Teachers" at Gazi University in 2023.

** *Corresponding Author:* Dr., Ministry of National Education, Antalya, Türkiye, samiyollu@gmail.com, https://orcid.org/0000-0002-3261-0255

*** Prof. Dr., Gazi University, Ankara, Türkiye, korkmaz@gazi.edu.tr, https://orcid.org/0000-0001-7600-5121

Citation Information
Yollu, S., & Korkmaz, M. (2024). The mediating role of moral courage in the relationship between authentic leadership and teachers' positive psychological capital. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 17*(3), 698-718.

ISSN: 1308-1659

According to the classical management approach, the human, cannot go beyond being seen as a part of a machine, although technology seems to be advancing rapidly with the 21st century and technological products are replacing human power, making technology functional depends on the existence of qualified human characteristics. In this context, as the classical management approach has evolved into the contemporary management approach, the value attributed to humans has increased, and it has become even more significant to comprehend human behaviours and mental processes. Along with these experiences, the science of psychology, which examines human behaviour and psychological processes, has continued its development with theory and applications, and recently positive psychology, which emphasises the positive aspects of people by considering also their negative aspects, has become the focus of attention (Akçay, 2011). Positive psychology is a scientific field that interprets people's pursuit of happiness, makes life meaningful, and contributes to related processes (Seligman & Csikszentmihalyi, 2000). It emphasises the positive aspects of people as well as their negative aspects and focuses on their development processes (Kanten & Yeşiltaş, 2013). In this context, it can be said that positive psychology contributes to the creating suitable environments to improve the positive aspects of people. According to Luthans and Youssef (2004), positive psychology has two main purposes. The first is that it contributes to the search for meaning in people's lives and makes life productive, and the second is that it helps people to reveal their potential. These two main objectives have attracted the attention of management science researchers; it has influenced many scientific fields such as leadership, human resources management, organisational behaviour and ethics.

Positive psychology has an impact on schools, as they function as social organisations similar to other organisations. Looking at studies in the field of educational administration, it has been observed that positive cases are also discussed in addition to negative cases; however, there is a more prominent emphasis on negative facts. It is claimed that the approaches are more problem-oriented since the research focus on solving problems (Cameron & Spreitzer, 2011). While Aydın et al. (2013) argues that studies in the national literature primarily focus on negative phenomena like stress, conflict, and burnout, Demir (2011) stated that concepts such as flow, awareness, optimism, and resilience gain importance for research.

Different perspectives have emerged on the effect of positive psychology on the organisational field. Luthans (2002) provided the emergence of positive organisational behaviour. His studies took their source from positive psychology. Luthans et al. (2007) stated that positive organisational behaviour includes positive psychological processes which can be developed, managed and measured, and are a source for the emergence of positive leadership approaches. The relationship between authentic leadership, positive psychological capital and moral courage, which benefit from positive psychology, are discussed within the scope of this research. Moral courage is one of the three types of the concept of courage shown among the individual study areas of positive psychology (Seligman & Csikszentmihalyi, 2000; Peterson & Seligman, 2004). Based on the aforementioned explanations, it can be argued that the studies in educational administration mostly focus on negative concepts such as stress, conflict, and burnout; and positive psychology-based studies, which aim to emphasise and improve the positive aspects of people and make human life more meaningful, are insufficient. The

concepts of authentic leadership, positive psychological capital and moral courage, which are rooted in positive psychology, can develop schools and teachers and obtain positive school outputs by emphasising positivity in schools. Thus, created positive school environment contributes to the development of both teachers and the school by revealing positive developmental aspects. In this way, teachers can improve their positive psychological capital and spread them to students and society with exemplary behaviours. A positive school environment also makes students happy. Students who are content at school come to school willingly, and by working harder, they can increase both their own and the school's academic success. Hopefully, this study will provide a different perspective on the science of educational administration and positive psychology, and contribute to the relevant literature, while drawing a different framework for school administrators and providing positive school outcomes.

Upon reviewing the literature on positive psychological capital, it becomes evident that studies (Carmona–Halty et al., 2018; Datu et al., 2016; Luthans et al., 2012; Luthans et al., 2016; Ortega-Maldonado & Salanova, 2018; Siu et al., 2014; You, 2016) focus on uncovering the link between positive psychological capital and academic performance. Furthermore, the stress experienced by teachers and students has caught the attention of researchers, prompting an investigation into its connection with psychological capital (Rodrigues et al., 2017; Gautam & Pradhan, 2018; Kaur & Amin, 2017; Shen et al., 2014). These studies indicate that positive psychological capital is negatively correlated with stress and moderates the relationship between stress and academic achievement. In a study conducted with teachers, it was found that those with higher levels of positive psychological capital exhibited lower ratings of anxiety, depression, and stress (Rodrigues et al., 2017). Additionally, positive psychological capital may be protective against depressive symptoms (Shen et al., 2014).

It can be said that studies examining the relationship between psychological capital and authentic leadership (Aria et al., 2019; Clapp-Smith et al., 2009; Çetin and Tanoba, 2020; Feng, 2016; Öztekin-Bayır and Aydın, 2019; Yollu and Korkmaz, 2021; Walumbwa et al., 2011) are almost nonexistent. This is particularly evident in the field of education. Therefore, the lack of studies that reveal the effects of authentic leadership on teachers' psychological capital is noticeable. In addition, the concept of moral courage, which is one of the three types of courage, has recently emerged in national and international literature. Studies regarding the mediating role of the concept of moral courage include those by Hannah et al., 2011; Pulungan et al., 2021; Saleem et al., 2021.

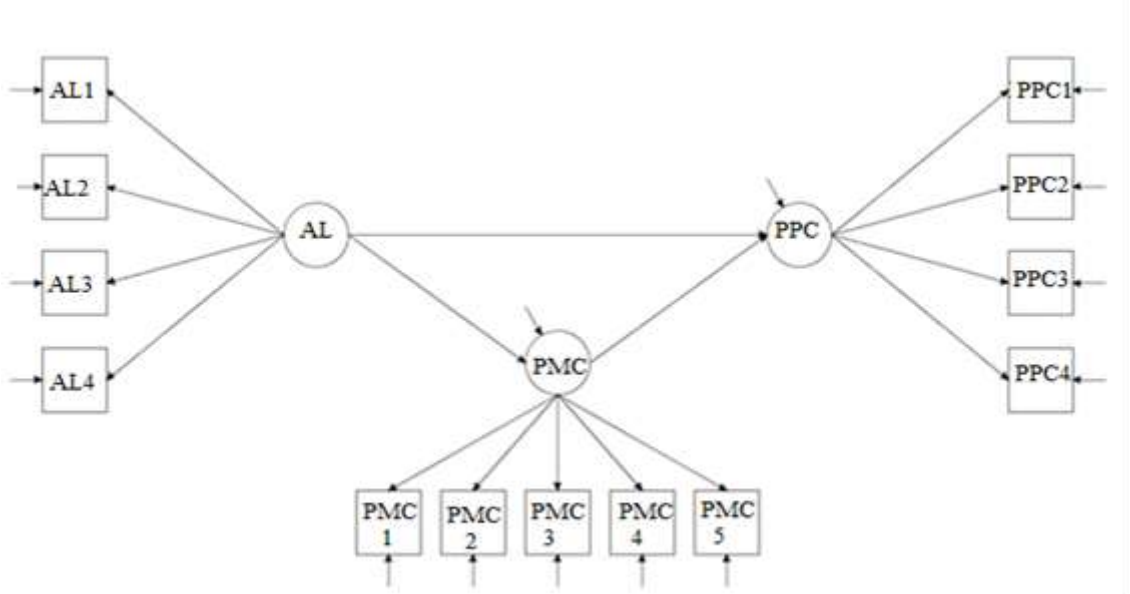
In the study by Pulungan et al. (2021), the relationship between moral courage behavior and knowledge sharing behavior with authentic leadership was examined; Saleem et al. (2021) investigated the relationship between emotional intelligence of civil servants and life satisfaction; Hannah et al. (2011) explored the mediating role of moral courage behavior in the relationship between authentic leadership and followers' ethical and pro-social behaviors. However, the mediating role of moral courage in the relationship between authentic leadership and positive psychological capital has not been extensively examined. The relationship between authentic leadership and positive psychological capital is often examined in terms of how authenticity, sincerity, and honesty in leadership enhance employees' positive psychological capital. However, the mediating role of moral courage in this relationship has not been widely discussed. Moral courage involves individuals demonstrating courage to behave in accordance

with ethical values. This can include making difficult decisions, speaking out against unethical practices, or standing up against injustices. Therefore, moral courage can play an important mediating role in the relationship between authenticity in leadership and employees' positive psychological capital. Moral courage can serve as an example for employees while leaders demonstrate their authenticity and honesty. This can increase employees' sense of trust and strengthen their positive psychological capital. Additionally, employees who demonstrate moral courage may be more willing to resist unethical behaviors and do what is right, which can further enhance positive psychological capital.

Further research into this area and a more detailed examination of the role of moral courage in the relationship between authentic leadership and positive psychological capital could contribute significantly to the leadership and management literature. To establish the relationship between these concepts derived from positive psychology and to contribute to achieving positive outcomes in the school environment, it is hoped that this will fill a noticeable gap in the literature. Therefore, the accuracy of the mediation model presented based on literature has been tested. This model is presented as follows.

Figure 1

Mediating Model



Authentic Leadership and Teacher's Positive Psychological Capital

Ethical and social problems, social pressures and changes put the school principals in a difficult situation. While Feng (2016) discussed that the differences, uncertainties and tensions in schools put school administrators under pressure and difficulties, Fox et al. (2015) stated that school principals were exposed to pressures that have reached an all-time high. In these conditions, failing to reach an agreement between school stakeholders may cause moral and ethical problems. In this context, authentic leadership, which strives to provide for all stakeholders who value moral and ethical issues, is considered necessary, especially in effective leadership. School administrators must be authentic leaders to cope with the instability caused by

conflicting internal and external values, structures and expectations (Walker & Shuangye, 2007). Authentic leadership emphasises teachers' participation in the school, encouraging the occupational development of teachers and learning of students (Gumus et al., 2018). Therefore, researchers argue that the presence of authentic leadership can enhance a school's capacity for facilitating positive change (Frick, 2011). Authentic leadership is a leadership model that is conducive to the development of positive psychological processes and an ethical climate, and it expands self-awareness, moral perspective, objective evaluation of information, and transparency (Walumbwa et al., 2008). Having a sense of Self-awareness involves recognizing and understanding one's own perceptions of oneself, as well as acknowledging both personal strengths and weaknesses. It also involves recognizing how these attributes may affect those around us. One's personal values and moral standards guide their behaviour and actions through self-regulation, known as the internalised moral perspective. Relational transparency pertains to how openly one shares information and to what extent one displays their true thoughts and feelings. Balanced evaluation of information refers to the degree to which a leader considers all available information before deciding on a decision-making process. Therefore, authentic leaders show a high level of consistency between their values and actions and display high ethical and moral standards without compromising their internalised values in the face of demands (Avolio et al., 2004). From this perspective, authentic leadership behaviours of school principals can guide their schools to success toward their goals when faced with uncertainties in schools, individual and cultural differences and the pressures and difficulties they cause. Therefore, it can be argued that it has a critical importance in ensuring the development of schools and in creating a school climate based on moral and ethical principles and values.

Crowded classrooms, reduced resources, increased workload and unfair rewards cause burnout, stress and job dissatisfaction in teachers (Chen et al., 2019). In this process, schools become a more complex structure, and this complexity causes teachers to go through negative experiences such as depression, dropping out, and burnout (Jalongo & Heider, 2006). It can be said that these psychological factors negatively affect teachers and school environment. Therefore, coping with these negative situations and finding approaches that reduce stress and related symptoms is critical. In this context, positive psychological capital, considered an effective structure against stress, negative emotions and burnout, have become important (Feng, 2016). Significant findings show that positive psychological capital is positively associated with various helpful outcomes like job satisfaction, positive health and psychological well-being (Avey et al., 2011). Cheung et al. (2011) found that teachers have more job satisfaction and less burnout when their positive psychological capital is high. Shen et al. (2014) revealed that psychological capital is adversely associated with the depressive symptoms of faculty members. Demir (2018) stated that teachers' positive psychological capital levels were negatively correlated with anxiety, burnout, and stress, revealing that it is positively related to job engagement and satisfaction.

Positive psychological capital is the self-confidence which the person will overcome the difficulties they will encounter to attain their objectives, confidence and belief in their abilities; having the point of view that they will always be successful no matter what the circumstances, being satisfied in the way of reaching the goals and

trying different ways and being able to survive by resisting the difficulties. Positive psychological capital, referring to the individual's positive psychological development, focuses on who the person can be, taking into account the developmental process of who they were in the past (Luthans, et al., 2007b). Positive psychological capital can increase school's academic success by ensuring that teachers are freed from negative attitudes and behaviours and improve their job performance. From this point of view, managers who expect high performance from their employees by creating a positive climate must understand their employees' strengths and inadequacies, positive and negative behaviours, and develop their psychological capital (Keleş, 2011).

Positive psychological capital is shown among the basic elements of authentic leadership consisting of four dimensions (Luthans & Youssef, 2004). Gardner et al. (2005) argued that authentic leaders enable their followers to improve their positive psychological capital by using their own positive psychological states and role model behaviours. Authentic leadership is a leadership model which encourages positive psychological capital and positive personal development (Walumbwa et al., 2008). In this context, it is possible to discuss the existence of a relationship between authentic leadership and positive psychological capital, and the hypothesis expressing this relationship is formed as follows.

H_1: A positive relationship exists between school principals' authentic leadership behaviours and teachers' positive psychological capital.

Authentic Leadership and Teacher's Moral Courage

Moral courage is shown as one of the three types of the concept of courage, which is one of the concepts in the field of positive psychology at the individual level (Seligman & Csikszentmihalyi, 2000). Moral courage is seen as a way out for modern organisations that have become morally complex environments which place significant ethical demands and challenges on their employees (Hannah et al., 2011). In order to fulfil these demands and overcome ethical difficulties, it is proposed that organisational ethical behaviour should be developed, and to achieve this, individuals should have a high level of character, and for a strong character, individuals should have moral courage (Peterson & Seligman, 2004). Morally complex environments can lead to morally distressing situations. These troublesome situations can be a source of conflict of values, which can lead to disagreements among employees. Moral courage is considered significant in dealing with value conflict and moral distress among employees (Sharma, 2018). Moral courage represents a personal attitude to confront ethical issues, challenges and dilemmas and to manage them in a virtuous manner (Sekerka & Yacobian, 2017). The purpose of moral courage is to facilitate and promote the use of moral power in organisational settings. The disappearance of moral values day by day puts organisations in a difficult situation for both employees and managers. Moral courage encourages the use of moral power and enables organizations to overcome ethical issues and difficulties encountered in daily life (Sekerka et al., 2009) Moral courage leads to the existence of a positive organisation by resolving moral issues and forming an ethical environment in organisations.

Individuals with moral courage strive to act in the best interest of others (Sekerka & Bagozzi, 2007); even if they are at risk, they stick to their values and display attitudes and behaviours in line with them (Kidder, 2005). Although there is a

high level of consistency between authentic leaders' values, attitudes, and behaviours, authentic leaders do not compromise their internalised values in the face of demands and have high ethical and moral standards (Avolio et al., 2004). Authentic leaders are committed to their values even if they fail, and they make decisions based on their followers' development and well-being. Authentic leaders adhere to their moral values and encourage their followers to show moral courage by emphasising that they should act in line with their values (Hannah et al., 2005). Based on these explanations, it can be argued that authentic leaders display moral courage. In this context, the hypothesis proposing that authentic leadership and moral courage are interconnected is formed as follows:

H_2: A positive relationship exists between school principals' authentic leadership behaviours and teachers' moral courage behaviours.

Mediating Effect of Moral Courage

Moral courage, as Kidder (2005) states, is the courage to be moral. Moral courage can be defined by five essential qualities: honesty, honour, responsibility, decency and compassion. Demonstrating moral courage is seen as a factor in ensuring and improving organisational ethics. A person who acts with moral courage does not compromise on positive attitudes and behaviours such as honesty; thus, it emphasises the creation of an ethical and positive organisational environment by providing the development of values that contribute to the development of organisational ethics. It can be argued that moral courage behaviour is associated with positive psychological capital and promotes positive psychological capital because moral courage behaviour aims to develop moral and ethical characteristics in individuals and organisations by using moral power. In environments where the concept of morality and ethics develops, there are positive relations, and a sense of mutual trust prevails. The point where positive psychological capital grows is in ethical environments where transparency is dominant and mutual trust is created. Therefore, it can be argued that people with moral courage have high levels of positive psychological capital and that moral courage affects and encourages psychological capital. In this context, the hypothesis regarding the potential mediating role of moral courage in the correlation between authentic leadership and positive psychological capital was formed as follows:

H_3: Teachers' moral courage behaviours have a mediating effect on the relationship between authentic leadership behaviours of school principals and positive psychological capital levels of teachers.

Method

Research Model

This research is a relational survey model that aims to analyse the mediating role of teachers' moral courage behaviours in the relationship between school administrators' authentic leadership behaviours and teachers' positive psychological capital. In survey research, data is generally collected from a large group using response options determined by the researcher. Researchers are often more interested in how opinions and characteristics are distributed among individuals in the sample rather than the underlying reasons for them (Fraenkel & Wallen, 2006). The study's independent variable is the school administrators' authentic leadership behaviours, whereas the mediator variable is the moral courage behaviour of the teachers, and the dependent variable is the positive psychological capital levels of the teachers. Structural Equation Modeling (SEM) and the mediation model, including latent variables and indicators were used to test the theoretical model of the research.

Population and Sample

The population of the research comprises of 8665 teachers and also the sample comprises 474 teachers working in the central districts of Antalya province (Aksu, Döşemealtı, Kepez, Konyaaltı and Muratpaşa) in the 2020-2021 academic year. The fact that the research was conducted during the pandemic when schools were closed has influenced the sampling method. Therefore, convenience sampling, also known as accidental or convenient sampling, was used in the study. This approach is a method that aims to prevent loss of money, labour and time, as well as allows taking samples from close surroundings (Büyüköztürk et al., 2008).

The sample size that can be selected according to the size of the population is given in different sources at the point of what the appropriate sample size should be. Balcı (2015) argues that 384 people can represent the population with 95% confidence in large populations. In this context, it can be said that the data collected from 474 teachers in this study is sufficient. Of these participants, 286 (60.3%) were female and 188 (39.7%) were male. 228 (48.7%) of the participants worked in primary school and 246 (51.9%) worked in secondary school.

Data Collection Instruments

AL Questionnaire

ALQ used in this study which consisted of 4 dimensions and 16 items was developed by Walumbwa et al., (2008). Tabak et al. (2012) adapted the authentic leadership questionnaire into Turkish language. In the reliability analysis Tabak et al. (2012); found the Cronbach Alpha internal consistency coefficients of the dimensions as follows: "relational transparency" 0.81; "self-awareness" 0.89; "balanced processing" 0.78, and "internalised moral perspective" 0.78. In this study, the Cronbach Alpha internal consistency coefficients of the dimensions were found as follows: relational transparency 0.85; self-awareness 0.88; balanced processing 0.77, and internalised moral perspective 0.81. According to the results of confirmatory factor analysis (CFA), when the fit indices were examined in general, it was possible to say that the research

data fitted the model well, so the model-data fit was relatively high (X^2 /sd= 2.86, RMSEA= 0.063, CFI= 0.95, TLI= 0.94, SRMR= 0.04).

PC Scale

The PC scale, which consisted of 24 items and 4 dimensions (optimism, hope, self-efficacy, resilience) and was developed by Luthans et al. (2007), was utiliezed in this study. The PC scale was adapted to Turkish by Çetin and Basım (2012) by conducting validity and reliability analyses with the data obtained from 235 public sector employee managers at different levels. As a result of a series of analyses, Çetin and Basım (2012) revealed that the reliability coefficients of the dimensions of the scale ranged from 0.67 to 0.85. The Cronbach Alpha internal consistency coefficients of the dimensions were found as follows in this research: optimism 0.71, hope 0.84, self-efficacy 0.91, and resilience 0.83. In general, fit indices showed that the research data fitted the model well. Therefore, it was possible to say that the model-data fit was good (X^2 /sd= 2.79, RMSEA= 0.062, CFI= 0.91, TLI= 0.90, SRMR= 0.05).

PMC Scale

The PMC scale was developed by Sekerka et al. (2009). The scale consists of 5 dimensions (moral agency, multiple values, endurance of threat, going beyond compliance, moral goal) and 15 items. The scale was designed to improve ethics education in the US Navy. The scale was adapted to Turkish by the authors of this study. In the process of adapting the scale to Turkish, the 5-stage method proposed by Brislin et al. (1973) was used. After the final version of the scale was revealed, its validity and reliability were tested by applying it to two different samples (n=105, n=474). In the pre-application fit indices generally show that the research data fit the model well. Therefore, it was possible to say that the model-data fit was high (X^2 /sd= 1.19, RMSEA= 0.043, CFI= 0.98, TLI= 0.98, SRMR= 0.04). In this study the Cronbach Alpha internal consistency coefficients of the dimensions were found to be between 0.79 to 0.92. Also, main application fit indices generally showed that the research data fitted the model well (X^2 /sd= 1.93, RMSEA= 0.045, CFI= 0.97, TLI= 0.96, SRMR= 0.03). The Cronbach Alpha internal consistency coefficients of the dimensions were found as follows: moral agency 0.83; multiple values 0.88; endurance of threat 0.92; going beyond compliance 0.86, and moral goal 0.87.

Data Analysis

The data set was first examined before analysing the data collected within the scope of the research. As a result of the examination, it was determined that the information of some participants was missing from the data. After examining whether the missing data formed a pattern or not, it was determined that it did not form a pattern, so data assignment based on the mean was made. To ascertain whether the data conforms to a normal distribution or not, the Kolmogorov-Smirnov test, which is suitable for 29 or more observations, was used and the $p \geq .05$ criterion required for normal distribution was sought (Kalaycı, 2014). It was concluded that the Kolmogorov-Smirnov test was significant ($p \leq .05$) and therefore the data were not normally distributed. As the estimation method, the MLM method, in which the standard errors were estimated more strongly against the data that did not show normal distribution was

used. For other analyses, SPSS 25 package program was used. Table 1 provides the kurtosis and skewness values.

Table 1

Descriptive Istatistics

	AL	**PPC**	**PMC**
Min.	16	23	15
Max.	80	126	105
Mean	62.12	113.37	94.88
Standart deviation	12.07	13.02	10.97
Skewness	-1.05	-2.44	-2.83
Kurtosis	1.62	11.18	14.27

CFA was applied to reveal the scales' construct validity. The following criteria were taken into account while examining the model fit for CFA. RMSEA value < .05 was considered a good fit, and .05 < RMSEA value <.08 was an adequate fit (Browne & Cudeck, 1993). The confidence interval obtained for RMSEA shows in which intervals the true value of this fit index can take place in the population (MacCallum et al., 1996). An SRMR value of less than .05 is an indicator of a good fit, while a value of less than .10 is an indicator of an acceptable fit (Hu & Bentler, 1995; Schermelleh-Engel & Moosbrugger, 2003). CFI and TLI values close to 1 indicate a good fit, over 0.95 suggest a perfect fit, and an acceptable model-data fit between 0.90-0.94 (Sümer, 2000). In addition, CFI values around 0.95 indicate a suitable model fit (Thompson, 2004). $\chi 2/sd$ value less than 2 points is deemed a good fit, while a value between 2-3 points is deemed an acceptable fit (Browne & Cudeck, 1993). In addition, the fact that this ratio is less than 5 indicates an acceptable fit (Sümer, 2000).

The maximum likelihood (ML) method among data estimation methods in structural equation modelling is the most widely used method (Sen, 2020). The most critical assumption in using this method is that the data are continuous and show a normal distribution. An alternative method may be needed if the data is not continuous or does not show a significant normal distribution even though it is continuous (Kline, 2019). SEM-based analyses can be used in data consisting of nonlinear relationships, non-normally distributed data, and variables with categorical and ordinal measurement levels, with appropriate method preference (Bollen & Pearl, 2013). In the continuous data set that does not show normal distribution, ML (if the deviation from normality is very low), MLM, MLR, and Bootstrap methods are used as the estimation method (Gana & Broc, 2019, as cited in Sen, 2020). Although these research data are continuous, they do not show a normal distribution. Therefore, the MLM method, which is suitable for data sets that was not normally distributed, was used as the estimation method.

Ethical Procedures

This study is a product of the doctoral dissertation conducted by the authors. Ethics committee approval was obtained based on the letter from Gazi University Measurement and Evaluation Ethics Committee dated 21.10.2020 and numbered E.113162.

Results

Testing Hypotheses

The correlation between variables was determined using Spearman's Correlation Coefficient, which was used for data that was not normally distributed. The relationship between school administrators' authentic leadership behaviours, teachers' moral courage behaviours and positive psychological capital is given in Table 2.

Table 2

The Relationship Between School Administrators' Authentic Leadership Behaviours, Teachers' Moral Courage Behaviours and Positive Psychological Capital

Variables		1	2	3
1. AL	R	1		
	p			
2. PPC	R	.214**	1	
	p	.000		
3. MC	R	.313**	.594**	1
	p	.000	.000	

***p<0.01*

As seen in Table 2, a low level of positive correlation exists between the authentic leadership behaviours of school principals and the positive psychological capital of teachers (r=.214, p=.00). It is possible to say that this finding supports the first hypothesis of the study. Also, a moderate relationship exists between school principals' authentic leadership behaviours and teachers' moral courage behaviours (r=.313, p=.00). This finding supports the study's second hypothesis. According to these findings, authentic leadership behaviours of school principals are positively related to both positive psychological capital and moral courage behaviours of teachers.

In order to examine the moral courage behaviour of teachers in the relationship between the school principals' authentic leadership behaviours and the teachers' positive psychological capital, a structural equation model was established, and the mediating effect of moral courage behaviour was tested. The model established to examine the effect of teachers' moral courage behaviours on the effect of authentic leadership behaviour on psychological capital. In this model, authentic leadership, moral courage and psychological capital structures were included as latent variables, and their sub-dimensions were considered indicators of each latent variable. Model-fit indices for the established model are given in Table 3.

Table 3

CFAs of Scales, Mediation Model

Fit Indices	CFAs of Scales			Mediation Model	Reference Value(s)
	AL	PPC	PMC		
X^2	280.84	506.714	155.173	123.528	
p value	<.05	<.05	<.05	<.05	
df	98	181	80	62	
X^2 /df	2.87	2.80	1.94	1.99	< 3
CFI	.95	.91	.97	.99	≥ .90
TLI	.94	.90	.96	.99	≥ .90
SRMR	.04	.05	.03	.02	< .10
RMSEA	.063	.062	.045	.046	≤ .08

When the presented the model fit indices in Table 3 are analysed; it is observed that the RMSEA value is 0.046 and the confidence interval for this value is between 0.34 and 0.57. Chi-square goodness-of-fit index value was obtained as 123.528/62=1.99. Since this value was less than 3, it was accepted as an indicator of a good fit. It is seen that both CFI and TLI fit index values are estimated as 0.99. It is seen that the SRMR cut-off value, which is another fit index, is 0.02. In general, the fit indices fit the research data very well with the model, so the model-data fit is relatively high.

Table 4

Testing Hypotheses

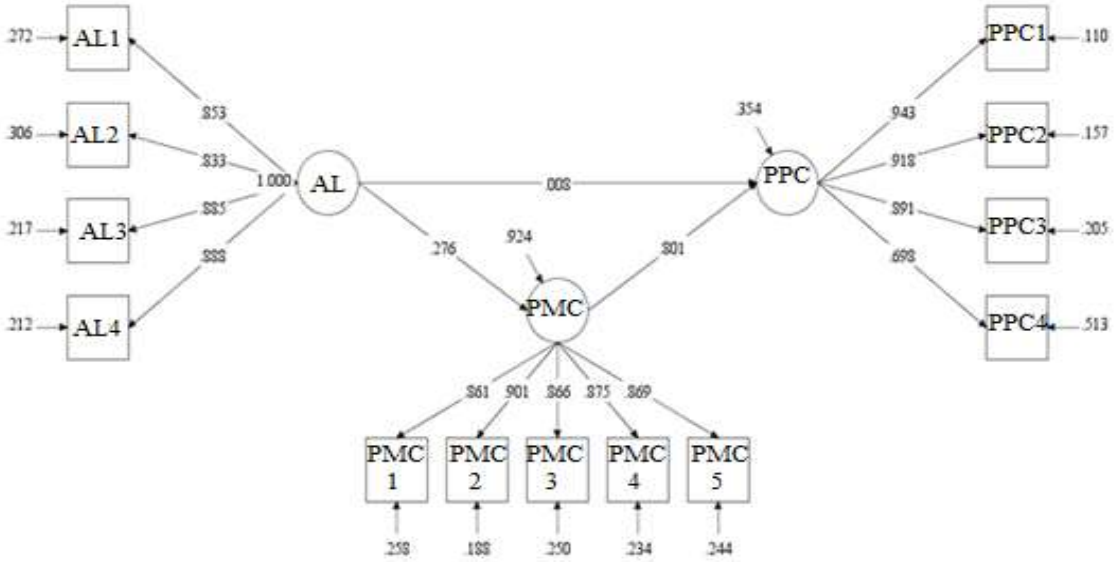
	β	SE	% 95 CI Lower	%95 CI Upper	z	*p*
OL -> PPC	.008	.034	.058	.075	.232	.81
OL -> PMC	.276	.056	.168	.391	4.923	.00
PMC -> PPC	.801	.046	.697	.873	17.241	.00
OL -> PMC -> PPC	.221	.050	.105	.332	4.391	.00

In Table 4 it is seen that authentic leadership behaviour does not have a direct effect on psychological capital (B=0.008, p>0.05). However, the impact of authentic leadership behaviour on teachers' moral courage behaviour was found to be statistically significant (B=.28, p<0.05). In addition, the effect of teachers' moral courage behaviour on psychological capital was found to be statistically significant (B=.80, p<0.05). Accordingly, it is possible to say that authentic leadership directly affect psychological capital, but impacts moral courage behaviour (B=0.22, p<0.05) and thus acts as a mediator. Therefore, our third hypothesis is also supported.

As regards to the traditional approach of Baron and Kenny, the independent variable should directly affect the dependent variable in mediation tests, and mediation tests in which there is no direct effect should be terminated. However, the contemporary approach denies that the independent variable should directly affect the dependent variable and accepts the mediation model as validated if the indirect effect is significant (Fritz & MacKinnon, 2007; MacKinon et al., 2002). In other words, the contemporary approach has suggested that the indirect effect may be significant when the total effect is not statistically significant. As a matter of fact, many articles (Cole et al., 2008; Fillo et al., 2016; Hammond et al., 2012; Maguen et al., 2011; Petrocelli et al., 2016) reporting the mediation effect, although the total effect is not significant, have been published in respected journals of their field.

Figure 2

SEM Result on the Mediating Model



In addition, the variance explained by school administrators' authentic leadership behaviours on teachers' moral courage behaviours is approximately 8%. The variance explained by authentic leadership and moral courage on psychological capital was found to be approximately 65%. Accordingly, it can be concluded that authentic leadership predicts moral courage behaviour at a low level. On the other hand, authentic leadership predicts moral courage behaviour and psychological capital at a high level.

Discussion

Positive psychology is a science that focuses on improving people's positive characteristics, having positive life experiences, and improving their personal well-being through education (Seligman & Csikszentmihalyi, 2000). Positive psychology provides the necessary conditions and processes for the optimal development of individuals, groups, and organisations (Gable & Haidth, 2005). These positive psychology features have attracted different scientists' attention over time. In this process, positive psychology has revealed different perspectives in research that have influenced organisational behaviour, leadership and management science. Recently, studies that benefit from this trend have emerged. Likewise, in this study, concepts that

benefit from positive psychology (authentic leadership, psychological capital, moral courage) were discussed, and an attempt was made to provide a new outlook on positive psychology and educational administration.

The first hypothesis suggests a positive correlation between school principals' the authentic leadership behaviours and teachers' positive psychological capital. The results obtained support this hypothesis. Based on the findings of the study, it has been determined that there is a low positive relationship between school principals' authentic leadership behaviours and teachers' positive psychological capital. When the literature is examined, studies reveal that there is a positive relationship between the authentic leadership behaviours of managers and the psychological capital of employees (Aria et al., 2019; Çetin & Tanoba, 2020; Feng, 2016; Öztekin-Bayır & Aydın, 2019; Yollu & Korkmaz, 2021; Walumbwa, et al., 2011). In their research Çetin and Tanoba (2020) conducted in primary, secondary and high schools; Yollu and Korkmaz (2021) in primary and secondary schools found that there is a moderately positive relationship between school administrators' authentic leadership behaviours and teachers' psychological capital. In both national and international literature, there are studies that back up this particular study.

In the second hypothesis of the study, it is asserted that a positive relationship between school principals' authentic leadership behaviours and teachers' moral courage behaviours. Based on the findings, a positive and middle-level relationship exists between school principals' authentic leadership behaviours and teachers' moral courage behaviours. Thus, it can be argued that the hypothesis is supported. Abney (2016), in their doctoral thesis titled "Authentic Leadership: A Model for Professional Moral Courage", concluded that there is a positive relationship between the participants' perceptions of authentic leadership and their perceptions of moral courage behaviour. In another study (Hannah et al., 2011), a significant positive relationship was found between authentic leadership and the moral courage behaviours of followers. Authentic leadership requires having an internalised moral perspective. This moral perspective provides the power to not compromise their moral values even under pressure. Vrapca (2015) argued that authentic leaders exhibit leadership behaviours in line with their values and beliefs. This perspective predicts the relationship between these two concepts. As a result, it can be said that both the literature and empirical studies support this study.

In the third hypothesis, it is examined that teachers' moral courage behaviours have a mediating effect on the relationship between school principals' authentic leadership behaviours and teachers' positive psychological capital levels. Pulungan et al. (2021) determined the full mediating role of moral courage behaviour in the relationship between authentic leadership and whistleblowing behaviour. Saleem et al. (2021) determined the full mediating role of moral courage behaviour in the relationship between emotional intelligence and life satisfaction of civil servants. In the study of Hannah et al. (2011) at the US military base, moral courage behaviour was found to have a fully mediating role in the relationship between ethical and pro-social behaviours of authentic leadership. It is possible to say that the results of the research support this research result.

Conclusion and Suggestions

This study showed that school principals' AL behaviours have a positive effect on teachers' PPC and MC. In addition, teachers' MC behaviours have a mediating effect on the relationship between school principals' OL behaviours and teachers' PPC. Moreover, model fit indices point to a high level of fit in the model. In this research and previous research results, it is seen that MC behaviour has a fully mediating role in processes that contribute to the formation of a positive organisational environment and individual and organisational performance such as authentic leadership, PPC, pro-social behaviour, emotional intelligence, life satisfaction and ethical behaviours. According to another result of these studies, it is possible to talk about the existence of a positive correlation between MC behaviour and the concepts that support positive processes. It can be argued that MC behaviour has a crucial place in achieving positive outcomes for organisations. On the other hand, it is possible to say that these results support the literature suggesting that MC behaviour derives from positive psychology.

It would be appropriate to make some suggestions to practitioners and researchers in the range of the research results. Research based on positive psychology that emphasises positive situations that do not ignore the negative aspects that support a positive school environment should be increased. The research can be repeated with a larger sample group at different levels and public/private education institutions and by using different methods and techniques. In terms of future research, scale development studies can be conducted to measure teachers' moral courage behaviours. School principals should increase the positive psychological capital of teachers and enable them to use their existing potential at the highest level. If school principals demonstrate authentic leadership behaviors, they can enhance teachers' psychological capital through role modeling. Authentic leaders are those who possess psychological capital themselves by exhibiting optimistic, hopeful, and transparent behaviors, thus fostering psychological resilience. Teachers who follow an authentic school principal will reflect the behaviors they model, thereby enhancing their own psychological capital. In this context, it is crucial to first develop authentic leadership qualities in school principals. To achieve this, leadership training programs for school principals become crucial. These programs aim to enhance principals' authentic leadership qualities, which in turn empower teachers and contribute to the improvement of the school environment.

Acknowledgements

Thanks to the school principals who supported the study and the teachers who volunteered to partake in the study. Thanks to my English teacher friends for language control of the study.

Statement of Responsibility

Both authors contributed to the whole process of the study and the study is responsibility of both authors. All responsibility for the study belongs to the authors.

Conflicts of Interest

No financial support was provided for this research. During the research, the authors did not declare any conflict of interest.

Author Bios:

Sami YOLLU: He graduated from Gazi University, Kastamonu Faculty of Education as a primary school teacher. And then, he graduated from Ankara University, Faculty of Educational Sciences, Department of Educational Administration in 2017. He finished his doctorate in the Department of Educational Administration at Gazi University, Institute of Educational Sciences, in May 2023. He worked in Diyarbakır and Ankara as a teacher and deputy school principal in various schools. He has been in Antalya since 2013 and has been working as a deputy school principal for about nine years. His domains of interest are leadership in education, positive psychology and ethics.

Mehmet KORKMAZ: He finished his undergraduate education at Ankara University, Faculty of Educational Sciences, Department of Educational Administration in 1982. He graduated from Ankara University, Social Sciences Institute, Department of Educational Administration and Planning in 1988. And he finished his doctorate at Gazi University, Social Sciences Institute, Department of Educational Administration Supervision, Planning and Economics. He is still working as a professor at Gazi University Department of Educational Administration. His research areas are Social Sciences and Humanities. He has consulted many theses, and he has published many articles.

References

Abney, A. C. (2016). *Authentic leadership: A model for professional moral courage* [Unpublished doctoral dissertation]. Regent University, London.

Akçay, V. H. (2011). Pozitif psikolojik sermayenin kişisel değerler bakımından iş tatminine etkisi ve bir araştırma [The effect of positive psychological capital on job satisfaction in terms of personal values and a research] [Unpublished doctoral dissertation]. İstanbul Üniversitesi, Sosyal Bilimler Enstitüsü, İstanbul.

Aria, A., Jafari, P., & Behifar, M. (2019). Authentic leadership and teachers' intention to stay: The mediating role of perceived organizational support and psychological capital. *World Journal of Education, 9*(3), 67-81. https://doi.org/10.5430/wje.v9n3p67

Avey, J. B., Reichard, R. J., Luthans, F., & Mhatre, K. H. (2011). Meta-analysis of the impact of positive psychological capital on employee attitudes, behaviours, and performance. *Human Resource Development Quarterly, 22*, 127-152. doi: 10.1002/hrdq.20070

Avolio, B. J., Gardner, W. L., Walumbwa, F. O., Luthans, F., & May, D.R. (2004). Unlocking the mask: A look at the process by which authentic leaders impact follower attitudes and behaviors. *The Leadership Quarterly, 15*, 801–823. https://doi.org/10.1016/j.leaqua.2004.09.003

Aydın, A., Yılmaz, K., & Altınkurt, Y. (2013). Positive psychology in educational administration. *Journal of Human Sciences, 10*(1), 1470-1490.

Balcı, A. (2015). *Sosyal bilimlerde araştırma yöntem, teknik ve ilkeler.* Ankara: Pegem Akademi.

Bollen, K. A., & Pearl, J. (2013). Eight myths about causality and structural equation models. In S. L. Morgan (Ed.), *Handbook of causal analysis for social research* (pp. 301-328). New York: Springer.

Brislin, R. W., Brislin, R. W., Lonner, W. J., & Thorndike, R. M. (1973). *Cross-cultural research methods* (Vol. 11). New York: J. Wiley.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In A. Bollen& J. S. Long (Eds.), *Testing structural equation models* (pp. 136-162). Newbury Park, CA: Sage.

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2008). *Bilimsel araştırma yöntemleri.* Ankara: Pegem Akademi.

Cameron, K. S., & Spreitzer, G. M. (2011). Positive organizational scholarship handbook: Introduction. In K. S. Cameron & G. M. Spreitzer (Eds.), *The Oxford handbook of positive organizational scholarship* (pp. 1-14). New York: Oxford University.

Carmona–Halty, M., Salanova, M., Llorens, S., & Schaufeli, W. B. (2018). How psychological capital mediates between study–related positive emotions and academic performance. *Journal of Happiness Studies*, 1–13. https://doi.org/10.1007/s10902-018-9963-5

Chen, X., Zeng, G., Chang, E. C., & Cheung, H. Y. (2019). What are the potential predictors of psychological capital for Chinese primary school teachers? *In Frontiers in Education, 4*, 1-8. https://doi.org/10.3389/feduc.2019.00050

Cheung, F., Tang, C. S. K., & Tang, S. (2011). Psychological capital as a moderator between emotional labor, burnout, and job satisfaction among school teachers in China. *International Journal of Stress Management, 18*(4), 348. https://psycnet.apa.org/doi/10.1037/a0025787

Clapp-Smith, R., Vogelgesang, G. R., & Avey, J. B. (2009). Authentic leadership and positive psychological capital: the mediating role of trust at the group level of analysis. *Journal of Leadership & Organizational Studies, 15*(3), 227-240. https://doi.org/10.1177/1548051808326596

Cole, M. S., Walter, F., & Bruch, H. (2008). Affective mechanisms linking dysfunctional behavior to performance in work teams: A moderated mediation study. *Journal of Applied Psychology, 93*(5), 945–958. https://doi.org/10.1037/0021-9010.93.5.945

Çetin, F., & Basım, H. N. (2012). Örgütsel psikolojik sermaye: Bir ölçek uyarlama çalışması [Organizational psychological capital: A scale adaptation study]. *Amme İdaresi Dergisi,* 45(1), 121-137.

Çetin, M., & Tanoba, T. (2020). Okullarda otantik liderlik ve psikolojik sermaye ilişkisi [The relationship between authentic leadership and psychological capital in schools]. *Eğitim Yönetimi ve Politikaları Dergisi, 1*(2), 8-19.

Datu, J. A. D., Valdez, J. P. M., & King, R. B. (2016). The successful life of gritty students: Grit leads to optimal educational and well-being outcomes in a collectivist context. In King, R., Bernardo, A. (Eds.), *The psychology of Asian learners: A festschrift in honor of David Watkins* (pp. 503-516). Springer.

Demir, K. (2011). Pozitif örgüt araştırmaları [Positive organization research]. *Eğitim Bilimleri Araştırmaları Dergisi, 1*(2), 1-8.

Demir, S. (2018). The relationship between psychological capital and stress, anxiety, burnout, job satisfaction, and job involvement. *Eurasian Journal of Educational Research, 75*, 137-153.

Feng, F. I. (2016). School principals' authentic leadership and teachers' psychological capital: Teachers' perspectives. *International Education Studies, 9*(10), 245-255. http://dx.doi.org/10.5539/ies.v9n10p245

Fillo, J., Alfano, C. A., Paulus, D. J., Smits, J. A., Davis, M. L., Rosenfield, D., & Zvolensky, M. J. (2016). Emotion dysregulation explains relations between sleep disturbance and smoking quit-related cognition and behavior. *Addictive Behaviors, 57*, 6-12. https://doi.org/10.1016/j.addbeh.2016.01.013

Fox, J., Gong, T., & Attoh, P. (2015). The impact of principal as authentic leader on teacher trust in the K-12 educational context. *Journal of Leadership Studies, 8*(4), 6-18. https://doi.org/10.1002/jls.21341

Fraenkel, J.R., & Wallen, N.E. (2006). *How to design and evaluate research in education.* New York: McGaw-Hill International Edition.

Frick, W.C. (2011) Practicing a professional ethic: Leading for students best interest. *American Journal of Education, 117*(4), 527-562. https://doi.org/10.1086/660757

Fritz, M. S., & MacKinnon, D. P. (2007). Required sample size to detect the mediated effect. *Psychological Science, 18*(3), 233-239. https://doi.org/10.1111/j.1467-9280.2007.01882.x

Gable, S. L., & Haidt, J. (2005). What (and why) is positive psychology? *Review of General Psychology, 9*(2), 103-110. https://doi.org/10.1037/1089-2680.9.2.103

Gana, K., & Broc, G. (2019). *Structural equation modeling with lavaan.* Hoboken, Nj, USA:Wley-ISTE.

Gardner, W. L., Avolio, B. J., Luthans, F., May, D. R., & Walumbwa, F. (2005). Can you see the real me?: A self-based model of authentic leader and follower development. *The Leadership Quarterly, 16*(3), 343-372. https://doi.org/10.1016/j.leaqua.2005.03.003.

Gautam, P., & Pradhan, M. (2018). Psychological capital as moderator of stress and achievement. *Indian Journal of Positive Psychology,* 9(1), 22–28. https://doi.org/http://dx.doi.org/10.15614/ijpp.v9i01.n73.

Gumus, S., Bellibas, M. S., Esen, M., & Gumus, E. (2018). A systematic review of studies on leadership models in educational research from 1980 to 2014. *Educational Management Administration & Leadership, 46*(1), 25–48. https://doi.org/10.1177/1741143216659296.

Hammond, S. I., Müller, U., Carpendale, J. I. M., Bibok, M. B., & Liebermann-Finestone, D. P. (2012). The effects of parental scaffolding on preschoolers' executive function. *Developmental Psychology, 48*(1), 271–281. https://doi.org/10.1037/a0025519.

Hannah, S., Avolio, B., & Walumbwa, F. (2011). Relationships between authentic leadership, moral courage, and ethical and pro-social behaviors. *Business Ethics Quarterly, 21*(4), 555–578. https://doi.org/10.5840/beq201121436.

Hannah, S. T., Lester, P. B., & Vogelgesang, G. (2005). Moral leadership: Explicating the moral component of authentic leadership. W. L. Gardner, B. J. Avolio and F. O. Walumbwa (Ed.) *Authentic leadership and practice: Origins, effects, and development.* Amsterdam: Elsevier.

Hu, L., & Bentler, P. (1995). Evaluating model fit. R. H. Hoyle (Ed.), *Structural equation modeling. Concepts, issues, and applications* (pp. 76−99). London: Sage.

Jalongo, M. R., & Heider, K. (2006). Editorial teacher attrition: An issue of national concern. *Early Childhood Education Journal, 33*(6), 379-380.

Kalaycı, Ş. (2014). *SPSS uygulamalı çok değişkenli istatistik teknikleri* (6. Baskı). Ankara: Asil.

Kanten, P., & Yeşiltaş, M. (2013). Pozitif örgütsel davranışlar üzerine kavramsal bir inceleme [A conceptual study on positive organizational behaviors]. *Süleyman Demirel Üniversitesi Vizyoner Dergisi, 4*(8), 83-106.

Kaur, J., & Amin, S. (2017). Psychological capital and stress among school students. *Indian Journal of Positive Psychology*, *8*(4), 495–499.

Keleş, H. N. (2011). Pozitif psikolojik sermaye: Tanımı, bileşenleri ve örgüt yönetimine etkileri. *Organizasyon ve Yönetim Bilimleri Dergisi, 3*(2), 343-350.

Kidder, R. M. (2005). *Moral courage*. New York: William Morrow.

Kline, R. B. (2019). *Yapısal eşitlik modellemesinin ilkeleri ve uygulaması* (Çev. Ed.: Sedat Sen). Ankara: Nobel Akademik Yayıncılık.

Luthans, F. (2002). The need for and meaning of positive organizational behavior. Journal of Organizational Behavior: The International Journal of Industrial, *Occupational and Organizational Psychology and Behavior, 23*(6), 695-706. https://doi.org/10.1002/job.165

Luthans, F., & Yousseff, C. M. (2004). Human, social and now positive psychological capital management: Investing in people for competitive advantage. *Organizational Dynamics, 33*(2), 143-160. http://dx.doi.org/10.1016/j.orgdyn.2004.01.003

Luthans, F., Youssef, C. M., & Avolio, B. J. (2007). Psychological capital: Investing and developing positive organizational behavior. *Positive Organizational Behavior, 1*(2), 9-24.

Luthans, F., Youssef, C. M., & Avolio, B. J. (2007b). *Psychological capital: Developing the human competitive edge.* New York: Oxford University.

Luthans, B. C., Luthans, K. W., & Jensen, S. M. (2012). The impact of business school students' psychological capital on academic performance. *Journal of Education for Business, 87*(5), 253–259. https://doi.org/10.1080/08832323.2011.609844

Luthans, K.W., Luthans, B.C. and Palmer, N.F. (2016). A positive approach to management education: The relationship between academic PsyCap and student engagement. *Journal of Management Development, 35*, 9, 1098-1118. https://doi.org/10.1108/JMD-06-2015-0091

MacCallum, R. C., Browne, M. W., and Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods1*, 130−149. https://psycnet.apa.org/doi/10.1037/1082-989X.1.2.130

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods, 7*(1), 83–104. https://doi.org/10.1037/1082-989X.7.1.83

Maguen S., Luxton D.D., Skopp N.A., Gahm G.A., Reger M.A., Metzler T.J., Marmar C.R. (2011). Killing in combat, mental health symptoms, and suicidal ideation in Iraq war veterans. *Journal of Anxiety Disorders, 25*(4), 563-567.

Ortega-Maldonado, A., & Salanova, M. (2018). Psychological capital and performance among undergraduate students: the role of meaning-focused coping and satisfaction. *Teaching in Higher Education, 23*(3), 390-402. https://doi.org/10.1080/13562517.2017.1391199

Öztekin-Bayır, Ö. & Aydın, A. (2019). Otantik liderliğin psikolojik sermaye, işe kapılma ve okul başarısıyla ilişkisi [The relationship of authentic leadership with psychological capital, employment and school success]. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 19*(4), 1232-1254. https://doi.org/10.17240/aibuefd.2019..-631377.

Peterson, C., & Seligman, M. E. P. (2004). Character strengths and virtues: A handbook and classification. New York: Oxford University.

Petrocelli, J. V., Rubin, A. L., & Stevens, R. L. (2016). The sin of prediction: When mentally simulated alternatives compete with reality. *Personality and Social Psychology Bulletin, 42*(12), 1635-1652. https://doi.org/10.1177/0146167216669122

Pulungan, A. H., Sari, K. J. A. T., Maharsi, S., & Hasudungan, A. (2021). Authentic leadership and whistleblowing: The mediating roles of trust and moral courage. *Jurnal Kajian Akuntansi, 5*(2), 265-289. https://dx.doi.org/10.33603/jka.v5i2.5424.

Rodrigues, R. I., Carochinho, B. J.-A., & Rendeiro, O. M. M. (2017). The impact of positive psychological capital on the psychological distress of primary and secondary education teachers. Psique. *Journal of Research Centre for Psychology of the Universidade Autonoma de Lisboa, 12*, 40–56.

Saleem, S., Khalid, A., & Ashraf, R. (2021). Emotional intelligence and life-satisfaction: mediating role of moral courage in government employees of Pakistan. *Journal of Research & Reviews in Social Sciences Pakistan, 4*(1), 1157-1168.

Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online, 8*(2), 23-74.

Sekerka, L., & Bagozzi, R. (2007). Moral courage in the workplace: moving to and from the desire and decision to act. *Business Ethics: A European Review*, 16(2), 132-149. https://doi.org/10.1111/j.1467-8608.2007.00484.x.

Sekerka, L., Bagozzi, R., & Charnigo, R. (2009). Facing ethical challenges in the workplace. *Journal of Business Ethics, 89*, 565-579. https://doi.org/10.1007/s10551-008-0017-5.

Sekerka, L., & Yacobian, M. (2017). Understanding and addressing Islamophobia in organizational settings. Leading with moral courage. *International Journal of Public Leadership, 13*(3), 134-150. https://doi.org/10.1108/IJPL-10-2016-0040

Seligman, M., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist, 55*(1), 5-14. https://doi.org/10.1037/0003-066X.55.1.5.

Sen, S. (2020). *Mplus ile yapısal eşitlik modellemesi uygulamaları.* Ankara: Nobel.

Sharma, E. (2018). Professional moral courage to combat ethical challenges in the workplace. Int J Dev Conflict.

Shen, X., Yang, Y. L., Wang, Y., Liu, L., Wang, S., & Wang, L. (2014). The association between occupational stress and depressive symptoms and the mediating role of psychological capital among Chinese university teachers: a cross-sectional study. *BMC psychiatry, 14*(1), 1-8.

Siu, O. L., Bakker, A. B., & Jiang, X. (2014). Psychological capital among university students: Relationships with study engagement and intrinsic motivation. *Journal of Happiness Studies, 15*, 979-994. https://doi.org/10.1007/s10902-013-9459-2.

Sümer, N. (2000). Yapisal eşitlik modelleri: Temel kavramlar ve örnek uygulamalar [Structural equation modeling: Basic concepts and applications]. *Türk Psikoloji Yazilari, 3*(6), 49–74.

Tabak, A., Polat, M., Coşar, S., & Türköz, T. (2012). Otantik liderlik ölçeği: güvenirlik ve geçerlik çalışması. *Endüstri İlişkileri ve İnsan Kaynakları Dergisi, 14*(4), 89-106. http://dx.doi.org/10.4026/1303-2860.2012.0212.x.

Thompson, B. (2004). Exploratory and confirmatory factor analysis: Understanding concepts and applications. *American Psychological Association.*

Walker, A., & Shuangye, C. (2007). Leader authenticity in intercultural school contexts. *Educational Management Administration and Leadership, 35*(2), 185-204. https://doi.org/10.1177/1741143207075388.

Walumbwa, F., Avolio, B., Gardner, W., Wernsing, T., & Peterson, S. (2008). Authentic leadership: Development and validation of a theory-based measure. *Journal of Management, 34*, 89–126. https://doi.org/10.1177/0149206307308913.

Walumbwa, F.O., Luthans, F., Avey, J.B., & Oke, A. (2011). Retracted: Authentically leading groups: The mediating role of collective psychological capital and trust. *Journal of Organizational Behavior, 32*, 4-24. https://doi.org/10.1002/job.653.

Yollu, S., & Korkmaz, M. (2021). Öğretmen görüşlerine göre okul müdürlerinin otantik liderlik davranışları ile öğretmenlerin pozitif psikolojik sermayeleri arasındaki ilişki [The relationship between school principals' authentic leadership behaviors and teachers' positive psychological capital according to teachers' opinions]. *Cappadocia Journal of History and Social Sciences, 17*, 186-208. http://dx.doi.org/10.29228/cahij.52211.

You, J. W. (2016). The relationship among college students' psychological capital, learning empowerment, and engagement. *Learning and Individual Differences, 49*, 17–24. https://doi.org/10.1016/j.lindif.2016.05.001.

Journal of Theoretical Educational Science, 17(3), 719-737, July 2024
Kuramsal Eğitimbilim Dergisi, 17(3), 719-737, Temmuz 2024
[Online]: http://dergipark.org.tr/akukeg
DOI number: http://doi.org/10.30831/akukeg.1424778

Perceived Social Development Scale for Physical Education Lessons (PSDSPEL) - Parent Version

Beden Eğitimi ve Spor Dersine İlişkin Alglıanan Sosyal Gelişim Ölçeği (BESDASG-Ö)-Veli Versiyonu

Yasin KARACA * **Bijen FİLİZ** **

Received: 24 January 2024 **Research Article** **Accepted:** 06 June 2024

ABSTRACT: In this study, a valid and reliable scale was developed to measure parents' perceptions of their children's social development in physical education classes. In the first part of the research, the relevant literature reviewed and student-parent interviews were held. As a result of the data obtained from the interviews, a 30-item draft scale was created. The draft scale was applied to 30 parents of students, and as a result of the feedback received, 5 items were removed from the pool. The remaining draft scale items were submitted to expert opinion and the number of items was reduced to 22. The 22-item scale was applied to 240 volunteer parents for Exploratory Factor Analysis (EFA) and to 216 different volunteer parents for Confirmatory Factor Analysis (CFA). As a result of the analyses, the final scale consisting of 15 items and four sub-dimensions was obtained. The Cronbach's Alpha values of the sub-dimensions were found to be between .74-.79. In the final part, the 15-item scale was applied to 540 volunteer parents. Accordingly, while it was observed that parents' PSDSPEL scores were higher in the sub-dimension of showing positive behavior, it was determined that male parents' perception levels were higher than female parents. As a result of the study, it was found that the validity, reliability and internal consistency coefficients of the scale were at acceptable levels

Keywords: Physical education and sports, showing responsibility, cooperating, showing positive behavior, scale development.

ÖZ: Bu çalışmada, ebeveynlerin beden eğitimi derslerinde çocuklarının sosyal gelişimine ilişkin algılarını ölçebilecek geçerli ve güvenilir bir ölçek geliştirilmiştir. Araştırma doğrultusunda ilk aşamada ilgili literatür taranmış, öğrenci-veli görüşmeleri yapılmıştır. Görüşmelerden elde edilen veriler sonucunda 30 maddelik taslak ölçek oluşturulmuştur. Oluşturulan taslak ölçek 30 öğrenci velisine uygulanmış ve alınan geri bildirimler sonucunda beş madde havuzdan çıkarılmıştır. Kalan taslak ölçek maddeleri uzman görüşüne sunulmuş ve madde sayısı 22'ye düşürülmüştür. 22 maddelik ölçek, Açımlayıcı Faktör Analizi (AFA) için 240 gönüllü ebeveyne, Doğrulayıcı Faktör Analizi (DFA) için 216 farklı gönüllü ebeveyne uygulanmıştır. Yapılan analizler sonucunda 15 maddeden ve dört alt boyuttan oluşan nihai ölçek elde edilmiştir. Alt boyutların Cronbach's Alpha değerlerinin .74- .79 arasında olduğu tespit edilmiştir. Son aşamada, 15 maddelik ölçek 540 gönüllü ebeveyne uygulanmıştır. Buna göre, olumlu davranış gösterme alt boyutunda ebeveynlerin BESDASG-Ö puanlarının yüksek olduğu görülürken, erkek ebeveynlerin algı düzeylerinin kadınlardan daha yüksek olduğu belirlenmiştir. Araştırma sonucunda, ölçeğin geçerlilik, güvenirlik ve iç tutarlılık katsayılarının kabul edilebilir seviyelerde olduğu görülmüştür.

Anahtar kelimeler: Beden eğitimi ve spor, sorumluluk gösterme, iş birliği yapma, olumlu davranış gösterme, ölçek geliştirme.

* *Corresponding Author*: Assoc. Prof. Dr., Osmaniye Korkut Ata University, Osmaniye, Türkiye, yasinkaraca99@gmail.com, https://orcid.org/0000-0001-6024-7679
** Assoc. Prof. Dr., Afyon Kocatepe University, Afyonkarahisar, Türkiye, bijenfiliz@gmail.com, https://orcid.org/0000-0001-5863-3861

Citation Information
Karaca, Y., & Filiz, B. (2024). Perceived Social Development Scale for Physical Education Lessons (PSDSPEL) - parent version. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 17*(3), 719-737.

ISSN: 1308-1659

People's being able to fulfil the roles that society expects from them as social beings and take their rightful places in the community is possible only through both satisfying their psychological needs and completing their social developments in a healthy way. Social development is a process that starts from the birth of a person and continues until his/her death. Also, social development is one of the essential processes of childhood, as in other area of development. In order for children to adapt to and socialize with the society and environment they live in, they need to gain social skills such as interacting with peers as well as other people in a healthy way, expressing emotions, controlling social reactions, empathizing, establishing close relationships with others, displaying a positive image, cooperating and sharing (Arslan & Uyanık, 2018). Social development plays an essential role in a child's acquisition of these values.

Social development is defined as learning actions that can be accepted by the society in which a person lives (Fazlıoğlu, 2009). The first indicators of a child's socialization process are beginning to perceive the social values in the family, internalizing these values and transforming them into actions. Social experiences and values gained during childhood form the basis for social development in the future. People who have completed their social developments can establish positive and constructive relationships with other people around them, solve their problems by social norms, establish a balance between their own needs and society's expectations, help their relatives and environment, and express their feelings appropriately (Baran, 2011). On the other hand, lack of social development can lead to many problems for children. For example, as a result of incomplete social development, children might be rejected by their peers or their academic success might decline. Children who do not complete their social developments adequately might experience more social problems in later stages of life than their peers (Baran, 2011). For these reasons, it is essential to focus on the factors that affect a child's social development.

Although many factors play a role in a child's social development, the most influential and determining factors are family, school and environment. Öztürk (1998) states that a child with his/her birth establish the first communication and social interaction with his/her family. Öztürk (1998) also states that children learn every act they see in the family through imitation. They shape their interest in speech, painting, music, and sports as well as eating habits, sleeping patterns, reading habits according to the actions they observe in their family. On the other hand Özçelik (2007) states that the family in childhood and the school and the environment in adolescence are determinants of social development. Başaran (1984) states that individuals need to train themselves in terms of knowledge, skills, manners and mentality to adapt themselves to their social environments and survive in these environments. He also states that individuals could acquire these abilities through education, which are possible thanks to schools.

Education is an essential tool that reveals individuals' hidden strengths and abilities and helps them improve those in the best way possible. In education, individuals should be approached as a whole: physically, mentally, emotionally, and socially because success in education can be achieved by combining mental education with physical education (Öncü & Güven, 2011). For this reason, physical education and sports are among the courses that are considered essential and prioritized in educational curriculums worldwide. In addition to this, educators emphasize the social aspects of physical education and sports. They also accept a higher participation of the population

in regular sports as an indicator of a higher civilization (Öncü & Güven 2011; Varış, 1990). From this point of view, it can be stated that physical education and sports are essential tools in raising individuals who can develop themselves physically and mentally. They can have healthy and strong personalities. They can be constructive, creative, productive, gentlemanly, and discreet (Ersoy et al., 2006). Thanks to physical education and sports which play important roles in the realization of sports activities at schools, it is ensured that children and young people gain values that contribute to social development such as solidarity, cooperation, responsibility, sharing, justice, tolerance, and helpfulness (Kayışlıoğlu et al., 2015). While children socialize through sports, they also gain the habit of learning better and respecting authority by interacting more with their teachers and coaches (Firek et al., 2020). This situation coincides with moral principles and Kohlberg's theory of social development, because children develop the ability to understand social cues and comply with laws and authority through sports (Ma, 2013). Physical education teachers are important role models for children, and children often imitate the behavior of these important figures. The concept of imitating behavior is supported by social learning theory, which suggests that new behaviors are acquired by observing and imitating others (Li & Shao, 2022). The theory of positive youth development, which proposes that the child is prone to healthy environmental development during a period when he/she becomes more interested in his/her own ecology, has been examined in the context of sports. The results obtained revealed that sports positively affected children in terms of their sense of confidence, family relationships, academic success, social competence and honesty (Linver et al., 2009). When look at the issue from the perspective of social development, there is no doubt that the basic element of social development is family. The important point here is the perspective of families and evaluation of sports activities because it teaches a child custom, traditions, and behavioural patterns effectively (Erkal et al., 1998).

Every sociological theory about sports provides a framework to help understand the importance of sports. For example, according to Critical theory, sport affects social relationships in various ways. Coakley (2003) through Critical theory, stated that the family is effective in the child's participation in sports activities. According to this theory, the family's ideals influence their children's participation in sports. Families can direct, limit or support their children's participation in sports, taking into account their general social and cultural situation. Strandbu et al. (2019) puts forward a hypothesis on the role of the family in sports participation, suggesting that there is a strong relationship between the family's sports culture and children's participation in sports. Accordingly, the basic role of the family in the socialization of the individual is; It is to convey the idea that sports are a natural part of life to children by emphasizing habits and lifestyles. Strandbu et al. (2019) was inspired by Bourdieu's (1984, 1996) theoretical framework on the impact of the concept of 'family' on socialization and the views of other sports researchers when creating this hypothesis. (Coakley, 2006; Dagkas & Burrows, 2016).

Güven and Öncü (2006) state that children's participation in sports activities and families' attitude towards physical education and sports are determinants for their children's participation in physical education and sports. Moreover, families who are conscious of the contributions that physical education and sports make to social development have a positive attitude and they induce their children to such activities. In

contrast, some parents have stated that they disapprove of sports activities because their children's academic success might decrease. Öztürk (1998) states that families' sympathy and involvement in sports play an essential role in their children's participation in sports. Uslu (2005) states that families should motivate their children to various social activities, and that sports activities are among the main activities which ensure children's multi-directional developments. Karakuş (2005) states that families have an active role in their children's participation in physical education and extracurricular sports activities, as well as guiding them to the areas where their children are talented. Seghers et al. (2003) emphasize the importance of school and family collaboration in guiding children and young people to physical education. They state that the school and families should make an effort to increase the participation of children in physical education and sports activities and encourage them in this regard. It is seen that sports research in the literature deals with the family as a whole. It is rare for sport-related research to focus solely on father or solely mother-child interactions and their impact on sport and health relationships (Coakley, 2011; Knoester & Fields 2019; Knoester & Randolph, 2019; Messner & Musto, 2014). This is surprising, considering that, for example, sports activities play an important role in the father's relationship with his children (Coakley, 2006). On the other hand, Knoester and Field (2019) they state that most mothers participate in sports activities with their children once a week or more often. Knoester and Field (2019) also noted that mother-child interactions in sports and outdoor activities were positively associated with mothers' reports of health and relationship closeness. These studies reveal that it is essential to learn parents' social development perceptions regarding physical education lessons.

When the literature on the subject matter is examined, considering the scales globally, it is noticed that the individual and social responsibility scale (Conrad & Hedin, 1982) and the personal and social responsibility scale (Li et al., 2008) are used for determining the individual and social behavioural development of children and young people In the national platform, the social responsibility scale (Önal, 2005), responsibility and behaviour scale (Özen, 2013), personal and social responsibility scale (Filiz & Demirhan, 2015) and personal and social responsibility behaviours scale (Filiz & Demirhan, 2018) are noticed. Again, it is observed that in the international platforms where parental attitudes towards physical education and sports activities are evaluated, physical education activities attitude scale (Mowatt, DePauw & Hulac, 1988), attitudes of parents and children towards physical education lesson scale (Tannehill, Romar, & O'Sullivan, 1994) and scale for evaluating parental attitudes regarding the participation of school-age children in sports and physical activities are applied to evaluate the attitudes of parents towards physical education and sports activities (Latorre, 2006). However, at the perceived social development for physical education lessons in Turkey regarding family attitudes, only the scale of the parent's opinions on physical education classes' effects to socialize which is intended for elementary school students' parents is used (Öncü & Güven, 2011; Selçuk, 2010).

It is useful to include parents in the process to understand the contributions of students' physical education lessons to their social development. Therefore, it is thought that there is a need for more measurement tools in this regard. It is considered important for parents to know and internalize the benefits that physical education lessons can provide their children's social development with so that they can guide their children to

physical activity. Hence, it is thought that it would be useful to develop a measurement tool to evaluate parents' social development perceptions regarding physical education lessons. In this context, this study aims at developing a valid and reliable measurement tool that can reveal parents' perceptions of social development about physical education lessons and examine parents' perceptions of social development and social development perceptions in terms of gender.

Method

Study Group

The research group was selected according to the purposeful sampling method (Büyüköztürk, 2019) amongst the parents of the students living in the province of Malatya, Turkey and whose children were attending grades 5, 6, 7, and 8. In the first part of the study, 240 student parents were included for exploratory factor analysis and 216 different student parents were included for confirmatory factor analysis. A total number of 250 parents participating in the study were females (54.8%), 206 of them (45.1%) were males. In the second part in the study, there were 540 parents. In this group, 224 of the parents were females (49.8%), and 226 of them (50.2%) were males.

Scale Development Process

At this stage, the primary purpose was to create items to determine the effects of physical education lessons on students' social development. First of all, 30 voluntary parents of the students attending 5th, 6th, 7th, and 8th grades were interviewed and the parents' opinions were recorded about the contribution of physical education lessons to the social development of their children. Then social responsibility programs such as the personal and social responsibility model used in physical education and sports education, the sports education model, the collaborative learning model, the peer teaching model, and the social-emotional learning model were examined (Collaborative for Academic, Social, and Emotional Learning [CASEL], 2013; Cohen 1994; Hellison, 2014; Metzler, 2011; Siedentop, 1994). With the information achieved as a result of the literature review and parent interviews, 45 items were formed, including the effects of physical education lessons on students' social development. For testing the comprehensibility of the items' language; the items were applied to the 30 parents interviewed. According to the parents' feedback, five items were removed from the pool, and a 25-item scale form was created. In the following process, 25 items were examined by three faculty members who were experts in the field of sports pedagogy. The experts stated that three items did not measure the desired behaviors and suggested that these items be removed from the scale, and a final 22-item form was created. As a result, for determining the effects of physical education lessons on the social development of students, a five-point Likert-type scale was prepared as "Strongly Disagree (1), Disagree (2), Undecided (3), Agree (4), and Strongly Agree (5)".

Data Analysis

SPSS 20.0 package program and LISREL 8.80 were used in the analysis of the data. In the first part of the study, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were performed to construct the scale's construct validity (Büyüköztürk, 2019). In order to provide evidence for item validity, the correlations of

the items in the sub-dimensions of the scale with each other were examined. Cronbach Alpha coefficiency was calculated for the internal consistency reliability of the scale. Pearson correlation analysis was performed to test the linear relationship between four sub-dimensions. In the second part, mean and standard deviation analysis were used to determine the social development perception levels of the parents regarding physical education lessons, and the MANOVA analysis was used to determine whether there was a difference in the scores of the parents from the PSDSPEL according to the gender variable. This analysis was preferred since the dependent variables are moderately correlated with each other.

Ethical Procedures

Ethics committee approval was obtained for the research from Afyon Kocatepe University, Social and Human Sciences Scientific Research and Publication Ethics Committee (26.05.2021-23677).

Results

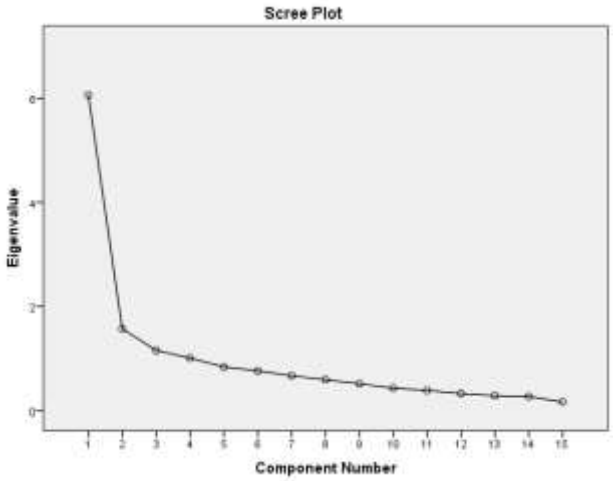
Development of the Scale

Exploratory Factor Analysis (EFA)

For EFA, data were collected from 240 parents of the students. Reliability analysis was conducted for 22 items before EFA. As a result of the analysis, three items with corrected item correlation values below .40 were removed from the scale (16, 19, 22), and the procedures were proceeded with 19 items. Bartlett test was found to be meaningful as a result of principal components analysis before rotation ($\chi 2 = 2016.364$; sd = 171; $p < .01$). The Kaiser Mayer Olkin (KMO) value, which was used for determining the suitability of the sample size for factoring, was determined as 79. Before transforming for factor analysis, five sub-dimensions with an eigenvalue greater than 1.00 achieved. These sub-dimensions explained 63.496% of the variance. For factor analysis, principal component analysis and Varimax vertical rotation technique were used. In the analysis, the cut-off point was accepted as .40 (Büyüköztürk, 2019), and four items were removed from the scale (17, 18, 20, 21), and 15 significant items were obtained. When the analysis was repeated, four sub-dimensions with eigenvalues greater than 1.00 were determined. These four sub-dimensions explained 65.277% of the total variance. The KMO value was found to be .83, and the significance level of the Bartlett test was found to be 0.000 ($\chi 2 = 1632.885$; sd = 105; $p < .01$). The number of factors in the scale is shown in Figure 1.

Figure 1

Exploratory Factor Analysis Scatter Plot



While the scatter plot is examined, it is seen that the items subsequent to the fourth item have values very close to each other. In this respect, the scale is considered as four sub-dimensioned. Table 1 includes factor load values of items and item test correlation values.

Table 1

Factor Load Values and Item Total Correlation (R) Values of the PSDSPEL

				Varimax components factor load values				
Sub-dimensions	**Item number**	**New item number**	**Factor load value**	**1**	**2**	**3**	**4**	**R**
Showing responsibility	7	1	.73	.81				.61
	8	2	.70	.80				.57
	6	3	.68	.75				.68
Cooperating	10	4	.68		.81			.47
	12	5	.53		.68			.43
	9	6	.61		.55			.61
	11	7	.46		.49			.59
Showing positive behavior	15	8	.83			.86		.89
	13	9	.62			.70		.54
	14	10	.76			.62		.88
Communicating	2	11	.71				.76	.55
	3	12	.63				.60	.60
	5	13	.68				.59	.42
	4	14	.66				.58	.62
	1	15	.60				.53	.64
Eigenvalue				6.062	1.571	1.153	1.006	
Total variance				40.414	10.474	7.684	6.705	

In addition the factor names (sub-dimensions), each item must be clearly written on the table.

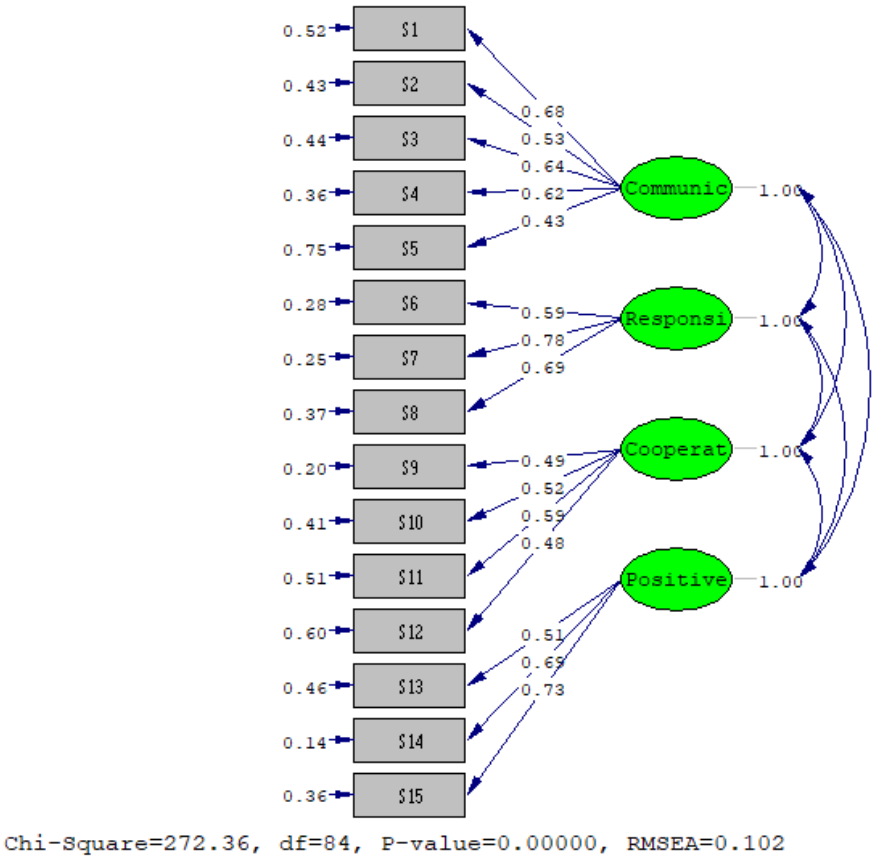
In Table 1, it is seen that the factor loading values of the first sub-dimensions are between .75 and .81, the second sub-dimensions are between .49 and .81, the third sub-dimensions are between .62 and .86, and the fourth sub-dimensions are between .53 and .76. It is observed that the total correlation values of the items are between .42 and .89. Item total correlation is expressed as the item's distinction parameter. It is stated that the distinction quality of the item is sufficient for values of .30 and above (Büyüköztürk, 2019), Therefore, it shows that the items have a sufficient level of discrimination. According to the properties of the items collected in the sub-dimensions, the first sub-dimension is named as showing responsibility, the second sub-dimension as cooperating, the third sub-dimension as showing positive behaviour, and the fourth sub-dimension as communicating.

Confirmatory Factor Analysis (CFA)

Confirmatory Factor Analysis was performed with different data sets obtained from 216 parents in order to reach the goodness of fit values of the four sub-dimensional models. The diagram of the model is given in Figure 2.

Figure 2

Path Diagram of the Model



In Figure 2, for CFA, it is seen that the factor load values are between .44 and .88, the error variance values are between .23 and .80, and all of them reach a significant level. The Chi-square value for the four sub-dimensional model is

determined as $\chi 2$ (84, N = 216) = 272.36, p <.001. As a result of the calculation, it is seen that it has a good value with the value of $\chi 2$ / df = 3.24. This value`s being less than 5 indicates that the model is at an acceptable level (Hu & Bentler, 1999). RMSEA = .10, SRMR = .07, CFI = .93, NFI = .91, NNFI = .91, and GFI = .86 fit values are found to be good and perfect (Hu & Bentler, 1999; Brown, 2006). RMSEA and SRMR values` being 10 or less indicate that the model is at an acceptable level (Anderson & Gerbing, 1984; Cole, 1987). The findings obtained from the confirmatory factor analysis shows that the factor structure of the scale is in acceptable agreement with the collected data.

Internal Consistency Coefficient

In order to determine the internal consistency coefficient of the Turkish form of PSDSPEL, Cronbach's Alpha and correlation coefficient was calculated. Cronbach's Alpha and correlation coefficient values of the sub-dimensions are presented in Table 2.

Table 2

Mean, Standard Deviation (Sd), Correlation Coefficients, and Cronbach's Alpha Values of the Sub-Dimensions

Sub dimension	**Co**	**SR**	**C**	**SPB**
Communicating (Co)	-			
Showing responsibility (SR)	.59**	-		
Cooperating (C)	.57**	.49**	-	
Showing positive behavior (SPB)	.55**	.44**	.56**	-
Mean	19.96	12.51	16.27	11.96
Sd	3.37	2.27	2.48	2.21
Cronbach's Alpha	.74	.79	.78	.79

As a result of the analysis, the reliability coefficient for the four sub-dimensions of the scale was found to be α = .81. As it can be seen, the reliability coefficient values were around .74 for the first sub-dimension, .79 for the second sub-dimension, .78 for the third sub-dimension, and .79 for the fourth sub-dimension. It is stated that the correlation coefficiency is perfect around .90, very good around .80, sufficient around .70, and the dimensions are dependent and all measure a single conceptual structure together when it is above .60, and it is insufficient below .50 (Kline, 2011). Also, in the sub-dimensions correlation coefficient values, positive and statistically significant relationships between .44 and .59 were achieved (Table 2).

Test-Retest Reliability

The test-retest method was used to statistically test the stability of the PSDSPEL. In order to determine the test-retest reliability coefficient of the scale, the scale was administered to 40 volunteer parents of students at two-week intervals. In order to calculate the correlation coefficient, the normality distribution of the scale was examined, and it was determined that the scores of the parents from the PSDSPEL were between -2 and +2 standard deviations and it was observed that the data were normally

distributed (Tabachnick & Fidell, 2013). Pearson Product Moment Correlation Coefficient was used to test the stability between the scores of the parents from both applications. Accordingly, it was observed that there was a high, positive and significant correlation between the two applications of the PSDSPEL [r(40)=.82, p<.05].

Parents' Perceptions of Social Development Regarding Physical Education Lessons

In this section, results regarding the parents' social development perceptions related to physical education lessons in general in terms of gender are presented.

Table 3

Social Development Perception Levels of Parents Regarding Physical Education Lessons

	N	$\overline{X}$	Sd	Minimum	Maximum
Communicating	540	3.99	.66	2.40	5.00
Showing responsibility	540	4.17	.75	2.00	5.00
Cooperating	540	4.07	.61	2.25	5.00
Showing positive behavior	540	4.00	.73	2.00	5.00
Total	540	4.05	55	2.33	5.00

In Table 3, it is seen that the social development perceptions of the parents regarding physical education lessons are at high levels in the sub-dimensions of "communicating" (3.99 ± .66), "showing responsibility" (4.17 ± .75), "cooperating" (4.07 ± 61), and "showing positive behaviour" (4.00 ± .73). Considering the total scores, it is seen that their perceptions are at a high level. According to the analysis (4.05 ± .55), it can be stated that the parents think that physical education lessons contribute to the social development of the students.

Table 4

MANOVA Results According to Gender Variable of PSDSPEL

Sub-dimensions	Gender	N	$\overline{X}$	Sd	F	p
Communicating	Male	226	4.04	.57	2.536	.112
	Female	224	3.94	.74		
Showing responsibility	Male	226	4.15	.72	.343	.558
	Female	224	4.19	.78		
Cooperating	Male	226	4.11	.58	2.597	.108
	Female	224	4.02	.64		
Showing positive behavior	Male	226	4.09	.68	7.696	.006*
	Female	224	3.90	.76		

According to the MANOVA results in table 4, the main effect of the gender variable on the PSDSPEL sub-dimensions was found to be significant. MANOVA was

conducted to understand which dependent variable contributes to multivariate significance. In terms of the main effect of gender, it was determined that the scores for "showing positive behaviour" differ significantly. In this sub-dimension in which a significant difference is detected, male parents' mean scores are higher than female parents' mean scores.

Discussion and Conclusion

In this study, "Perceived Social Development Scale for Physical Education Lesson-Parent Version" was developed for determining the social development perceptions of the students' parents regarding physical education lessons. And the perception levels of the parents towards social development and their perceptions of social development by gender were examined. First of all, validity and reliability studies of the scale were carried out.

The findings of the study's validity and reliability reveal that the scale can be used for determining the perceived social development levels of the students' parents regarding physical education lessons in accordance with the purpose of the scale. Also, it is determined that parents' perceptions of social development are high, and the perception levels of male parents are higher than that of female parents in the sub-dimension of displaying positive behaviour.

As a result of the Explanatory Factor Analysis (EFA) conducted within the scope of the validity of the scale, four sub-dimensions with eigenvalues greater than 1.00 were identified. These four sub-dimensions explain 65.277% of the total variance. The KMO value was found to be .83, and the significance level of the Bartlett test was found to be 0.000 ($\chi2$=1632.885; df=105; p<.01). Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) being higher than 0.60 and Bartlett's test being significant indicates that the data is suitable for factor analysis (Büyüköztürk, 2019). Tavşancıl (2002) states that it is acceptable for the KMO value to be between 0.50 and 1. Scale's it was determined that the factor load values of the sub-dimensions and the item-total correlation values were above the explained values (Büyüköztürk, 2019), and the items were found to have a sufficient level of distinctiveness. These findings show similarity with some studies conducted for relevant subject (Güven & Öncü 2011; Kremer-Sadlik et al., 2010).

As a result of the Confirmatory Factor Analysis (CFA) conducted to evaluate the factor structure of the attitude scale; Values of $\chi2$/df=3.24, RMSEA=.10, SRMR=.07, CFI=.93, NFI=.91, NNFI=.91, GFI=.86 were obtained. RMSEA and SRMR values` being 10 or less indicate that the model is at an acceptable level (Anderson & Gerbing, 1984; Cole, 1987). CFI 0.95 and NNFI value of 0.95 and above indicates good compatibility. (Hu & Bentler, 1999; Sümer, 2000). GFI be 0.85 or above is sufficient for model-data fit. (Marsh & Balla 1992; Frias & Dixon, 2005). NFI and GFI of be 0.90 or above it is an indicator of acceptable fit (Schermelleh-Engel et al., 2003). As a result of CFA, it was determined that the factor load and error variance values of the scale were at acceptable levels. The goodness of fit index findings obtained from CFA showed that the model was good and perfect, and the factor structure of the scale was in an acceptable fit (Hu & Bentler, 1999; Brown, 2006).

Cronbach Alpha reliability coefficients for the whole scale and its sub-dimensions were found to meet the criteria. It was found .74 for communicating, .79 for

showing responsibility, .78 for cooperating, .79 for displaying positive behaviour, and .81 for the whole scale. The values obtained showed that there was a positive and linear relationship between the whole scale and its sub-dimensions (Kline, 2011). Reliability coefficient of 0.70 or higher is sufficient for the reliability of test scores (Büyüköztürk, 2019). It is seen that similar results have been reached in the studies conducted on the subject (Kremer Şadlık et al., 2010; Öncü & Güven, 2011). As a result, it was determined that the internal consistency of PSDSPEL was at an appropriate level. As a result of the analysis performed to test the scale's stability, it was determined that there was a high level, positive, and significant relationship between both applications. The results showed that the measurement tool had a high degree of error-free, and the measurement obtained from the test was stable (Alpar, 1998).

As a result of the research, it was observed that the parents' social development perceptions towards physical education lessons were high. According to this result, it can be said that parents understand the importance of the role that physical education lessons play in their children's individual and social development. This result also indicates that parents are sensitive to their children's personal and social development. When the literature on the subject is examined, it is seen that similar results have been reached. Stucke and Heim (2006) and Edwarson and Gorely (2010) found in their research that the vast majority of parents find sports lessons important for children's development. In the study conducted by Pehlivan (2009), it was observed that parents had positive opinions about sports activities as they acquired habits such as being healthy, establishing friendships, cooperating, self-confidence, and avoiding harmful habits thanks to their children's sports activities. In the study conducted by Boyraz et al. (2017), it was stated that parents consider physical education lesson important for their children thanks to their positive contribution to health, quality of life, and behaviours. In the study conducted by Sunay and Kaya (2020), it was observed that the parents of the students had positive opinions about physical education lessons owing to their positive contributions in terms of physical and social development as well as academic success. Yaldız (2018) stated that the parents of the studentshave positive opinionsabout physical education lessons. The results show that families put importance on physical education lessons and consider sports positively. Chiarlitti and Kolen (2017) stated that parents'opinions are essential on many cases from the students' application of knowledge and skills they learn in physical education to their physical activities outside the school; from adapting healthy diets to their food and beverage preferences. Thus, it can be said that it may be useful for the authorities in the field of education to consider the parents' opinions in taking decision and application processes related to physical education lessons and extracurricular sports activities at schools.

In the study, a significant difference was observed in the favour of male parents in "showing positive behaviour" sub-dimension. According to the result, it can be stated that male parents think that students gain more positive behaviour in physical education classes than female parents. Physical education and sports, which have an impact on the child's development, are one of the most common ways for male parents to participate in fatherhood activities and interact with their children (Konester & Randolph, 2019). Reasons such as the fact that physical education supports the individual to be healthy and strong, the passion, talent and experiences related to sports contribute to the establishment of a common bond between father and child, and the concept of

masculinity encourages sports may have led men to this idea. Studies supporting this idea have been found in the literature (Coakley, 2006; Knoester & Randolph, 2019). Similar to the results of this study, Akdoğan (2017) found that male parents had a more positive attitude towards physical education than female parents. On the other hand at the studies conducted by Öncü (2007), Yaldız (2018), and Lago-Ballesteros et al., (2019) no significant difference was found in the parents' views on physical education lessons.

As a result, the findings achieved shows that PSDSPEL is a valid and reliable measurement tool for determining the effect of parents' physical education lessons on social development. PSDSPEL is easy to understand and answer by parents of students. For researchers, it is an easy-to-apply, short, accessible, and free scale. PSDSPEL will enable parents to be aware of the positive effects of physical education lessons on their children's social development and will help them guide their children to physical education activities deliberately. Therefore, it will be possible to raise awareness of parents, to teach the lesson more effectively and efficiently, to teach students better manners, to increase the participation of students in sports, to contribute to the planning, projects, and services, and to guide them to sports.

The PSDSPEL was developed on students' parents, but the scale's expressions are adjustable so that they can be adapted for students, teachers, and school administrators when necessary. Therefore, in the future studies, the scale can be adapted to students, teachers, and school administrators in order to make more comprehensive evaluations about the effects of physical education lessons on social development. Comparative studies can also be conducted on the subject. Also, providing individual student and parent meetings with the PSDSPEL can strengthen the research results.

Acknowledgements

The research was not funded by any institution.

Statement of Responsibility

Conceptualization, methodology, software, validation, formal analysis, research, resources, data curation, writing-original draft, writing-review & editing, visualization and supervision were done by both authors.

Conflicts of Interest

Both authors declare that they have no financial, commercial, legal or professional relationships that could affect the research.

Author Bios:

Dr. Yasin Karaca is an Assoc. Prof. in the Department of Recreation Management at Osmaniye Korkut Ata University. His teaching and research interest lies in themes related to sports management, recreation, teaching in physical education, physical education and sports education, sports psychology, sociology of sports.

Dr. Bijen Filiz is an Assoc. Prof. in the Department of Coaching Education at Afyon Kocatepe University. Her educational and research interest lies in themes related to instructional, curriculum, and hidden programs in physicaleducation, physical education teacher education and sports education, measurement and evaluation in

physicaleducation, physical activity and academic achievement, and sports sociology. Dr. Filiz is a member of the FutureLeader Volunteer/ Global Community Health, the World Leisure Organization.

References

Alpar, R. (1998). *İstatistik ve spor bilimleri [Statistics and sports science].* Bagırgan Printing Housse.

Anderson, J. C., & Gerbing, D. W. (1984). The effect of sampling error on convergence, improper solutions, and goodness-of-fit indices for maximum likelihood confirmatory factor analysis. *Psychometrika, 49,* 155-173.

Arslan Ç. H., & Uyanık, B. G. (2018). Sosyal-duygusal gelişim değerlendirme ölçeği: 48-66 aylık çocuklar için uyarlama çalışması [Social-emotional development assessment scale: Adaptation study for 48-66 months old children]. *Journal of İnönü University Faculty of Education, 19*(3), 74-87. https://doi.org/inuefd.310000.

Akdoğan, B. (2017). *Lise öğrencilerinin ve ebeveynlerinin beden eğitimi dersine ilişkin tutumları. [Attitudes of high school students and their parents towards physical education lesson]* [Unpublished master's thesis]. Gelişim University.

Baran, G. (2011). *Çocuk gelişimine giriş [Introduction to child development].* In N. Aral & G. Baran (Eds.), *Çocuk gelişimi [Child development]* (pp 17-49). YaPa Publications.

Başaran, İ. E. (1984). *Eğitime giriş [Introduction to education].* (5th ed.). Sevinc Printing House.

Baxter-Jones A. D., & Maffulli N. (2003). Parental influence on sport participation in elite young athletes. *J. Sports Med. Phys. Fitness. 43*(2), 250-255.

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. Guilford Press.

Boyraz, Ş., Özbar, N., & Küçük Yetgin, M. (2017). *İlköğretim 6. sınıf öğrencilerinin, ailelerinin ve branş öğretmenlerinin beden eğitimi dersine bakış açılarının değerlendirilmesi [Evaluation of primary school 6th grade students, their families and branch teachers' perspectives on physical education lesson]* [Unpublished master's thesis]. Marmara University.

Bourdieu, P. (1984). *Questions de sociologie*. Paris: Minuit.

Bourdieu, P. (1996). Understanding. *Theory, Culture & Society, 13*(2), 17-37. https://doi.org/10.1177/026327696013002002

Büyüköztürk, Ş. (2019). *Sosyal bilimler için veri analizi el kitabı [Manual of data analysis for social sciences].* (25. Ed.). Pegem.

Chiarlitti, N. A., & Kolen, A. M., (2017). Parental influences and the relationship to their children's physical activity levels, *International Journal Exercise Sciences, 10*(2), 205–212.

Coakley, J. (2003). *Sports in society (Issues and Controversies) (8th Edition*). Mc Graw-Hill Publishing.

Coakley, J. (2006). The good father: Parental expectations and youth sports. *Leisure Studies, 25*(2), 153-163.

Coakley, J. (2011). Youth sports: What counts as "positive development?" *Journal of Sport &Social Issues, 35*(3), 306-324.

Cohen, E. G. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research*, 64, 1-35.

Cole, D. A. (1987). Utility of confirmatory factor analysis in test validation research. *Journal of Consulting and Clinical Psychology,* 55, 1019-1031.

Collaborative for Academic, Social, and Emotional Learning (2013). *2013 CASEL guide: Effective social and emotional learning programs. preschool and elementary school edition*. Retrieved January 9, 2021, from https://casel.org/wp-content/uploads/2016/01/2013-casel-guide-1.pdf

Conrad, D., & Hedin, J. A. (1982). *Executive summary of the final report of the experiential education evaluation project.* University of Minnesota, Center for Youth Development and Research.

Dagkas, S., & Burrows, L. (Eds.). (2016). *Families, young people, physical activity and health: Critical perspectives* (1st ed.). Routledge. https://doi.org/10.4324/9781315734576

Edwarson C. L., & Gorely, T. (2010). Activty-related parenting practices and children's objekively measures physcial activity. *Pediatric Exercise Science, 22*, 105-113.

Erkal, M, Güven, Ö., & Ayan, D. (1998), *Sosyolojik açıdan spor [Sports from a sociological point of view]*. Der Publications.

Ersoy, A., Kalkavan, A., Kalfa, M., Özdilek, Ç,. Demirel, M,. Bişgin, H., & Eynur, BR. (2006, November 3-5). *Üniversitelerarası Türkiye şampiyonasına katılan sporcuların kendi üniversitelerinden beklentileri [The expectations of the athletes participating in the Turkish Interuniversity Championship from their own universities]* [Paper presentation] 9th International Congress of Sports Sciences, Muğla, Turkey.

Fazlıoğlu, Y. (2009). *Sosyal gelişim [Social development].* In N, Aral & T, Duman (Eds.), *Eğitim psikolojisi [Education psychology]* (pp. 133-135). Kriter Publications.

Filiz, B., & Demirhan, G. (2015). Bireysel ve sosyal sorumluluk ölçeğinin Türk diline uyarlanma çalışması [Adaptation of individual and social responsibility scale to Turkish language]. *Hacettepe Journal of Sports Sciences, 26*(2), 51-64.

Filiz, B., & Demirhan, G. (2018). Development and examination of personal and social responsibility behaviors scale. *Journal of Measurement and Evaluation in Education and Psychology*, *9*(1), 1-16.

Frias, C. M., & Dixon, R. A. (2005). Confirmatory factor structure and measurement invariance of the memory compensation questionnaire. *Psychol Assess, 17*(2), 168-178.

Firek, W., Płoszaj. K. & Czechowski M. (2020). Pedagogical function of referees in youth sport: Assessment of the quality of referee–player interactions in youth soccer. International Journal of Environmental *Research and Public Health, 17*(3), 905. https://doi.org/10.3390/ijerph17030905.

Güven, Ö., & Öncü, E. (2006). Beden eğitimi ve spora katılımda aile faktörü [Family factor in participation in physical education and sports]. *Aile ve Toplum Dergisi, 3*(10), 81-90.

Öncü, E., & Güven, Ö. (2011). Ana-babaların çocuklarının beden eğitimi dersine katılımına yönelik tutumları. [The development of a parents attitude scale towards physical education class]. *Spor ve Performans Araştırmaları Dergisi*, *2*(2), 28-37. https://doi.org/10.17155/spd.83677

Hendley, K. L. (2004). *Parental involvement in youth sports* [Unpublished master's thesis]. North Carolina State University.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1-55.

Karakuş, E. (2005*). Resmi ortaöğretim kurumlarında beden eğitimi dersinin uygulamalarında karşılaşılan sorunlara ilişkin öğrencilerin ve beden eğitimi öğretmenlerinin görüşleri [Opinions of students and physical education teachers about the problems encountered in the practice of physical education lessons in public secondary education institutions]* [Unpublished master's thesis]. Ankara University.

Kayışlıoğlu, N. B., Altınkök, M., Temel, C., & Yüksel, Y. (2015). Ortaokul öğrencilerinin beden eğitimi dersi sportmenlik davranışlarının incelenmesi: Karabük ili örneği [Examining the physical education lesson sportsmanship behaviors of secondary school students: The case of Karabuk]. *International Journal of Social Sciences and Education Research, 1*(3), 1044-1056.

Kremer-Sadlik, T., Izquierdo, C., & Fatigante, M. (2010). Making meaning of everydaypractices: parents' attitudes toward children's extracurricular activities in the United Statesand in Italy. *Anthropol. Educ. Q*. (41), 35–54.

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3nd edition). The Guilford Press.

Knoester, C. Randolph, T. (2019). Father-child sports participation and outdoor activities: Patterns and implications for health and father-child relationships. *Sociology of Sport Journal, 36*(4), 322-329.

Knoester, C. Fields, V. T. (2020). Mother-child engagement in sports and outdoor activities: Intensive Mothering, purposive leisure, and implications for health and relationship closeness. *International Review for the Sociology of Sport, 55*(7), 933–52.

Lago-Ballesteros J., Martins J., González-Valeiro M. Á., & Fernández-Villarino M. A. (2019). Parental assessment of physical education in the school curriculum: A brief report on the influence of past experiences as students. *Plos One 14*(7), e0219544. https://doi.org/10.1371/journal.pone.0219544.

Latorre Peña, J. (2006). *El deporte en edad escolar en los colegios públicos de educación primária de la ciudad de Zaragoza [Sports at school age in public primary schools in the city of Zaragoza]* [Unpublished doctoral dissertation]. Universidad de Zaragoza.

Li, W., Wright, P. M., Rukavina, P., & Pickering, M. (2008). Measuring students' perceptions of personal and social responsibility and its relationship to intrinsic motivation in urban physical education. *Journal of Teaching in Physical Education, 27*, 167-178.

Li J, Shao, W. (2022). Influence of sports activities on Prosocial Behavior of children and adolescents: A systematic literature review. *International Journal of Environmental Research and Public Health, 19*(11), 6484. https://doi.org/10.3390/ijerph19116484

Linver, M. R., Roth, J. L., Brooks-Gunn J. (2009). Patterns of adolescents' participation in organized activities: Are sports best when combined with other activities? *Developmental Psychology, 45*(2), 354–67. https://doi.org/10.1037/a0014133

Marsh, H. W., & Balla, J. (1994). Goodness of fit in confirmatory factor analysis: The effects of sample size and model parsimony. *Quality and Quantity*, *28*(2), 185-217.

Ma, H. K. (2013). The moral development of the child: An integrated model. *Frontiers in Public Health, 1*, 57. https://doi.org/10.3389/fpubh.2013.00057

Metzler, M. (2011). *Instructional models for physical education* (3rd ed.). Holcomb Hathaway.

Messner, M. A., & Musto, M. (2014). Where are the kids?. *Sociology of Sport Journal, 31*(1), 102-122.

Mowatt, M., DePauw, K. P., & Hulac, G. M. (1988). Attitudes toward physical activity among college students. *Physical Educator, 45*, 103-108.

Önal, Ş. (2005). *Bir sorumluluk eğitim programının lise dokuzuncu sınıf öğrencilerinin sorumluluk düzeylerine etkisi [The effect of a responsibility education program on the responsibility levels of high school ninth grade students]* [Unpublished master's thesis]. Uludag University.

Öncü, E. (2007). *Ana-babaların çocuklarının beden eğitimi dersine katılımına yönelik tutumları ve beklentileri [Attitudes and expectations of parents towards their children's participation in physical education lessons]* [Unpublished doctoral dissertation]. Gazi University.

Öncü, E., & Güven, Ö. (2011). Beden eğitimi dersine yönelik ana-baba tutum ölçeğinin geliştirilmesi [Developing a parent attitude scale towards physical education lesson]. *Niğde University Journal of Physical Education and Sport Sciences, 5*(3), 184-195.

Özçelik, E. (2007). *Öğrencilerin sosyalleşmesinde beden eğitimi dersinin rolü [The role of physical education lesson in the socialization of students]* [Unpublished master's thesis]. Beykent University.

Özen, Y. (2013). Sorumluluk duygusu ve davranışı ölçeğinin geliştirilmesi geçerliği ve güvenirliği [Development, validity and reliability of the sense of responsibility and behavior scale]. *Gümüşhane University Electronic Journal of Social Sciences,* 7, 343-357.

Öztürk, F. (1998). *Toplumsal boyutlarıyla spor [Sports with its social dimensions].* Bagırgan Printing House.

Pehlivan, Z., (2009). Spora katılan çocuklara yönelik ailelerin beklentileri, çocuklarda gözlenen davranış değişimleri ve spora katılımın önündeki engeller [Expectations of families for children participating in sports, behavioral changes observed in children and barriers to participation in sports]. *Spormetre Journal of Physical Education and Sport Sciences, 2*, 69-76.

Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the Fit of Structural Equation Models: Tests of Significance and Descriptive Goodness-of-Fit Measures. *Methods of Psychological Research, 8*(2), 23–74.

Seghers, J., Martelaer, K., & Cardon, G. (2009). Young people's health as a challenge for physical education in schools in the twenty-first century: The case of flanders (Belgium). *Physical Education and Sport Pedagogy, 14*(4), 407- 420.

Selçuk, M. H. (2010). *Beden eğitimi dersinin sosyalleşmeye olan etkisine ilişkin ilköğretim öğrenci velilerinin görüşleri [Opinions of parents of primary school students about the effect of physical education lesson on socialization]* [Unpublished master's thesis]. Inonu University.

Siedentop, D. (1994). *Sport education: Quality PE through positive sport experiences*. Human Kinetics.

Strandbu, A., Stefansen, K., Smette I & Sandvik M. R. (2019). Young people's experiences of parental involvement in youth sport, *Sport, Education and Society*, *24*(1), 66-77. https://doi.org/10.1080/13573322.2017.1323200

Stucke C., & Heim R. (2006). *Sportunterricht aus Elternsicht [Physical education from a parent's perspective]*. In J. Becker (Ed.). *Die-Sprınt-Studie Eine Untersuchung zur Situation des Schulsports in Deutschlands [The sprint study an investigation into the situation of school sport in Germany]* (pp. 181-203). Deutscher Sportbund, Meyer und Meyer Verlag.

Sunay, H., & Kaya, B. (2020). İlkokulda beden eğitimi ve oyun dersinin okul başarısına, fiziksel ve sosyal davranışlarına etkisinin veli görüşüne göre incelenmesi [Examination of the effect of physical education and game lessons on school success, physical and social behaviors in primary school, according to parents' opinion]. *The Journal of International Social Research, 13*(70), 1242-1270. https://doi.org/10.17719/jisr.2020.4172.

Tabachnick, B, & Fidell, L. (2013). *Using multivariate statistics, (6th international edition covers ed.).* Sage Publications.

Tannehill, D., Romar J. E., O'Sullivan, M., England, K., & Rosenberg, D. (1994). Attitudes toward physical education: their impact on how physical education teachers make sense of their work. *Journal of Teaching in Physical Education, 13*(4), 406-420.

Tavşancıl E. (2002). *Tutumların ölçülmesi ve SPSS ile veri analizi, [Measurement of attitudes and data analysis with SPSS]* 1st Edition, Nobel Publishing, Ankara.

Uslu, S. (2005). *Ortaöğretim sporcu öğrencilerinin problemleri, spordan ve beden eğitimi dersinden beklentilerinin incelenmesi ve karşılaştırılması [Examining and comparing the problems of secondary school athlete students, their expectations from sports and physical education lessons]* [Unpublished master's thesis]. Gazi University.

Varış, F. (1990). *Eğitim bilimine giriş [Introduction to educational science].* Anadolu University Faculty of Educational Sciences Publication.

Yaldız, A., & Özbek, O. (2018). İlköğretim okullarında beden eğitimi dersine yönelik öğrenci ve ana-baba tutumları. [Student and parent attitudes towards physical education lesson in primary schools]. *Kastamonu Journal of Education, 26*(1), 75-82.

Journal of Theoretical Educational Science, 17(3), 738-764, July 2024
Kuramsal Eğitimbilim Dergisi, 17(3), 738-764, Temmuz 2024
[Online]: http://dergipark.org.tr/akukeg
DOI number: http://doi.org/10.30831/akukeg.1390764

Interactive Videos in Web-Based Education: Technology Proficiency and Digital Literacy Levels

Web Tabanlı Eğitimde İnteraktif Videolar: Teknoloji Yeterlilikleri ve Dijital Okuryazarlık Düzeyleri

Cengiz GÜNDÜZALP *

Received: 14 November 2023 **Research Article** **Accepted:** 16 July 2024

ABSTRACT: The objective of this study is to ascertain the impact of interactive videos on web-based courses on students' technology proficiency and digital literacy levels, as well as their perceptions of this approach. To achieve this objective, the study was conducted using quasi-experimental designs, which are a type of quantitative research approach. The research group was selected using the convenience sampling method. The quantitative data gathered with the aid of data collection instruments were analyzed using dependent and independent samples t-tests. Qualitative data were analyzed using content analysis. The study's findings revealed a significant difference between the technology proficiency and digital literacy pre-test and post-test scores of the students in the experimental group. Furthermore, the findings indicated a significant difference between the technology proficiency and digital literacy scores of the groups, with the experimental group exhibiting superior performance. The results demonstrated that the use of interactive videos in web-based lessons can enhance students' technology proficiency and digital literacy levels. Therefore, the findings and results of the study will make a significant contribution to the field.

Keywords: Interactive video, web-based teaching, technology competencies, digital literacy, interactive.

ÖZ: Bu çalışmanın amacı, web tabanlı derslerde etkileşimli videoların kullanımının öğrencilerin teknoloji yeterlilikleri, dijital okuryazarlık düzeyleri ve bu yaklaşıma ilişkin algıları üzerindeki etkisini tespit etmektir. Bu amaca ulaşmak için çalışma, nicel araştırma yaklaşımının bir türü olan yarı deneysel desen kullanılarak gerçekleştirilmiştir. Araştırma grubu kolayda örnekleme yöntemi kullanılarak seçilmiştir. Veri toplama araçları yardımıyla toplanan nicel veriler bağımlı ve bağımsız örneklem t-testleri kullanılarak analiz edilmiştir. Nitel veriler ise içerik analizi kullanılarak analiz edilmiştir. Çalışmanın bulguları, deney grubundaki öğrencilerin teknoloji yeterliliği ve dijital okuryazarlık ön test ve son test puanları arasında anlamlı bir fark olduğunu ortaya koymuştur. Ayrıca, bulgular grupların teknoloji yeterliliği ve dijital okuryazarlık puanları arasında anlamlı bir fark olduğunu ve deney grubunun daha üstün performans sergilediğini göstermiştir. Sonuçlar, web tabanlı derslerde etkileşimli video kullanımının öğrencilerin teknoloji yeterliliklerini ve dijital okuryazarlık düzeylerini artırabileceğini göstermiştir. Dolayısıyla çalışmanın bulgu ve sonuçları alana önemli bir katkı sağlayacaktır.

Anahtar kelimeler: Etkileşimli video, web-tabanlı öğretim, teknoloji yeterlilikleri, dijital okuryazarlık, etkileşim.

* Asst. Prof. Dr., Kafkas University, Kars, Türkiye, cengizgunduzalp@kafkas.edu.tr., https://orcid.org/0000-0001-5108-437X

Citation Information
Gündüzalp, C. (2024). Interactive videos in web-based education: Technology proficiency and digital literacy levels. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 17*(3), 738-764.

ISSN: 1308-1659

The impact of diverse digital resources used to reinforce pedagogical approaches and augment the efficacy and durability of learning in various educational contexts remains a subject of ongoing investigation. A considerable number of educational settings employ digital materials, with animation, simulation, digital text, and video being among the most commonly used (Taşlıbeyaz & Karaman, 2015). These materials are used in different segments of education, and positive outcomes have been documented (January 2004; Albanese, 2005; Katz et al., 2009). To enhance the effectiveness of this approach, digital materials have recently been augmented with novel features, increasing their impact on the educational environment. In this context, efforts have been made to facilitate learning by incorporating diverse forms of interaction into digital materials tailored to specific course topics (Domagk, Schwartz & Plass, 2010; Cardoso & Santos, 2014; Petan et al., 2014). This approach aims to enhance cognitive processes (Petan et al., 2014). One category of digital material that can be augmented with diverse forms of interaction is interactive video.

Interactive Videos

In contrast to traditional video formats, interactive videos permit a range of interactions to be incorporated into the content, offering a more dynamic and engaging experience for the viewer. The integration of diverse interaction types into video content has resulted in a notable surge in their utilization and a discernible enhancement in their overall quality. Several studies have identified the potential advantages of utilizing interactive videos instead of conventional video formats (Vural, 2013; Kolås, 2015). These studies have demonstrated that incorporating interactions into videos enables students to become more active in their use (Kolås, 2015). The active use of interactive videos by students facilitates the formation of a flexible learning environment that they control (Domagk et al., 2010; Petan et al., 2014). This results in a more permanent and powerful learning environment (Hrastinski & Monstad, 2014; Vural, 2013), which motivates students to achieve effective learning (Zhang et al., 2006). In this context, the various interaction types present in interactive videos are regarded as significantly important. The specific interaction types employed in interactive videos depend on the goals and objectives of the course or subject. To achieve these objectives, a variety of question types can be used, including open-ended questions, multiple-choice questions, comment and discussion-based activities, fill-in-the-blank questions, and quizzes (Dong & Goh, 2015; Wachtler et al., 2016). Additionally, features such as adjusting the video speed, fast-forwarding, rewinding, highlighting, receiving feedback, and searching for alternative resources (Delen et al., 2014; Dong & Goh, 2015; Schwan & Riempp, 2004) can be employed. The deployment of interactive video functionality can help discern students' comprehension, identify areas requiring improvement, and determine subjects on which they may be experiencing difficulties. Moreover, the integration of these features can significantly enhance students' capacity for higher-order thinking (Wilson, 2016).

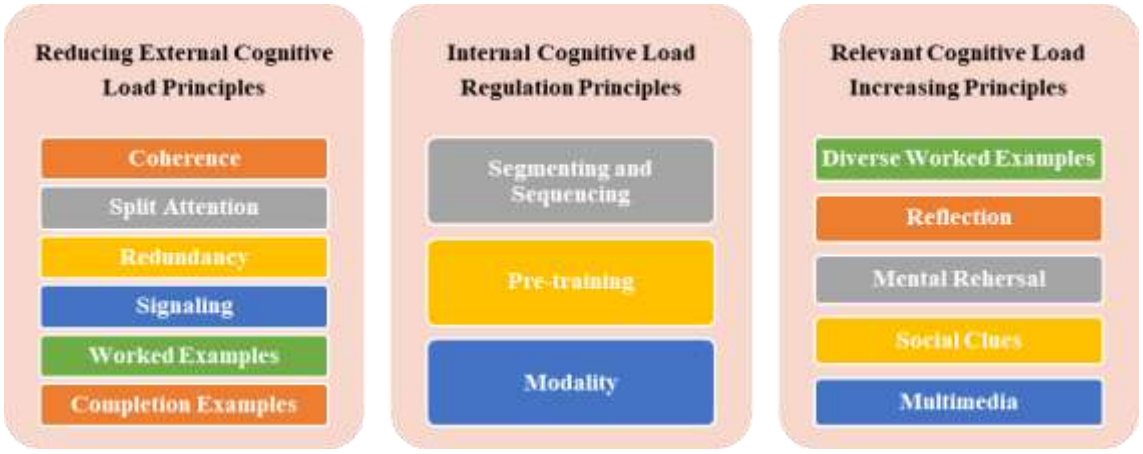
Interactive Videos and Message Design

The use of interactive videos plays a pivotal role in fostering and enhancing the interaction between students and content, which is of paramount importance for the learning resources available in a particular program (Aydin, 2011). For this reason, videos are widely employed in traditional and blended learning and teaching processes,

as well as in tertiary education and massive open online courses (MOOCs) (Emirtekin, 2019). Moreover, studies demonstrating the effectiveness of videos as multimedia tools also emphasize their importance (Means et al., 2010). Videos, as multimedia tools, comprise a variety of elements, including images, sounds, pictures, and texts. Materials with multiple elements may prove challenging for students, particularly in terms of their cognitive capacities. Consequently, it is paramount to consider cognitive load (Brame, 2016) during the video preparation process. Cognitive load theory and the cognitive theory of multimedia learning have led researchers to propose several principles that should be considered when designing messages for use in learning and teaching environments. The aforementioned principles are designed to reduce external cognitive load, regulate internal cognitive load, and enhance germane cognitive load (Yildirim, 2016). Videos prepared with these cognitive load principles in mind can be effective tools in various learning and teaching processes and environments. Moreno and Mayer (2010) posit that providing students with explanatory feedback on their understanding of multimedia content facilitates the selection and organization of new information, thereby contributing to germane cognitive load. Furthermore, the findings of a study by Kilic and Yildirim (2010, 2013) indicate that students are significantly more successful and motivated when they utilize their working memory more effectively in a multimedia environment designed with principles to manage external cognitive load. In light of the aforementioned points and the findings of previous studies, the interactive videos created for this study were designed in accordance with the following message design principles (Figure 1).

Figure 1

Message Design Principles



Note. (Yıldırım, 2016).

Interactive video material prepared with these principles in mind will help students achieve a fast and effective learning experience without straining their cognitive systems and will greatly improve their performance in various areas of competence and skills. Based on this intuition, the study used interactive videos to demonstrate changes in students' technology proficiency and digital literacy levels.

Technology Proficiency

The advent of new technologies is rapidly transforming the manner in which teaching is conducted, the nature of learning environments, and the role of teachers within the classroom. It is therefore essential that teachers possess the requisite technological competencies to enable them to effectively keep pace with the aforementioned change process. Consequently, it is paramount that teachers not only have access to digital devices but also can utilize various technologies effectively within the classroom (U.S. Department of Education, 2017). Nevertheless, many educators currently encounter difficulties in integrating contemporary technologies into their pedagogical practices, aligning technological applications with the course objectives, and developing an understanding of these technologies (Çuhadar, 2018; Heitink, Voogt, Verplanken, Braak, & Fisser, 2016; Instefjord & Munthe, 2015). In light of this, recent studies of teacher education programs have focused on creating a technologically rich environment, particularly on how teachers interact with various technologies in the classroom (Foulger, Graziano, Schmidt-Crawford, & Slykhuis, 2017; Instefjord & Munthe, 2015). In this context, teachers' desire to effectively and efficiently leverage technology in educational settings has underscored the importance of their technological proficiency levels. Teachers' technology competencies differ from those of ordinary technology users due to their connections to teaching and learning, necessitating examination (Wang & Lu, 2021). However, few studies in the literature have addressed the measurement of technological literacy (Wang & Lu, 2021), indicating a gap in the existing literature regarding the assessment of teachers' technological competence. The objective of this study was to address this gap in the literature.

Digital Literacy

The term "literacy" encompasses not only the ability to read and write but also the capacity to create, comprehend, apply, analyze, synthesize, organize, and evaluate information using technology (Çetin, 2021). The use of technology in learning and teaching contexts can facilitate the development of literacy skills (Çetin, 2021). Incorporating video, images, graphics, filmmaking, and other similar audiovisual materials contributes to the enhancement of literacy skills (Collier, 2013). The five categories of literacy skills include digital, visual, technological, global, and information literacy (Robin, 2008). Upon reviewing the definitions of digital literacy in the literature, it became evident that this concept arises from the intersection of students' cognitive, technical, and socio-emotional competencies (Ng, 2012). Digital literacy is defined as the practical skills required to use digital technologies, as well as social and creative abilities (van Deursen, Helsper & Eynon, 2016). The prevailing perspective is that digital literacy is essential for students who must navigate the technological, cognitive, and socio-emotional demands of the digital age (List, Brante & Klee, 2020). The concept of digital literacy encompasses a range of competencies, including information literacy, computer literacy, information and communication technologies (ICT) literacy, and media literacy, among others. Employing these digital literacy competencies ensures the integration of various technologies, particularly in educational environments, thereby facilitating learning and teaching processes. Teachers and prospective teachers play a crucial role in this process, necessitating examination of the factors influencing changes in digital literacy levels. Consequently, the study aimed to

determine the impact of interactive video in web-based courses on prospective teachers' digital literacy levels.

Aim and Importance of the Study

Researchers have proposed that teaching in various learning environments should be more interactive, purposeful, and stimulating, supported by technology (Caamaño-Navarrete et al., 2021). Interactive videos represent a technology that incorporates a range of interaction types for diverse purposes, thereby motivating students to engage effectively in learning (Zhang et al., 2006). These videos comprise elements such as images, sound, and illustrations (Kasturi et al., 2022), offering a versatile learning environment with active engagement (Domagk et al., 2010; Petan et al., 2014). They provide students with materials and questions that allow specialization in different situations, based on images and sound (Lakapu et al., 2023). Given these attributes of interactive videos, it is postulated that such videos can effectively develop diverse skills and abilities in students. It is also important to consider digital literacy and technology competencies. As Collier (2013) suggests, using audiovisual materials with diverse characteristics and evaluations in a technological context significantly contributes to the development of digital literacy skills. The prevalence of such materials in interactive videos indicates that digital literacy can be enhanced through their use. Furthermore, interactive videos can be employed in contexts where students lack opportunities for practice and learning through usage, aiding them in learning technology use (Çetin, 2021) and enhancing the retention and efficacy of students' learning (Hrastinski & Monstad, 2014; Vural, 2013). This suggests that digital literacy skills and technology competencies can be developed through interactive video use. The ability of interactive videos to be used synchronously and asynchronously, without temporal or spatial constraints, coupled with their incorporation of interactions with diverse features, enables repeated student engagement. Such videos can effectively support courses requiring the application of knowledge (edtech, 2022), facilitating students' learning of technological concepts and applications. Interactive videos accommodate individual differences in learning by providing a personalized learning environment, enabling students to direct content and personalize experiences (Çetinoğlu, 2024). As technological tools, equipment, concepts, and applications are often learned through actions and decisions, interactive videos can provide similar experiences (Çetinoğlu, 2024). In light of these scenarios, it can be posited that interactive videos are more effective than other technologies and tools with different features when used in lesson contexts. This study examines whether interactive videos affect students' technology proficiency and digital literacy levels.

The findings of various experimental studies on the use of videos in learning and teaching processes have shown that videos are beneficial for learning (Chan, 2010). However, there is a scarcity of literature specifically investigating the effects of interactions in interactive videos. This is evidenced by the limited number of studies in this area, including those by Mar et al. (2017), Rice et al. (2019), Vural (2013), and Wachtler et al. (2016). These studies indicated that interactive videos are effective learning materials for students (Cherrett et al., 2009). Among the few studies on interactive videos, investigations into their effects when used in web-based systems on various variables have also been conducted. Findings from Zhang et al. (2006)

suggested that integrating interactive videos into e-learning systems enhances students' learning and satisfaction. Building on these findings, Petan et al. (2014) suggested that interactive videos should be considered the primary resource in massive open online courses (MOOCs). Overall, there remains a scarcity of studies examining the effects of interactive videos on different variables and integrating them into any web-based system. Despite discussions in the literature on various variables and scientific issues related to interactive videos, no study has thoroughly examined students' technology proficiency and digital literacy levels. This study aims to address this gap in the literature. Its principal objective is to determine the impact of using interactive videos in web-based courses on students' technology proficiency and digital literacy levels, as well as their perceptions there of.

Accordingly, the answers to the research questions listed below will be sought in accordance with the study's purpose.

1. Is there a difference between students' technology proficiency and digital literacy pretest-posttest scores?
2. Is there an effect of using interactive video in web-based courses on students' technology proficiency and digital literacy levels?
3. What are students' perspectives on the effects of using interactive video in web-based courses on technology proficiency and digital literacy levels?

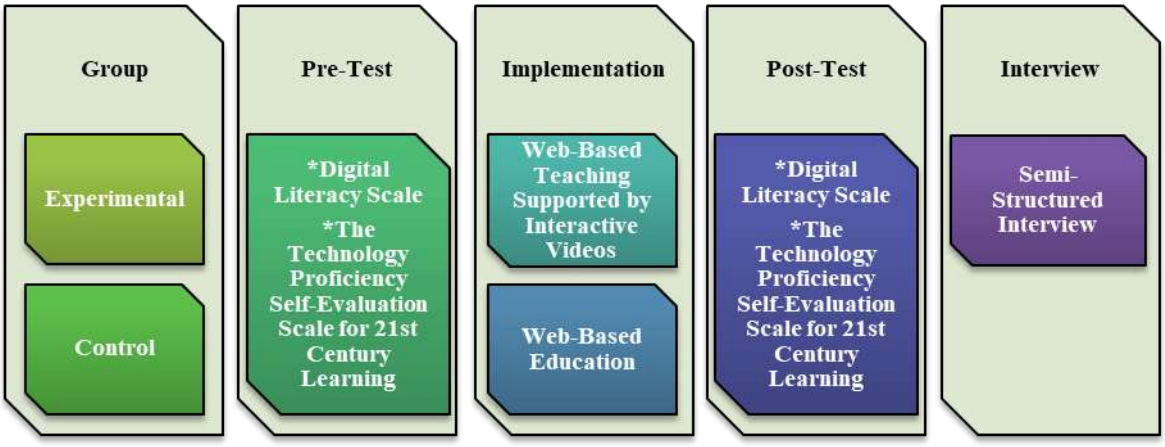
Method

Research Model

In the study, the effect of using interactive videos in web-based courses on students' technology proficiency and digital literacy levels was investigated using a quasi-experimental design, which is one of the quantitative research methods. In cases when experimental and control groups cannot be formed randomly and instead existing classes are used, the quasi-experimental design can be preferred (Fraenkel & Wallen, 2000; McMillan & Schumacher, 2010). In this design, the experimental and control groups are compared using pre-tests over the scores of the independent variable or variables. In this comparison, if the pre-test scores of the groups show similarity, one of the groups can be designated as the experimental group and the other as the control group (Şahin & Yilmaz, 2020). In the study, pre-tests were given to all students in two groups. The pre-test scores for the technology proficiency and digital literacy levels of the students in the groups were compared with the independent samples t-test. The results of this test revealed that there was no significant difference ($t(88)_{\text{Technology Prof.}} = .309$, $p = .758$), ($t(88)_{\text{Digital Lit.}} = .520$, $p = .605$) in technology proficiency and digital literacy levels between the experimental ($M_{\text{Technology Prof.}} = 64.66$, $SD_{\text{Technology Prof.}} = 8.87$), ($M_{\text{Digital Lit.}} = 35.97$, $SD_{\text{Digital Lit.}} = 5.36$) and control ($M_{\text{Technology Prof.}} = 65.75$, $SD_{\text{Technology Prof.}} = 10.9$), ($M_{\text{Digital Lit.}} = 36.35$, $SD_{\text{Digital Lit.}} = 6.21$) groups. Because the two groups have similar levels of technology proficiency and digital literacy, one was randomly assigned as an experiment and the other as a control group. The study's design process is given in Figure 2.

Figure 2

The Study's Design Process



The study's implementation lasted for a total of seven weeks (21 hours). During this period, the curriculum covered the following subjects: "Problem-solving concepts and approaches", "Algorithms and flowcharts", "Internet use in education", "Communication and collaboration technologies", "Safe use of the Internet", and "Information ethics and copyrights". In the experimental group, active course processes and extracurricular activities were conducted with the assistance of interactive videos. These videos were used in the introductory part of lessons to review previous topics, administer short quizzes based on video content, and introduce new topics. Additionally, at the end of each lesson, a brief review of the subject matter was conducted using interactive videos to identify any points not fully understood, followed by a short quiz based on video questions. Students were encouraged to use interactive videos independently for repetitions, self-testing, learning at their own pace, and self-assessment, particularly during extracurricular activities, with careful monitoring of their progress. Conversely, lessons in the control group were conducted using traditional methods such as direct instruction, Q&A sessions, and discussions. The researcher planned and conducted lessons for both the experimental and control groups in line with the course curriculum. All lessons were conducted via the Microsoft Teams program, with separate one-hour sessions scheduled for each group at different times for web-based courses.

The "Digital Literacy Scale" and the "Technology Proficiency Self-Evaluation Scale for 21st Century Learning" were used as pre-test and post-test to determine the experimental and control groups' levels of technology proficiency and digital literacy. Furthermore, a "Semi-Structured Interview Form" was used to elicit the students' perspectives on this. The differences in pre-test and post-test scores of students in the experimental and control groups were investigated in the study to determine the effects of using interactive video in web-based lessons. Following that, the two groups were compared to determine the effects of using interactive video in web-based lessons on students' technology proficiency and digital literacy levels. Finally, the students' perspectives in this sense were revealed.

Research Group

The study's research group is composed of 90 undergraduate students in the first year of the faculty of education. The students in the research group took the information

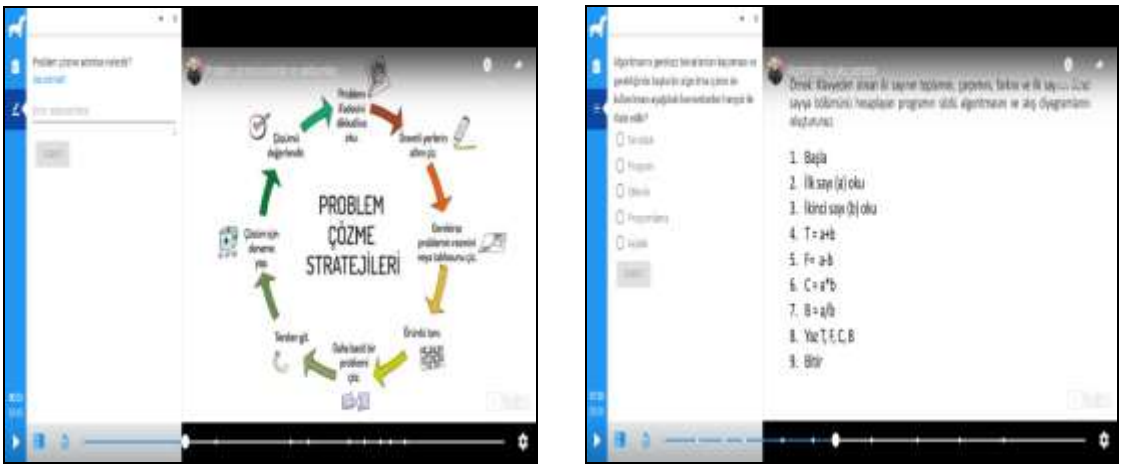
technology course in a web-based class. These students have never used interactive video in any of their classes. The study included two groups, experimental and control, with each group containing 45 students. There were 29 girls and 16 boys in the experimental group, and 36 girls and 9 boys in the control group. The convenience sampling method was used to determine the research group. With this method, the research gains momentum by selecting a sample that is easily accessible (Yildirim & Simsek, 2016). In this sense, the reason why this method was chosen is that the information technology course of the students in the research group was being done by the researcher.

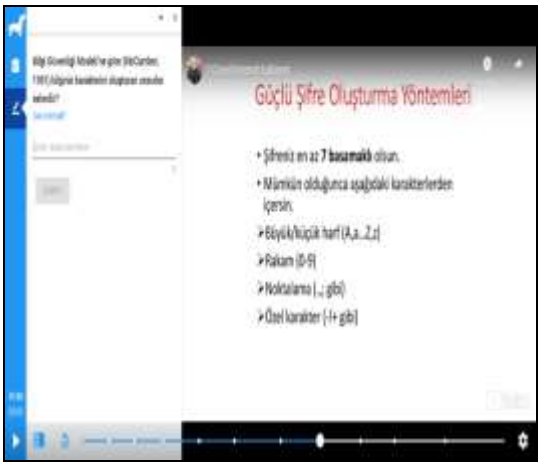
Interactive Videos

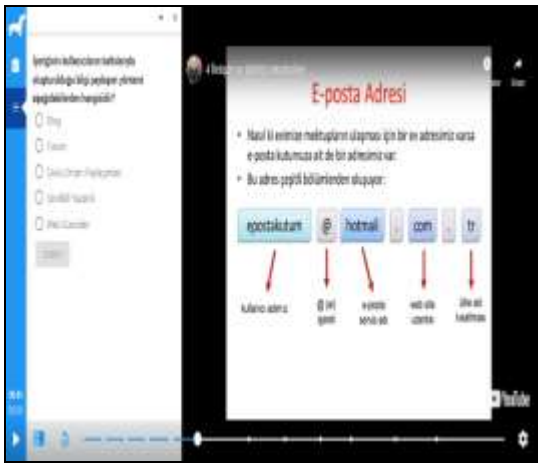
The interactive videos used in the study were prepared in the PlayPosit program. In this program, a virtual classroom was created for the study's activity phase. This class included students from the study's experimental group. The researcher created the videos for the study in accordance with the course curriculum and weekly lectures. The videos were uploaded to the researcher's YouTube channel and turned into an interactive structure using the PlayPosit program. The YouTube channel is set to be seen only by students participating in the study. Only the students who participated in the study were included in the virtual classroom in the PlayPosit program. The interactive videos created for the study ranged in length from six to nine minutes. In this way, it is aimed to increase the participation time. To ensure interaction in certain parts of the videos, various types of questions and activities were added. In addition to open-ended, multiple-choice, and fill-in-the-blank questions, the videos include checklists, surveys, and discussions to support interaction. After the videos began to play, these question types and activities appeared on the left side of the screen at various points, allowing students to respond. Depending on whether the students' answers to the questions were correct or incorrect, different feedback was provided. In the virtual classroom environment, the information about which videos the students watched and how many times they watched them, the answers they gave to the questions, and the activities were carefully monitored. Some images of interactive videos are given in Figure 3.

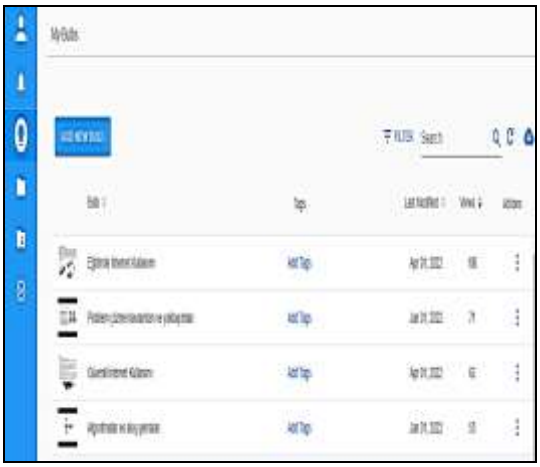
Figure 3

Some Images of Interactive Videos Used in the Study





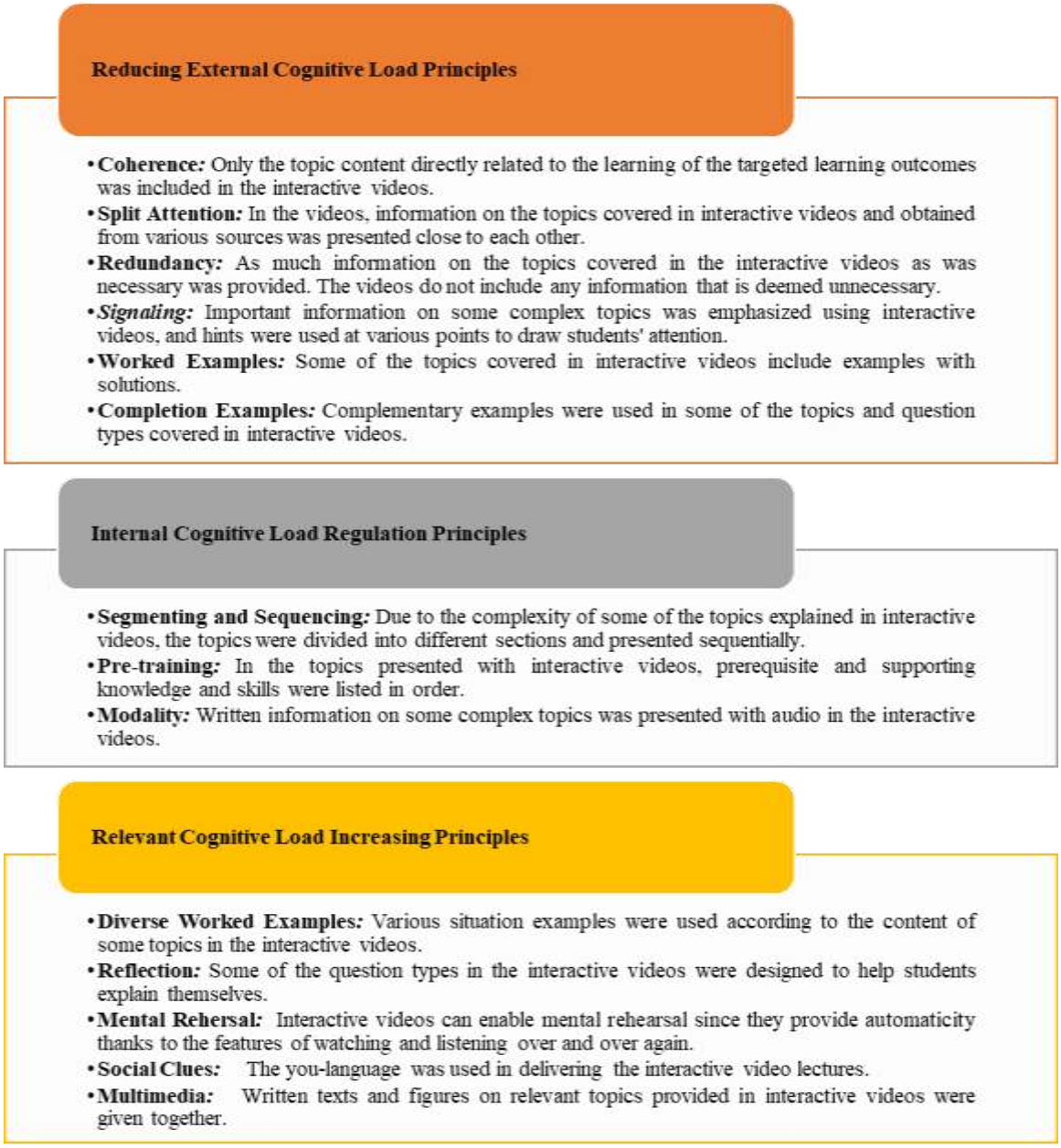




The interactive videos created for the study adhered to the principles of cognitive load theory and cognitive multimedia learning theory (Mayer & Moreno, 2010), which is a theory adapted from cognitive load theory, as well as the principles proposed by the researchers (Yildirim, 2016) of these theories. These principles and the considerations regarding the principles while preparing interactive videos are given in Figure 4.

Figure 4

Considerations Regarding the Principles while Preparing Interactive Videos



Data Collection Tools

Different data collection tools were used to collect data in the study. The first two are the digital literacy scale and technology proficiency self-assessment questionnaire for 21st century learning. The digital literacy scale was developed by Ng (2012). The scale was adapted to Turkish by Ustundag, Gunes, and Bahcivan (2017), and this version was used in the study. The scale consists of ten items in total. The scale has four factors: cognitive, technical, social, and attitude, and in the structure of a five-point Likert scale (1, "I strongly disagree," 5, "I strongly agree"). The original scale's Cronbach alpha value was .89, the Turkish version's Cronbach alpha value was .91, and the Cronbach alpha value in this study was .84. Christensen and Knezek (2017) developed the other data collection tool for the study, technology proficiency self-assessment questionnaire for 21st century learning, which Fidan, Debbag, and Cukurbasi (2020) adapted to Turkish conditions. In the study, the adapted version of the

scale to Turkish conditions was used. There are twenty-four items in total in the scale. The scale is divided into four sub-dimensions: e-mail, www, integrated activitys, and technology-enhanced education. The scale is in the structure of a five-point Likert scale (1, "I strongly disagree," 5, "I strongly agree"). The original scale's Cronbach alpha value was .96, the Cronbach alpha value adapted to Turkish conditions was .81, and the Cronbach alpha value in this study was .91. On the other hand, the third data collection tool in the study is the researcher's semi-structured interview form, which was designed to reveal the students' perspectives on the use of interactive video in web-based teaching. There are two open-ended questions in the form. The form's open-ended questions were developed in consultation with experts from various fields. Two of these experts specialize in education sciences, two in computer education and instructional technology, and one in assessment and evaluation.

Validity Threats

In order to address potential threats to the study's internal validity, certain precautions were taken. The internal validity of a study is contingent upon a number of factors, including the temporal aspect, the subject selection process, the data collection tools employed, the subjects' backgrounds, and the potential for interaction effects (Büyüköztürk et al., 2013). In order to prevent the influence of extraneous variables on the dependent variables in the study, the application process was limited to seven weeks. The participants were randomly allocated to the groups. The students in the experimental groups were selected from those who had no previous experience with interactive videos. The same measurement tools were employed in the experimental and control groups. The entire process was conducted by the researcher. The study also sought to evaluate the technological proficiency and digital literacy levels of the students. The internal validity of the study was ensured under the specified conditions. Conversely, factors such as sampling, reactivity, and the interaction effect of the experimental variable impact the external validity of the study. To address these concerns, a pre-test was administered to both groups, thereby preventing any variability differences that might occur during the experiment. Furthermore, the participants were not informed of their involvement in an experimental study. These precautions served to enhance the external validity of the study. Furthermore, construct validity was ensured by clearly defining the reasons, effects, environment, and participants in the study.

A number of potential threats may compromise the reliability of the results obtained in experimental studies. These include inappropriate sample size, uniform data collection, inappropriate statistical tests and procedures, violations of assumptions in the tests, and low statistical power. The study ensured that the sample size was appropriate for the experimental application, in accordance with the relevant statistical principles. Both quantitative and qualitative data were collected in the study. The most appropriate statistical tests were employed for the analysis of the data. No assumptions were violated during the statistical analysis. Furthermore, effect size values were examined to determine the strength of the relationships between the variables, thereby increasing statistical power. The data were subjected to rigorous analysis, ensuring the reliability and validity of the study's results.

Data Analysis

The data collected with the technology proficiency self-evaluation scale for 21st century learning for digital literacy showed a normal distribution. A dependent sample t test was used to reveal the differences between the students' pre-test and post-test scores. On the other hand, an independent sample t-test was used to determine if the usage of interactive video in web-based courses influences students' technology proficiency and digital literacy levels. Eta squared (η2) value was used to determine whether the differences reached by the dependent and independent sample t-test results have practical significance. Furthermore, the content analysis method was used to examine students' perspectives on the effects of interactive video use in web-based courses on technology proficiency and digital literacy levels. The themes and codes linked to the subject were determined for this study, and the relationships between them were revealed. In this way, an in-depth analysis was conducted (Creswell, 2014).

Ethical Procedures

Ethical permission (31/01/2022-E-66323135-900.99-4512) was obtained from Kafkas University Social and Humanities Ethics Committee institution for this research.

Findings

Differences between Pretest and Posttest Scores of Students in Groups

The dependent sample t-test was used to compare the students' technology proficiency and digital literacy pre-test and post-test results in the experimental and control groups. According to the findings, there was a significant difference between the experimental (t= -13.279, p< .05) and control (t= -10.295, p< .05) groups' technology proficiency pre-test and post-test scores. The average technology proficiency score of the experimental group increased from 64.86 to 94.55, whereas the average score of the control group increased from 65.75 to 89.73 (See Table 1).

Table 1

The Results of Dependent Sample T-Test on the Groups' Technology Competencies

		N	M	SD	t	df	p	η2
Experimental	Pretest	45	64.86	8.44	-13.279	44	.000	.800
	Posttest		94.55	11.60				
Control	Pretest	45	65.75	10.90	-10.295	44	.000	.706
	Posttest		89.73	9.70				

Table 2 shows that, in terms of digital literacy, there is a significant difference between the pre-test and post-test scores of the experimental group (t= -2.226, p<.05), but not in the control group (t= -.574, p>.05). The average digital literacy score of the experimental group increased from 36.20 to 38.28, whereas the average score of the control group increased from 35.95 to 36.71 (See Table 2).

Table 2

Dependent Sample T-Test Results Regarding the Digital Literacy of the Groups

		N	M	SD	t	df	p	η2
Experimental	Pretest	45	36.20	5.01	-2.226	44	.031	.101
	Posttest		38.28	4.16				
Control	Pretest	45	35.95	6.12	-.574	44	.569	-
	Posttest		36.71	5.65				

The Effects of Interactive Video Use on Students' Technology Proficiency and Digital Literacy Levels

The effect of employing interactive video in web-based classes on students' technology proficiency was studied using an independent sample t-test. The test results revealed a significant difference in technology proficiency ratings ($p < .05$) favoring the experimental group (See Table 3).

Table 3

Independent Sample T-Test Results Regarding the Technology Proficiency Levels of the Groups

	N	M	SD	t	df	p	η2
Experimental	45	94.55	11.60	2.139	88	.035	.049
Control	45	92.40	12.17				

An independent sample t-test was conducted in order to evaluate the effect of interactive video usage on web-based courses in terms of digital literacy. It was observed that there was a considerable difference between the scores of digital literacy levels ($p < .05$) in favor of the experimental group according to the test results (See Table 4).

Table 4

Independent Sample T-Test Results Regarding the Digital Literacy Levels of the Groups

	N	M	SD	t	df	p	η2
Experimental	45	38.28	4.16	2.113	77.5	.038	.048
Control	45	35.95	6.12				

Student Opinions on The Effects of Interactive Video Use on Technology Proficiency And Digital Literacy Levels

Students' perspectives on the effects of interactive video use in web-based courses on students' technology proficiency and digital literacy levels were determined using the content analysis method. First, the answers to the question "How do you think the use of interactive video in your lessons affects your proficiency in different technologies?" were analyzed. Secondly, the answers to the question "How do you think the use of interactive video in your lessons affects your digital literacy skills?" were

analyzed. Within the parameters of the available data, themes and codes were developed (See Table 5).

Table 5

The Effects of Interactive Video Use on Students' Technology Proficiency and Digital Literacy Levels

Theme	Codes	**f**
Technology Proficiency	The ability to perform e-mail operations (creating an e-mail address, sending and receiving e-mail, sending bulk e-mail, etc.)	40
	The ability to browse web pages as well as download and save files from them	38
	The ability to watch and download videos from the internet using multiple devices	37
	The ability to use office programs (Microsoft Word, Excel, etc.)	37
	The ability to use various technologies for communication and collaboration	36
	The ability to use mobile devices effectively	35
	The ability to use both synchronous and asynchronous tools in distance education	34
Theme	Codes	**f**
Digital Literacy	Interest in various technologies	39
	The ability to develop different skills for various technologies	39
	Increasing self-confidence to use different technologies	38
	The ability to safely use internet technologies	36
	The ability to communicate and collaborate using various technologies	35

According to Table 5, students who use interactive videos in their classes stated that they can use them to perform various actions related to their e-mails (f= 40), effectively research different web pages, download and save different types of files on the internet (f= 38), and play videos on the internet on various devices and watch and download them (f= 37). Furthermore, students stated that they could use different office programmes for their purposes (f = 37) and that they could effectively use various communication and collaboration technologies (f = 36) thanks to the information they learned from the interactive videos. Additionally, students stated that they could use this information to effectively use mobile devices (f = 35) and synchronous and asynchronous tools related to the distance education process (f = 34). The following are some student perspectives on these issues:

> "By using interactive video, I was able to use technological devices like computers and phones more comfortably and clearly." (S:12)
>
> "Thanks to the interactive videos, I was able to learn the operating logic of applications such as Microsoft Teams and Zoom." (S:13)
>
> "The interactive videos that we watched in the lessons helped me to learn more about different technologies that we didn't know about or knew very little about, and I gained the ability to use them." (S:29)

"The interactive videos that we watched in the class had a significant impact on my technology competencies. My computer skills have greatly improved. I learned how to use software such as PowerPoint, Word, and Excel." (S:36)

When Table 5 is examined, the students stated that the use of interactive videos increased their interest in various technologies (f= 39), improved their various skills towards these technologies (f= 39), and increased their self-confidence in using them (f= 38). Furthermore, the students stated that the use of interactive videos aided them in terms of safely using various internet technologies (f= 36) and communicating and collaborating using various technologies (f= 35). The following are some participant perspectives that revealed these instances:

"The knowledge I gained from interactive videos enabled me to conduct more detailed and informed internet research." (S:14)

"The use of interactive video in our lessons assisted me in becoming acquainted with various technologies and keeping up with the digital environment." (S:19)

"Interactive videos taught me a lot about creating strong passwords, understanding and using privacy settings, and what can and cannot be shared on social media and internet safety." (S: 21)

"Interactive videos have advanced my digital literacy to a higher level. Thanks to these videos, I can now better understand and use technologies that I had no idea how to use, their operating logic, or that I had only a vague understanding of." (S:44)

Discussion and Conclusion

The objective of this study is to ascertain the impact of interactive videos in web-based courses on students' technology proficiency and digital literacy levels, as well as their perspectives on the subject. The study findings indicate that students in the experimental group exhibited notable improvements in their technology proficiency and digital literacy levels. Furthermore, the experimental group demonstrated superior performance to the control group in both technology proficiency and digital literacy, with a statistically significant advantage in favour of the former. The students' feedback indicated that the use of interactive videos in web-based courses had a positive effect on their technology proficiency and digital literacy levels. These results indicate that the use of interactive videos in lessons is an effective method for improving these skills. Given the importance of these concepts for teacher candidates, interactive videos related to technology proficiency and digital literacy, which are integral to many topics in the information technology course, were developed and applied in the experimental group. These skills are essential for individuals to actively participate in the information society and adapt to social and economic changes (Reisoglu & Cebi, 2020). Given the complexity and multifaceted nature of technology proficiency and digital literacy, the process of learning and developing these skills can be challenging and time-consuming for students. Nevertheless, the interactive videos enabled students in the experimental group to gain a more comprehensive and expedient understanding of these concepts, resulting in a higher level of technology proficiency and digital literacy compared to the control group.

Differences between Pretest and Posttest Scores of Students in Groups

The study examined the differences in pre-test and post-test scores between the experimental and control groups. The results demonstrated a notable disparity in the experimental group's scores between the pre-test and post-test periods, particularly in

terms of technology proficiency and digital literacy levels. In contrast, a significant difference was observed only in the technology proficiency levels for the control group. The mean score for technology proficiency in the experimental group increased from 64.86 to 94.55, while the mean score for digital literacy increased from 36.20 to 38.28. The change in mean scores for digital literacy was less pronounced. The effect size calculated from these mean scores also indicated that the effect of the method was weak. This may be attributed to students encountering difficulties in organising interactive videos in a manner that aligns with the course aims and objectives, as well as in forming a comprehensive understanding of them (Çuhadar, 2018; Heitink et al., 2016; Instefjord & Munthe, 2015). Furthermore, the weak effect observed may be attributed to the limited impact of interactive videos on students' knowledge of accessing information, using information, and employing digital tools necessary for sharing information (Makers, 2024).

The experimental group demonstrated superior post-test scores for technology proficiency and digital literacy levels in comparison to the control group. While the mean scores of the two groups were comparable, the effect size values, as defined by Cohen (2013), indicated that the interactive video method had a moderate effect in practice. This suggests that the utilisation of interactive videos in web-based courses has the potential to enhance students' technology proficiency and digital literacy levels. A comparison of the pre-test and post-test results indicates that the incorporation of interactive videos into lessons has a beneficial effect on the learning process, as evidenced by an enhancement in students' scores in technology proficiency and digital literacy. It is possible that the improvement in scores observed in both groups may be attributed to the teacher's explanations during active lessons. However, the use of interactive videos in certain parts of the course, particularly in extracurricular activities that do not involve the teacher, may be more beneficial. Consequently, interactive videos can be regarded as a valuable multimedia learning tool. Similar outcomes have been documented in the literature (Chen & Wu, 2015; Dieck-Assad et al., 2020; Barut Tuğtekin & Dursun, 2022). Nelles et al. (2011) posited that converting simulations into digital video format has the potential to develop complex skills. Furthermore, Hrastinski and Monstad (2014) demonstrated that employees who actively utilise videos exhibited enhanced cognitive and behavioural skills compared to those who did not. It is of the utmost importance to prepare learning materials that appeal to more than one sensory organ, whether visual, auditory, or audio-visual. This is because it allows for a more effective addressing of students' diverse learning and motivation needs (Jethro, Grace, & Thomas, 2012; Mayer, 2014). Videos are particularly useful in this context for conveying information to students at the higher education level (Smyth, 2011). They are frequently employed as educational and instructional materials in online and blended learning environments and courses (Ljubojevic, Vaskovic, Stankovic, & Vaskovic, 2014; Rice, Beeson, & Blackmore-Wright, 2019). The use of interactive videos, created to support a theoretical framework while considering students' cognitive loads, can assist in making sense of the information presented, actively participating in the learning process, and reducing cognitive load (Sorden, 2012; Cummins, Beresford, & Rice, 2016). The absence of any incorporation of theory or principles regarding cognitive load during the preparation of the videos is exemplified by Wilson’s (2016) study, which concluded that videos with embedded questions do not result in increased

student achievement. With regard to cognitive load, the incorporation of various interactions in interactive videos with a theoretical framework has been demonstrated to facilitate learning by appealing to different senses, both visually and audibly. This allows information to be transmitted to memory with greater efficiency (Schwan & Riempp, 2004). This approach facilitates learning while also enhancing retention. A number of studies in the literature provide evidence to support this (Schreiber et al., 2010; Chen & Wu, 2015). Our conclusions may also contribute to the existing body of literature in a similar manner.

The Effects of Interactive Video Use on Students' Technology Proficiency and Digital Literacy Levels

In terms of technology proficiency and digital literacy levels, there was a significant difference between the experimental and control groups. Students who used interactive videos demonstrated superior performance in both technology proficiency and digital literacy compared to those who took their courses in a traditional manner. It can be concluded that the use of interactive videos in the experimental group contributed to the observed differences between the groups. These findings are consistent with previous studies on interactive videos in the literature (Afify, 2020; Chen & Wu, 2015; Geri et al., 2017; Mahmudovna et al., 2024). Delen et al. (2014) found that the interactive video learning environment is a superior teaching tool compared to traditional video learning environments in terms of students' learning performance. A number of potential explanations can be put forward for the beneficial effects of using interactive videos on students' technology proficiency and digital literacy levels. For instance, students experienced a new and engaging learning format when they first used interactive videos in their lessons (Yilmaz, Kucuk, & Goktas, 2017). The increased interest in interactive videos among students in the experimental group contributed to their higher technology proficiency and digital literacy levels. Furthermore, the literature indicates that the integration of new technologies in education effectively captures students' interest and enhances their motivation (Şahin & Yilmaz, 2020). The utilisation of interactive videos in educational settings has been demonstrated to facilitate active participation in the learning process and to enhance students' understanding of the course content (Kreijns, Acker, Vermeulen, & Buuren, 2013; Küçük, 2015; Shen, Liu, & Wang, 2013). Furthermore, the incorporation of interactive videos, which combine visual and auditory content, has the potential to enhance the learning environment (Sever, Oguz-Unver, & Ruyamezoglu, 2013). It can be reasonably concluded that the experimental group's superior performance in terms of technology proficiency and digital literacy levels can be attributed to the various types of interaction present in the videos. The incorporation of interactive elements into videos can facilitate interaction between the learner and the content, transforming students from passive viewers to active participants (Ugur & Okur, 2016; Wachtler, Khalil, Taraghi, & Ebner, 2016; Zhang et al., 2006). This approach assists students in focusing their attention on course subjects (Wachtler et al., 2016) and enhances their learning effectiveness by motivating them (Zhang et al., 2006). Furthermore, the incorporation of interactive elements enables the assessment of students' comprehension of course subjects and the identification of areas where they may require additional support, while simultaneously fostering the development of higher-order thinking skills

(Wilson, 2016). Consequently, it is evident that the utilisation of interactive videos in the classroom is an efficacious instrument for the advancement of students' diverse abilities, aptitudes, and competencies.

Student Opinions on the Effects of Interactive Video Use on Technology Proficiency and Digital Literacy Levels

The students who participated in the study indicated that the use of interactive videos in lessons enhanced their technology proficiency and digital literacy levels. The students whose opinions were gathered reported that the use of interactive videos had a positive effect on their performance in these areas and expressed satisfaction with the results. Similarly, Zhang et al. (2006) found that students who used interactive videos in an e-learning environment performed better than those who did not. This improvement may be attributed to the engaging nature of interactive videos and their integration as new technology in their courses. The capacity to review subjects at any time and place, rewind videos, watch specific sections, engage in various types of interaction, and receive feedback can be considered effective features. The study concluded that students demonstrated enhanced knowledge and skills in technology proficiency, including email and web page operations, using office programs, employing different technologies for communication and collaboration, and effectively utilising mobile devices and both synchronous and asynchronous tools for distance education. The effect size values indicate that interactive videos have a significant impact on the development of these knowledge and skills. This may indicate that interactive videos are effective in web-based teaching environments where there are difficulties in implementing practice-based teaching and where the expectation is that knowledge will be applied (edtech, 2022). Furthermore, since such skills can be learned through actions and decisions, interactive videos, which provide students with similar experiences (Çetinoğlu, 2024), may also influence this outcome. The opinions of students in the experimental group corroborate this finding. Nevertheless, it cannot be asserted that all of the knowledge and skills developed by the students in the experimental group were acquired exclusively through interactive videos. In this context, it is important to consider individual factors that positively relate to technological competencies (Lucas et al., 2021). Furthermore, the experiences that students gain from using different technologies in their daily lives are worthy of note. In conclusion, the evidence suggests that interactive videos are an effective tool for developing students' technology competencies. A paucity of studies in the literature examines the impact of various technologies employed in educational settings on students' technology competencies. The number of studies in this area could be increased to provide valuable contributions to the field.

Conversely, the study's findings indicated that students exhibited enhanced digital literacy and interest in technology, developed proficiency in various technologies, demonstrated increased confidence in their use, utilized internet technologies in a secure manner, and engaged in communication and collaboration through various technologies. Similar results have been reported in previous studies (e.g., Taşlıbeyaz, 2015; Gijsen et al., 2024; Mahmudovna et al., 2024). It is plausible that the utilisation of interactive videos may result in alterations to students' understanding and abilities pertaining to technology competencies and digital literacy.

Furthermore, the opinions of students in the experimental group also support this hypothesis. Indeed, a substantial proportion of students in the experimental group expressed positive opinions in this context. Nevertheless, in terms of effect size, the evidence suggests that the use of interactive videos has a relatively weak impact on students' knowledge and skills related to digital literacy. This indicates that interactive videos are not an effective method for developing digital literacy in students in the experimental group. Furthermore, the impact of other variables on the acquisition of digital literacy competencies should not be underestimated. For example, the students' prior practical, social, and creative skills, which are related to digital literacy (van Deursen, Helsper & Eynon, 2016), may have positively influenced these outcomes. Furthermore, the students' existing competencies in areas such as computer, information and communication technologies, and media literacy (Liang, de la Torre & Law, 2021) prior to the study may have also influenced the results. The utilisation of interactive videos in the context of problem-based learning has been demonstrated to enhance students' decision-making abilities (Taşlıbeyaz, 2015). The recommendations for the use of interactive videos in teaching, which can facilitate the achievement of complex procedural gains (Schwan & Riempp, 2004), are in accordance with this view. The interactive elements of the videos facilitate a more active role for students in the teaching process, enabling them to engage in content creation and enhance their interaction with the material (Ugur & Okur, 2016). It can be concluded that students can gain knowledge and skills in various technologies by utilising different features and types of interaction in interactive videos.

The findings of this study indicate a notable disparity in the test scores of students who utilise interactive videos in web-based courses, with regard to their levels of technology proficiency and digital literacy. The study also demonstrated a significant disparity in technology proficiency and digital literacy levels between students who utilized interactive videos and those who did not. Students who utilise interactive videos demonstrate superior performance in both technology proficiency and digital literacy. The study found that students who use interactive videos tend to hold positive attitudes towards technology. Furthermore, the findings indicated that students perceived the use of interactive videos to be an effective means of acquiring substantial knowledge and skills related to these concepts, with improvements observed in their technology proficiency and digital literacy levels. Consequently, the study is expected to provide guidance to professionals in this field on the use of interactive videos, environments where interaction is prioritised, and the preparation of activities or materials.

Limitations, Suggestions and Future Studies

The study group consisted of 90 first-year students enrolled in the Faculty of Education. The researcher's direct involvement in conducting the courses may have influenced the study outcomes. The researcher oversaw the entire application process, which could be considered a potential limitation of the study. To ensure efficient execution and manage the application process, the study was conducted over a seven-week period. Another limitation was the students' lack of prior experience with interactive videos in their courses. Additionally, conducting the lessons online could be seen as a limitation in the study's implementation. Considering these constraints, future research in this context should address the following implications:

- The study group consisted of pre-service teachers. Future studies could involve students from different undergraduate or associate degree programs.
- The study examined the effects of interactive video use on students' technology proficiency and digital literacy levels. Future research could explore the impact of interactive videos on various variables.
- Future studies could investigate the effects of different technologies used in lessons on students' technology proficiency and digital literacy levels.
- The study's application phase lasted seven weeks. Future studies could extend this period to explore longer-term effects.
- Participants in the study had no prior experience with interactive videos. To enhance future study effectiveness, students with interactive video experience could be included.
- Based on the study's results and findings, several recommendations were made for researchers and teachers.
- The study focused on the effects of using interactive video in a web-based information technology course on teacher candidates' technology proficiency and digital literacy levels. Future studies could encompass a wider range of courses, research groups, and variables.
- The study did not investigate the research group's readiness for interactive video use. Future studies might consider assessing students' readiness levels to enhance study effectiveness.
- Students generally viewed the use of interactive videos positively. Thus, expanding the use of interactive videos in educational settings and activities could be beneficial.
- A limitation of the study was that devices used to watch videos had to be connected to the internet. Future studies could increase applicability by ensuring videos can be viewed offline.
- While some interactive videos in the study included discussion-based interactions, they primarily emphasized individual work. Therefore, future studies could diversify interactions to emphasize collaborative and group work.

Acknowledgements

This research was not funded by any institution or organization**.**

Conflicts of Interest

There is no conflict of interest in the study

Author Biography:

The researcher completed his doctorate Department of Computer and Instructional Technologies Education. He is currently working as a assistant professor doctor in the Computer Aided Design and Animation program, Department of Computer Technologies. The researcher's areas of interest are education and instructional technologies, computer-aided instruction, interactive videos in education,

educational digital games, web technologies, instructional methods and techniques, e-learning, distance education, instructional design and research methods.

References

Albanese, M. (2005). Coming to a medical school near you: full motion video medical education. *Medical Education, 39*(11), 1081-1082. https://doi.org/10.1111/j.1365-2929.2005.02311.x.

Afify, M. K. (2020). Effect of interactive video length within e-learning environments on cognitive load, cognitive achievement and retention of learning. *Turkish Online Journal of Distance Education, 21*(4), 68-89. https://doi.org/10.17718/tojde.803360.

Barut Tuğtekin, E., Dursun, O.O. (2022). Effect of animated and interactive video variations on learners' motivation in distance Education. *Educ Inf Technol*, 27, 3247–3276. https://doi.org/10.1007/s10639-021-10735.

Brame, C. J. (2016). Effective educational videos: Principles and guidelines for maximizing student learning from video content. *CBE—Life Sciences Education, 15*(4). https://doi.org/10.1187/cbe.16-03-0125.

Büyüköztürk, Ş., Akgün, Ö. E., Karadeniz, Ş., Demirel, F. & Kılıç, E. (2013). *Scientific research method*s. Ankara: Pegem Akademi

Caamaño-Navarrete, F., Latorre-Román, P. Á., Párraga-Montilla, J., Jerez-Mayorga, D., & Delgado-Floody, P. (2021). Selective attention and concentration are related to lifestyle in chilean schoolchildren. *Children, 8*(10), 856.

Cardoso, A., & Santos, T. (2014). An interactive video to demonstrate the main features of the pendulum. In *11th International Conference on Remote Engineering and Virtual Instrumentation Remote Engineering and Virtual Instrumentation* (REV), Porto, Portugal.

Chan, Y. M. (2010). Video instructions as support for beyond classroom learning. *Procedia-Social and Behavioral Sciences, 9*, 1313-1318. https://doi.org/10.1016/j.sbspro.2010.12.326.

Chen, C.-M., & Wu, C.-H. (2015). Effects of different video lecture types on sustained attention, emotion, cognitive load, and learning performance. *Computers & Education, 80*, 108-121. https://doi.org/10.1016/j.compedu.2014.08.015.

Cherrett, T., Wills, G., Price, J., Maynard, S., & Dror, I. E. (2009). Making training more cognitively effective: Making videos interactive. *British Journal of Educational Technology, 40*(6), 1124–1134. https://doi.org/10.1111/j.1467-8535.2009.00985.x.

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge. https://doi.org/10.4324/9780203771587.

Collier, L. (2013). Changes in writing instruction the challenge and the promise. *The Council Chronicle*, *6*-9.

Creswell, J. W. (2014). *Qualitative, quantitative and mixed methods approaches*. California: SAGE Publications.

Cummins, S., Beresford, A. R. and Rice, A. (2016). Investigating engagement with in-video quiz questions in a programming course. *IEEE Transactions on Learning Technologies*, *9*(1), 57-66. https://doi.org/10.1109/TLT.2015.2444374.

Çetin, E. (2021). Digital storytelling in teacher education and its effect on the digital literacy of pre-service teachers. *Thinking Skills and Creativity*, *39*, 100760. https://doi.org/10.1016/j.tsc.2020.100760.

Çetinoğlu, B (2024, January, 26). *Discover the power of interactive videos*. Enocta. https://www.enocta.com/blog/interaktif-videolarin-gucunu-kesfedin.

Çuhadar, C. (2018). Investigation of pre-service teachers' levels of readiness to technology integration in education. Contemporary Educational Technology, *9*(1), 61–75. https://doi.org/10.30935/cedtech/6211.

Delen, E., Liew, J., & Willson, W. (2014). Effects of interactivity and instructional scaffolding on learning: Self-regulation in online video-based environments. *Computers & Education*, *78*, 312-320. https://doi.org/10.1016/j.compedu.2014.06.018.

Dieck-Assad, G., Hinojosa-Olivares, J. M., & Colomer-Farrarnos, J. (2020). Study of the effectiveness of interactive videos in applied electronics courses. *International Journal on Interactive Design and Manufacturing (IJIDeM)*, *14*(3), 983-1001. https://doi.org/10.1007/s12008-020-00689-2.

Domagk, S., Schwartz, R. N., & Plass, J. L. (2010). Interactivity in multimedia learning: An integrated model. *Computers in Human Behavior*, *26*(5), 1024-1033. https://doi.org/10.1016/j.chb.2010.03.003.

Dong, C., & Goh, P. S. (2015). Twelve tips for the effective use of videos in medical education. *Medical Teacher*, *37*(2), 140-145. https://doi.org/10.3109/0142159X.2014.943709.

Emirtekin, E. (2019). *The effect of feedback types given to embedded questions in an interactive educational videos on the achievement and cognitive load of teacher candidates* [Master's thesis, Ege University]. Head of higher education institution thesis center https://tez.yok.gov.tr/UlusalTezMerkezi/TezGoster?key=4J_FzTwlrMCH4qBROpXPH8yu6aaCJuS0adrLR4XEMkxOsY3Foidqst0wcqNFOSco.

Edtech (2022, January, 19). *How can you effectively use interactive videos in distance education?*. Edtech Türkiye. https://edtechturkiye.com/uzaktan-egitimlerde-etkilesimli-videolari-nasil-etkili-bir-sekilde-kullanabilirsiniz.

Foulger, T. S., Graziano, K. J., Schmidt-Crawford, D., & Slykhuis, D. A. (2017). Teacher educator technology competencies. *Journal of Technology and Teacher Education*, *25*(4), 413-448. Retrieved from https://www.learntechlib.org/primary/p/181966/.

Fraenkel, J.R. & Wallen, N.E. (2000). *How to design and evaluate research in education*. Maidenhead: McGraw Hill.

Geri, N., Winer, A., & Zaks, B. (2017). Probing the effect of interactivity in online video lectures on the attention span of students: A learning analytics approach. In

12th Chais Conference for the Study of Innovation and Learning Technologies: Learning in the Technological Era, Raanana, Israel.

Gijsen, M., Catrysse, L., De Maeyer, S., & Gijbels, D. (2024). Mapping cognitive processes in video-based learning by combining trace and think-aloud data. *Learning and Instruction*, *90*, 101851. https://doi.org/10.1016/j.learninstruc.2023.101851.

Heitink, M., Voogt, J., Verplanken, L., Braak, J., & Fisser, P. (2016). Teachers' professional reasoning about their use of technology. *Computers & Education*, *101*, 70–83. https://doi.org/10.1016/j.compedu.2016.05.009.

Hrastinski, S., & Monstad, T. (2014). Exploring the relationship between the use of an interactive video website and organizational learning. *New Media & Society, 16*(4), 594-614. https://doi.org/10.1177/1461444813487961.

Instefjord, E., & Munthe, E. (2015). Preparing pre-service teachers to integrate technology: An analysis of the emphasis on digital competence in teacher education curricula. *European Journal of Teacher Education*, *39*(1), 77–93. https://doi.org/10.1080/02619768.2015.1100602.

Jethro, O. O., Grace, A. M. and Thomas, A. K. (2012). E-learning and its effects on teaching and learning in a global age. *International Journal of Academic Research in Business and Social Sciences*, *2(*1), 203.

Kasturi, L. I., Istiningsih, S., & Tahir, M. (2022). Pengembangan media pembelajaran video ınteraktif pada mata pelajaran ılmu pengetahuan alam (IPA) siswa kelas V SDN 2 batujai. *Jurnal Ilmiah Profesi Pendidikan*, *7*(1), 116–122. https://doi.org/10.29303/jipp.v7i1.432.

Katz, M. L., Heaner, S., Reiter, P., van Putten, J., Murray, L., McDougle, L., . . . Slater, M. (2009). Development of an educational video to improve patient knowledge and communication with their healthcare providers about colorectal cancer screening. *American Journal of Health Education, 40*(4), 220-228. https://doi.org/10.1080/19325037.2009.10599097.

Kilic, E., & Yildirim, Z. (2010). Evaluating working memory capacity and cognitive load in learning from goal based scenario centered 3D multimedia. *Procedia-Social and Behavioral Sciences*, *2*(2), 4480-4486.

Kilic, E., & Yildirim, Z. (2012). Cognitive load and goal based scenario centered 3D multimedia learning environment: Learners' motivation, satisfaction and mental effort. *Journal of Educational Computing Research*, *47*(3), 329-349.

Kolås, L. (2015). Application of interactive videos in education. In *Information Technology Based Higher Education and Training* (ITHET), Lisbon, Portugal

Kreijns, K., Van Acker, F., Vermeulen, M., & Van Buuren, H. (2013). What stimulates teachers to integrate ICT in their pedagogical practices? The use of digital learning materials in education. *Computers in Human Behavior*, *29*(1), 217-225. https://doi.org/10.1016/j.chb.2012.08.008.

Küçük, S. (2015). *Effects of learning anatomy via mobile augmented reality on medical students' academic achievement, cognitive load, and views toward implementation* [Doctoral dissertation]. Ataturk University, Türkiye.

Lakapu, D. E., Lakapu, P. A., & Taloim, D. (2023). Pengembangan media video ınteraktif pada pembelajaran bangun ruang bola bagi siswa SD. *Junal Kependidikan Matematika*, *4*(2), 167–177. https://doi.org/https://journal.unwira.ac.id/index.php/ASIMTOT.

Liang, Q., de la Torre, J., & Law, N. (2021). Do background characteristics matter in children's mastery of digital literacy? A cognitive diagnosis model analysis. *Computers in Human Behavior*, *122*, 106850. https://doi.org/10.1016/j.chb.2021.106850.

List, A., Brante, E. W., & Klee, H. L. (2020). A framework of pre-service teachers' conceptions about digital literacy: Comparing the United States and Sweden. *Computers & Education*, *148*, 103788. https://doi.org/10.1016/j.compedu.2019.103788.

Ljubojevic, M., Vaskovic, V., Stankovic, S. and Vaskovic, J. (2014). Using supplementary video in multimedia instruction as a teaching tool to increase efficiency of learning and quality of experience. *The International Review of Research in Open and Distributed Learning*, *15*(3), 275-291 https://doi.org/10.19173/irrodl.v15i3.1825.

Lucas, M., Bem-Haja, P., Siddiq, F., Moreira, A., & Redecker, C. (2021). The relation between in-service teachers' digital competence and personal and contextual factors: What matters most? *Computers & Education*, *160*, 104052. https://doi.org/10.1016/j.compedu.2020.104052.

Mahmudovna, Z. F., Ko'klanboy, G. Z., & Ergash, X. S., (2024). Development of a mobile application based on interactive videos from grade 5 computer science. *PEDAGOG*, *7*(3), 445-453.

Mar, C., Sohoni, S., & Craig, S. D. (2017). The effect of embedded questions in programming education. In IEEE Frontiers in Education Conference (FIE), Indianapolis, USA.

Makers Consulting (2023, January, 10). *What is digital literacy and why is it necessary?* Makers consulting. https://makersconsulting.co/21-yy-yetkinlikleri-dijital-okuryazarlik-nedir-neden-gereklidir/.

Mayer, R. E. (2014). Incorporating motivation into multimedia learning. *Learning and Instruction*, *29*, 171-173. https://doi.org/10.1016/j.learninstruc.2013.04.003.

Mayer, R. E., & Moreno, R. (2010). Techniques that reduce extraneous cognitive load and manage intrinsic cognitive load during multimedia learning. In J. L. Plass, R. Moreno, & R. Brünken (Eds.), *Cognitive load theory* (pp. 131–152). Cambridge: Cambridge University Press

McMillan, J.H., & Schumacher S. (2010). *Research in education: Evidence-basedinquiry*. Boston: Pearson.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2010). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. Washington, DC: U.S. Department of Education, Office of Planning, Evaluation, and Policy Development

Merkt, M., Weigand, S., Heier, A., & Schwan, S. (2011). Learning with videos vs. learning with print: The role of interactive features. *Learning and Instruction*, *21* (6), 687-704. https://doi.org/10.1016/j.learninstruc.2011.03.004.

Nelles, L. J., Smith, C. M., Lax, L. R., & Russell, L. (2011). Translating face-to-face experiential learning to video for a web-based communication program. *Canadian Journal for the Scholarship of Teaching and Learning, 2*(1), 8. https://doi.org/10.5206/cjsotl-rcacea.2011.1.8.

Ng, W. (2012). Can we teach digital natives digital literacy? *Computers & Education*, *59*(3), 1065–1078. https://doi.org/10.1016/j.compedu.2012.04.016.

Petan, S., Mocofan, M., & Vasiu, R. (2014). Enhancing learning in massive open online courses through interactive video. In *The International Scientific Conference eLearning and Software for Education*, Bucharest, Romania

Reisoğlu, İ., & Çebi, A. (2020). How can the digital competences of pre-service teachers be developed? Examining a case study through the lens of DigComp and DigCompEdu. *Computers & Education*, *156*, 103940. https://doi.org/10.1016/j.compedu.2020.103940.

Rice, P., Beeson, P., & Blackmore-Wright, J. (2019). Evaluating the Impact of a quiz question within an educational video. *TechTrends*, *63*(5), 522-532. https://doi.org/10.1007/s11528-019-00374-6.

Robin, B. R. (2008). Digital storytelling: A powerful technology tool for the 21st century classroom. *Theory into practice*, *47*(3), 220-228. https://doi.org/10.1080/00405840802153916.

Schreiber, B. E., Fukuta, J., & Gordon, F. (2010). Live lecture versus video podcast in undergraduate medical education: A randomised controlled trial. *BMC Medical Education*, *10*(1), 68. https://doi.org/10.1186/1472-6920-10-68.

Schwan, S., & Riempp, R. (2004). The cognitive benefits of interactive videos: Learning to tie nautical knots. *Learning and Instruction, 14*, 293–305. https://doi.org/10.1016/j.learninstruc.2004.06.005.

Sever, S., Oguz-Unver, A., & Yurumezoglu, K. (2013). The effective presentation of inquiry-based classroom experiments using teaching strategies that employ video and demonstration methods. *Australasian Journal of Educational Technology*, *29*(3). https://doi.org/10.14742/ajet.229.

Shen, C. X., Liu, R. D., & Wang, D. (2013). Why are children attracted to the Internet? The role of need satisfaction perceived online and perceived in daily real life. *Computers in Human Behavior*, *29*(1), 185-192. https://doi.org/10.1016/j.chb.2012.08.004.

Smyth, R. (2011). Enhancing learner–learner interaction using video communications in higher education: Implications from theorising about a new model. *British Journal*

of Educational Technology, *42*(1), 113-127. https://doi.org/10.1111/j.1467-8535.2009.00990.x.

Sorden, S. D. (2012). The cognitive theory of multimedia learning. *Handbook of Educational Theories*, *1*(2012), 1-22.

Şahin, D., & Yılmaz, R. M. (2020). The effect of augmented reality technology on middle school students' achievements and attitudes towards science education. *Computers & Education*, *144*, 103710. https://doi.org/10.1016/j.compedu.2019.103710.

Taşlıbeyaz, E. (2015). *The effect of interactive videos on achievement and decision making processes of students in medical education* [Master's thesis]. Ataturk University, Türkiye.

Taşlıbeyaz, E., & Karaman, S. (2015). Who Should teach in lecture videos? Expert, instructor or a good speaker. *Route Educational and Social Science Journal, 2*(2), 423-433.

Taşlıbeyaz, E., Dursun, O. B., & Karaman, S. (2018). Examining of the experiences of students about interaction types used in digital materials. *İnönü University Journal of the Faculty of Education*, *19*(2), 240-254.

U.S. Department of Education, Office of Educational Technology. (2017). *Reimagining the role of technology in education: 2017 National Education Technology Plan update*. Washington, DC.

Uğur, S., & Okur, M. R. (2016). Use of interactive video in open and distance learning. *Journal of Open Education Practices and Research, 2*(4), 104-126.

Üstündağ, M. T., Güneş, E. & Bahçıvan, E. (2017). Turkish adaptation of digital literacy scale and investigating pre-service science teachers' digital literacy. *Journal of Education and Future,12*, 19-29.

Van Deursen, A. J., Helsper, E. J., & Eynon, R. (2016). Development and validation of the ınternet skills scale (ISS). *Information, Communication & Society*, *19*(6), 804-823. https://doi.org/10.1080/1369118X.2015.1078834.

Vural, O. F. (2013). The Impact of a question-embedded video-based learning tool on e-learning. *Educational Sciences: Theory and Practice, 13*(2), 1315-1323.

Wachtler, J., Hubmann, M., Zöhrer, H., & Ebner, M. (2016). An analysis of the use and effect of questions in interactive learning-videos. *Smart Learning Environments*, *3*(1), 1-16. https://doi.org/10.1186/s40561-016-0033-3.

Wachtler, J., Khalil, M., Taraghi, B., & Ebner, M. (2016). On using learning analytics to track the activity of interactive MOOC videos. *In LAK 2016 Workshop on Smart Environments and Analytics in Video-Based Learning*, Edinburgh, Scotland.

Wang, Y., & Lu, H. (2021). Validating items of different modalities to assess the educational technology competency of pre-service teachers. *Computers & Education*, *162*, 104081. https://doi.org/10.1016/j.compedu.2020.104081.

Wilson, A.D. (2016). The flipped approach: The use of embedded questions in math videos (Master's dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 10118228).

Yılmaz, R. M., Kucuk, S., & Goktas, Y. (2017). Are augmented reality picture books magic or real for preschool children aged five to six?. *British Journal of Educational Technology*, *48*(3), 824-841. https://doi.org/10.1111/bjet.12452.

Yıldırım, A. & Şimşek, H. (2016). *Qualitative research methods in the social sciences*. Ankara: Seçkin.

Yıldırım, Z. (2016). Instructional technologies and message design. In K. Çağıltay & Y. Göktaş (Eds.), *Fundamentals of ınstructional technologies: Theories, research, trends* (2th ed., pp. 279-296). Ankara: Pegem.

Zhang, D., Zhou, L., Briggs, R.O., & Nunamaker, J.F. (2006). Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness. *Information & Management, 43(1),15-2*. https://doi.org/10.1016/j.im.2005.01.004.