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FROM THE EDITOR

Dear Colleagues,

The *Journal of Theoretical Educational Science* is happy to publish the fourth and last issue of 2022! In this issue, you will find 10 research articles by 23 authors from different disciplines. We hope that these articles will contribute to the literature.

Starting in 2022, we included the reviewer list in the last issue of the year. As you see in the following pages, 125 reviewers from 7 countries and 73 different institutions contributed to the issues of 2021. Although this is a faculty journal, just 3 of these reviewers were from Afyon Kocatepe University. In 2023, we will endeavor much more to internationalize our journal, not with our reviewer list but also author list.

Finally, we should also express our sincere thanks to the Editorial Board, reviewers, and authors for their invaluable contributions. Also, we would like to announce that our redaction editor, Mehmet Ertürk Geçici, became a doctor of Mathematics Education and was promoted to the assistant editor position. We congratulate him on his Ph.D. degree and a new position in our journal.

For the following issues, we look forward to receiving submissions of sufficient rigor and quality. We wish you good health and hope to meet again for the 2023 January issue!

Fatih GÜNGÖR, PhD
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The Efficiency of Argument-Based Inquiry Practices in Science Teacher Candidate Education*

Argümantasyona Dayalı Araştırma-Sorgulamaya Uygulamalarının Fen Öğretmen Adayı Eğitimindeki Etkililiği

Tuğba ECEVİT** **Fitnat KAPTAN*****

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ABSTRACT: This study aimed to develop, implement, and evaluate argumentation-based inquiry teaching practices to train qualified science teachers. In this context, first, practices in argument-based inquiry were developed to have highly qualified individuals with cognitive flexibility; the ability to look at happening from divergent perspectives and consider them in alternate ways is an essential skill for the 21st century. Second, the designed argument-based inquiry practices were applied for 14 weeks in the "Science Literacy" elective course. Teacher candidates' scientific process skills, high-level thinking skills, and consideration of the nature of science were researched to evaluate the effect of the implementation. A "concurrent triangulation design" was utilized in this mixed methods research. The study group comprised 38 science teacher candidates. Quantitative data were collected utilizing a scientific process skills test, critical thinking disposition instruments, a metacognitive awareness inventory, and a nature of science views test. Qualitative data were collected through a semi-structured interview and documents (reflective learning diaries, reflective evaluation notes). The results show that the quantitative and qualitative findings support each other. It was found that the practices carried out during the 14 weeks contributed to the science teacher candidates' development of scientific process skills, critical thinking tendencies, metacognitive awareness, and views about the nature of science.

Keywords: Argumentation, inquiry-based learning, science teacher education, science process skills, higher-order thinking skills, nature of the science.

ÖZ: Bu araştırmada, nitelikli fen öğretmenleri yetiştirilmesi için argümantasyona dayalı araştırma-sorgulama uygulamalarının tasarlanması, uygulanması ve etkisinin ortaya konulması hedeflenmiştir. Bu kapsamda, öncelikle mental esnekliğe sahip, eleştirel, yaratıcı ve yenilikçi düşünebilien, yaşanılan çağa uyum sağlayabilen öğrenciler yetiştirilmesi için argümantasyona dayalı araştırma-sorgulama uygulamaları tasarlanmıştır. Daha sonra, tasarlanan argümana dayalı araştırma-sorgulama etkinlikleri Fen Eğitimi bölümü "Fen Okuryazarlığı" dersinde 14 hafta boyunca uygulanmıştır. Bu etkinliklerin öğretmen adayları üzerindeki etkisini ortaya koymak amacıyla, fen öğretmen adaylarının bilimsel süreç becerileri, üst düzey düşünme becerileri ve bilimin doğası anlayışlarındaki gelişimleri araştırılmıştır. Araştırmada karma yöntemlerden "eş zamanlı üçgenleme deseni" kullanılmıştır. Araştırmanın çalışma grubunu 38 fen öğretmen adayı oluşturmaktadır. Nicel veri toplama araçları; bilimsel süreç becerileri testi, eleştirel düşünme eğilimi ölçeği, üstbiliş farkındalık envanteri, bilim doğası görüşleri testi; nitel veri toplama araçları ise yarı yapılandırılmış görüşme formu ve dokümanlardır. Yapılan uygulamaların öğretmen adaylarının bilimsel süreç becerilerinin, eleştirel düşünme eğilimlerinin, üst biliş farkındalık düzeylerinin, bilimin doğası hakkındaki görüşlerinin gelişmesine yol açtığı belirlenmiştir.

Anahtar kelimeler: Argümantasyon, araştırma-sorgulamaya dayalı öğrenme, fen öğretmen eğitimi, bilimsel süreç becerileri, eleştirel düşünme, üstbilişsel düşünme, bilimin doğası anlayışları.

* This study is based on Tuğba Ecevit's doctorate dissertation titled The Effectiveness of Argumentation based Inquiry Teaching Practices in Science Teacher Education.

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Developed and developing countries have started to give more importance to science education to continue the leadership race with each other in the economic field since the second half of the 20th century (Barrow, 2006). Today the fourth industrial revolution is taking place, and one way to show progress and development as a country is to train qualified science teachers. The targeted teacher profile for the 21st century is the ability to be competent in many areas with the knowledge, skills (cognitive skills, internal skills, social skills, research skills, learning-teaching skills), and values that have the needs of the age.

Science education is of vital importance in developing 21st-century skills, namely life skills. Students build their cognitive and psychomotor skills in science education while working on specific science subjects and concepts (Bybee, 2009). Providing students with authentic learning environments enable life skills, so 21st-century skills to develop (Larson & Miller, 2011). The National Science Teacher Association [NSTA] emphasizes that science practices that appeal to the nature of science offer a rich context for developing many skills, such as critical thinking, problem-solving, and science literacy (NSTA, 2011). According to Bybee (2009), inquiry-based learning environments have great potential to develop 21st-century skills. In this age of technological and scientific developments, 21st-century skills can be developed with scientific process skills, especially in science lessons. Students' use of scientific process skills in science classes requires higher-order thinking skills. Thanks to quality science education, it can be possible for students' 21st-century life skills can be improved (Turiman et al., 2012).

Theoretical Background and Literature Review

Science Teaching Curriculum in Turkey

In the 21st century, where scientific knowledge has grown day by day and technology is developing rapidly, to be among the developed countries, the importance given to science education is increasing day by day. Reform documents published in the field of science education focus on promoting scientific literacy for all students (Ministry of National Education [MoNE], 2018; National Research Council [NRC], 2000). To improve the quality of science education in Turkey, many national and international research and projects have been carried out (Ex: MASCIL, PATHWAY, PRIMAS, PROFILES, SAILS, S-TEAM, STING, etc.). In Turkey, since the declaration of the Republic in 1926, 1936, 1948, 1968, 1972, 1974, 1992, 2000, 2005, 2013, 2017, and 2018, the science teaching curriculum has been changed and updated to improve science learning and teaching (MoNE, 2005, 2013, 2018; Yılmaz & Morgil, 1992). Until 2004, with the effect of behavioral learning theory, a teacher-centered approach called the 'traditional learning approach' was adopted. In this approach, the student is the receiver and storage of knowledge; the teacher is the server of scientific knowledge. Considering the reforms in science education, it was realized that it is important for the students to evaluate the ever-changing information in a questioning and critical manner and to make logical decisions (NRC, 2000). In line with this, the science teaching curriculum has been updated to train students who will produce new knowledge and sign important discoveries and inventions. The vision of the Science and Technology Teaching Curriculum in 2005 was defined as "Regardless of individual differences, all

students are educated as science and technology literate." There has been a radical change based on the 'constructivist learning approach, which requires the student's active participation (MoNE, 2005). In this context, it is proposed to organize teaching-learning environments. In 2013, the vision of the science teaching curriculum was updated as 'To educate all students as science-literate individuals.' To educate science-literate students, it is recommended to use the 'inquiry-based learning approach' in the science teaching curriculum (MoNE, 2013). The inquiry learning process is considered not only as a "discovery and experiment" but also as an "explanation and argument" creation process (MoNE, 2013). In 2018, the science teaching curriculum was again updated, as in the 2013 curriculum; it aims to train science-literate individuals. It is recommended to use the "inquiry-based learning and argumentation-based learning approach with STEM (Science, Technology, Engineering, and Mathematics) integrated perspective (MoNE, 2018). In the science teaching curriculum (2018), the acquisitions for the areas of "knowledge" (earth and universe, physical events, matter and its nature, creatures, and life), "skill" (scientific process skills, life skills; high-level thinking skills, engineering, and design skills) and "science, engineering, technology, society, environment" (views of nature of science) learning areas are included. MoNE (2018) suggested that these acquisitions should be realized through inquiry-based learning and argumentation-based learning environments.

Literature Review for Needs Analysis

Despite the studies and arrangements in the field of science education, it has been revealed that the students (Gonzales et al., 2008; Nwosu & Ibe, 2014; OECD, 2013; Özdem et al., 2010), teacher candidates (Özdemir, 2010; Yetişir & Kaptan, 2007), and even teachers (Özdemir, 2011; Sülün et al., 2009) have not a sufficient level of science literacy.

Although there are positive developments in science education and teaching programs to improve education quality, some problems in the science teaching-learning process prevent students from becoming science-literate individuals. Some problems arise from the teacher. Capps et al. (2010) stated that teachers did not sufficiently apply the inquiry-based learning approach in their classrooms. Küçüköner (2011) determined that teachers could not adopt constructivist teachers' roles. Şimşek et al. (2012) determined that science teachers continue to use traditional teaching methods such as lecture, question, and answer. In the study conducted by Erişti and Tunca (2012), it was found that teachers were insufficient in teaching affective skills. A study conducted by Geçer and Özel (2012) found that teachers continued to use teacher-centered learning methods in their classrooms for various reasons. As Korkmaz and Kaptan (2002) stated, the student model, who takes the knowledge from the teacher, has to leave the place to a student model, who can access the knowledge, select and remove the knowledge from the complex knowledge network and solve the problems by using this knowledge. In a study conducted by Aydın and Çakıroğlu (2010), teachers stated that in-service training for the new program is insufficient. Akıncı et al. (2015) reported that in-service teacher training does not provide professional development and experience. Kaya and Böyük (2011) found that teachers were insufficient in many subjects during laboratory studies. Yoon et al. (2012) determined that teachers experienced problems in the practices of the inquiry-based learning approach in their classes. Newton et al. (1999) determined that

the dialogues in the science classes are teacher-centered, and that the student is not interactive. Besides, it was found that the students are not allowed to explain and share their views, are not considered from different perspectives, and are given almost no opportunity to reason based on the evidence (Newton et al., 1999). It is emphasized that teachers do not have sufficient knowledge and experience in the argumentation-based learning approach, and as a result, they are insufficient to implement the argumentation-based learning approach (Driver et al., 2000; Erduran & Jiménez-Aleixandre, 2007). Although the inquiry-based learning approach is recommended in Turkey's Science Teaching Curriculum, in the study conducted by Feyzioğlu (2019), it was found that this approach was not used at the specified level. Zeidler (1997) stated that teachers should participate in this process as students to conduct the argumentation process well. In addition, it is stated in the research (Driver et al., 2000; Jiménez-Aleixandre et al., 2000; Newton et al., 1999; Simon & Johnson, 2008) that argumentation and inquiry-based implementations are insufficient and teacher education is needed in this subject.

When the results of the research in the literature are evaluated with a holistic evaluation, it can be said that most teachers have difficulties due to their education with a teacher-centered approach, and they have difficulty changing their teaching routines. It is challenging to change the image of the teacher. NRC (1996), *"...If reform is to be accomplished, professional development must include experiences that engage prospectively and practicing teachers in active learning that builds their knowledge, understanding, and ability. The vision of science and how it is learned as described in the Standards will be impossible to convey to students in schools if the teachers themselves have never experienced it*." (p. 56).

Furthermore, it is emphasized that teachers play an essential role in developing science-literate individuals and that teachers should have knowledge skills, attitudes, and values related to science to educate students as science-literate individuals (NRC, 1996). Therefore, to contribute to the professional development of teachers, the implementation of pre-service and in-service education should include practices that will contribute to the development of knowledge, skills, and practical learning areas of teachers (Driver et al., 2000). Otherwise, no matter how functional the Science Teaching Curriculum is prepared, it is seen that if the teachers are not equipped with appropriate features, it is challenging for the program to be successful (Demirel, 2005).

Importance of the Science Teacher Education in Turkey

In these days of the fourth industrial revolution, a way to show progress and progress as a country is to educate qualified teachers. The teacher professional development program is an essential factor that will affect the next generations of education, determining teacher qualifications, what to teach, and what to value and how to behave (Özcan, 2011). It can be said that this is the teaching-learning approach that science teachers adopt while teaching science is the most necessary feature that determines the quality of science teachers in the 21st century. The goal of the Turkey Science Teaching Program is to hope that teachers will have the knowledge, skills (cognitive skills, internal skills, social skills, research skills, teaching-learning skills), and values that will adapt to the era's needs and be competent in many areas (MoNE, 2013, 2018). Science lessons improve the cognitive, affective, social, and psychomotor skills of 21st-century students. To educate individuals with qualified science literate,

Science Teaching Program was reformed (MoNE, 2013, 2018). Because the common trend is still a more teacher-centered learning approach, more importance should be attached to the education of science teachers so that the changing teaching program (student-centered learning approach) can be implemented as targeted and reveal the targeted learning outcomes. For the science teachers to implement argumentation and inquiry-based learning, long-term professional development programs should be attended. Only in this way do they adopt the learning environment based on inquiry and argumentation.

Significance of the Study

As can be seen, argumentation and inquiry-based learning emphasize life skills such as scientific process skills and critical thinking skills. This study aimed to develop, implement, and evaluate argumentation-based inquiry teaching practices in this context. The practices based on argumentation-based inquiry teaching have been developed to educate teachers/teacher candidates/students with mental flexibility, an ability to look at events from different perspectives, think alternatively, and have the necessary skills for the 21st century. The approach that constitutes the theoretical foundation of the developed implementations is the open inquiry and argumentation-based learning process. In the literature, it is seen that there are various argumentation and inquiry-based learning stages, cycles, and models, but there is no consensus on specific components (Pedaste et al., 2015). In line with the objectives of the study (the development of 21st-century skills), a teaching model named "argumentation-based inquiry teaching model" was designed as a result of its synthesis of various inquiry and argumentation models (Bybee et al., 2006; Keys et al., 1999; Minner et al., 2010; NRC, 2012; Pedaste et al., 2015; Toulmin, 1958; Walton, 2006; White & Frederiksen, 1998). This designed model is described in the method section. The planned argumentation-based inquiry teaching practices were applied for 14 weeks in the "Science Literacy" elective course in the undergraduate program of science education. The following questions were investigated in the study to examine the effect of argumentation-based inquiry teaching practices on science teacher education.

Sub-problems:

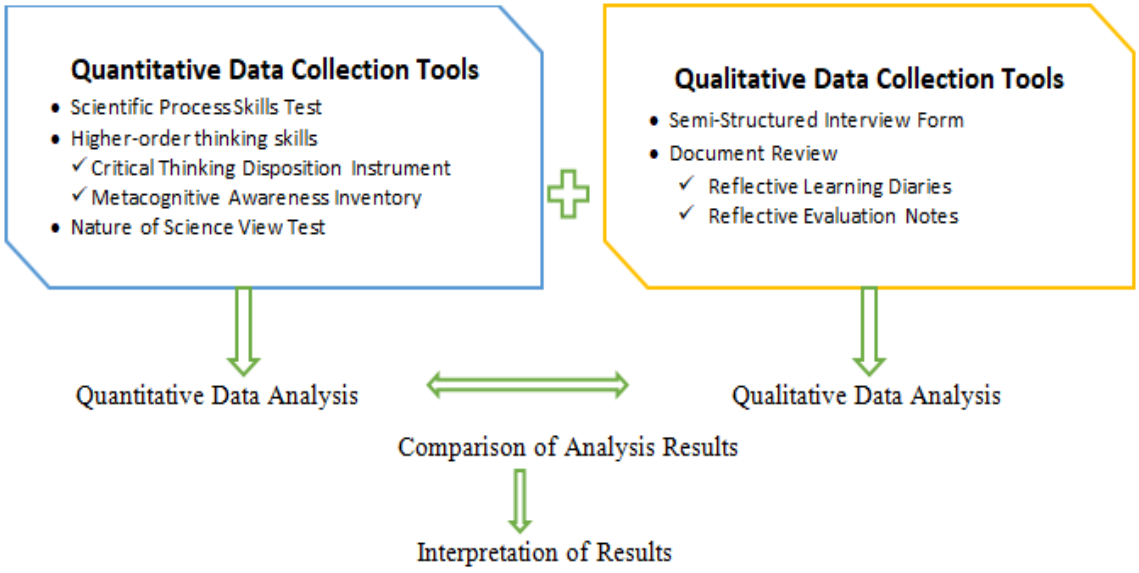
1. What impact do argumentation-based inquiry practices have on improving science teacher candidates' *scientific process skills*? What are the views of teacher candidates' on improved scientific process skills?
2. What impact do argumentation-based inquiry practices have on improving science teacher candidates' *higher-order thinking skills* (*critical thinking, metacognitive awareness*)? What are the views of teacher candidates' on improved higher-order thinking skills?
3. What impact do argumentation-based inquiry practices have on improving science teacher candidates' *views of the nature of science*? What are the views of teacher candidates' on an improved view of the nature of science?

Method

In this study, which investigated the efficacy of "*argument-based inquiry"* activities in training science teacher candidates' education, "*Convergent parallel design*" was used as mixed-method research (Creswell, 2009).

Figure 1

Research Method: Convergent Parallel Design, Mixed Method



The convergent parallel design combines qualitative and quantitative methods' differentiating strengths and non-overlapping weaknesses. It allows triangulation of methods to compare and strengthen quantitative and qualitative findings (Creswell & Plano-Clark, 2007). The quantitative section of the study was designed as a "*one group pretest-posttest poor experimental design*" (Fraenkel et al., 2012). The absence of the control group in the study is among the study's limitations. The qualitative part of the study was structured as a *"phenomenology design"* (Merriam, 2009) to reveal the opinions and perceptions that individuals developed based on their experiences.

Study Group

In this study, a convenient sampling method was used. The study group comprised 38 science teacher candidates who enrolled in the elective course "*Science Literacy"* in the science teaching program of a public university in Ankara. 4 of the teacher candidates are male, and 34 are female. The average score of academic achievement of science teacher candidates was calculated as 2.83 out of 4.0.

Interview Group

Interviews were conducted with 14 teacher candidates from the study group. Voluntary participation in the study group was considered to determine the teacher candidates who would participate in the interview. Eleven of them are female teacher candidates, and 3 of them are male teacher candidates. Three of them are in 2nd grade, six are in 3rd grade, and five are in 4th grade.

Data Collection Tools

The most significant advantage of mixed-method research is that more reliable results can be achieved by integrating qualitative and quantitative data collection instruments. It is possible to make a comparative evaluation by ensuring the consistency and complementarity of the quantitative and qualitative findings obtained (Creswell, 2009).

Quantitative Data Collection Tools

The scientific Process Skills Test. It was adapted to Turkish by Geban et al. (1992) from Okey et al. (1985) and was used to measure the improvement of scientific process skills. This test is preferred and reliable in order to measure teacher candidates' scientific process skills (Arı et al., 2017; Bahtiyar & Can, 2017; Kanlı & Temiz, 2006; Karapınar & Şaşmaz Ören, 2015; Sezek et al., 2015; Temel & Morgil, 2007; Yurdatapan, 2013). The Cronbach Alpha reliability coefficient calculated by Geban et al. (1992) was calculated as (Alpha) .81. Karapınar and Şaşmaz Ören (2015) have tested the reliability of the test with 247 teacher candidates. They calculated the reliability coefficient as .79. For the current study, the KR-20 reliability coefficient value was .76. The scientific process skills test consists of 36 multiple-choice questions. Five sub-dimensions consist of identifying and stating hypotheses, identifying variables, investigations designing, operationally defining, graphing, and interpreting data consists of 5 sub-dimensions. The correct score of the scientific process skills test is '1 point,' and if it is false and empty, it is evaluated as '0 points'. Usually, the lowest score received due to scoring is '0' while the highest score is '36'. However, since the number of items in the sub-dimensions is not equal, the maximum score is 100 for facilitating comparisons and increasing intelligibility. It was applied as a pre-test and post-test.

Critical Thinking Disposition Instrument UF/EMI Critical Thinking Disposition Instrument. It was developed by Irani et al. (2007). The instrument used to measure the development of critical thinking tendencies of teacher candidates was adapted to Turkish by Ertaş Kılıç and Şen (2014). This scale consists of 25 items in a 5-Likert type format and has three sub-dimensions: Engagement, Cognitive Maturity, and Innovativeness. In Likert-type scale is coded as follows: *"I strongly agree (5 points), I agree (4 points), I am undecided (3 points), I disagree (2 points), I strongly disagree (1 point)"*. The dimension of engagement is 11 items, the cognitive maturity dimension is seven items, and the innovativeness dimension consists of 7 items. Ertaş Kılıç and Şen (2014) determined the internal consistency coefficient of the whole scale as .91; the internal consistency coefficient of the engagement dimension as .88, the internal consistency coefficient of the Cognitive Maturity dimension as .70; and the internal consistency coefficient of the Innovativeness dimension as .80. Instrument's reliability, this study was applied to 140 teacher candidates**.** As a result of the present study, the internal consistency coefficient for the whole instrument was calculated as .96; the internal consistency coefficient for the engagement dimension was obtained at .91; the internal consistency coefficient for the cognitive maturity dimension was obtained at .89; the internal consistency coefficient for the innovativeness was 0,88. It was applied as a pre-test and post-test.

Metacognitive Awareness Inventory. It was developed by Schraw and Dennison (1994) and adapted to Turkish by Akın et al. (2007). It was used to determine the development of metacognitive awareness levels of teacher candidates. This inventory composes of 52 items in a 5-Likert type format. In Likert-type inventory, it is coded as follows: *"always (5 points), usually (4 points), frequently (3 points), rarely (2 points), never (1 point)"*. The scale has two sub-dimensions: The Structure of Cognition and Regulation of Knowledge. The dimension of the structure of cognition is 17 items, and the regulation of knowledge dimension consists of 35 items. Akın et al. (2007) determined the internal consistency coefficient of the whole scale as .95; the internal

consistency coefficient of the structure of cognition dimension as .88; the internal consistency coefficient of the regulation of knowledge dimension as .93. The present study was applied to 140 teacher candidates to test the instrument's reliability. As a result of the present study, the internal consistency coefficient for the whole inventory was calculated as .96; the internal consistency coefficient of the structure of cognition dimension as .91; the internal consistency coefficient of the regulation of knowledge dimension .89. It was applied as a pre-test and post-test.

Nature of Science Views Test. It developed by Yalaki et al. (2014), was used to determine the development of views on the nature of science. This test consists of 24 questions in multiple choices. The internal consistency coefficient of the test was determined as .74 by the researchers. The present study was applied to 140 teacher candidates to test the instrument's reliability. As a result of the present study, the internal consistency coefficient for the whole inventory was calculated as .63. Although this value was low, it was decided to use the test within the present study since qualitative data were also used. It was applied as a pre-test and post-test.

Qualitative Data Collection Tools

Semi-Structured Interview Form. Within the present study, semi-structured interviews were carried out at the end of the implementation to determine the views of science teacher candidates on the effectiveness of argument-based inquiry practices. Firstly, the researcher prepared the semi-structured interview form as a draft form. The interview form includes open-ended and easy-to-understand questions. After the interview form was prepared, qualitative research and science education experts were consulted, and after taking feedback and making corrections, a pilot study was conducted with two teacher candidates. At the end of the semester, teacher candidates were informed about the interview. Semi-structured interviews were managed with fourteen volunteer teacher candidates. Each interview continued for about 20 minutes. Interview questions are presented in Appendix 1.

Reflective Evaluation Notes. A reflective evaluation form was prepared to find out the opinions of the teacher candidates about the practices. The prepared form consists of 5 open-ended questions. (*-what are your thoughts on the teaching of this course? -What do you think were the strengths and weaknesses of the course? -What was the contribution of this course in terms of science teaching to you? -How would you explain the content of this course to your friends who want to take this course next year? -what aspects of this course do you intend to use when you become a teacher? in terms of target, content, measurement, evaluation method, and science teaching approach.)* This form was applied to thirty-eight teacher candidates at the end of the semester.

Reflective Learning Diaries. from all teacher candidates in the study group were called to keep a reflective learning diary to improve their metacognitive awareness after each lesson. Learning diaries include the experiences of teacher candidates about the knowledge, skills, and practical learning areas that were learned as a result of the practice and also the problem encountered in the practice process, and the solution suggestions. Moreover, the learning diaries include the reflective evaluations of teacher candidates to determine what they need to change, what they can do differently, and what kind of equipment and materials they need to be more successful. In addition,

teacher candidates were called to write their emotions and opinions about argument-based inquiry practices. In this way, it aimed to define teacher candidates' opinions about the practices.

Implementation Process

The implementation was carried out in the *"Science Literacy"* elective course in a public university's undergraduate science education program in Ankara during the fall semester of the 2016-2017 academic years. An implementation process was prepared, including argument-based inquiry activities in which teacher candidates designed their experiments. The activities were developed and implemented by the researcher. Activity plans, including detailed process steps for each activity, were prepared. Activity plans consist of the activity's goal, concepts, principles, generalizations, and targeted skills. The weekly implementation process is presented in Table 1.

Table 1

Implementation Process of Study

Week	The Subject of the Course
1. Week	Pre-test application Introduction of the course
2. Week	Science literacy, Asking questions skills, The importance of conversation in science teaching *Activity 1:* Peanut monkey experiment. *This activity aims to reveal the research and questioning skills of teacher candidates.*
3. Week	Claims, Evidence concepts, Elements of argumentation *Activity 2:* Death of Mr. Star, Ghosted house. *With this activity, it is aimed that teacher candidates gain awareness about the concepts of a question, claim, and evidence that constitutes the general structure of the argumentation process and distinguish these concepts from each other.* *Activity 3:* Greenhouse effect. *With this activity, it is aimed that teacher candidates gain awareness about the research question, dependent, independent, control variables, and the elements of the argument (claim, evidence, justification, supportive, qualitative, rebuttal), which form the general structure of the argument-based inquiry process and distinguish these concepts from each other.*
4. Week	Introducing the report format Concept map preparation The importance of reflective daily questions
5. Week	*Activity 4:* Investigation of floating and sinking conditions of an object. *This activity was aimed at the teacher candidates to design and carry out different activities based on argument-based inquiry related to the factors affecting an object's floating and sinking conditions.*
6. Week	*Activity 5:* Investigation of gravitational forces and air resistance effect on objects. *This activity was aimed at the teacher candidates to design and carry out different activities based on the argument-based inquiry related to gravity force and air resistance.*
7. Week	*Activity 6:* Investigation of motion and friction force in the inclined plane. *This activity aimed at the teacher candidates to design and carry out different activities based on the argument-based inquiry related to the factors affecting the movement on the inclined plane and the factors affecting the friction force.*
8. Week	*Activity 7:* Investigation of invisible forces (magnetic and electrostatic). *This activity was aimed at the teacher candidates to design and implement different activities based on argument-based inquiry related to invisible forces.*
9. Week	*Activity 8:* Investigation of conductivity and insulation conditions of materials and liquid solutions. *This activity aimed at the teacher candidates to design and carry out different activities based on the argument-based inquiry related to electrical conductivity.*

10. Week	*Activity 9:* Investigation of factors affecting the brightness of the lamp. *This activity aimed at teacher candidates to design and carry out different activities based on argument-based inquiry related to the factors affecting the brightness of the lamp.*
11. Week	*Activity 10:* Investigation of heat-temperature relationship and heat transfer between materials. *This activity aimed at teacher candidates to design and carry out different activities based on argument-based inquiry related to the heat and temperature relationship and heat transfer between substances.*
12. Week	*Activity 11:* Investigation of factors affecting evaporation and boiling. *This activity aimed at teacher candidates to design and carry out different activities based on argument-based inquiry related to the factors affecting the evaporation, boiling, and surface tension.*
13. Week	*Activity 12:* Investigation of factors affecting melting and dissolution. *This activity aimed at teacher candidates to design and carry out different activities based on argument-based inquiry related to the factors affecting melting and dissolution.*
14. Week	Post-test application

In the first week, quantitative data tools were applied as a pre-test. Teacher candidates will carry out activities by doing a group study. Therefore, the teacher candidates were divided into seven groups. An activity table was identified for each group. In addition, requested to identify own group name from each group. In the second week, activities started to be implemented. The first three activities are an introduction activity. The process of argumentation and inquiry was introduced to teacher candidates through introduction activities. Starting from Activity 4, main activities, including argument-based inquiry practices, were carried out. The primary teaching-learning approach of activities is the integration of argumentation and the open inquiry process. The researcher developed this process due to synthesizing various models in the literature. The main activities process comprises three stages. In the first stage, big group discussion reveals knowledge through reasoning; The second stage, small group discussion, takes place to design argument-based inquiry activities; The third stage, each group shares the results. Big group discussion takes place to decide the accuracy of the results. The stages of the argument-based inquiry teaching model are presented in Figure 2.

Figure 2

Stages of Argument-Based Inquiry Teaching Model

The first stage is aimed to be able to understand the environment of teacher candidates. To create a sense of curiosity, ask open-ended questions rather than questions with one correct answer to teacher candidates. Thus, it was provided that teacher candidates realized what they were true about the subject, false about the subject, or what they wanted to learn about it. In the second stage, the teacher candidates are aimed to design and conduct experiments. Teacher candidates are expected to reason based on experimental data and make inferences from experimental data. In stage 2, teacher candidates designed and carried out their experiments and wrote

experiment reports. Teacher candidates were guided by asking questions. In Stage 2, teacher candidates used the activity report format of nine sections prepared by the researcher. The activity report format was created by synthesizing the *"Science Writing Heuristic"* developed by Keys et al. (1999) and *"The Inquiry-Based Learning Cycle*" developed by Pedaste et al. (2015). Activity reports prepared by teacher candidates during the activities were collected every week. The researcher gave feedback by reading the reports of the teacher candidates every week. The reports were redistributed to teacher candidates the following week. Thus, the weekly development of teacher candidates was followed. In the third stage, it is aimed that teacher candidates share and explain the experimental results using scientific terminology. Each group presented their experimental results and compared the similarities and differences of the experimental results with the other groups. In stage 3, it was ensured that the teacher candidates could explain their thoughts with their reasons, express their unclear explanations, produce different explanations, and question the explanations' accuracy. In these processes, no evaluation was made about the answers of the teacher candidates correctly or incorrectly. All activities between the fifth and thirteenth weeks were carried out similarly. Activity 12 teacher's guide is presented in appendix II as an example. At the end of the practice, quantitative data collections were reapplied as a post-test.

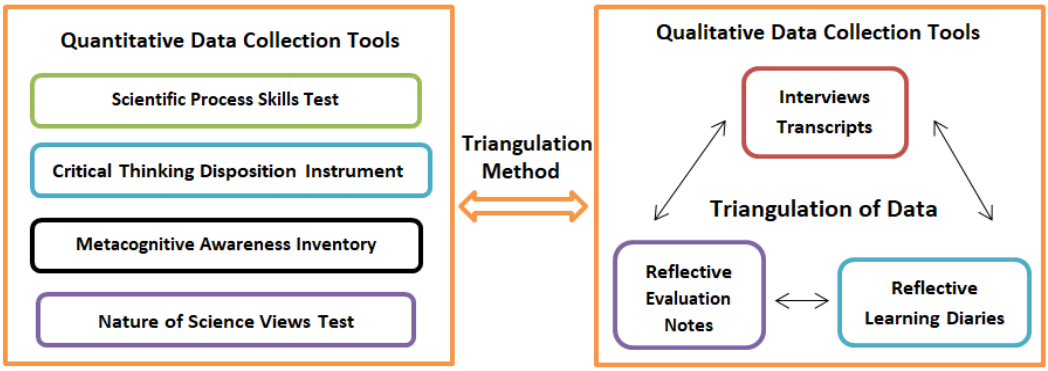
Data Analysis

Quantitative data were analyzed by using SPSS 22 Statistical Program. It is recommended to use the paired samples t-test to discover whether the mean grades of the relationship measurement sets differ significantly (Büyüköztürk, 2015). However, some assumptions must be met to implement for paired samples t-test. For this reason, firstly, kurtosis and skewness coefficients were examined to discover whether the data showed normal distribution. Then, it was examined by the normality test. It was determined that the data were distributed normally. Paired samples t-test was used from parametric tests.

The descriptive analysis method was used to analyze the qualitative data (Yıldırım & Şimşek, 2008). The qualitative data obtained were analyzed and interpreted according to the quantitative themes (scientific process skills, higher-order thinking skills, and the views of the nature of science). Direct quotations were presented to reflect the views of teacher candidates.

Figure 3

Confirmation of Data



Even if qualitative and quantitative findings were collected and analyzed separately, the findings and results section was compared by combining them by the research design, and to what extent they supported each other were discussed. The data collection tools, data collection phase, and data analysis methods used in the sub-problems of the research are presented in Table 2.

Table 2

Data Collection Tools, Data Collection Phase, and Data Analysis Methods

Sub-Problems	Data Collection Tools	Data Collection Phase	Data Analysis Method
First Sub Problem	Scientific Process Skills Test	Pretest-Posttest	Paired Samples T-Test
Related to *scientific process skills*	Semi-Structured Interview Form Reflective Learning Diaries Reflective Evaluation Notes	After Practices Practices Process	Descriptive Analysis
Second Sub Problem	Critical Thinking Disposition Instrument Metacognitive Awareness Inventory	Pretest-Posttest	Paired Samples T-Test
Related to *higher-order thinking skills, critical thinking, metacognitive awareness*	Semi-Structured Interview Form, Reflective Learning Diaries Reflective Evaluation Notes	After Practices Practices Process	Descriptive Analysis
The Third Sub Problem	Nature of Science Views Test	Pretest-Posttest	Paired Samples T-Test
Related to *views of the nature of science*	Semi-Structured Interview Form, Reflective Learning Diaries Reflective Evaluation Notes	After Practices Practices Process	Descriptive Analysis

Validity, Reliability, and Ethics

The fact that the research does not pose an ethical problem has been confirmed by the ethics committee report issued 1413 and dated 08.06.2016 received from the Human Research Ethics Committee of Hacettepe University.

Before starting the implementation, the teacher candidates were informed about the research. The teacher candidates participated in the pre-posttest based on entirely voluntary. Similarly, voluntary teacher candidates were interviewed. The names of teacher candidates were reported using codes by ethical rules.

Quantitative data collection tools are measurement tools conducted previously for validity and reliability studies. However, reliability studies were re-conducted within the scope of the research. There are 13 weeks between pre-test and post-test applications. Considering the length of the implementation, it can be interpreted that the test grades of individuals are not increased with maturation threat. The researcher took courses and practiced argumentation and inquiry-based learning before the application.

Direct quotations are included in the findings section to ensure external validity in the qualitative aspect of the research. To ensure internal validity, qualitative data collected were analyzed by another expert except the researcher. Huberman and Miles's (2002) [Consensus/(Consensus+Disagreement)x100] formula was used to calculate inter-experts compliance. This value was calculated as 87%.

In the study, both quantitative and qualitative methods are recommended to enrich the study data and provide reliability-validity (Lincoln & Guba, 1985). Fraser and Tobin (1992) indicate that "*the use of quantitative and qualitative data in the study increases the data richness and the level of reliability of the results obtained in these studies is much higher"* (p. 33). In this study, which was conducted as a mixed method, the study's internal validity was strengthened with the triangulation of quantitative and qualitative methods. Using the triangulation method, the findings obtained from the quantitative and qualitative data collection instruments were integrated, compared, and connected. Thus, the findings were made rich and more detailed. Direct quotations are presented in the findings section to provide external validity to qualitative findings.

Results

First Sub-Problem Results

The first dependent variable examined in the study is scientific process skills. The averages of the pre-post scientific process skills scores were compared using paired samples t-test. The findings are presented in Table 3, along with descriptive statistics.

Table 3

T-Test Results of Scientific Process Skills Test Pre-Post Test

Test and Sub-Dimensions		*N*	*x*	*S*	*sd*	*t*	*p*
Scientific Process Skills Test	Pre-test	33	66	11.90	32	-10.282	.000*
	Post-test	33	87	7.69			
Identifying Variables	Pre-test	33	54	19.98	32	-9.784	.000*
	Post-test	33	88	15.99			
Identifying Hypotheses	Pre-test	33	72	13.91	32	-6.060	.000*
	Post-test	33	87	10.80			
Operationally Defining	Pre-test	33	61	21.10	32	-3.689	.001*
	Post-test	33	77	14.32			
Investigations Designing	Pre-test	33	81	22.19	32	-1.647	.109
	Post-test	33	89	18.00			
Graphing and Interpreting Data	Pre-test	33	79	18.62	32	-4.055	.000*
	Post-test	33	93	9.26			

*p<.05

The mean score before the practice of scientific process skills was 66 out of 100, and it increased to 87 points after the implementation. Table 4 shows a statistically

significant difference between pre-test and post-test mean scores, $t(32)=-10.282$ $p<.05$. This result shows that the argument-based inquiry teaching practices for 14 weeks had a statistically significant influence on the improvement of the scientific process skills levels of the teacher candidates. When the sub-dimensions of scientific process skills were examined at the end of the practices, it was seen that identifying variables, identifying hypotheses, operationally defining, graphing, and interpreting data of teacher candidates' post-test scores were significantly higher than pre-test scores ($p<.05$). When the pre-test and post-test mean scores of the dimension of investigations designing were examined, it was determined to increase, but there was no statistical significance ($p>.05$).

The data collected with qualitative data collection tools were analyzed using the descriptive analysis method. The triangulation method aims to connect the results obtained by qualitative and quantitative methods. In this way, the results are compared and validated. The codes and frequencies obtained from the interviews within the scientific process skills theme are presented in Table 4.

Table 4

Codes and Frequencies Obtained from Interviews on Developing Scientific Process Skills

Theme	Code	*f*
Scientific Process Skills	Designing and conducting experiments	12
	Identifying research questions	4
	Identifying hypothesis	2
	Identifying variables	7
	Determination of test materials	5
	Create an experiment set up	4
	Observation	3
	Using measurement and measurement units	1
	Data collection and recording	3
	Drawing tables and graphics	12
	Data interpretation and inference conclusion	7
	Report experiment results	4

During the interview, the teacher candidates suggested that the second stage of the course practices improved their scientific process skills. The teacher candidates stated that they had developed the skills of designing experiments, determining and controlling the variables, drawing tables and graphing, and writing reports. For example, a teacher candidate made his assessment as follows: *"At first, I was not very dominant in making research questions and determining variables. Something was going on in my mind, but it was hard to write and present in a way everyone could understand. I developed these skills. I am better at drawing graphics. For example, I was not exactly dominant in the claim, evidence, and hypothesis. I learned these. I know*

what they are." Another teacher candidate expressed the development of scientific process skills in this process: *"My skills in making observations have evolved. I think that interpreting and designing experiments have shown great improvement. We did our experiments ourselves. I've never been in the process of experimenting so much before. Now I can design an experiment on any subject."* After the practice, it is seen that the teacher candidates are more confident about designing and conducting an experiment.

Data triangulation was performed to support the qualitative data obtained from the interviews. For triangulation, quotations were made from evaluation notes and learning diaries.

The reflective evaluation notes of teacher candidates revealed explanations about the development of scientific process skills. For example, a teacher candidate's reflection is as follows. *"For example, we learned dependent, independent, and control variables. It was the most confusing topic."* It shows that this process has developed scientific process skills. Another of the teacher candidates made the following explanations regarding the development of scientific process skills in the reflective learning diary. In the first weeks, *"I started to produce more questions on a subject. I am on my way to producing different solutions for questions. This shows that my scientific process skills have improved*." In the middle of the implementation, "*It has been a great pleasure for me to experiment. When I became a teacher, I decided to apply what I learned."* At the end of the process, *"I can say that my scientific process skills are greatly improved and will make great contributions to me in the future."*

In the learning diaries of the teacher candidates, some findings were found that scientific process skills improved. For instance, a teacher candidate stated an improved ability to design experiments in the learning diary. *"Through this course, I have learned to design experiments to embody the concepts easily."* Another teacher candidate stated that he/she learned the dependent and independent variables. This indicates that he/she has learned to identify the variables.

The qualitative and quantitative findings support each other. Consequently, it can be determined that the scientific process skills of teacher candidates are improving as a result of the argument-based inquiry activities.

Second Sub-Problem Results

The second dependent variable examined in the study is the higher-order thinking skills. The first variable examined within higher-order thinking skills is critical thinking tendencies. The averages of pre-post-test the critical thinking dispositions levels were compared using paired samples t-test. The findings are presented in Table 5, along with descriptive statistics.

Tablo 5

T-Test Results of UF/EMI Critical Thinking Disposition Pre-Post Test

		N	*x*	*S*	*sd*	*t*	*p*
UF/EMI Critical Thinking Disposition	Pre-test	33	4.10	.32	32	-3.274	.003*
	Post-test	33	4.30	.44			
Engagement Dimension	Pre-test	35	4.03	.40	34	-3.012	.005*

Cognitive Maturity Dimension	Post-test	35	4.25	.48	37	-2.249	.031*
	Pre-test	38	4.25	.34			
	Post-test	38	4.39	.39			
Innovativeness Dimension	Pre-test	35	4.11	.32	34	-2.993	.005*
	Post-test	35	4.29	.46			

*p< .05

Critical thinking disposition grades of science teacher candidates show a statistically meaningful difference between pre-post implementation, $t(32)=-3.274$, $p<.05$. The mean levels of teacher candidates' critical thinking disposition before the practices were 4.10 out of 5, and it increased to 4.30 points after the practices. When the sub-dimensions of critical thinking dispositions are examined, teacher candidates' engagement, cognitive maturity, and innovativeness post-test levels were significantly higher than pre-test levels ($p<.05$). This result shows that the argument-based inquiry teaching practices for 14 weeks had a statistically significant influence on improving the critical thinking disposition levels and sub-dimensions of teacher candidates' cognitive maturity, engagement, and innovativeness.

On the other hand, the data collected with qualitative data collection instruments were analyzed using the descriptive analysis method. The triangulation method aims to connect the results obtained by qualitative and quantitative methods. In this way, the results are compared and validated. The codes and frequencies obtained from the interviews within critical thinking disposition category scope are presented in Table 6.

Table 6

Codes and Fre. Obtained from Interviews on Developing Critical Thinking Dispositions

Category	Code	*f*
Critical Thinking Dispositions	Gain a different perspective	12
	Scientific thinking	6
	Scientific inquiry	7
	Critical thinking	9
	Establishing a cause-effect relationship	2
	Presenting claim and evidence	2
	Defending an idea	2
	Rest with respect	2

The interviewed teacher candidates claimed that critical thinking skills were developed in this process. For example, a teacher candidate expressed the development of critical thinking disposition in this process: "Now I think I have learned to look at facts and *events from a different perspective. I have started to take events from a different perspective."* Another teacher candidate stated that she/he started to look at the events more critically and thought more deeply. *"My thoughts have evolved. I had a*

little more mature. My point of view has changed. I started questioning. I wonder why this? Why so? How else could it be?" Another teacher candidate stated that he gained critical thinking skills at the end of this process. *"I started to critical looking. I think this is a huge gain for me."* The other teacher candidate stated that he listened carefully to the ideas of others even if he disagreed with them. *"One of our friends within and among the groups, I listen to it even if it is an opposite thought. I am not saying that is not right now. I listen to him/her first, I consider."* This situation shows that the teacher candidates' critical thinking skills have improved because thinking critically requires consciously evaluating their own thoughts and the thoughts of others.

Data triangulation was performed to support the qualitative data obtained from the interviews. For this purpose, quotations were made from evaluation notes and learning diaries.

In the reflective evaluation notes, teacher candidates explain developing critical thinking skills. For example, a teacher candidate reflected that this process developed critical thinking skills. "*We gained different perspectives through class discussions.*" Another teacher candidate evaluated his/her development in this process as follows. *"I feel I'm quite improving critical thinking."*

In the learning diaries of the teacher candidates, some findings were found that critical thinking skills improved. For example, a teacher candidate has expressed critical thinking in the process of practice. *"At the end of this activity, I think we use our skills such as persistent learning, curiosity, teamwork, creative thinking, critical thinking, and effective communication."*

The qualitative and quantitative findings support each other. Consequently, it can be said that teacher candidates' critical thinking dispositions are improving due to the argument-based inquiry activities.

Another variable examined within the context of higher-order thinking skills is metacognitive awareness. The averages of the metacognitive awareness levels pre-posttest were compared using a paired samples t-test. The findings are shown in Table 7, along with descriptive statistics.

Tablo 7

T-Test Results of Metacognitive Awareness Pre-Post Test

		N	*x*	*S*	*sd*	*t*	*p*
Metacognitive Awareness Inventory	Pre-test	31	3.75	.37	30	-2.327	.027*
	Post-test	31	3.95	.49			
Structure of Cognition	Pre-test	33	3.88	.44	32	-2.605	.014*
	Post-test	33	4.06	.46			
Regulation of Knowledge	Pre-test	35	3.71	.36	34	-2.202	.035*
	Post-test	35	3.88	.51			

*p< .05

The mean levels of teacher candidates' metacognitive awareness levels before the practices were 3.75 out of 5, and it increased to 3.95 points after the practices.

Metacognitive awareness levels of teacher candidates were significantly improved after argument-based inquiry teaching practices, $t(30)=-2.327$ $p=.027$. When the sub-dimensions of metacognitive awareness are examined, science teacher candidates' structure of cognition and regulation of knowledge post-test levels were higher than pre-test levels ($p<.05$). This result shows that the argument-based inquiry activities for 14 weeks had a statistically significant influence on improving the teacher candidates' metacognitive awareness levels and sub-dimensions (structure of cognition and regulation of knowledge). It can be interpreted that teacher candidates have a high grade of metacognition awareness after the implementation.

On the other hand, the data collected with qualitative data collection tools were analyzed using the descriptive analysis method. The triangulation method aims to connect the results obtained by qualitative and quantitative methods. In this way, the results are compared and validated. Codes and frequencies obtained from qualitative data within the metacognition awareness category are presented in Table 8.

Table 8

Codes and Frequencies Obtained from Interviews on Developing Metacognition Awareness

Category	Code	*f*
Metacognition Awareness	Learning to inquiry	2
	Learning to scientific research	7
	Learning scientific discussion	5
	Learning way to obtain knowledge	1
	Learning to teach	2
	Learning to learn	6
	Recognizing and correcting misconceptions	7
	Understanding and interpreting the world	2

During the interviews, teacher candidates explained the promotion of cognitive knowledge and regulation of knowledge. Teacher candidates stated that they realized what they knew, they had the misconceptions, and learned how they could use the knowledge and skills they learn when they are teachers. For example, teacher candidates explained the awareness that she/he has experienced in the first stage of the lesson as follows. *"We lost our ability to ask questions over time. I realized how little I was asking questions as a teacher. Thanks to you, I realized how little less critical I was thinking. Why is that? I noticed that I did not question."* It is seen that another teacher candidate makes the structure of cognition and regulation of knowledge while explaining his/her views about the second stage of the lesson. *"How can I ask children what is coming from? In fact, I saw exactly how I could teach the student. I learned how to ask students questions."* While other a teacher candidate expressed his/her thoughts about the third stage of the lesson, it is seen that he/she makes debugging for the regulation of knowledge *"Friends like this. Friends disagree with us. We discussed why this is the case."* According to the qualitative findings obtained from the interviews, it

was determined that the practices carried out in all three stages impacted the metacognition awareness of teacher candidates. In addition to the teacher candidates, the following question was asked during the interviews. "*How do you evaluate your progress in this process by considering your situation before and after the implementation?"* With this question, it is ensured that teacher candidates evaluate themselves. This situation contributes to the development of metacognitive awareness. For example, a teacher candidate's statement in the following figure indicates that he/she will need what to do when he/she becomes a teacher. This shows that she/he could make the planning and planning of cognition. *"I am taking notes in class. This is to be done, this is to be done in this way. I think that this course improves me in terms of teacher."* Another teacher indicates that he/she evaluates cognition with his/her expression as follows. *"I am looking at my first report, for example, I see that there are really missing things. I cannot draw graphics. I could not determine my variables correctly. My research question is not appropriate. I think I have developed these slowly in my progressive activities reports."* Another teacher candidate can be said to be more confident about what he/she knows or does not know. *"Now, I can express my ideas clearly."* It is seen that another teacher candidate explains the usefulness of open-ended experiments and makes situational analysis in the knowledge dimension of cognition. "*In closed-ended experiments, people work until they find the truth. It does not matter what you found your own. We have found the truth, or it is over. That experiment is finished. You did the research. What was its result? You did this. You have to share the results. You should go on top of it, but we did not have it. This is the result, everyone found it, so I have to find it. But now I am trying to find my own. We have presented what our result is.*"

Data triangulation was performed to support the qualitative data obtained from the interviews. For triangulation, quotations were made from evaluation notes and learning diaries.

The reflective evaluation notes of teacher candidates revealed explanations about the development of metacognitive awareness. For instance, *"I learned excellent information and experiments that I could use in my professional life. The aim was to learn and apply the argumentation process rather than experiments. I think I learned this process well and that practice in this course."* It is seen that the teacher candidate evaluates how well he understood something.

In the learning diaries of the teacher candidates, some findings were found that metacognitive awareness improved. Such as *"Now, when I encounter a problem, I think as a solution-oriented. I am trying different solutions to solve the problem."* It is seen that the teacher candidate explains how he used his knowledge and skills in his daily life. This situation can be interpreted as the teacher candidate managing and monitoring the information in the regulation of knowledge. It can be interpreted that the learning diaries serve the development of metacognitive awareness because the teacher candidates are summarizing what they have learned on that day and directing them to assess the dimension of cognition.

The qualitative and quantitative findings support each other. Consequently, it can be interpreted that science teacher candidates' metacognitive awareness is improving due to the argument-based inquiry activities.

Third Sub-Problem Results

The third dependent variable examined in the study is the views of the nature of science. The averages of pre-posttest the BILTEST scores were compared using by paired samples t-test. The findings were presented in Table 9, along with descriptive statistics.

Table 9

T-Test Results of BILTEST Pre-Post Test

		N	*x*	*S*	*sd*	*t*	*p*
BİLTEST	Pre-test	37	81	12.39	36	2.089	.044*
	Post-test	37	85	8.79			

**p<.05*

BILTEST score of the teacher candidates was 81 out of 100 points and increased to 85 points after the practices. Table 7 shows a statistically significant difference between pre-test and post-test mean scores, $t(36)=-2.089$ $p<.05$. This result shows that the argument-based inquiry teaching activities had a statistically profound influence on improving the nature of science scores of the teacher candidates.

On the other hand, the data collected with qualitative data collection tools were analyzed using the descriptive analysis method. The triangulation method aims to connect the results obtained by qualitative and quantitative methods. In this way, the results are compared and validated. The codes and frequencies obtained from the interviews within the scope of the views of the nature of science theme are presented in Table 10.

Table 10

Codes and Frequencies Obtained from Interviews on Developing the Views of the Nature of Science

Theme	Code	*f*
Views of Nature of Science	Doing scientific research	12
	Learning by experiencing the scientific process	6
	Scientific thinking and questioning	7
	Understanding the changing nature of scientific knowledge	4
	Development of imagination and creativity	3

During the interviews, the teacher candidates stated that the practices developed an understanding of the nature of science. For example, a teacher candidate asserted that practices are an effective method for understanding the nature of science. *"I think these practices are a good way to raise individuals who are open to change, do not believe in the certainty of information, and believe that there may be different things.*" Another teacher candidate *"I thought science was unchanging. I am starting to question now. I*

wonder if that is true. Do you have proof? We are now that size. This information is correct in advance, it is ok to say yes, but now we are starting to question. We can even try to continue through that person's idea. For example, we can work on that idea. "In this statement, the teacher candidate stated that s/he has an inadequate understanding of the nature of science before the practice and after the implementation and has a more advanced understanding of the nature of science. We learned from the other teacher candidates, "How a scientist goes through a process. *We learned how the scientific process works. This was an important improvement for me.*" In this statement, the teacher candidate expressed the effect of this process on the development of views of science's nature. Another teacher candidate *"I have learned that I should be open to change. It is necessary to investigate rather than accept that information is accurate. We need to look at another source. I learned this. Then I can interpret the information."* In this statement, the teacher candidate explained the improvement of the views on the nature of science.

Data triangulation was performed to support the qualitative data obtained from the interviews. For triangulation, quotations were made from evaluation notes and learning diaries.

In the reflective evaluation notes of the teacher candidates reflective revealed explanations about the development of the views of the nature of science. Such as a teacher candidate *"Before and after the course, I understood that every information was not correct when writing the report."* In this reflection, the teacher candidate states that this process impacts the development of the view about the nature of science. *"Our imagination and creativity have evolved. It contributed to our imagination and creativity.*" Many teacher candidates have included similar reflections. It can be interpreted that argument-based inquiry practices also foster the imagination and creativity of science teacher candidates.

In the learning diaries of the teacher candidates, some findings were found about the nature of science. In addition, some findings have been found in the learning diaries of teacher candidates. For example, one of the teacher candidates said I understand that we can obtain by investigating, questioning, and deducting science. Another teacher candidate, *"The results of another group doing the same experiment with us were different from ours. This situation shows us that the margin of error can always exist; we should be cautious in our observations."* The other teacher candidate "*We have measured at least three times and averaged them to be consistent and accurate. We made inferences."* In this reflection, the teacher candidate stated that they made inferences from the experiment and observation data during the implementation process.

The qualitative and quantitative findings support each other. Consequently, it can be said that teacher candidates' views of the nature of science are improving due to the argument-based inquiry activities.

Discussion and Conclusion

The first dependent variable examined in the research is the level of scientific process skills. Due to the nature of the science course and the expectations of the era, we argue that developing scientific process skills of teacher candidates should be aware of the importance of scientific process skills. The studies conducted with science

teacher candidates demonstrate that teacher candidates gaining experience using scientific process skills help candidates provide inquiry-based science education more effectively when they are teachers and help students develop scientific process skills (Eick & Reed, 2002; Windschitl, 2003). It is thought that the practices in the second stage of the argument-based inquiry teaching model will promote the scientific process skills of the teacher candidates. Because, at this stage, it is aimed that teacher candidates design and conduct experiments, reasoning based on the data obtained, making abstract inferences from the data, and reporting the experiment results. The report format used during the practices at this stage requires the use of teacher candidates' basic and integrated process skills. According to the qualitative and quantitative analysis conclusions obtained from this research, it has been revealed that the argument-based inquiry teaching practices have played a role in developing the scientific process skills of teacher candidates. According to this finding, it can be said that the argument-based inquiry teaching practices are effective in developing the scientific process skills of teacher candidates. Although, according to the quantitative findings, there is no significant difference between pre-test and post-test scores of investigation designing, the teacher candidates claim that their investigation designing skills have improved during the interviews and document analysis. With this, the report format (see appendix 3) used in the second stage of the course was designed to improve the investigation designing skills of teacher candidates. Also, qualitative data collection tools show that teacher candidates said that the practices conducted in the second stage of the course improve their scientific process skills. As a result, both quantitative and qualitative findings support each other. It has been determined that argument-based inquiry activities conducted for 14 weeks contributed to developing the scientific process skills of teacher candidates. Like this result, Demircioğlu and Uçar (2015) found that the teacher candidates' arguments and inquiry-based laboratory practices develop the science process skills. Similarly, when the related literature was examined that laboratory applications based on argumentation (Aslan, 2016), inquiry-based approach (Akben, 2015; Arı et al., 2017; Ateş, 2004; Duru et al., 2011; Kaya & Yılmaz, 2016; Şen & Vekli, 2016; Şimşek & Kabapınar, 2010) argument-driven inquiry learning approach (Dina et al., 2022), inquiry-based science writing tool (Ulu, 2011) was effective in promoting scientific process skills.

The second dependent variable examined in the research is the level of higher-order thinking skills. Higher-order thinking skills were examined in the context of teacher candidates' critical thinking dispositions and metacognitive awareness levels. With the fourth industrial revolution, the importance of educating individuals with 21st-century skills that can keep up with the changing era is increasing. Considering the demands of the era, a teaching environment was provided where teacher candidates could gain the skills to develop higher-order thinking skills for future students. The practices of all course stages could contribute to the development of critical thinking skills and metacognitive awareness skills of teacher candidates. Because of the questioning during the big group discussions (in the first and third stages) are capable of developing the teachers' critical thinking and metacognitive awareness skills. Small group discussions in the second stage also serve this purpose. According to Coll et al. (2005), group work and peer discussions are essential in improving cognitive and metacognitive thinking skills. In addition, the 'claims, evidence, rebuttals, and backing'

sections in the report format used during the second stage of the course contribute to the critical thinking skills of teacher candidates. 'The initial ideas, what to research, the materials I need, backings, rebuttals, and reflections' sections in the report format have the characteristics that contribute to the development of metacognitive awareness skills of teacher candidates.

Furthermore, it is thought that teacher candidates' reflective learning diary writing contributes to developing metacognitive skills. In his study, Martin-Kniep (2000) emphasized that candidate teachers improve metacognitive thinking skills while answering reflective questions. Reflective questions activate metacognitive processes such as planning, monitoring, and evaluating the individual's learning process (Lin et al., 1999). Çavuş (2015) stated that using a science diary in science and technology courses positively affects the level of metacognitive awareness of elementary school students. Within the scope of this research, it has been determined by the quantitative and qualitative analysis results that teacher candidates developed critical thinking dispositions and metacognitive levels after the argument-based inquiry teaching practices. Similar to this result, Usta Gezer (2014) found in his doctoral study that general biology laboratory activities based on reflective inquiry had an important effect on developing the critical thinking tendencies of science teacher candidates. In this research, it can be said that the argument-based inquiry practices are effective in developing the metacognitive awareness skills of teacher candidates.

Similarly, Ulu and Bayram (2014) found that inquiry-based science writing tool usage successfully developed students' metacognitive knowledge and skills. In the scope of this research, the argument-based inquiry report format and the science writing tool have similar sections. In addition, Keys et al. (1999) found that using science writing tools in laboratory practices provided metacognitive thinking in students. Research results show that science writing-based heuristic learning approach (Şahin, 2016), inquiry-based laboratory practices (Evren, 2012), argumentation-based learning (Öztürk, 2017), critical thinking-based science education (Yıldırım, 2009), and constructivist learning practices (Aydın & Yılmaz, 2010; Kaya, 2010) are effective in developing critical thinking and metacognitive awareness skills. Qualitative findings obtained from the interview and document analysis support the quantitative findings. Qualitative findings: It has been shown that teacher candidates develop critical thinking skills such as looking at events from a different perspective, critically looking at events and questioning. In addition, it reveals that the teacher candidates realize how they can use the knowledge and skills they have learned in the future when they are teachers. As a result, the qualitative and quantitative findings obtained support each other.

The third dependent variable studied in the research is the views of the nature of science. To educate individuals in science literacy, science teacher candidates need to develop their views on the nature of scientific knowledge (AAAS, 1990; Lederman, 1992; McComas et al. 2000). The development of teacher candidates' views on the nature of science helps them to teach science more effectively (Driver et al., 1996). It is thought that the practices made in the second and third stages of the argument-based inquiry teaching model will improve the views of the nature of the science teacher candidates. Because in the second stage, science teacher candidates designed and conducted experiments. This process enables them to how the scientific process studies, how scientists work, and how scientific knowledge is learned by experience. Although

this process allows teacher candidates to explore the nature of science, research shows that such practices develop a limited understanding of science (Abd-El-Khalick, 2002; Khishfe & Abd-El-Khalick, 2002; Lederman, 1992). On the other hand, Welch et al. (1981) state that those who do not have enough experience in scientific research will develop an insufficient understanding of the nature of science. In this direction, it can be said that the designing and conducting experiment process, which is the second stage of the course, have an important place when teacher candidates are not enough to develop their understanding of the nature of science but when supported with an explicit-reflective approach. In this context, argumentation-supported big group discussions were conducted in the third stage of the course. During this period, scientific information is based on evidence, different conclusions can be made by using the same data, observation and inference are different from each other, and evidence can be obtained by direct observations or indirect observations, as there is no only method used in science, these themes of the nature of science are directly emphasized. In this manner, it is aimed at teacher candidates to internalize the themes of the nature of science. Furthermore, during the big group discussions, teacher candidates may realize that it is possible to interpret the same data in different ways, that it is not always possible to obtain definitive evidence in science and can create a more realistic understanding of the nature of science (Crawford et al., 2000; Driver et al., 2000). Big group discussions can benefit teachers' perceptions of science as a process where ideas are constantly put forward, questioned, and open to development and change (Strike & Posner, 1992). In this study, to develop the views of the nature of the science of teacher candidates, the process of designing and conducting an experiment based on argument-based inquiry was supported by an explicit-reflective approach. It can be said that teacher candidates effectively develop views of the nature of science. In parallel with this result, Özgelen (2010) conducted explicit-reflective and inquiry-based laboratory practices to improve science teachers' views on the nature of science. He found that discussions and presentations, the use of research skills, and inquiry-based laboratory activities improved teacher candidates' understanding of the nature of science. At the same time, he expressed that the explicit-reflective approach is complementary to each other by inquiry-based laboratory teaching and demonstrated an effective method for improving the nature of science. Also, in many studies, the explicit-reflective approach effectively develops the views of the nature of science (Abd-El-Khalick & Lederman, 2000; Kaya et al., 2016; Khishfe & Abd-El-Khalick, 2002). Tümay and Köseoğlu (2011) indicated that argumentation-based teaching could improve the views of the nature of science. In addition, as in this study, the nature of science effectively combines the use of more than one method in teaching (Allchin et al., 2014; Ecevit et al., 2018). Qualitative findings obtained from the interview and document analysis support the quantitative findings. Qualitative findings suggest that the teacher candidates' views on the nature of science evolve. As a result, the qualitative and quantitative findings obtained support from each other. In the 14-week practices, supporting the argument-based inquiry experiment process with an explicit-reflective approach contributed to the development of teacher candidates' views on the nature of science.

Suggestions

In science teacher education, argument-based inquiry practices can contribute to the training of better equipped and competent teachers. Argument-based inquiry practices can provide science teachers with the knowledge, skills, and attitudes necessary for science and provide convenience in science teaching when they start working as teachers. Research has pointed out that argument-based inquiry practices aiming to learn science by doing, living, and thinking can make students educated by the era's requirements. To educate science-literate individuals with 21st-century skills that can keep up with the changing era, it is recommended to conduct argument-based inquiry practices in preschool, primary and secondary school student education. It is possible to provide teachers with this learning method by planning practical in-service training rather than theoretical training related to current science teachers' argument-based inquiry learning method.

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All authors have participated sufficiently in the work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the manuscript. Furthermore, each author certifies that this manuscript has not been and will not be submitted to or published in any other publication before its appearance in the Journal of Theoretical Science.

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.

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APPENDIX I

SEMI-STRUCTURED INTERVIEW FORM

1. What kind of contributions do you think the first stage (big group discussion) of the course has for you?

Probes: *Encouraging inquiry, developing creativity, thinking, developing opinions.*

2. What kind of contributions do you think the course's second stage (designing an argumentation-based inquiry experiment) has for you?

Probes: *Did writing your own research question and identifying the variables for this question contribute to your learning? Which skills did you develop by presenting your experiment and observation results in the form of tables and graphs?*

3. What do you think about the activity report you used during your research in the 2nd stage of the lesson?

Probes: Which part did you find more compelling? Can you explain why? In which part are you bored? Can you explain why? What would you recommend to make this section more effective?

4. What were the benefits of preparing an activity report in the 2nd stage of the lesson?

5. What was the benefit of sharing your research results and having a big group discussion in phase 3 of the lesson?

6. Considering your situation at the beginning and after the implementation, how would you describe your development in this process?

Probes: Permanent trace learning, developing high-level thinking skills, developing scientific process skills, developing scientific communication skills, science teaching self-efficacy belief, positive attitude towards science, motivation for science.

APPENDIX II

Activity 12: Investigation of factors affecting melting and dissolution

The purpose of the activity

This activity aims to teach candidates to design and carry out different activities based on argument-based inquiry related to melting and dissolution factors.

Concepts

Dissolution**,** Resolution**,** Solution**,** Solute, Solvent**,** Factors affecting the dissolution rate**,** Melting**,** Factors affecting the melting time

Principles and Generalizations

- Changing the temperature of the liquid affects both the solubility and the rate of dissolution.
- Increasing the temperature increases the solubility of solids and liquids.
- Increasing the temperature increases the dissolution rate.
- The solubility of gases is inversely proportional to temperature.
- Dissolving solids in water is endothermic. As the temperature increases, the solubility increases.
- Pressure changes the solubility of gases.
- The particle size of the solute affects the dissolution rate; it does not change the solubility.

Skills to be Gained

Scientific Research Skills

Basic Process Skills

- ✓ Observation
- ✓ Communication
- ✓ Estimate
- ✓ Making Comments

Integrated Process Skills

- ✓ Defining and Controlling Variables
- ✓ Identifying Hypotheses
- ✓ Investigations Designing
- ✓ Graphing and Interpreting Data
- ✓ Experimenting

Argumentation Skills

- ✓ Claim
- ✓ Evidence
- ✓ Justification/ Backing
- ✓ Rebuttal

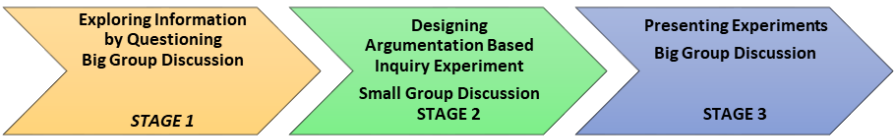
Higher Thinking Skills

- ✓ Critical thinking skills
- ✓ Reflective thinking skills
- ✓ Inquiry thinking skills

Views of Nature of Science

- ✓ Scientific knowledge is based on empirical data.
- ✓ Observation and inference are different from each other.
- ✓ Imagination and creativity

Stages of Argumentation based Inquiry Teaching Model



Stage 1: Exploring information by questioning, big group discussion

Stage 1 is aimed at teacher candidates can understand the world. In order to create a sense of curiosity was asked open-ended questions rather than questions with one correct answer to teacher candidates. Thus, it was provided that teacher candidates realized what they were true about, false, or what they wanted to learn about the subject.

1. Some water is poured into the beaker, adding and mixed sugar. Where did the sugar go? What happened to the sugar?
2. I have 100 ml of water and 10 grams of sugar in my hand. What do you think about the total mass and volume when I throw sugar into the water? So why didn't its volume increase while its mass increased?
3. When making coffee, we use hot water and mix it. What do we expect to happen when we use cold water? What difference does temperature make? How can you explain this situation regarding the particulate nature of matter?
4. What do you think is why you do not write cold drinks on acidic drinks?
5. What are the factors affecting resolution?
6. What is dissolution? What is the solution? What are solvent and solute? What do supersaturated, saturated and unsaturated solutions mean?
7. How do you prepare a 10 percent salt solution?
8. How does an increase in concentration affect the rate of dissolution?
9. What are the factors affecting the dissolution rate?
10. What happens when we throw a piece of ice into the water?
11. What is melting? How does the structure of ice change as it melts? Is this change a chemical or physical change?
12. When the ice melts, does it increase in mass, that is, in the number of particles?
13. How does the volume of ice change when it melts? What is the reason for the decrease?
14. What is why salty pebbles are thrown on the roads after a snowfall in winter? What would happen if sugar was used instead of salt?
15. Does the shape of the ice pieces affect the melting time? So, if it does, how does it affect it?
16. Which ice cubes, cylinders or circles do you prefer to keep your coke cold for longer?
17. What are the factors affecting the melting time of ice pieces?

Using the questions given above, the opinions of the teacher candidates about the subject are revealed. In this process, a learning environment must create where teacher candidates can easily explain their thoughts, put forward different views, and explain their

thoughts with their justifications. In this process, it is essential to associate the subject with daily life and to question the reasons for the occurrence of events and phenomena. Key concepts from teacher candidates can be written on the board. Key concepts from teacher candidates can be written on the board to guide them on what to research.

Stage 2: Designing argumentation-based inquiry experiment, small group discussion

In the second stage, the teacher candidates are aimed to design and conduct experiments. The teacher candidates' are expected to reason based on experimental data and make inferences from experimental data. In stage 2, the teacher candidates design and carry out their own experiments and write experiment reports. The teacher candidates are guided by asking questions. In Stage 2, the teacher candidates use the activity report format of nine sections prepared by the researcher. The report format consists of the section presented below.

1) My initial thoughts *(know, wonder, learn)*
2) What will I investigate *(my question, dependent variable, independent variable, control variables, hypothesis)*
3) Materials I need *(for safety)*
4) Designing an experiment
5) Observations and findings
6) Claims
7) Evidence
8) Backing and rebuttal *(when I compare with my friends, sources of error)*
9) Reflection *(my ideas have changed because my ideas haven't changed because what questions would you ask to research again)*

The activity report format was created by synthesizing the student template of the Science Writing Heuristic developed by Keys, Hand, Prain, and Collins (1999) and the inquiry-based learning cycle developed by Pedaste et al (2015). See appendix 3. Activity reports prepared by teacher candidates during stage 2 collect every week. The researcher gives feedback by reading the reports of the teacher candidates every week. The reports redistribute to teacher candidates the following week. Thus, weekly the experience improvement of teacher candidates follows.

At this stage, teacher candidates will design experiments to investigate the factors affecting melting and dissolution. Each group is provided to inquire about different factors and design an experiment. Teacher candidates can design experiments such as presented below.

The first group can investigate the effect of temperature on dissolution.
The second group can investigate the effect of temperature on the dissolution rate.
The third group can investigate the effect of solvent type on dissolution.
The fourth group can investigate the effect of changing the type of solute on dissolution.
The fifth group can investigate the effect of mixing on the dissolution rate.
The sixth group can investigate the effect of the contact surface of solute on the dissolution rate.
The seventh group can investigate the effect of the shape of ice pieces on the melting time.
The eighth group can investigate the effect of the poured materials on the ice pieces on the melting time.

The teacher guides the groups in determining the research questions, and in this process, She/he asks guiding questions to the teacher candidates and assists the teacher candidates in the inquiry-based activity. Each group creates the research question themselves and discusses it with their groupmates, planning how to design an experiment to test the research questions. The following tools and equipment are offered to teacher candidates. At this stage, the teacher interacts with each group and guides them where the groups need them. Teacher candidates are active group members from the beginning to the end of the activity.

Required Tools and Materials: Hot and cold water, food coloring, ink, beaker, equal amounts of ice particles in different shapes, salt, baking powder, baking soda, powdered sugar, sugar cubes, granulated sugar, Alka-Seltzer tablets, naphthalene, vinegar, alcohol, weigher, mixer...

Stage 3: Presenting experiments, big group discussion

The third stage aims for teacher candidates to share and explain the experimental results using scientific terminology. Each group presented their experimental results and compared the similarities and differences of the experimental results with the other groups. In the third stage, it must be ensured that teacher candidates can explain their thoughts with their reasons, express their unclear explanations, produce different explanations, and question the accuracy of the explanations. There must be no evaluation of the teacher candidates' answers correctly or incorrectly in these processes.

Each group presents their experiment to the class. During the presentations, teacher candidates share their research questions, the variables they changed and controlled, what they claimed as a result of the experiment, and what their evidence is included. The groups' results with similar research questions are compared and discussed over their similarities and differences. Teacher candidates are guided to present the experiment's results using scientific terminology.

APPENDIX III
The Activity Report Format

Argümantasyon Destekli Araştırma-Sorgulamaya Dayalı Etkinlik Raporu

Adınız Soyanız:	Grubunuz:
Etkinliğin Adı:	

1) BAŞLANGIÇ DÜŞÜNCELERİM

Bu konuda neler biliyorum?	*Bu konu neler öğrenmek istiyorum?*	*Bu konuda yeni neler öğrendim?*

2) NEYİ ARAŞTIRACAĞIM

Araştırma sorum nedir? Bu konu ile ilgili neleri merak ediyorum?	Bağımlı değişken: Bağımsız değişken: Kontrol değişkeni:	Hipotezim: ☐ Kabul edildi. ☐ Reddedildi.

3) İHTİYACIM OLAN MALZEMELER

Araştırma sorumu test etmek için hangi malzemelere ihtiyacım var?	Güvenlik için nelere dikkat etmeliyim?

4) DENEY TASARLAMA

Araştırma sorumu test etmek için nasıl deney tasarladım? Yani, Sorularıma cevap bulmak için ne yaptım?

5) GÖZLEM VE BULGULARIM

Neleri gözlemledim? Hangi özellikleri ölçtüm? Yaptıklarım sonucunda neler buldum?	Verileri tablo ve grafik olarak nasıl gösterebilirim?

6) İDDİALARIM

Neleri iddia ediyorum? Bulduklarım ve gözlediklerim sonunda ne iddia ediyorum?

7) DELİLLERİM

İddiamı destekleyen delillerim neler? Bulduklarım ve gözlediklerim sonunda yukarıdaki iddiamı yaptım çünkü delillerim şunlardır:

8) DESTEKLEYİCİ VE ÇÜRÜTÜCÜLERİM

Arkadaşlarımla karşılaştırdığımda	***Kaynak 1'deki sorumun cevabı***	***Kaynak 2'deki sorumun cevabı***	***Kaynak 3'deki sorumun cevabı***
Araştırmamda hata kaynakları neler olabilir?			
	Kaynakça:	***Kaynakça:***	***Kaynakça:***

Kaynaklardan edindiğim bilgiler iddia ve delillerim ile nasıl bir benzerlik ve zıtlık içerisindedir?

9) YANSIMALAR

Düşüncelerinizde ne gibi değişiklikler oldu?

Düşüncelerim değişti, çünkü…

Düşüncelerim değişmedi, çünkü…

Bu konuda kafama takılanlar?

Tekrar bu konuyu araştırmak veya test etmek için hangi soruları sorardınız?

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Is presenteeism good or bad? A phenomenological study in schools

Presenteeism iyi midir kötü müdür? Okullarda fenomenolojik bir çalışma

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ABSTRACT: The study aims to analyse the phenomenon in a holistic and comprehensive way according to the perceptions of education workers who experience presenteeism more frequently and reveal the relationship of presenteeism with the sociological, psychological, and theological dynamics of Turkish society. The study was conducted with a phenomenological design, one of the qualitative research methods. The study group consists of five teachers and five school administrators working in Elazığ, a province in Türkiye in the 2020-2021 academic year. It was determined that educators can voluntarily decide to work when they are not feeling well due to motivations such as a sense of responsibility, conscience, commitment to work, public service, and religious sensitivity. In addition, some participants stated that due to organisational pressure, economic difficulties, and workload, employees make a forced decision to work when they are not well. Finally, in addition to the negative results of presenteeism, positive results, which are rarely seen in the literature, were also obtained. Therefore, the experience of presenteeism should be evaluated considering its positive and negative effects on organisations and employees. Finally, suggestions were developed to monitor the situation of employees experiencing presenteeism, develop policies regarding this, and prevent them from being forced to work in bad situations they cannot tolerate.

Keywords: Presenteeism, bad presenteeism, good presenteeism, involuntary presenteeism, voluntary presenteeism.

ÖZ: Bu çalışma presenteeismi daha sık deneyimleyen eğitim çalışanlarının algılarına göre olguyu bütüncül ve kapsamlı bir şekilde analiz etmeyi ve Türk toplumunun sosyolojik, psikolojik ve teolojik dinamikleriyle ilişkisini ortaya koymayı amaçlamaktadır. Araştırma, nitel araştırma yöntemlerinden fenomenolojik desende yürütülmüştür. Çalışma grubunu Türkiye'nin Elazığ ilinde 2020-2021 eğitim-öğretim yılında görev yapan beş öğretmen ve beş okul yöneticisi oluşturmaktadır. Katılımcıların sorumluluk duygusu, vicdan, işe bağlılık, kamu hizmeti, dini duyarlılık gibi motivasyonlar nedeniyle kendilerini iyi hissetmedikleri durumlarda gönüllü olarak çalışmaya karar verebildikleri belirlenmiştir. Ayrıca bazı katılımcılar örgütsel baskı, ekonomik zorluklar ve iş yükü nedeniyle iyi olmadıkları zamanlarda zorunlu bir şekilde çalışmaya karar verdiklerini ifade etmiştir. Son olarak, Presenteism'in olumsuz sonuçlarına ek olarak, literatürde nadiren görülen olumlu sonuçları da öngördüğü belirlenmiştir. Dolayısıyla presenteeism deneyimi, örgütler ve çalışanlar üzerindeki olumlu ve olumsuz etkileri dikkate alınarak değerlendirilmelidir. Bu bağlamda son olarak, presenteism yaşayan çalışanların durumlarının izlenmesi, buna yönelik politikalar geliştirilmesi ve tahammül edemeyecekleri kötü durumlarda çalışmaya zorlanmalarını engellenmeye yönelik öneriler geliştirilmiştir.

Anahtar kelimeler: Presenteeism, kötü presenteeism, iyi presenteeism, gönülsüz presenteeism, gönüllü presenteeism.

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Human resources are shown as the principal capital of organisations (Ployhart et al., 2014) established to realise specific goals (Chams & García-Blandón, 2019). Organisations want to use their human resources most effectively to achieve their goals (Açıkalın, 1994). With the policies they have developed for this purpose, traditional human resources departments try to keep their employees at work (Nahar, 2018), build their competencies, and benefit from them (Torraco, 2005). However, this point of view has brought with it a focus on preventing the absenteeism of employees under all circumstances. This situation revealed the phenomenon of presenteeism, known to cause a loss of approximately 150 billion dollars in the USA (Hemp, 2004) and 225 billion Euros in Germany (Abasilim et al., 2015) and negatively affected the well-being of employees (Caverley et al., 2007; Kim et al., 2016; McGregor et al., 2016).

When the literature on presenteeism is examined, it is difficult to say that there is a consensus on the meaning of the concept. European researchers (e.g., Aronsson et al., 2000; Hansen & Andersen, 2008) act in a reductionist framework toward the premises of the phenomenon, the motivation behind it, and its consequences. In contrast, North American researchers (e.g., Caverley et al., 2007; Koopman et al., 2002) focus more on the results of the case. However, as Johns (2010) states, the phenomenon lacks a conceptual point of view, and this situation needs to be handled holistically.

Therefore, in this study, the strengths of qualitative research (understanding, definition, and explanation) will be used to form a basis for understanding presenteeism from a holistic perspective. Presenteeism is experienced more intensely in the field of education compared to other areas (Aronsson et al., 2000; Bergström et al., 2009; Ferreira & Martinez, 2012; Lohaus & Habermann, 2019). In this context, determining the relationship of presenteeism with social, cultural, and individual variables and revealing the results of this experience will contribute to the literature. In particular, it can be said that some cultural codes (e.g., the perception of work as worship, the sanctity attributed to services such as education, and the dominance of social control mechanisms) will help to understand the sociological and psychological elements underlying the presenteeism experience (Cooper & Lu, 2016; Ferreira et al., 2021). For this purpose, the phenomenon of presenteeism is examined according to the participants' perceptions, using a phenomenological design to analyse the phenomenological interviews, memoing, and messages received from the participants after the interviews.

What Is Presenteeism?

Although it is a common experience for organisations, organisational presenteeism is a relatively new concept for organisational behaviour researchers (Cooper & Lu, 2016). In addition to this innovation, it cannot be said that an agreed-upon definition of the concept has been made (Freeling et al., 2020; Hansen & Andersen, 2008) because the concept is both inconsistent (Johns, 2011) and complex (Wang et al., 2010). Therefore, different definitions of the phenomenon are encountered in the literature (Johns, 2011).

We can divide these different definitions of existence into three approaches to research. The first, presenteeism, is formulated as *continuing to work while sick*, predominantly accepted by European researchers (Johns, 2010), aiming to understand the phenomenon's antecedents, consequences, and the primary motivation behind the

phenomenon. Concentrating on antecedents and conclusions, this approach refers to employee-related factors, working conditions, and environmental factors associated with presenteeism (Karanika-Murray & Biron, 2019). This perspective, which explains presenteeism as a result of a decision-making dilemma (staying at home, resting, and working while sick), examines the antecedents and consequences of the phenomenon separately, with a behaviourist/reductionist attitude. Some researchers in this approach (e.g., Karanika-Murray & Biron, 2019) emphasise that working can have positive effects, especially in some mild disease states, contrary to the common belief that the experience of presenteeism can have negative consequences.

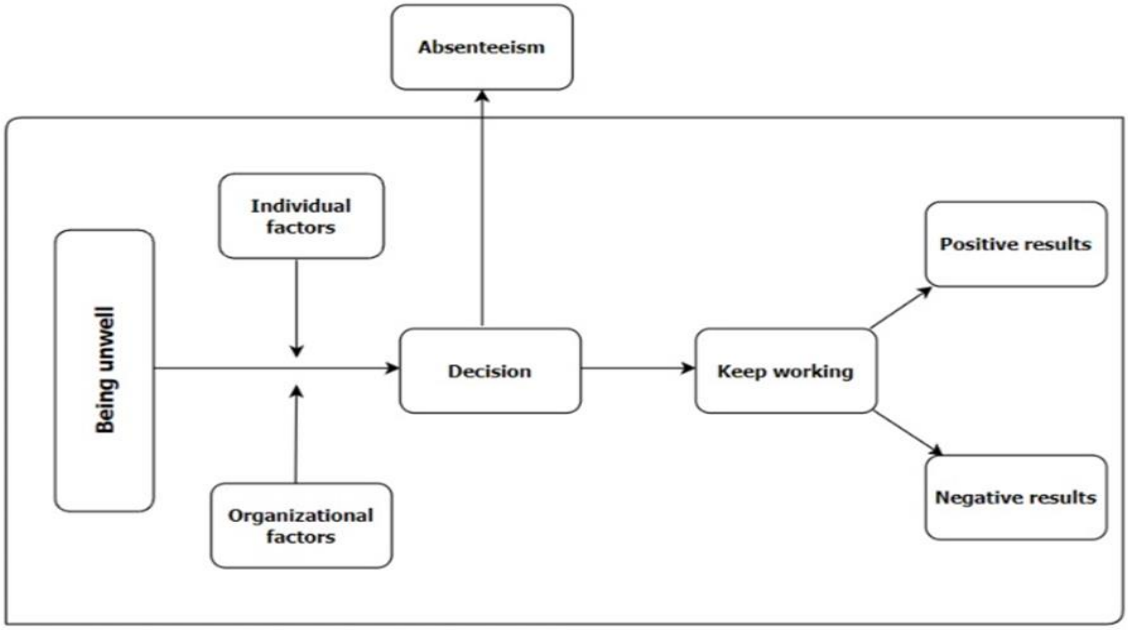
The second research approach led by North American researchers (Johns, 2010) defines presenteeism as a loss of productivity due to continuing to work despite health problems (Goetzel et al., 2004; Hummer et al., 2002; Turpin et al., 2004; Whitehouse, 2005). This approach focuses on the medical interventions necessary to measure the loss of productivity caused by presenteeism (Goetzel et al., 2004; Koopman et al., 2002; Li et al., 2019; Schultz et al., 2009) and reducing the loss resulting from these measurements (e.g., Ammendolia et al., 2016; Burton et al., 2006). Therefore, this approach evaluates presenteeism as a completely negative experience (Johns, 2010) and characterises it as a situation that needs to be controlled.

Contrary to the first two approaches, which limited the presenteeism name to *come to work while sick*, the approach that can be considered as a third approach tried to explain the concept by expanding it. Presenteeism, which is associated with factors such as stress (Gilbreath & Karimi, 2012), depression (Wang et al., 2010), and private jobs (D'Abate & Eddy, 2007), as well as physical health problems that will prevent the employee from performing at a high level and collecting his cognitive energy in the workplace, is defined as existing but functionally disappearing (Cooper & Lu, 2016). This definition does not limit presenteeism with the disease but associates the employee's functioning in the workplace with variables unrelated to the disease. While this perspective broadens the meaning of presenteeism, it still refers to its negative consequences.

Unlike these three research traditions, we explain presenteeism as *a phenomenon that predicts positive and negative results as a result of which the employee continues to work compulsorily and voluntarily despite reasons that may prevent him from feeling well* (Fig. 1). In this definition, we refer to the reality that presenteeism is a process (Vera-Calzaretta & Juarez-Garcia, 2014), which the three research traditions overlook. Besides, we do not deal with presenteeism from a reductionist point of view, as in the first tradition, by separating its causes and effects. We combine the cause and effect by considering the phenomenon holistically. In addition, we consider the phenomenon in the second and third approaches not only as a loss of productivity but as a reality of business life that can be associated with positive and negative results. Again, as in the first and second traditions, we associate the phenomenon not only as an experience based on health conditions but also with variables other than the illness that prevents the employee from performing his duties generally at work.

Figure 1

Presenteeism Process



Another issue that we think is important in our definition is that, unlike other definitions, the elements of obligation and voluntariness are mentioned. What this obligation and/or volunteering means are the requirements and motivations behind the decision to presenteeism. Indeed, research on presenteeism has shown that compelling or motivating factors such as public service motivation (Deng et al., 2019), organisational culture (Ruhle & Süß, 2020), nature of work (Caverley et al., 2007; MacGregor et al., 2008; Veale et al., 2016), manager and colleague pressure (Baker-McClearn et al., 2010; Rebmann et al., 2016), workload (Shan et al., 2022), the difficulty of employee substitution (Aronsson & Gustafsson, 2005), and economic difficulties (Chiu et al., 2017; Hemp, 2004; Webster et al., 2019) are effective in making a presenteeism decision.

Presenteeism as Being Unwell

Generally, presenteeism research focuses on the health problems behind the inability to function of employees in the workplace (Evans, 2004; Johansson & Lundberg, 2004; Turpin et al., 2004). Much of the research focuses on physical health problems such as allergies, diabetes, arthritis, asthma, heart disease, hypertension, migraine/headache, fatigue, respiratory infections, and neck and back pain (Aronsson et al., 2000; Bae, 2021; Baker-McClearn et al., 2010; Caverley et al., 2007; Dudenhöffer et al., 2017; Gwinnutt et al., 2020; Hiles et al., 2018; Kinman & Wray, 2018), relatively ignoring the other health problems of individuals. However, the World Health Organisation (WHO) defines health as the absence of symptoms of physical illness and a state of complete physical, mental, and social well-being (Ni et al., 2020). As can be understood from the definition, health is evaluated multidimensionally and is explained by the state of well-being. Therefore, it would be an incomplete and wrong attitude to consider presenteeism as a process that starts with only physical health problems because presenteeism is an experience that begins with the employee's decision to

continue working in inappropriate bio-psycho-social conditions (Vera-Calzaretta & Juarez-Garcia, 2014).

As we mentioned, well-being enables individuals to increase their capacity to use their abilities and skills and to reach their maximum potential (Myers & Williard, 2003). In this sense, well-being is a comprehensive state and negativity in any of these states can hinder the energy, attention, and motivation to perform a task (Gómez et al., 2022). Consequently, we associate the experience of presenteeism not only with physical health problems but also with negativities in the state of mental and psychological that will put the person in a negative state of well-being.

Why Does A Person Keep Working When Unwell?

There is surprisingly little research on this topic in the presenteeism literature. This issue was partially addressed in the comprehensive literature review conducted by Johns (2010). The motivation and obligations behind the employee's continuing to work despite not feeling well psychologically, physically, and cognitively will have an essential place in understanding the presenteeism phenomenon. Studies in the literature indicate that when employees are not well, they may work voluntarily (e.g., Cooper & Lu, 2019; Grant, 2008; Grant & Parker, 2009; Humphrey et al., 2007) or involuntary (e.g., Baker-McClearn et al., 2010; Biron & Saksvik, 2009). In this sense, presenteeism can be divided into *involuntary presenteeism* and *voluntary presenteeism* (Holland & Collins, 2018).

Organisational policies (Holland & Collins, 2018), pressures to participate (manager, colleague, clients) (Baker-McClearn et al., 2010; Biron & Saksvik, 2009; Rebmann et al., 2016), the interdependence of tasks (Grant & Parker, 2009), fear of losing one's job (Holland & Collins, 2018), economic concerns (Aronsson & Gustafsson, 2005; Chiu et al., 2017), workload (Hansen & Andersen, 2008; Shan et al., 2022), and organisational culture (Ruhle & Süß, 2020) are widespread situations for the employee to participate in working life due to obligation (Biron et al., 2006). This situation is defined as involuntary presenteeism in the literature (Gosselin & Lauzier, 2011). Involuntary presenteeism is a type of presenteeism that predicts specific results and where the employee continues to work, forced by factors that he cannot control.

On the other hand, the type of presenteeism, which is directly dependent on the employee's personal decision, can be controlled by the employee regardless of compelling reasons and is formed by internal motivation (Cooper & Lu, 2019; Gosselin & Lauzier, 2011). The critical point here is that the decision to continue working when the employee is not well is not a result of necessity but an extension of the person's desire, belief, responsibility, and commitment attitudes. Studies proved that although employees are not well, they continue to work because of commitment to work (Snir & Harpaz, 2012), professionalism (Gosselin & Lauzier, 2011), and perceived importance of the task (Grant, 2008), conscientiousness (Johns, 2011).

Presenteeism as A Fearful Process

The New York Times called presenteeism the most significant discovery of 2004 (Zengerle, 2004). In recent years, research on presenteeism has shown the considerable impact of the phenomenon on individuals and organisations. In particular, studies indicated that presenteeism is somewhat associated with adverse outcomes (Johns,

2010, 2011; Lohaus & Habermann, 2019). Results from both cross-sectional (Conner & Silvia, 2015; Goldstein et al., 2019; Miraglia & Johns, 2016) and longitudinal studies (Beswick et al., 2018; Chen et al., 2021; Chou & Mach, 2021; Demerouti et al., 2009; Hiles et al., 2018; Lu et al., 2013) show that presenteeism in organisational life generally predicts adverse outcomes, that is, bad presenteeism (Cooper & Lu, 2016). Bad presenteeism is when the experience of presenteeism is seen as a risk factor for employees and organisations.

The risk that presenteeism poses can be grouped under two headings: employee well-being and employee performance. In a two-wave study of Taiwanese workers, Lu et al. (2013) revealed a negative impact of presenteeism on mental health, physical health, and job satisfaction. The same study determined that employees who experienced presenteeism experienced a significant sense of exhaustion. The state of being unwell, which can be eliminated by rest or treatment, worsens by continuing to work. Deprivation of recovery status of employees and their worsening can lead to chronic problems in the future. Indeed, Bergström et al. (2009) found that participants were absent from illness for more than 30 days due to the psychological and physical disorders caused by presenteeism.

Presenteeism, which predicts various psychological and physical disorders, also negatively affects the performance of employees because when people do not feel well, they naturally cannot do their jobs in the best way (Hemp, 2004). Therefore, employees who do not feel well will not be as productive as their colleagues and will spend more time and effort to fill the gap that will occur (Roe, 2003). The extra time and effort will deplete the employee's energy and regenerate itself through performance degradation. The performance decline of the employee due to presenteeism will also harm teamwork in areas with mutual task dependence (Johns, 2010). In such a case, other employees who need to focus on their tasks will need to help their teammates who do not feel well or fill the gap left, which will negatively affect the performance of other employees (Abasilim et al., 2015).

Presenteeism has significant risk factors for organisations and the risk it poses for employees. First, it is considered to pose a risk of loss of productivity for organisations (Hemp, 2004; Knies et al., 2012). The employee who is not suitable for work in the workplace may cause a decrease in work speed, an increase in the repetition rate and error rate, the emergence of work accidents (D'Abate & Eddy, 2007), low service quality, and fewer new ideas being introduced (Gilbreath & Karimi, 2012). This leads to a decrease in the amount of production. Burton et al. (2004) stated that migraines or headaches cost $12 billion and allergies cost $2.8 billion annually due to a decrease in productivity in the USA. In the same year, the total loss caused by other diseases or ill health was around $150 billion per year (Hemp, 2004). Abasilim et al. (2015) stated that the annual cost loss is estimated to be around 225 billion Euros in Germany, considered the largest economy in Europe.

As a result, the perspective that evaluates presenteeism as a bad organisational reality sees the phenomenon as a process that creates serious problems for both the employee and the organisation (Perez-Nebra et al., 2020). This approach emphasises that working when you are not well will lead to increased stress, weakening of relations with colleagues, damage to service recipients, and dissatisfaction with service recipients. Likewise, presenteeism, which reduces the quality of working life and

creates a perception of ineffectiveness in the workplace (Ferreira & Martinez, 2012), can be considered a process that requires precautions.

Presenteeism with Positive Consequences

In the literature, presenteeism is generally evaluated as a negative phenomenon that should be avoided (Johns, 2010) because presenteeism is associated with adverse outcomes for both employees and organisations (Strömberg et al., 2017). Taking a healthy and, therefore, fully productive employee as a reference in a phenomenon that starts with an essentially unwell process normalises this point of view. However, many researchers criticise this understanding for ignoring the fact that not every unwell state will negatively affect an employee's future well-being, performance (Steinke & Badura, 2011), or productivity (Vingård et al., 2004). As Halonen et al. (2016) pointed out, a few numbers of unwellness can affect an employee's ability to focus on his job and healthily complete tasks. However, some researchers state that presenteeism can have positive consequences, especially under certain conditions and in some unwell situations (e.g., Demerouti et al., 2009; Karanika-Murray & Biron, 2019; Steinke & Badura, 2011; Urtasun & Nuñez, 2018). This perspective, which can be called good presenteeism (Miraglia & Johns, 2016), has rarely been discussed in the relevant literature. As stated by Johns (2008), although it may seem surprising that presenteeism can be positive, it is understood that this is possible when the subject is analysed in depth.

Those who refer to the positive consequences of presenteeism concentrate on the concept of work as the first argument. Focusing on the positive aspects of working, these researchers believe working is good for health and well-being. Because working is meaningful for individuals (Karanika-Murray & Biron, 2019) — namely, it can help meet basic psychological needs (Van den Broeck et al., 2016) — it can distract employees from daily stress and also work to eliminate certain unwell situations (Halonen et al., 2016). Sanderson et al. (2008) state that continuing relations with work can be an important strategy in rehabilitating employees with psychological problems. Therefore, given the relaxing (Baker-McClearn et al., 2010; Whysall et al., 2018) and therapeutic (Karanika-Murray & Biron, 2019) characteristics of working, presenteeism may also have functional consequences in some cases.

Job control can be cited as the second argument that presenteeism may have functional consequences (Biron & Saksvik, 2009). Job control, an important reality of working life, is an important determinant of stress and tension that an employee may experience in business life and job demands (Karasek, 1979). It is the ability of employees to meet job demands, perform job duties, and keep work activities under control (Margot & Stan, 1999). An employee's absence due to unwellness may prevent him from meeting job demands and performing job duties. Employees who are absent because they are not well will naturally accumulate their work, which may impact job control and cause a stressful situation. However, as Biron and Saksvik (2009) stated, low productivity due to lack of well-being (due to presenteeism) is better than no productivity due to absenteeism. Employees who can do their jobs to some extent with the presenteeism process can maintain job controls to adjust their workloads and tasks. Not losing job control is important not only for the employee but also for the organisation and colleagues.

As the third argument, the relationship between presenteeism and organisational citizenship behaviour can be shown (Karanika-Murray & Biron, 2019). Some researchers consider continuing to work even in the absence of well-being as organisational citizenship behaviour (Miraglia & Johns, 2016). Continuing to work despite being unsuitable for work is considered a sign of commitment to work and loyalty to managers and colleagues (Kinman & Wray, 2018). This may result in appreciation for the employee (Johns, 2010). Perceiving presenteeism as a commitment reflex can contribute positively to social relations in organisations. Therefore, if appropriately managed and supported by adequate resources, continued work during ill health can benefit well-being, performance, and social relationships.

Presenteeism at Schools

Although presenteeism is a phenomenon encountered in almost every profession, it is more common in educational institutions (Bergström et al., 2009). Aronsson et al. (2000) found a rate of presenteeism among preschool teachers of 55% in Sweden. Studies show that education workers are consistently at risk of common mental health disorders compared to other professions (Johnson et al., 2005; Stansfeld et al., 2011). Similarly, according to the 2009 report of the International Labor Organisation (ILO), it was determined that educators experience very common chronic physical disorders (ILO 2009). These data indicate that presenteeism is common in schools.

In addition, the unique feature of the educational activity also increases the frequency of experiencing presenteeism (Ferreira & Martinez, 2012). Education is vital for societies, and this importance brings a high sense of responsibility (Widera et al., 2010). This sense of importance and responsibility enables teachers to work even when they are not well enough to meet their students' learning and help needs (Aronsson & Gustafsson, 2005; Grant, 2008). Organisational dynamics also prepare a suitable environment for presenteeism, just as Johns (2011) stated. The lack of replacement in case of absenteeism (Caverley et al., 2007) or the uncertainty about how these employees should behave in case of being unwell (Dew et al., 2005), organisational policies that are not compatible with education and do not support the teacher (Wrate, 1999), managers who do not have enough information about the potential effects of presenteeism, and an organisational climate that sees absenteeism as illegitimate (Dew et al., 2005) make presenteeism a frequently experienced phenomenon in educational institutions.

Some cultural codes are also known to increase the prevalence of presenteeism. For example, it was determined that presenteeism is experienced intensely and widely in eastern societies where duty is seen as sacred and/or work is perceived as worship (Cooper & Lu, 2016; Dew et al., 2005). Working in institutional places where the personality and future of individuals are built increases the importance of the task performed. In addition, the perception of the sanctity and the evaluation of education as an act of worship in society (Polat & Özdemir, 2017) can be a source of motivation for education employees to continue working when they are not well.

Although there are many studies on presenteeism in the literature, no qualitative study has been encountered examining the concept from a comprehensive and holistic perspective. Considering the prevalence of the presenteeism process in the field of education (Aronsson et al., 2000; Bergström et al., 2009), it is considered important to

be able to reveal the relationship of the phenomenon with sociological and psychological dynamics, work practices, and workplace norms, and the results that this process can predict. Therefore, it is thought that a comprehensive analysis of what the phenomenon is, what consequences it predicts, and why it occurs will contribute to the literature.

Purpose of the Study

This research aims to reveal the components of presenteeism and holistically examine it by analysing it in depth according to the perceptions of the education workers (EWs) who experience presenteeism more frequently. In line with this purpose, answers to the following questions were sought based on the opinions of EWs:

RQ1. EWs continue to work despite what kinds of unwell?

RQ2. How often do EWs work even though they are not well?

RQ3. What are the factors that cause EWs to make presenteeism decisions?

RQ4. What are the positive and negative consequences of working without feeling good?

Method

Research Design

This study adopted the qualitative research paradigm, considered appropriate to reveal and understand what is behind any phenomenon that is not sufficiently understood (Strauss & Corbin, 1990). Because the subject of our study is an experience that is not well defined, qualitative research is the best way to obtain information about subjective experiences by turning to someone who knows the subject (Auerbach & Silverstein, 2003). The phenomenological design is a qualitative research design that focuses on the phenomena that are experienced but not fully realised and therefore deprived of detailed information and are used to determine a person's perceptions to understand the experiences of the person (Creswell, 2013). In phenomenological designs, in-depth analyses are made by turning to the subject to understand the phenomenon and adhering to the research discipline through the subject (Patton, 2014). In this study, to find answers to the what, how, and why questions about presenteeism, the phenomenological design was chosen to understand how the participants explained their experiences (Moustakas, 1994) and how they perceived them.

Study Group

Purposeful sampling, which is accepted as the most important type of qualitative sampling design (Yıldırım & Şimşek, 2011), was used to identify the participants to examine presenteeism in depth. In this framework, the participants were selected from those who may have experience with presenteeism. Therefore, EWs, the groups with the most intense experience of presenteeism in the literature, were preferred for the study. The study was carried out among teachers working in the province of Elazığ in Türkiye in the 2020-2021 academic year. We chose to conduct the research in institutions (private schools, public schools) with a high level of sensitivity to rules and norms and where disciplinary problems and violence against employees are experienced. These institutions were visited, and we tried to identify employees who might experience

presenteeism (chronic illness, heavy workload, time pressure due to working hours, divorced and having children, having to do additional work, etc.). Identified participants formed the primary analysis unit after their consent was obtained.

Snowball sampling based on participants in the primary analysis unit (informant) was used to identify additional participants. Snowball sampling is based on the logic of enriching information by identifying situations by reaching person-to-person (Creswell, 2013). This aims to expand the sample by asking participants to recommend others for interviews (Babbie, 1995). Necessary information was given about the purpose, risk, benefits, and importance of the research, as well as the procedures used to protect the confidentiality and the voluntariness of participation in the research to obtain reliable and valid information from the participants.

Because organisational presenteeism may differ with certain variables (e.g., gender, job, occupation, corporate culture, age, health status), we decided to use the maximum variation sampling method to ensure participant heterogeneity. Maximum variation sampling involves predetermining some criteria that are different in venues or individuals and then selecting venues or participants that differ significantly according to the criteria (Creswell, 2013). Therefore, the snowball sampling method was used until the predetermined diversity of the participants was achieved through key actors. To reach the ideal data in a phenomenological design, Creswell (2013) recommends having 10 participants, provided they conduct long interviews. So, to consider the different dynamics, a total of 10 participants were determined as the study group (Table 1).

Table 1

Sociodemographic Characteristics of Participants

Identifier	Gender	Marital status	Age	Kids	Occupational seniority	Profession	Education level	Weekly working hour(s)	Type of the current institution
T1	Male	Married	58	3	25	Teacher	Graduate	24	Public
T2	Female	Single	31	-	6	Teacher	Graduate	30	Public
T3	Female	Divorced	34	1	7	Teacher	Postgraduate	40	Private
T4	Male	Married	35	2	9	Teacher	Graduate	34	Private
T5	Female	Married	38	2	12	Teacher	Graduate	30	Public
SA1	Male	Divorced	52	3	20	School administrator	Graduate	40	Public
SA2	Male	Married	44	1	18	School administrator	Postgraduate	40	Public
SA3	Male	Married	54	4	19	School administrator	Graduate	40	Public
DH1	Male	Married	46	3	20	Deputy headmistress	Graduate	40	Private
DH2	Female	Single	48	-	25	Deputy headmistress	Graduate	40	Public

Data Collection

Appointments were made from the participants who stated that they wanted to express their opinions in the research, and interviews were done by visiting their schools. Before the interview, the researchers explained the definition of presenteeism to the participants in detail. Unstructured, in-depth phenomenological interviews were conducted with the participants. These interviews lasted between 40-45 mins. The phenomenological interview is a data collection method that helps the researcher understand how people attribute meaning to phenomena (Greasley & Ashworth, 2007) and is based on a conscious dialogue between the researcher and the participant (Bailey, 1996). These interviews aimed to reveal the perceptions about the phenomena to capture the essence of the phenomenon. In this direction, Husserl's (2003) phenomenological reduction method was used. We tried to get the participants to turn to the phenomenon essence by leaving aside the variables/issues and experiences unrelated to organisational presenteeism. In these interviews, questions and directions were used to reveal what the participant thinks, feels, and experiences about presenteeism.

Ensuring that the researcher brackets his prejudices is crucial in phenomenological research (Miller & Crabtree, 1992). In this method, which can be seen as second bracketing, the researcher's evaluation of data not related to the phenomenon as if they are related to the phenomenon may jeopardise the validity and reliability of the research. The data obtained during the interview about the phenomenon were confirmed simultaneously to eliminate this risk.

Interviews were recorded by phone. In addition, memoing was used to record the details/cues the researcher caught during the interview and thought important for the research and to draw inferences. Considered an important data source in qualitative research, memoing (Birks et al., 2008) are field notes that record what the researcher heard, saw, experienced, and thought during the interview process (Groenewald, 2004). After the data are collected and organised, the researchers overlook and forget the small details they noticed during the interview. Therefore, they do not include them in the evaluation process, which may lead to an incomplete or wrong analysis of the phenomenon. Details such as the code given to the participant, the date and time of the interview, the clues captured, the psychological state of the participant, and the body language he displayed at that moment were recorded in the memoing and then evaluated in the analysis process. The phone number and e-mail of the researcher were given to the participants so that they could also report the details about the phenomenon they could not express during the interviews and that they could remember later.

Data Analysis

A code was assigned to each participant (teachers: T1, T2, T3, T4, T5; school administrators: SA1, SA2, SA3; deputy headmistress: DH1, DH2). Each sound recording was stored electronically with these code names as a file, together with the e-mails or telephone messages received after the relevant memoing and interview. The 10 recordings that were created were transcribed and recorded after their analysis/listening and transcription were made. Notes (e.g., codes, themes, relational contexts) taken during the interview were also recorded in these files. While analysing voice recordings, memoing, and e-mails/phone messages, the following questions were considered to ensure a better analysis process and the research discipline.

What happened, and what was the mood?, What was it associated with?, Who was it associated with?, Why did the event occur?, How did the event take place? ,Under what conditions did it take place?, What consequences did the event predict?.

Descriptive and content analyses were carried out together on the data obtained during the research process. Since the themes related to presenteeism were determined beforehand, and research questions were created accordingly, the data were first subjected to descriptive analysis since, in descriptive analysis, categories are determined in advance, and the data are summarised and interpreted within these categories (Yıldırım & Şimşek, 2011). In addition, we tried to discover the underlying meanings of the data through content analysis (Krippendorff, 2004), an analysis technique used to make inferences about the subject from meaningful materials (text, sound recording, documents, etc.). Content analysis is a reproducible and valid technique used in qualitative research (Hsieh & Shannon, 2005; Renz et al., 2018) to reveal the characteristics of the phenomenon, especially in communication research (Krippendorff, 1989).

In content analysis, the triangulation technique (Denzin, 1970), which is used to increase the validity of the study, reduce the researcher's bias, and provide a multi-perspective approach to the examined phenomenon, was preferred to increase confidence in the research data and to provide a deeper analysis of the case. There are several types of content analysis (Casey & Murphy, 2009). This study used data triangulation (deciphering of interviews, memoing, and e-mails received from participants about the experience after the interview) and researcher triangulation (analysis by three different researchers).

The thematic inferences agreed by the three researchers were transferred to the NVivo 11 package programme. Detailed data analysis was conducted with this software, which provides significant advantages in systematising and associating themes and codes (Banihani & Syed, 2017). For a holistic evaluation, the matrix encoding query option of the software was used. In the tables created with the matrix coding query option, the categories and codes that participants refer to, how often each participant refers to these categories and codes, and their percentages are shown.

Validity and Accuracy

In qualitative research, where objectivity is difficult to achieve compared to quantitative research, it is necessary to ensure the accuracy and credibility of the findings and interpretations throughout the data collection and analysis process. There are various strategies used in qualitative research for this purpose. Creswell (2002) lists data diversity, expert review, and participant confirmation as the most critical strategies. All three strategies were used in the research to obtain valid, believable, and accurate results. Data triangulation was used to provide data diversity, and we tried to establish consistency between the findings obtained from the phenomenological interviews, memoing, and post-interview messages. With participant confirmation, the second strategy, the researchers' results and opinions reached during the interview were confirmed simultaneously, trying to avoid false inferences. In addition, evaluations were made by three different researchers (researcher triangulation) to ensure objectivity towards the inferences. The results of these three researchers were compared, and the

agreed conclusions were presented to another field expert for review. The desired revisions were evaluated, and the appropriate ones were made.

Ethical Procedures

With the decision of the Social and Human Sciences Research Ethics Committee of Firat University, dated 18.05.2021 and numbered 12/6, it was decided that this study complies with the ethical rules.

Results

In line with the sub-objectives of the research, four themes were created. First, the starting point of presenteeism, the quality of not being well, was determined. Secondly, it was determined how often it was experienced to continue working despite feeling unwell. Third, the factors related to the presenteeism decision of the employees were determined. In the last stage, it was tried to find out what results could be predicted by continuing to work when unwell.

State of Not Being Unwell

As the starting point of presenteeism, attention was drawn to *psychological unwellness* and *physical unwellness* (Table 2).

Table 2

The State of Being Unwell

1. State of being unwell											
	1.1. Physical							1.2. Psychological			
Part.	Dia.	NSP	BP	Mig.	Ecz.	Art.	Ast.	SD	Depr.	Anx.	OCD
T1	-	-	-	-	-	1	-	2	2	-	-
T2	-	-	-	2	-	-	1	-	-	-	-
T3	-	-	-	-	1	-	-	1	-	-	-
T4	2	-	-	-	-	-	-	-	-	-	3
T5	1	1	-	-	-	-	-	-	-	-	-
SA1	-	-	-	-	4	-	-	3	-	-	-
SA2	-	-	1	1	-	-	-	-	-	-	-
SA3	2	1	1	-	-	-	1	-	-	-	-
DH1	-	-	-	-	-	-	-	-	-	1	-
DH2	-	-	2	-	-	-	1	-	3	-	-
f	5	2	4	3	5	1	3	6	5	1	3
%	13.2	5.3	10.5	7.9	13.2	2.6	7.9	15.8	13.2	2.6	7.9
Physical unwell				*f*	23	%	60.5				
Psychological unwell				*f*	15	%	39.5				

Note. Dia=Diabetes; NSP=Neck and shoulder pain; BP=Blood pressure; Mig=Migraine; Ecz=Eczema; Art=Arthritis; Ast=Asthma; SD=Stress disorder; Depr=Depression; Anx=Anxiety; OCD=Obsessive compulsive disorder

First, the participants talked about physical health problems such as being diagnosed with diabetes, low back and neck disorders, blood pressure, migraine, eczema, arthritis, and asthma. One administrator explains this situation as follows:

> "*We are getting older now, and naturally, different ailments emerge every day. I have ailments such as diabetes, blood pressure, hernia, and asthma. These diseases do not leave me. Now I have to live with them. Naturally, I take them with me when I go to school.*" (SA3)

As the second important starting point of presenteeism, the participants highlighted their psychological problems: stress disorder, depression, obsessive-compulsive disorder, anxiety, etc. For example, a teacher expresses this situation in the e-mail he sent after the interview as follows:

> "*...In the interview, I talked about my diabetes while talking about things that I didn't feel well, but I also have an obsession problem called obsessive-compulsive disorder. This affects me more negatively than my diabetes. For a long time, I have not been as I want in classes. Both in my relationship with the students and while covering the subjects. I didn't want to talk about this at school. I also get professional help…*" (T4)

Keeping Working When You Are Unwell

The data shows that presenteeism is experienced at different intensities among teachers and school administrators. (Table 3). We used the categories *sometimes, often and very often* when describing the frequency with which participants experienced the presenteeism. None of the participants stated that they experience presenteeism *sometimes*. Participants indicated that they had this experience *very often* and *often*. One participant said, "*Often is an understatement. I do very often. My wife passed away recently too. I am experiencing stress disorder intensely.* (T1); another participant said, *…lately I have been getting depressed. I come to school when I am bad in a way I can say often.*" (DH2)

Table 3

Continuing to Work When Unwell

	2. Keeping working when you are unwell		
Part.	2.1. Sometimes	2.2. Often	2.3. Very often
T1	-	-	1
T2	-	1	-
T3	-	1	-
T4	-	-	1
T5	-	-	1
SA1	-	-	1
SA2	-	1	-
SA3	-	-	1
DH1	-	1	-
DH2	-	-	1

f	0	4	6
%	0	40.0	60.0

Presenteeism Decision

The results reveal that the decision to work was made voluntarily and involuntarily, despite being unwell (Table 4). Therefore, two subcategories were created voluntary and involuntary presenteeism. In particular, some participants emphasised the factors of responsibility, conscientiousness, commitment to work, public service motivation, relaxation and religious duty and stated that they worked voluntarily despite not being well due to these factors. It can be said that having a sense of responsibility, not being able to fit into one's conscience to be absent, commitment to the work, caring about public service, to relax and seeing working as a form of worship lead employees to decide to work voluntarily despite feeling unwell. It was observed that these participants especially emphasised the sociological, psychological, and theological perception bases. In this regard, an administrator and a teacher used the following statements:

> "*Because I couldn't fit my conscience even when I shouldn't be at school at times... I started my job with the awareness that education is the future of society and that this is the most important worship... I have duties and responsibilities and I love my job very much.*" (SA2)

> "*…make sure there is no monetary value for the work we do. I take great pleasure in teaching students something. This is a social obligation. We must fulfil our debt to our nation and state in such situations (he talks about coming to work when he is not well). We must be altruistic. Let me say something like this; In these cases, I always say that my problems disappeared. I felt like I was cured.*" (T3)

Table 4

Presenteeism Decision

1.3. Presenteeism decision											
	3.1 Involuntary presenteeism					3.2. Voluntary presenteeism					
Part.	AP	CP	SP	ED	WL	Resp.	Relax	Con.	CW	PSM	RD
T1	-	-	-	-	-	1	1	-	-	1	-
T2	2	1	2	-	1	-	-	-	-	-	-
T3	-	-	-	-	-	2	-	3	1	1	-
T4	1	2	-	1	1	-	-	-	-	-	-
T5	-	-	-	-	-	1	2	1	-	-	1
SA1	-	-	1	1	2	-	-	-	-	-	-
SA2	-	-	-	-	-	2	-	1	2	1	2
SA3	-	-	-	-	-	1	1	-	1	2	-
DH1	1	-	2	2	1	-	-	-	-	-	-
DH2	1	-	-	-	1	1	1	-	-	-	1
f	5	3	5	4	6	8	5	5	4	5	4

%	9.3%	5.6	9.3	7.4	11.1	14.8	9.3	9.3	7.4	9.3	7.4
Involuntary presenteeism			*f*	23	%	42.6					
Voluntary presenteeism			*f*	31	%	57.4					

Note: AP=Administrator pressure; CP=Colleague pressure; SP=Student pressure; ED=Economic difficulties; WL=Workload; Resp=Responsibility; Con=Conscientiousness; CW=Commitment to work; PSM=Public service motivation; RD=Religious duty

When the memoings about those who decided to volunteer when they were unwell were examined, it was observed that the participants were proud and considered such behaviour as self-sacrifice. For example, in the memoing of SA2, "…*quite relieved. Opened his arms and began to give more details. Changed his sitting position and crossed his legs. Felt proud of himself as he talks about his experience. The initial tension is gone*." In the T3 memo, "*in a self-satisfied and haughty mood describing experience with presenteeism. Constantly mentioned that this decision is a sacrifice and quite comfortable. Started to lean back, smiling, emphasising the importance of what he is doing.*" notes were kept.

On the other hand, few participants stated that they work compulsorily and involuntarily although they are not well due to organisational pressure (administrator, colleague, and student), economic difficulties and workload factors. It is noteworthy that these participants hesitated to express their opinions during the interview and expressed this situation more easily in the messages they sent after the interview. They stated that they continue to work reluctantly when they are not well, citing the reasons for the interruption of their additional courses, especially when they are under organisational pressure, workload and absenteeism. A deputy headmistress made the following complaints during the interview and a teacher in the e-mail he sent after the interview:

> "*My salary is not enough. We have a hard time as a family during the vacation… So you understand. At these times (he is talking about when he is unwell) I have to come to school so that my extra class is not interrupted.*" (DH1)

> "*There is a perception at school that getting a report or permission is a crime. From students to teachers and administrators, everyone sees the teacher as a machine. Working in a science high school requires putting aside the human trait for them. You have to make up for the day you didn't come to school in the same week because the students are preparing for the exams and the subjects must be trained and their questions solved. So being sick doesn't mean anything. You have to go to school even if you are sick.*" (T2)

The statements of those who decided to work reluctantly were generally in the form of complaints and whining. In the notes taken during the interview about these participants, it was observed that they generally are in a distressed mood and they saw this experience as a serious problem in their working life. For example, in the memoing of T2 "*Stressed. Her brows furrowed and her voice rose. She took deep breaths and couldn't speak because she gets so angry now and then.*" notes were taken.

Consequences of Presenteeism

While some participants emphasised the negative consequences of presenteeism, the other emphasised the positive results (Table 5). Therefore, the results of presenteeism are grouped under two subcategories: bad presenteeism and good presenteeism. The effects of bad presenteeism on participants were determined as stress, loss of performance distraction, work-family conflict, harms social relation and service quality. Some participants stated that the effects of bad presenteeism, also lead to absence in the future. A teacher and an administrator said:

> "*Unfortunately, the results were generally negative. First of all, working while feeling bad is a stressful situation. You can't focus your attention on what you're doing. You can't show your real performance in a job you can't focus on… It has a reflection on the outside. For example, my daughter could not approach me during these tense times, I had problems with my wife.*" (T4)

> "*In these cases, my situation (stress disorder) became more burdened. When I'm stressed, I became dermatitis that I have increased ... Caused chronic discomfort. When I have dermatitis attacks, I stay in itching, rash, rashes and cannot go to school. I have to get a report at these times ... You know a problem is not staying alone. My relations with my colleagues and even with my students deteriorated… Of course, I started to make mistakes in my work. Unfortunately, complaints about me and my work have increased.*" (SA1)

Table 5

Consequences of Presenteeism

1.4. Consequences of presenteeism												
	1.4.1. Bad presenteeism							1.4.2. Good presenteeism				
Part.	SA	Stress	LP	Dist.	W-FC	HSR	HSQ	SP	ISR	MJC	BS-C	EUS
T1	-	-	-	-	-	-	-	2	-	-	-	1
T2	-	1	-	3	1	1	1		-	-	-	-
T3	-	-	-	-	-	-	-	1	-	2	1	2
T4	1	3	2	2	3	1	2	-	-	-	-	-
T5	-	-	-	-	-	-	-	1	2	-	1	1
SA1	2	3	1	-	-	1	2	-	-	-	-	-
SA2	-	1	-	-	-	-	-	1	-	2	3	1
SA3	1	-	1	2	-	-	-	1	-	-	-	-
DH1	-	1	1	-	1	-	2	-	-	2	-	-
DH2	-	1	-	1	-	-	1	-	-	4	1	-
f	4	10	5	8	5	3	8	6	2	10	6	5
%	5.6%	13.9	6.9	11.1	6.9	4.2	11.1	8.3	2.8	13.9	8.3	6.9
Bad presenteeism			*f* 43		% 59.7							
Good presenteeism			*f* 29		% 40.3							

Note: SA=Sickness absence; LP=Loss of performance; Dist=Distraction; W-FC=Work-family conflict; HSR=Harms social relations; HSQ=Harms service quality; SP=Spiritual peace; ISR=Improving social

relations; MJC=Maintaining job control; BS-C=Building self-confidence; EUS=Eliminating unwell situations

However, there were also findings that presenteeism predicts positive results. This kind of experience, which is considered good presenteeism, was stated by some participants as providing spiritual peace, improving social relations, maintaining job control, building self-confidence, and eliminating unwell situations. In particular, participants stated that when they work when they are not well, they receive appreciation from their managers and colleagues for fulfilling their duties. For this reason, they emphasised that they were happy, proud of themselves, and felt better. Participants used the following statements on this subject:

> "*…No, don't consider it a necessity… Yes, essentially the sacrifice we make. There are things we can do for this state and nation, and I am doing it. I don't do it for anything in return... At such times, I experience a spiritual pleasure. I get so caught up in my lessons that I feel like I'm getting better.*" (T1)

> "*Neither religion nor my conscience accept this, and getting a report is a burden. My colleagues will enter the empty class, they will be disturbed by the students of the empty class. My friends are also aware of this. They see this dedication. Relationships are naturally good too… The principal and deputy headmasters always appreciate me for this. I'd be lying if I said I'm not happy... Yes, it makes me proud to be appreciated.*" (T5)

> "*…If I get permission, the work to be done will pile up. Some work needs to be done at certain times. Even though it is difficult, I overcome my job… You know, your work is under your control… Yes, I do not allow any disruption in my work… That is, I do not do it for this reason, but when positive feedback is received from the environment, one's self-confidence also increases.*" (DH2)

Discussion and Conclusion

This study investigated the experience of presenteeism by education workers. Understanding what presenteeism is, why it occurs and what consequences it can predict is critical to ensuring the well-being of educators, their ideal performance, and creating a healthy working life. Four themes were created in this study, which was analysed from a holistic perspective. The first theme was about what could be the starting point of presenteeism. Some participants stated their physical unwellness (illness) just as stated in the literature (Aronsson et al., 2000; Dudenhöffer et al., 2017; Kinman & Wray, 2018). These participants stated that they work despite being sick, which is called sickness presenteeism in the literature. Some participants also stated that they work despite their unwell psychological conditions such as stress disorder, depression, obsessive-compulsive disorder, and anxiety. The analysis showed that some negative situations in their private lives and compelling factors in the working environment, such as organisational pressure and job demands, negatively affected their psychological well-being and continued to work despite these difficulties. This situation coincides with the data that educators experience intense psychological disorders, as stated in some studies (Johnson et al., 2005; Stansfeld et al., 2011). Employees who engage in demanding activities such as training that cause high levels of stress (Perez-Nebra et al., 2020) may experience worsening of their existing psychological disorders

as well as various psychological disorders. Because of these disorders, the frequency of experiencing presenteeism may increase.

The second theme that emerged was about how often presenteeism was experienced. Participants were presented with three options regarding the frequency of this experience (sometimes, often, and very often), and none of the participants expressed the *sometimes* option. Revealed results showed that presenteeism is a phenomenon experienced *very often* and *often* in this population, which is similar to other studies in the literature (Aronsson et al., 2000; Cho et al., 2016; Ferreira & Martinez, 2012).

In the third theme, the reality behind the presenteeism decision was tried to be determined. Some of the participants stated that they took this decision reluctantly (involuntary presenteeism) due to workload, organisational pressures and economic difficulties, as in previous studies (Aronsson & Gustafsson, 2005; Baker-McClearn et al., 2010; Hansen & Andersen, 2008; Holland & Collins, 2018; Johansson & Lundberg, 2004; Johns, 2011; Rebmann et al., 2016; Ruhle & Süß, 2020). These compelling factors for educators (Dudenhöffer et al., 2017) can make them reluctant to work despite psychological or physical disorders. The involuntary presenteeism form can be considered a situation that should be especially avoided due to its compelling nature. This form, considered a human resources problem for employees (Firns et al., 2006), requires effective organisational and humane measures to be taken.

In addition, for some participants, the decision to presenteeism is a preferred situation (voluntary presenteeism). The data showed that the presenteeism decision was taken using the participants' will, such as conscience, responsibility, religious duty, work commitment, public service motivation, and relaxation in the working life of the participants. Educators stated that they decided to work voluntarily and self-sacrificingly even though they were not suitable for work, due to the meaning and mission attributed to education, to be useful to students, and to adopt the educational task to a high degree. This situation reveals that sociological, psychological, and theological elements can be effective in the decision of presenteeism.

In the last theme, it is tried to determine the results that presenteeism can predict. While presenteeism was a negative phenomenon for some participants (bad presenteeism), it was an organisational reality with positive results for some participants (good presenteeism). It is rare to find such a detailed, comprehensive, and original explanation. The literature mostly shows the negative consequences of presenteeism (Bakker & Demerouti, 2007; Deery et al., 2014; Gómez et al., 2022; Lui et al., 2022; Rainbow et al., 2021; Roe, 2003; Whitehouse, 2005). Our data reveals that presenteeism can predict negative consequences such as stress, loss of performance, and distraction. Participants stated that presenteeism damaged the social relations and service quality within the organisation and caused work-family conflict. Some participants stated that presenteeism worsened their unwellness and resulted in absenteeism in the short and medium term.

In this sense, bad presenteeism, which predicts negative results, may prevent the formation of a positive and supportive school environment. In particular, its negative relationship with mood can damage communication with both students and staff and limit functional participation in the educational process. It can harm the management

processes by preventing school administrators from exhibiting healthy management behaviour. For teachers, failure in classroom management may lead to a loss of ability to be a correct model for students and lead to a non-pedagogical guidance process. In addition, this form of presenteeism, which may cause psychological problems and learning difficulties for students, requires organisational precautions. However, the participants very clearly describe the results such as spiritual peace, self-confidence, healthy relationships, job control, and recovery. Some teachers and school administrators who experienced presenteeism stated that they experienced a high level of spiritual satisfaction as a result of the decision of presenteeism within the framework of public service motivation and a religious necessity. A few of the participants, who continued to work instead of staying at home, stated that they were relieved and well. They stated that this behaviour gained appreciation from their colleagues, improving their relationships and strengthening their self-confidence. Especially those who have a heavy workload also stated that they provide work controls. Good presenteeism, which foresees such outputs that are valuable for both educational institutions and educators, such as spiritual satisfaction, job satisfaction, recovery, self-confidence, healthy relationships, and job control, can be considered an organisational opportunity. Good presenteeism, which allows employees to prove their commitment to the job and the organisation may also lead to other important results in the development of production and organisational climate.

Implications

In this study, presenteeism has been evaluated as a process, and we revealed what the phenomenon is, why it occurs, and its possible consequences. Therefore, a comprehensive and holistic view has been adopted rather than a reductionist perspective. We included physical and psychological well-being as the starting points for presenteeism. Thus, it was seen that presenteeism was experienced more than expected. The research results show that participants experience physical and psychological unwellness. Contrary to the common belief that the presenteeism decision was made because of the compelling elements of the working environment, such as organisational pressure, economic difficulties, and workload, we have determined that this decision can also be made voluntarily due to individual factors, such as sense of responsibility, conscience, commitment to work, public service motivation, to relax and religious sensitivities. Finally, we found that presenteeism is defined as *good presenteeism* rather than a fearful process with only bad consequences, and in some cases, it has positive results. Therefore, the experience of presenteeism should be evaluated considering its positive and negative effects on organisations and employees. In this sense, policies for presenteeism should be developed according to the situation of the employee. Employees should not be forced to work in unwell situations that they cannot tolerate. It should eliminate the compelling elements that may cause them to work. Considering the fact that voluntary presenteeism predicts positive results, an appropriate organisational climate and culture can be created for employees to experience voluntary presenteeism.

In our view, this study contributes to the literature on several issues. In particular, the data we obtained regarding voluntary presenteeism and good presenteeism can be considered valuable. In the future, longitudinal studies on the

subject can be carried out in different cultural structures and service sectors. In addition, empirical studies on this situation we encounter in EWs can better explain the issue. In this study, we only examined participants in Türkiye. The study of comparative presenteeism in different cultural structures may be important in the future.

Although this research was conducted with various strategies, it has some limitations inherent in qualitative research, such as the small size of the study group, the potential of participants to hide critical information, and evaluator subjectivity. As researchers, we conducted the interviews and are confident that our findings are valid, verifiable, and based on scientific processes. However, the brevity of the interviews can be considered a limitation, especially during the data collection process, as both the researchers and the participants experienced the threat of contamination during the COVID-19 pandemic. In addition, our data represent participants' subjective interpretations of unwellness, continuing to work in the case of unwellness, and the outcomes this process will predict, so the results cannot be generalised.

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Statement of Responsibility

Alper Uslukaya; Conceptualization, methodology, software, validation, formal analysis, investigation, resources, data curation, writing-original draft, and visualization. Zulfu Demirtas; Conceptualization, methodology, software, validation, formal analysis, investigation, resources, data curation, writing-original draft, visualization, supervision, and project administration. Muslim Alanoglu; Methodology, data curation, writing-review&editing, and writing-original draft.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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Reflective and Clinical Teacher Education: A Model Proposal towards Application*

Yansıtıcı ve Klinik Öğretmen Eğitimi: Uygulamaya Yönelik Bir Model Önerisi

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ABSTRACT: Very few teacher education models have integrated theory and practice on a context basis and used formative assessment in teachers' personal and professional development. Two are the Clinical Teacher Education Model and the Realistic Teacher Education Model based on reflection. These models prepare teacher candidates (TCs) for their profession as early as possible and most effectively by integrating their professional knowledge, skills, attitudes, and values with personality traits. In Turkey, what needs to be done for teacher education is a meta-philosophical mentality change, and this study aims to lay its foundations. Inspired by these two models, this theoretical study proposes a new and unique teacher education model based on reflection and teaching competencies considering the structure and resources of the Turkish teacher education system. In this model, TCs continue their professional development in a learning community where they internalize the determined competencies in a spiral structure every year, systematically reflect on every phase of the process and obtain regular feedback from their peers, advisors, and teachers from practice schools. This study explains the theoretical background and justifications of the model incorporating theory and practice in a four-year-teacher education, and concrete, practical examples are presented.

Keywords: Clinical teacher education, competencies, realistic teacher education, reflection, teacher education.

ÖZ: Kuram ve uygulamayı bağlam odaklı bütünleştirebilen ve biçimlendirici değerlendirmeyi öğretmenlerin kişisel ve mesleki gelişiminde kullanan pek az öğretmen eğitimi modeli geliştirilebilmiştir. Bunlardan ikisi Klinik Öğretmen Eğitimi Modeli ve Yansıtmaya Dayalı Gerçekçi Öğretmen Eğitimi modelidir. Bu iki model, öğretmen adaylarının mesleki bilgi ve becerisini, mesleğe yönelik inanç ve tutumlarını kişilik özellikleri ile bütünleştirerek onları mesleklerine olabilecek en erken zamanda ve en etkili biçimde hazırlamaktadır. Türkiye'de de öğretmen eğitimi alanında yapılması gereken felsefeler üstü bir zihniyet değişimidir ve bu çalışma ile bunun temellerinin atılması amaçlanmaktadır. Bu kuramsal çalışmada, bu iki modelden esinlenerek Türk öğretmen eğitimi sisteminin yapısı ve olanakları göz önünde bulundurularak yansıtmaya ve öğretmenlik yeterliliklerine dayalı yeni ve özgün bir öğretmen eğitimi modeli önerilmektedir. Bu modelde, öğretmen adayları belirlenen yeterlilikleri her sene sarmal bir yapıda içselleştirmekte, sürecin tüm aşamalarında sistematik yansıtma yapmakta, akranlarından, danışmanlarından ve uygulama okullarındaki öğretmenlerinden düzenli dönüt alarak kişisel ve mesleki gelişimlerini bir öğrenme topluluğu içinde gerçekleştirmektedir. Çalışma kapsamında, kuram ve uygulamayı dört yıllık öğretmen eğitiminde bütünleştiren bu modelin kuramsal altyapısı ve dayanakları açıklanmakta ve somut uygulama örnekleri sunulmaktadır.

Anahtar kelimeler: Klinik öğretmen eğitimi, yeterlilikler, gerçekçi öğretmen eğitimi, yansıtma, öğretmen eğitimi.

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Teacher education (TE) and how it should be conducted is a debate frequently brought into the agenda in Turkey. This is a necessary discussion, though, because, as it is known, the quality of any education system cannot be higher than the quality of its teachers (Barber & Mourshed, 2007). In the field of TE, a variety of implementations have been conducted in Turkey from time to time, just like in the rest of the world, some of which are doing minor for primary school teachers, concurrent teacher education model, consecutive teacher education model, and increasing or decreasing the practicum period. However, a TE model satisfying all stakeholders has not been put forward yet. While some models give more importance to theory and reduce the period for practice, others prioritize practice and neglect the necessary foundations of education. The structural regulations in TE have not yielded the intended results either, and in fact, the situation is not different in many other countries (Schleicher, 2016). Hence, new perspectives exceeding the limits of mainstream approaches have been sought in TE.

The failure of conventional TE has paved the way for teacher educators to develop new models, and two of these, which are based on reflection, have emerged as successful models; "*realistic teacher education (approach)"* (Korthagen, 2017) and "*clinical teacher education*" (Burn & Mutton, 2015; Darling-Hammond, 2006, 2014; McLean Davies et al., 2015). These two models have become so successful that similar TE models and programs have been adapted in different countries and obtained positive results (Adams et al., 2013; Attema-Noordewier et al., 2011; Burn & Mutton, 2015; Darling-Hammond, 2006; Stenberg & Maaranen, 2020).

This theoretical study on document analysis proposes an innovative TE model, which centers around reflection, teacher competencies, and application. The theoretical background of the proposed model implemented at education faculties has been created through the integration of reflection and clinical TE as a result of an extensive literature review considering the realities of the Turkish TE system and conditions. To this end, national and international reports, research studies, and books on teacher education, teacher competencies, clinical teacher education, and reflective teacher education were synthesized. Successful TE education programs integrating theory and practice were examined worldwide, and the features that make them prominent programs were identified. Therefore, in this study, firstly, the reflection and clinical teacher education approaches are explained, the concepts are clarified, sample applications are presented, and finally, the proposed model, which is expected to be put into practice for teacher education in the near future is introduced.

An Overview of Teacher Education

The traditional "*theory to application approach*" applied until the end of the last century was unsuccessful in TE, and this gave rise to school-based TE programs from the beginning of the 1990s (Korthagen, 2001). TE was begun to be given at schools, and "*on-the-job teacher training*" gained importance (Korthagen & Kessels, 1999) because the mainstream TE could not reflect the genuine setting and nature of classrooms and could not prepare teacher candidates (TCs) for genuine classrooms. However, this kind of TE approach caused polarization among teacher educators. The teacher educators who criticized school-based TE advocated that TE could not be reduced to an approach that depends on providing TCs with some practical knowledge of classroom

management. They also supported that TE should be grounded on psychological, sociological, and philosophical foundations and delivered through a broader perspective. According to Korthagen and Kessels (1999), these two views are mistaken since neither asks the critical question. The essential question is not whether teacher education should start with theory or practice but how prospective teachers should integrate theory and practice. Therefore, teacher education programs should emphasize learning for theory and practice and learning from practice by providing teacher candidates with opportunities to engage in reflections and discussions with their educators and peers.

Korthagen and Kessels (1999) advocate a TE model in which knowledge and experience integrate with theory. The most fundamental feature of this new paradigm is "*reflection*." The transfer of theory and its application is a subject addressed many times, yet concrete applications and curriculum proposals are very scarce. This study focuses on how this can be accomplished in Turkey by referring to Dutch teacher trainer Fred Korthagen. The concept of reflection, which was first addressed by Dewey (1910) and revisited by Schön (1987) in detail, was further developed and systematized by Fred Korthagen and his colleagues and emerged as a TE model.

The word "*theory*" is used with two different meanings in educational sciences, and this causes confusion (Biesta, 2012; Korthagen & Kessels, 1999; Lunenberg & Korthagen, 2009). To understand the concept better, Korthagen and his colleagues explain the difference between Aristotle's concepts "*episteme*" and "*phronesis*." When teacher educators provide TCs with "epistemic" knowledge, it is usually the knowledge of concepts and principles which can be generalized to wider areas. It is the type of knowledge obtained from scientific studies, defined as a goal, and used for validity and reliability principles. For instance, the questions such as "*What are the characteristics of effective education? What are the reasons for student drop-out*?" include this type of knowledge, and conventional TE programs are grounded on it (Lunenberg & Korthagen, 2009, p. 226). Although it is necessary for TCs, they also need to learn contextual knowledge and skills related to specific subjects and situations. This type of knowledge is used by researchers while solving problems they meet in their own contexts. Teachers have to make context-specific, spontaneous, and rational decisions in these situations. This requires them to go beyond the conceptual or "epistemic" knowledge and use "phronesis," which is subjective and often unconsciously perceptual knowledge (Biesta, 2012; Furman, 2016; Korthagen & Kessels, 1999; Lunenberg & Korthagen, 2009). Hence, while episteme is the knowledge of "what," phronesis is the knowledge of "how." For this reason, TE programs should be designed to enable TCs to explore how they can use their conceptual knowledge considering the context.

Realistic Approach in Teacher Education

The biggest problem in TE throughout the 20th century was the dichotomy of theory and practice (Korthagen, 2017). Many attempts to integrate theory and practice in TE have been unsuccessful. Korthagen (2017) puts these attempts into three phases. He defines the "*from theory to practice*" approach in which the educational theories are taught to TCs during their university education as "*professional development 1.0*." This approach had been used in TE until the 2000s with different versions for decades and became unsuccessful. Conventional TE schools were in the line of fire and deprived of

many resources (Cochran-Smith & Fries, 2009), and so different pedagogical applications that would make the theory more meaningful for TCs were implemented. Among these are sample lesson videos, computer-aided education, and recruiting TCs from alternative sources, but they were unsuccessful, too (Cochran-Smith & Fries, 2009; Korthagen, 2017). Korthagen defines these attempts as "*professional development 1.1*" since they were not philosophically different from the first approach.

The failure of the "from theory to practice approach" led teacher educators to an approach applying school-based practices through which TCs spend more time at schools (Korthagen, 2017; Lunenberg & Korthagen, 2009). However, spending more time at school does not guarantee to apply quality practices and bridging the gap between theory and practice (Maaranen & Stenberg, 2017). This time theory is pushed back into the background, and practice is overrated. Korthagen defines this kind of approach as "*professional development 2.0*." The most significant feature of this approach is school-university collaborations in which teachers have a word in the education of TCs. The primary problem in the implementation of this approach is the difficulty of associating practice with theory.

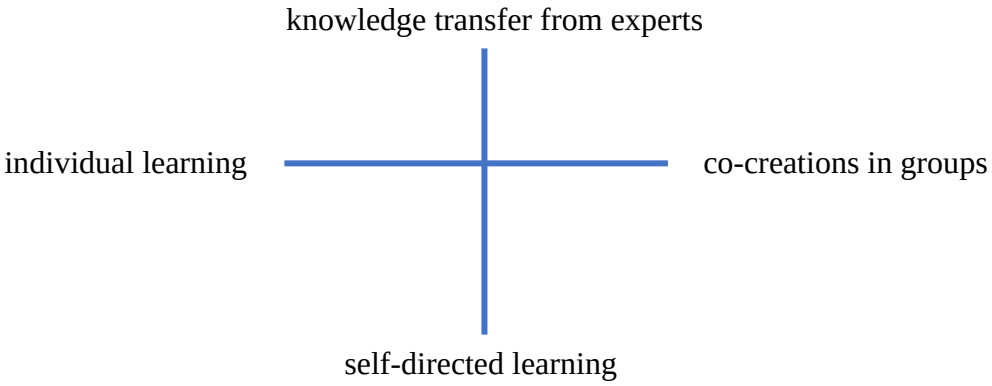
Since solely school-based practices were unsuccessful, Korthagen and his colleagues have advocated an approach based on reflection since the 2000s (Korthagen, 2001, 2005; Korthagen & Kessels, 1999; Korthagen & Vasalos, 2005). This approach is called the "realistic approach" (RA) and places special importance to the self of teacher and teacher's personality. Korthagen (2017) defines RA as "*professional development 3.0*". In this approach, TCs' own interests and concerns are the starting point of their education processes. TCs convene at certain intervals under the supervision of educators and reflect on their experiences, share solutions to the problems they face, and listen to their educators' views and suggestions regarding these issues. There are four key features of realistic approach (Korthagen, 2005):

1. Working on the real situations encountered during teaching that caused concern in teacher candidates,
2. Reflections and interactions of TCs with their peers,
3. Guided reinvention under expert supervision,
4. No Theory with capital (T) (subjects developed by researchers), small theory (t) (theory created by TCs). While capital T refers to "epistemic" (conceptual) knowledge, small t refers to "phronesis" (perceptual) knowledge, as is explained above.

Korthagen visualizes RA with two dimensions and shows the transformation of TE. Figure 1 shows this transformation via change in the vertical axis from top to down and horizontal axis from left to right.

Figure 1

The Transformation of Learning in Teacher Education



Note. (Korthagen, 2005, p. 83)

The vertical dimension in Figure 1 shows who is responsible for theory transfer and it shows a shift from top to bottom in TE. TCs should be provided with opportunities to direct their learning, construct their experiences and be equipped with the skills to develop the theory of their own practices. The second dimension in Figure 1 has to do with individual dimension versus group learning. Research shows that students and teachers learn and construct knowledge better in collaborative contexts (Korthagen, 2005). Therefore, schools should be transferred into learning communities and TCs must gain competencies that will enable them to develop their own knowledge along with expertise knowledge during their education period. Hence, TE shown in Figure 1 should situate somewhere at the bottom right but not at the top left as it is usually in conventional TE.

Reflection in Teacher Education

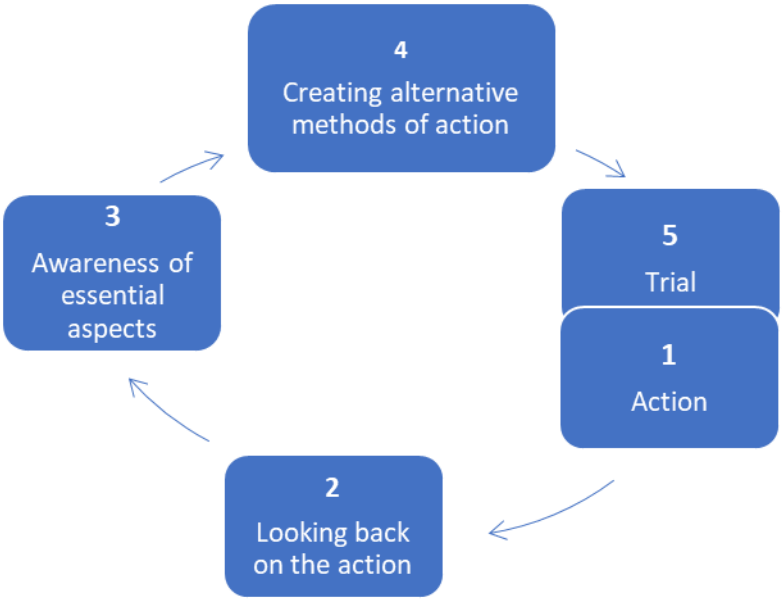
Although successful professionals in their fields have effective reflection skills, there is usually uncertainty about how to do it (Korthagen, 2014; Van Woerkom, 2010). Teachers make spontaneous decisions about the problems they face during their hectic workload, and most of these decisions are superficial and do not yield positive results. This is because of the rapid desire to find quick solutions to problems rather than finding out the underlying reasons. This kind of reflection is called "*action-oriented reflection*" (Hoekstra, 2007). However, the "meaning-oriented reflection" leads to radical change in the thoughts and applications of teachers in the long term. In this type of reflection, teachers engage in deep reflection by identifying the elements and situations in the occurrence of problems. Korthagen and Vasalos (2005) define this type of reflection as "core reflection". The systematic realization of this reflection is explained by what Korthagen calls the ALACT model, which he developed in the Netherlands and later became an integral part of TE in Australia and the USA.

The primary reason for the ALACT model's emergence is the "*reality shock*" that novice and prospective teachers face. This challenge led educators to develop a model bridging the gap between theory and practice. ALACT model grounds on TCs' learning from practice and is comprised of five circular phases. The model is named after the initials of these five phases in English: 1) **A**ction, 2) **L**ooking back on the action, 3) **A**wareness of essential aspects, 4) **C**reating alternative methods of action and

5) **T**rial. The last phase is also a new action and is the starting point of the next reflection cycle (Korthagen, 2014). Not only does the model focus on changing the intellectual structure of TCs but also considers their emotions and needs. The circular shape of the model is presented in Figure 2.

Figure 2

ALACT Model. Structured Reflection Processes



What makes ALACT model different from other action-oriented reflection models is its reliance on meaning-oriented reflection and the special importance it gives to the third phase since this phase is so important for meaningful and deep reflection. In this phase, TCs and their educators/supervisors ask themselves the following questions given in Table 1 for a smooth transition from phase two to phase three:

Table 1

Questions supporting the transition from phase two to phase three

0. What is the context?	
1. What did I think?	5. What did the pupils do?
2. What did I feel?	6. What did the pupils feel?
3. What did I want?	7. What did the pupils want?
4. What did I do?	8. What did the pupils do?

Note. (Korthagen, 2017, p. 394)

After asking and answering these eight questions, the final and most important phase is associating the answers with each other and analyzing the entire process among TCs, teachers and teacher educators (Korthagen, 2017; Lunenberg & Korthagen, 2009). For instance, the questions such as "*How did the teacher candidate's own feelings affect*

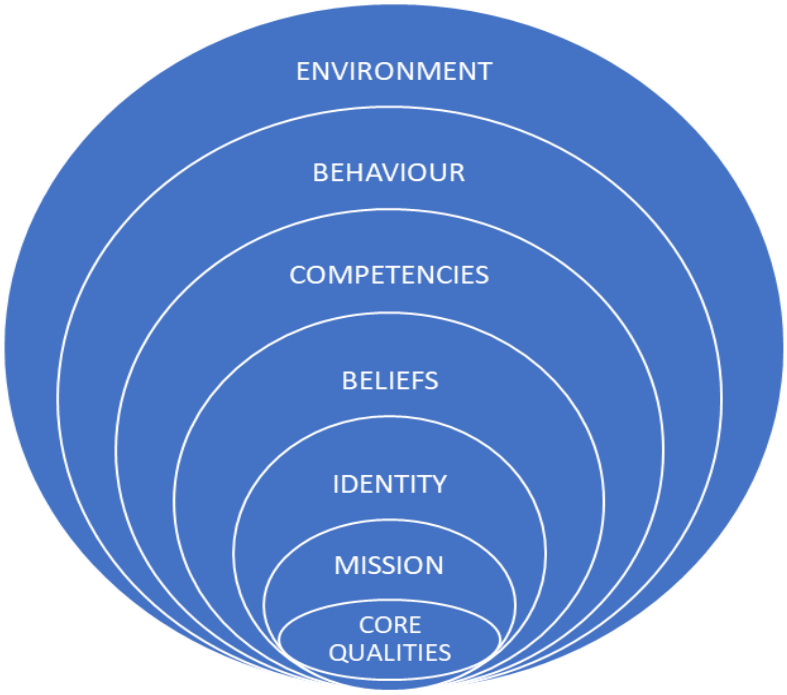
his/her actions and behaviors during the lesson? How did these actions affect what students wanted and felt? How did this affect the behaviors of pupils? What was the effect of this on teacher candidate's behaviors?" make the reflection process more apparent and meaningful for TCs. Besides, how influential these questions on the left and right-hand sides of the table are on each other and how they are mostly neglected can be understood. Hence, TCs can realize that certain behavioral patterns occur in certain situations and as Lunenberg and Korthagen (2009, p. 236) put it, they do not have to reinvent the wheel. As a result of the application of the model over the years, Korthagen (2014, 2017) found out that the concept of reflection is not understood accurately by some teacher educators and TCs and developed a reflection model that he calls "core reflection" (CR).

Core Reflection

CR depends on the onion model that Korthagen (2004) developed, and it is performed at certain phases. The model's logic is grounded on the interrelation of all phases or layers. A genuine professional reflection is an endeavor of unveiling deep relations. Figure 3 shows the phases of the onion model.

Figure 3

Onion Model: Phases of Reflection



Note. (Korthagen, 2004, p. 80)

1. Environment: This outmost layer refers to everything and everyone except the teacher. At this phase, the teacher candidate asks himself/herself, "*What did I face with? / What am I dealing with?*"

2. Behavior: This layer is related to what the teacher candidate does. The teacher candidate asks himself/herself, "*What am I doing?*"

3. Competencies: This layer refers to areas that teacher candidate is competent at. The teacher candidate asks himself/herself, "*What am I competent at?*"

4. Beliefs: This layer focuses on the beliefs of TCs about the situations/topics they deal with. "Beliefs" refers to the unconscious assumptions regarding the outer world.

5. Identity: This layer includes TCs' self-concepts, assumptions about themselves and the professional roles they consider for themselves. The teacher candidate asks himself/herself, "*Who am I (in my work?).*"

6. Mission: This layer has to do with what inspires TCs and what gives meaning to TCs' lives and jobs. While the identity layer focuses on how self-perceptions and how TCs deem themselves, this layer entails ideals.

"*Core qualities*" are at the heart of the model. These are dispositions like enthusiasm, curiosity, courage, tenacity, determination, openness and flexibility (Korthagen, 2014, p. 79). CR aims to raise awareness of these qualities and reveal the relationships between layers. It occurs as TCs focus on the layers of identity, mission and core qualities rather than the outer layers. Indeed, CR targets exploring and eliminating the internal elements that inhibit the use of core qualities and ideals of TCs. Hence, it dwells on two primary questions (Korthagen & Vasalos, 2005, p. 54):

1. *What is the ideal situation? - the situation that the teacher wants to bring about?*

2. *What are the limiting factors preventing the achievement of that ideal?*

CR facilitates identifying the factors preventing ideal classroom environment and instruction and finding the methods to overcome these obstacles. Rather than fight against these obstacles to an ideal situation, the essence of CR is to demonstrate a will to be conscious of and to solve them. Thus, TCs should be encouraged to focus on identity and mission layers in reflection and be autonomous (Meijer et al., 2009).

The ultimate purpose of CR is to equip TCs with what Lunenberg and Korthagen (2009) call "*practical wisdom*." It can be defined as the ability to identify the underlying elements of a situation or problem, find appropriate solutions, and take necessary actions. One of the reasons for the failure of the "*from theory to practice*" approach, as explained earlier, is the fact that "*some general or theoretical knowledge bases that work in certain situations may not work with a group of different students and in different contexts*" because as research shows, 75% of the decisions made by teachers in the classroom are spontaneous (Lunenberg & Korthagen, 2009, p. 228). Therefore, CR centers on the experiences of TCs during their practicum and focuses on their concerns, beliefs, interests, curiosity, or the concepts they developed regarding education through these experiences.

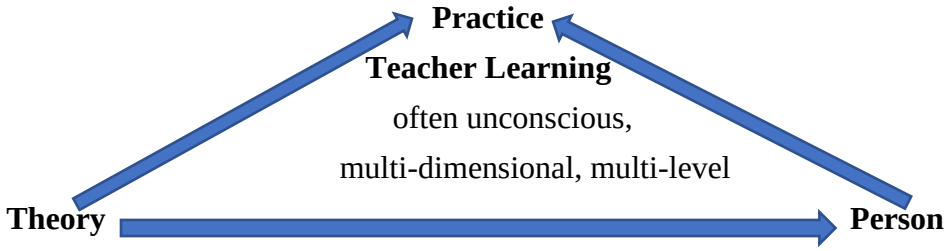
Emphasizing practical wisdom does not mean giving simple information or hints concerning education and teaching. On the contrary, it requires a high level of professional development and enables TCs to learn how theory can be put into practice. Körkkö (2021) advocates that the theoretical knowledge bases of teacher educators are highly influential on the development of meaning-oriented reflection abilities of TCs. In addition, practical wisdom should not be reduced to technical skills. Practical wisdom has to do with ethical values and actions and involves how to treat certain situations (Furman, 2018; Stenberg & Maaranen, 2020). Hence, TCs should be provided with

opportunities and sample cases through which they can listen to each other, raise awareness of authentic situations and internalize theory.

Teaching is a complex and multi-dimensional profession that cannot be performed with solely theoretical knowledge. Therefore, practical wisdom has a key role in properly fulfilling its requirements of it (Stenberg & Maaranen, 2020). This competency enables teachers to make effective pedagogical decisions regarding their situations and problems. Consequently, for an effective TE, the relationship between theory and practice should be linked, as well as personality traits. Korthagen (2017) holds that the connection between theory, practice, and the self can only be established through in-depth reflection. Figure 4 shows this relationship.

Figure 4

Teacher Learning Takes Place in the Connection between Theory, Practice and Person



Note. (Korthagen, 2017, p. 399)

As shown in Figure 4, teachers' learning processes often take place as unconscious, multi-dimensional and multi-level, so TE should be designed in a way to support this structure and these processes (Korthagen, 2017). This can be realized through classrooms that are transformed into learning communities under the supervision of TCs' advisors and applications in which they comfortably share and reflect on their interests, needs and concerns emerging from their own teaching experiences. This type of genuine reflection also functions as a facilitator for teacher educators who have crowded classrooms.

Korthagen (2017) defines an effective teacher as the one who can establish harmony among the phases he explained in the onion model and the one who has impact on the classroom and school with the coherence of his/her core qualities, ideals, sense of identity, beliefs, competencies and behaviors. Professional development also takes place through this coherence. CR and its ultimate result -practical wisdom- have empirically proved their effectiveness. Attema-Noordewier et al., (2011), Hoekstra and Korthagen (2011), Meijer et al., (2009) in the Netherlands; Adams et al. (2013) in the USA; and Körkkö, (2021), Maaranen and Stenberg (2017), Stenberg and Maaranen (2020) in Finland showed that CR or meaning-oriented reflection significantly contribute to the professional transformations of TCs.

A TE model similar to *3.0 teacher education* has started to be implemented especially in the USA, Canada, and Australia. The schools applying this approach have become prominent in the field of TE as exemplary schools. The basic approach adopted by these schools is called "*clinical teacher education*" (CTE), in which theory and

practice are integrated through reflection and school-based applications. It is a TE model that aims to develop pedagogical reasoning skills of TCs. The following part explains the philosophical foundations and exemplary applications of CTE.

Clinical Teacher Education

The failure of "*from theory to practice*" led teacher trainers to alternative approaches. Among these, the most successful and prominent one is CTE. CTE emerged at a time when school-based applications became prevalent. TCs' experiencing and testing the theoretical knowledge bases learned at university in practice schools is the foundation of CTE. However, CTE differs from what Korthagen (2017) calls *teacher education 2.0*, where TCs are left alone in practicum. The most distinctive feature of CTE from other context-oriented approaches is that TCs obtain systematical feedback from their colleagues, mentor teachers at practice schools, and teacher educators at university in a learning community, and they reflect on their practices, thoughts and feelings (Burn & Mutton, 2015; Darling-Hammond, 2006; McLean Davies et al., 2015; National Council for Accreditation of Teacher Education [NCATE], 2010).

CTE is an approach in which TCs apply the theory. The extent that they have acquired the competencies the program specified is tested through performance evaluations, especially with formative assessment (Darling-Hammond, 2014). The objective of CTE is to provide TCs with experiences regarding observation, doing research and teaching practice at schools as early as possible and reflect on and examine the theoretical knowledge they have learned before it has been a long time. Hence, TCs gain contextual knowledge and teaching experience as far as possible before they begin teaching. In the context specific CTE process, TCs develop strategies to enhance their decision-making skills via more structured teaching practices, work in stronger solidarity and collaboration with their colleagues and conduct professional and systematical interviews with their advisors and mentor teachers (McLean Davies et al., 2015). In this respect, CTE and RA explained earlier grounds on similar foundations. In the USA, there are outstanding schools applying for CTE. Boston University, St. Cloud State University, University of Northern Iowa and Hunter College are some examples of those schools.

One of the main reasons that paved the way for CTE in the USA is the Professional Development Schools (PDSs) opened in the 1908s. Being similar to the laboratory schools at the beginning of the 20th century, these schools aim to bridge the gap between practicum applications and university courses (Darling-Hammond, 2006). Thanks to these schools, pre-service teachers get prepared for the profession within the scope of CTE and in-service teachers can continue their professional development. Also, PDSs function as a laboratory for TCs to be able to conduct their educational research (Burn & Mutton, 2015; Darling-Hammond, 2006; Grossman et al., 2009) and they help bridge the gap between field studies and university courses. In the practicum, TCs discuss their observations, case studies, reflective diaries and experiences in practice schools with their mentor teachers and colleagues and in universities. During these discussions, TCs generate solutions to the problems faced, and reflect on lesson records, materials and examinations they have prepared. In CTE, mentor teachers are also an integral part of the process. Carefully selected mentor teachers may become assistants of advisors and at the same time, they can occasionally teach to TCs at

practice schools and university. What is more, mentor teachers take part in portfolio evaluation commissions of TCs and play an active role in the evaluation processes (Darling-Hammond, 2006).

CTE is applied in Europe, too. One of the best examples to CTE is Oxford Internship Scheme (OIS) conducted in the United Kingdom (UK). OIS refuses "from theory to practice" approach and focuses on clinical reasoning and "*practical theorizing*" (Burn & Mutton, 2015). In these two approaches, practice teachers share the underlying reasons of their classroom practices, reflect on and discuss the cause-and-effect relationships of these practices or the decisions they have taken with TCs. Such an implementation enables to unveil the tacit knowledge of teachers and helps TCs to internalize which decisions are taken under which circumstances (Kriewaldt & Turnidge, 2013). The success of OIS paved the way for OIS to be implemented in the other regions of the UK, and similar programs such as School-Centered Initial Teacher Training became widespread. (Conway et al., 2009).

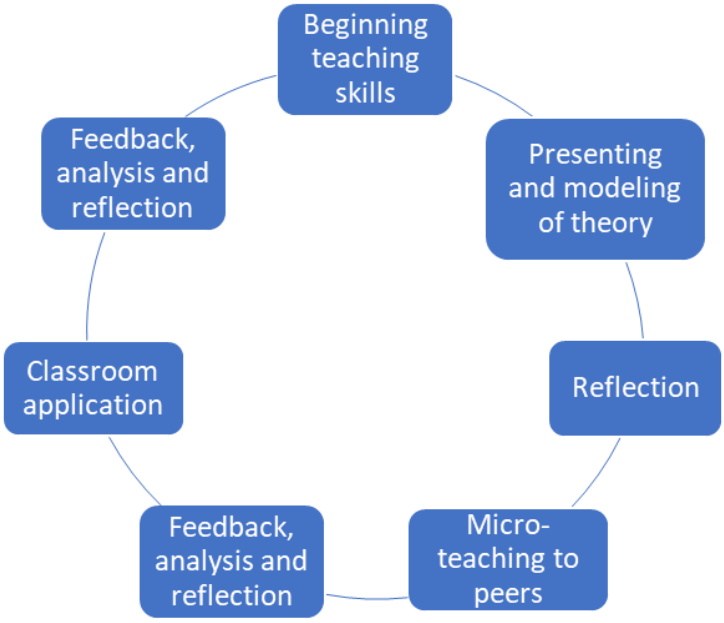
TE system in Finland can also be considered within the scope of CTE (Burn & Mutton, 2015). The most distinctive feature of Finnish TE is the effective cohesion of theory, practice and scientific research throughout the process (Körkkö, 2021; Maaranen & Stenberg, 2017; Sahlberg, 2010). In the final practicum where two teacher educators are assigned to a school in the fourth or fifth year of university education, TCs are expected to reflect on both the duties and responsibilities of teachers and the theory and practice. Regarding teaching practice, TCs are observed by their mentor teachers and university advisors at the same time, and they get feedback (Maaranen & Stenberg, 2017). In addition, Teacher Education Schools in Finland are similar to the PDSs in the USA. In these schools, TCs and teachers conduct research and development activities in the framework of collaborations with universities.

CTE and clinical reasoning approach in the USA and Europe have also been adopted in Australia. The Master Teaching Certificate program given at Melbourne Graduate School of Education is an example of this (Kriewaldt & Turnidge, 2013). As part of CTE, TCs are assigned to practice schools at the beginning of the semester, and their mentor teachers and university advisors educate them. The university teachers who are defined as clinical experts also take charge in practice schools and become a liaison between schools and the university. Clinical reasoning requires TCs and teachers to express and think aloud about their experiences regarding the issues discussed by providing evidence from student assignments, evaluation tools, or their own lesson records sincerely and thus, to make sense of their own experiences. This reflection process is conducted in a free environment based on mutual respect, dialog, criticism and feedback (Kriewaldt & Turnidge, 2013).

Another successful teaching application is conducted by Regina University in Canada. The program centers around the Teacher Competency Profile (TCP), which was developed by the collaboration of Regina University and regional schools (Lang & Evans, 2006). TCP consists of twelve core competencies and their performance indicators. Even though Lang and Evans (2006) do not define TCP explicitly as CTE, the way the model is applied and its components are the indicator of CTE. TCP consists of awareness, discussion, reflection and practice phases. In the TCP model, the competencies are targeted to be gained by TCs in a cycle. Figure 5 shows this cycle.

Figure 5

Professional Development Cycle



Note. (Lang & Evans, 2006, p. 15)

As shown in Figure 5, TCs initially study, discuss and reflect on the competency domain and related theoretical knowledge at university courses. Then the theoretical knowledge is experienced through micro-teaching. Lang and Evans (2006) suggest observing real classrooms or watching exemplary lessons if this is not possible. Following micro-teaching, TCs reflect on the practices and experiences under their advisors' guidance, and they prepare for the next phase, which is classroom application in a most effective way. TCs also reflect on their individual experiences into their professional development diaries. In the third phase, TCs apply their lesson plans regarding the target competency domain they develop with their peers at the practice school they have been assigned. The teacher candidate is observed by their mentor, teacher, and peer to obtain extensive feedback and reflect on and keep a record of his/her individual teaching experience. The objective is to minimize the problems due to inexperience before practice and to prepare TCs for the profession through context-specific continuous feedback.

In the following section, in light of these developments and considering successful TE implementations in various countries, a reflection and competency-based model is proposed for TE in Turkey. The model depends on bridging the gap between theory and practice within the framework of education given at education faculties and developing practical wisdom and clinical reasoning skills of TCs during their four-year education through applications.

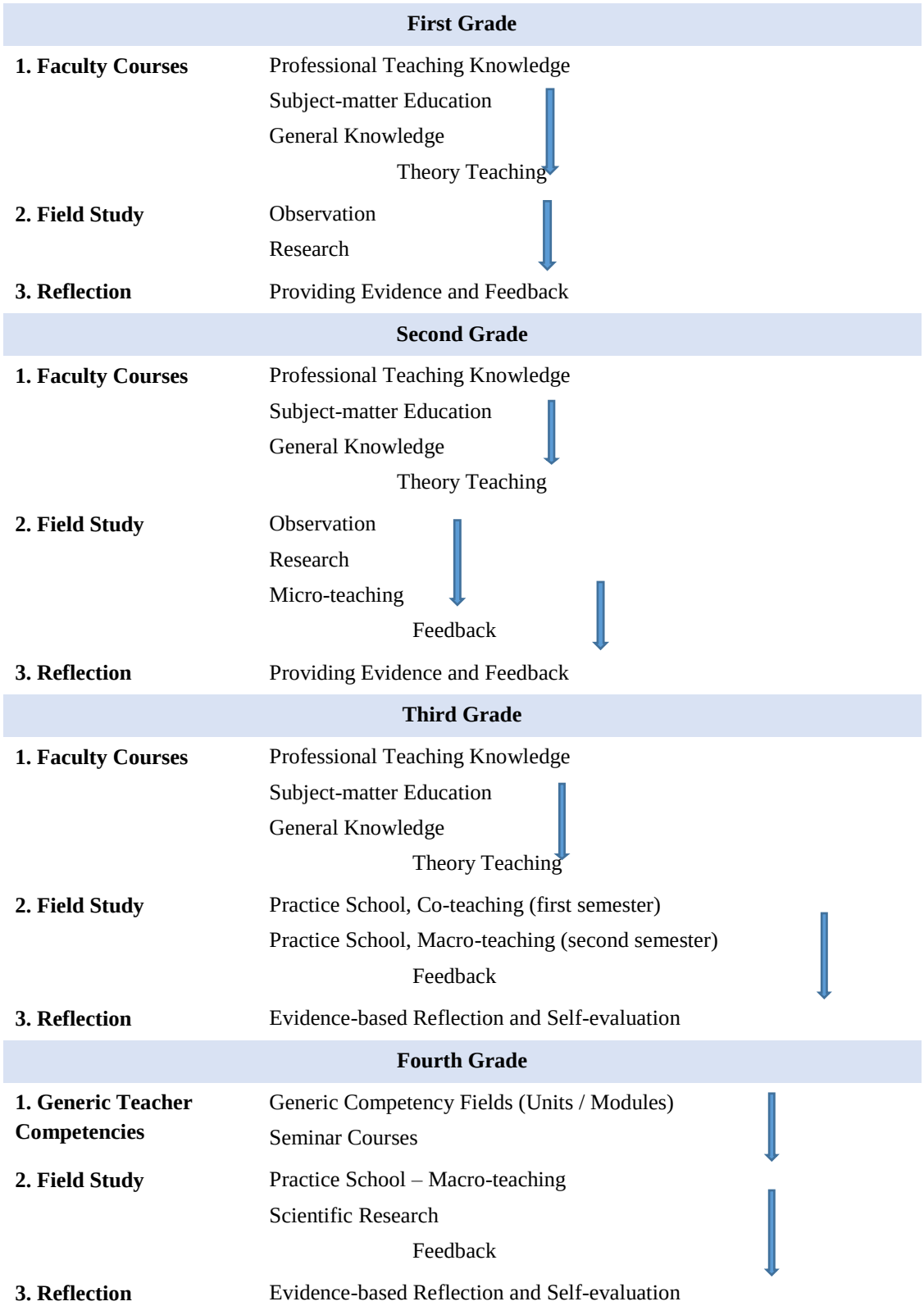
Four-Year Clinical Teacher Education Based on Reflection and Competency

TCs in Turkey take their professional teaching knowledge courses starting from the first year. However, these courses are deemed theoretical and cannot be associated with practice by TCs (Alan, 2019, p. 178). Alan's (2019) study revealed that TCs, who consider themselves quite knowledgeable in terms of theory and see their university teachers as well-equipped in their profession, state that they cannot find environments, opportunities and practical applications that will enable them to make sense of, test and evaluate their extensive knowledge. TCs think that their education does not prepare them for the profession with respect to practice. Alan's (2019) study indicates that TE system in Turkey still bears the trace of *teacher education 1.0* or *from the theory to practice approach*. Practicum applications (which can be accepted as *teacher education 2.0*) do not hold the quality to gain TCs practical wisdom in relation to the duration or the applications conducted. TCs are unable to experience and reflect on a topic they study in the first year until practicum applications are squeezed to the last year. There is a long time between their courses and teaching applications. They cannot find time and opportunities for practice, so they forget what they have learned. For instance, TCs study *developmental psychology* in the first or second grade but do not have a chance to experiment with it until the final year's practicum (Alan, 2019, p. 179). Some other courses like *classroom management* and *teaching principles and methods* can be given for further examples. It is of great significance with respect to this study and to the proposed model that the TCs interviewed regarding this subject gave examples from medical education, wanted to stay longer in the field and conduct practical applications at school even though they were not informed of clinical education while talking about ideal TE.

Within the scope of this study, a model in which theory and practice are experienced coordinately, TCs reflect systematically in all phases of the process, get regular feedback from their peers, advisors and teachers at practice schools, and develop knowledge, skills, attitudes and values towards their profession within a learning community. Figure 6 shows the stages and general framework of the CTE based on reflection and competency.

Figure 6

Stages of Clinical Teacher Education



As is seen, Figure 6 shows the applications of CTE expanding four years. According to this, practical applications are conducted at all stages and are not limited to the last year. The proposed model is aligned with the realities of Turkey. In education

faculties, similar to the examples across the world, professional teaching knowledge, subject-matter teaching and general knowledge courses are taught. These courses remain the same in this proposed model, but their delivery and timing change. More student-centered, school and reflection-based activities are conducted in these courses, and TCs' professional development is supported by formative assessment at all processes.

The proposed model is based on the determined teacher competencies (Alan & Güven, 2022). Likewise, Turkish Ministry of National Education (MoNE, 2017) also emphasizes the importance of designing and grounding programs and course contents of TE programs on MoNE's generic competencies and training candidates of competency. The motive for competency-based education (CBE) derives from the gap between the knowledge bases and skills of individuals they learn at university courses and the required knowledge and skills in the business world. The biggest issue in TE is the failure to build a bridge between theory and practice. This is why CBE, which entails knowledge use in authentic work context rather than knowledge transmission, has become widespread in TE (Koenen et al., 2015). CBE focuses on what an individual can do regarding a particular profession after completing training and in doing this, rather than their achievements in comparison to others, but the sector's standards and requirements are determined as a benchmark (Guthrie, 2009).

It might seem contradictory for some that the proposed TE model is reflection-based and centered around competencies because Korthagen (2017) developed the CR concept and advocates the professional development of TCs through this concept and approach, and also the starting point of this proposed model is against CBE. However, CBE that Korthagen is against is the technician TE approach in which competencies are dealt in quite a strict manner, neglects the complex structure of teaching and humanistic and personality traits, values, beliefs, and the influential factors shaping them. This view depends on the deficiency determining / diagnosis approach. Competencies are a crucial element and layer in Korthagen's onion model, but Korthagen emphasizes associating these competencies with what he calls core qualities, and personality traits.

The teacher competencies that Alan and Güven (2022) determined consist of six generic competencies and their sub-competencies and each sub-competency consists of observable and measurable performance indicators. Indeed, one of the reservations of Korthagen towards CBE is the difficulty of measuring competencies. The competencies Alan and Güven (2022) determined, though, define performance indicators at four different levels, and rather than being an ultimate summative assessment tool, it is a reference resource exemplifying the level of performance expected from teachers and TCs at varying ranks enabling them to do their self-evaluation and reflection. In addition, Alan (2019) revealed that the TCs also need a generic competency framework scaffolding their self-evaluation and professional development.

Competency and reflection-based CTE is modular, and the modules are comprised of the determined competency domains. The competencies (content) are targeted to be gained through structured modules or units. The competencies are studied by associating with the courses taught in the first, second, and third years. The theory learned at university is tested at schools through observation, research, application, and reflection. Within the framework of the courses at various grades designed with a spiral program, the competencies are revisited at an increasing width, depth and difficulty, and

they are experienced through activities based on application and reflection. Thus, TCs reach a certain competency level before the final and comprehensive practicum. This kind of TE model delivered in four years prepares TCs for the reality shock they may experience in the first years of their profession.

First and Second Grade

In the CTE model, TCs experience the professional teaching knowledge and skills and the applications that help them gain positive attitudes and values towards their profession from the first grade of their education. Apart from university courses, TCs are assigned to practice schools, and they test the theoretical knowledge they learn at university and self-reflect on their experiences by providing evidence from the field. In this way, they are able to experience the theory and practice coordinately and at the same time, they begin developing their clinical reasoning skills at the earliest through reflection. TCs benefit from the following methods and tools to gain clinical reasoning via reflection and evidence.

Observation and Research

Observations have a key place in CTE. TCs learn theoretical knowledge, discuss and examine the examples regarding their own discipline at faculty courses with their university teachers and then make observations related to these issues at practice schools. These observations might be about a wide range of topics such as duties, responsibilities and applications of teachers and administrators or for an understanding of why and how teachers and students treat in certain ways in certain situations regarding the subjects studied. In this respect, TCs conduct research and interviews with students and teachers. TCs examine the validity and practicality of theoretical knowledge they learn at faculty courses via findings and evidence they obtain from the field and do their self-reflections on the cause-and-effect relationship. The faculty teacher (field expert) leads and guides these reflection processes and gives feedback to TCs. These applications also provide a background for the scientific research TCs will conduct in the following years to feed theory and practice with scientific research, which is an important characteristic of CTE.

Peer Feedback

Another significant feature of CTE is that TCs are the members of a learning community, and they make sense of their experiences by sharing and discussing with each other. At the end of every unit (competency field) completed and the lived experience at practice school, TCs discuss their findings, thoughts, feelings, disappointments, problems and other aspects and factors that impact their professional and individual development. TCs compare and contrast the similarities and differences of the experiences lived and reflect on who did what in certain situations, which applications resulted positively and negatively and what kind of a clinical reasoning process they went through during these experiences. Thus, individual experiences become a learning tool for others, too, since these reflections will reveal some generalizable patterns of behavior. Besides, because TCs gain experience at different schools, they become knowledgeable about various student profiles and be more prepared for the probable situations they will face with. However, to this end, TCs should be provided with an environment in which they feel secure, be encouraged to

share their experiences without hesitations, and be informed that these applications are not for judgmental purposes but to support their professional development. They should also be given information about how to provide constructive criticism and the instructor should demonstrate concrete examples.

Interaction with Mentor Teachers

Practice schools and field studies are an integral component of CTE, but for these studies to be meaningful and supportive for the professional development of TCs, the mentor teachers bear important roles and responsibilities. Foremost among these is the framework of an intimate but professional interaction of mentor teachers with TCs. The professional development of TCs in practicum cannot solely be actualized by observing mentor teachers or doing research assignments. There might be various justifications beneath teachers' pedagogical decisions regarding their daily practices. What matters is their ability to understand why, how, when and with what justifications these decisions are made, and this can be achieved by establishing a systematical communication and feedback process. With this systematical communication, the clinical reasoning and practical wisdom of TCs are developed. Clinical reasoning is to make invisible things visible and to make indiscernible things discernible for TCs. During clinical reasoning, mentor teachers regularly meet with TCs after their in-class practices or teaching. In these reflection meetings, mentor teachers explain what they thought about, what they felt, what their motives were, why they changed their minds (if there are any) and how these impacted students' learning at that particular moment to TCs. TCs, on the other hand, share and reflect on their feelings and thoughts concerning the lesson they have observed with both mentor teachers and their peers.

The fact that TCs and mentor teachers mutually share mental and affective processes they have gone through in all applications sincerely and transparently provides invaluable opportunities for TCs' professional development. These applications within the scope of CTE are aligned with Korthagen's CR model, too, because in such a reflection environment grounded on collaboration and mutual sincerity, TCs reflect not only on the external factors influencing their professional development but also on the identity and mission layers that constitute the essence of CR. According to a recent study (Maaranen & Stenberg, 2020) conducted in Finland, the foremost factor in the identity development of TCs following internship studies is the collaboration with school staff and the share of school culture.

Micro-teaching Applications

The delivery of the first and second-grade courses and applications TCs conduct remain the same, but TCs begin micro-teaching applications starting from the second grade. TCs consider micro-teaching applications they conduct at university beneficial for gaining teaching experience by principle; however, they also believe that these applications are stilted and for this reason, they do not yield the intended results (Alan, 2019). TCs believe that playing student roles is effective to a certain extent, but they get bored or hesitant in this artificial setting, and they think that a genuine classroom environment and student interaction cannot be achieved no matter how hard it is tried. For this reason, TCs wish to gain micro-teaching experience at practice schools rather than at universities. This wish and view of TCs have similarities with the teaching

applications conducted abroad. For instance, in successful TE schools in the USA, TCs conduct teaching applications starting from the first semester of the second grade initially with shorter durations (5-10 minutes) and then at an increasing rate (Darling-Hammond, 2006).

The objective of conducting micro-teaching at practice schools is to gain teaching experience as much as possible and be familiar with working contexts and conditions at the earliest as a requirement of CTE. Just like skippers and pilots gain experience at different seas and weather conditions or medical students visit hospitals and take on different tasks by caring for patients from the beginning of their education, TCs should also be provided with opportunities and experiences to gain the competencies expected of them as early as possible (NCATE, 2010). The best place to gain these experiences is the practice schools.

Within the scope of micro-teaching, constructive feedback is an integral component of the proposed model as part of clinical and reflective education. With this application, TCs are able to test the theoretical knowledge they learn at university and experience its practicality in advance. This is called "practical theorizing" in the literature (Burn & Mutton, 2015). With practical theorizing, TCs can experience under which circumstances and on which student groups the theory they learn has an impact firsthand, and they reflect on these experiences by discussing. These applications positively reflect on faculty courses since classroom discussions become more authentic and meaningful, and university teachers provide TCs with richer and more constructive feedback. In this way, theory and practice mutually feed each other.

Following micro-teaching applications, TCs get feedback from their mentor teachers and colleagues regarding their teaching. The feedback they get on their teaching focuses on two fundamental issues. The first is about to what extent the targeted subject or learning outcome has been achieved or not by students and how it can be checked. The second is related to TCs' in-class performance. After TCs discuss and reflect on these two issues with their mentor teachers and colleagues, they share their experiences at university courses with their university teachers. TCs and university teachers associate micro-teaching experiences with the literature and university teachers give TCs feedback.

Third Grade

In CTE, the teaching applications of TCs increase gradually, their teaching duration gets longer, and they fulfill various duties and responsibilities.

Co-Teaching Application

In the third grade, TCs practice co-teaching different from micro-teaching. Co-teaching is a teaching application through which a candidate teacher and a mentor teacher teach either a whole lesson together or by sharing certain parts of it. This is such a practical and successful application that especially mathematics and reading skills achievement of students with special needs is 20% higher than the average (NCATE, 2010).

TCs begin teaching from the first semester of the third grade with and under the supervision of their mentor teachers and hold regular meetings before and after lessons. In these meetings, teachers and TCs discuss who will teach certain parts of the lesson,

how long it will take, what materials they will use and how they will use them. In the post-lesson meetings, mentor and candidate teachers reflect on the lesson they have conducted and get feedback about the process. Co-teaching is not an application that only TCs benefit from. Mentor teachers are also informed about the state-of-the-art educational approaches that TCs bring from universities and adapt them to their teaching applications. With the integration of TCs' dynamism and experiences of mentor teachers, richer learning settings emerge, turning into an acquisition for students (NCATE, 2010). Another feature of CTE is that students do not get harmed by these processes and are not deprived of quality education.

The fact that mentor teachers can instantly intervene in any problems that may occur in the classroom is another benefit of CTE for TCs. TCs who teach under the supervision of mentor teachers feel secure, and their self-efficacy does not break down since the potential problems they may face will be intervened without them worsening. In the second semester of the third grade, TCs continue co-teaching with mentor teacher or one of their colleagues but again under the supervision of their mentor teacher within the framework of the determined calendar. The difference in the second semester is, though, that TCs conduct macro-teaching instead of micro-teaching. In macro-teaching, TCs start teaching longer periods or the whole lessons. Apart from the regular meetings with mentor teachers as part of clinical and evidence-based education, TCs reflect on this process together with their university teachers and colleagues at university courses. TCs reflect on their experiences at school by providing evidence, discussing the applications that went right or wrong with reasons, and sharing how they felt and how they should behave the next time over concrete examples and evidence.

Scientific Research

Gaining scientific research skills and having competencies that will enable TCs to solve problems that might occur in their classrooms are more important than ever. For this reason, scientific research applications in which TCs can obtain and analyze data with regard to subjects such as school, students and learning-teaching have become an important part of TE programs in various countries. Some of these countries, Finland being in the first place, are Belgium, France, Lithuania, the United Kingdom and Spain. Studies analyzing successful TE policies of Finland show that research-based TE is the major reason why Finland stands out in this field (Conway et al., 2009). TCs in Finland conduct scientific studies with genuine classrooms and students at practice schools and link theory with practice.

CTE is evidence-based, and it feeds on scientific research. In this respect, TCs can conduct scientific research in the third grade thanks to the skills and knowledge they acquire from research assignments and courses they take since the first and second grades. These research studies are usually designed as case studies. TCs conduct case studies on particular students or subjects they are interested in. Case studies in the prominent TE schools in the USA are also an integral part of curricula (Darling-Hammond, 2006). TCs' self-efficacy with regard to conducting scientific research develops through these studies.

TCs conduct case studies about at least one of the students they teach. They collect systematical information about students' development they analyze, those students' behavioral patterns in certain situations and the impact of their applications on

students. Then TCs associate the information they obtain with theoretical knowledge they learn in university courses. In this respect, TCs' comprehensive observations, systematical data collection and analysis regarding a particular student are important applications of the program. Besides observations and case studies focusing on a single student, TCs can conduct studies about whole class.

Fourth Grade

One of the most distinctive features of the CTE based on competencies and reflection is the applications conducted in the last grade. Although competency and reflection-based CTE does not compress the practicum applications into the last grade, all of the last year is allocated for practicum. TCs who have already completed most of the courses at education faculty now focus on practical applications and conduct macro-teaching. TCs teach lessons within the framework of the determined target competencies in the autumn and spring terms of the academic calendar. TCs experience the determined competencies that constitute the program's content and become ready for the profession before graduation as much as possible. Practicum applications are not limited to practical teaching experiences at practice schools. TCs continuously and systematically reflect on the applications they conduct at practice schools and universities in a learning community.

Application – Reflection Cycle

The fourth-year practicum applications take place in two-week cycles in the CTE based on competency and reflection. TCs experience the competencies within the application-reflection cycle. TCs apply the target competency in the practice schools they are assigned and shoot the video of their lessons. They make their written and oral reflections after the evaluation and reflection meeting with mentor teachers following their lessons. TCs are assigned to practice schools as groups that are large enough to collaborate and support each other. They help their friends by shooting videos of their colleagues' lessons, preparing lesson plans, observing their colleagues' lessons, and giving them feedback after teaching. Thus, TCs both continue their professional development within a learning community and realize the importance of colleague solidarity before they begin their profession.

In the second week, TCs evaluate the previous week under the guidance of their university teacher and discuss to what extent they have gained the targeted competency, how successful students have been, what they have felt during this process, what difficulties they have faced and how they have coped with these difficulties by providing evidence (video records, lesson plans, lesson materials, student products, etc.). Other TCs also give their friends constructive feedback, compare and contrast their experiences and discuss the similarities and differences within cause-effect relationship, showing evidence. The university teacher provides TCs with individualized feedback and support during this process. According to Darling-Hammond (2006), the success of reflective practices depends on systematical and in-depth feedback that TCs obtain towards their reflective writings and thoughts.

In CTE, TCs utilize certain tools to make their individual reflections and develop clinical reasoning skills. Not exclusive to the fourth grade, observation notes, reflective diaries and writings about particular situations or problems are used in every

phase of CTE. Reflective writings may be about scientific texts TCs have read, teaching applications practiced, scientific research or observations conducted. Along with TCs' learning in a learning community and having necessary qualities regarding socialization, the "subjectification" dimension of the teaching profession should not be neglected (Biesta, 2012). It is a valuable tool for teachers and TCs to critically express any decisions they make, factors influencing these decisions and what they feel in these processes in written or oral ways. The most effective and systematic way to do this is through reflective practices (Biesta, 2012). The subjectification of TE is also aligned with Korthagen's CR model because a genuine reflection requires an in-depth reflection entailing the identity and mission phases, as emphasized earlier.

Based on competency and reflection in CTE, TCs keep reflective diaries starting from the first grade. A reflection application similar to the one conducted at Regina University in Canada is conducted in this model, too (Lang & Evans, 2006). TCs reflect on their individual experiences in these diaries as a constructive tool. They keep their diaries under certain headings; university course experiences, micro-teaching experiences, classroom experiences, school observations, skill inventory and career choices.

University Course Experiences. TCs reflect on the competency field targeted or subjects studied at university courses. The questions to be answered under this heading are as follows:

- Expression: What was the subject explained, discussed and exemplified in the lesson? What were the activities conducted?
- Effect: How influential were the subjects studied in the lesson on your professional development? What did you learn? How did you feel?
- Purpose: Regarding the target competency explained and exemplified in the lesson, what do you want to do in micro-teaching? How? / When?

Micro-teaching Experiences. Under this heading, TCs reflect on the lessons they have taught. They answer these questions:

- Expression: Explain your micro-teaching experiences briefly.
- Effect: Regarding the target competency, what did you learn from the lesson you taught and from your friends' lessons as well? How do you feel now?
- Purpose: How will you apply what you learned from micro-teaching in the classroom related to the target competency? Add your lesson plans and the feedback you get into your reflections.

Classroom experiences. With regard to classroom experiences, TCs answer these questions:

- Expression: How did you, your colleagues and mentor teacher apply the target competency? Explain.
- Effect: Regarding the target competency, what did you learn from the lesson you taught and from your friends' lessons as well? How do you feel now?
- Purpose: How do you plan to apply the same target competency in your next lesson? Add your lesson plans and the feedback you get into your reflections.

School Observations. For school observations, TCs write about the topics that arouse their interest at school, classroom, and during micro-teaching and answer these questions: Did you interview your advisor, mentor teacher, or school principal about this topic? Did you do any research?

Skill Inventory. TCs prepare a skill inventory showing their professional development. In the inventory, they explain what they knew and could do at the beginning of the semester and what they know and can do now. They repeat the same process at the middle and end of the semester.

Career Choice. TCs write their thoughts about the teaching profession at the end of the semester and answer these questions: Are you pleased with your choice? What are your plans? What are the factors influencing your choice and decisions?

TCs conduct their own self-evaluations through this reflection application. In this way, they can realize how much they have proceeded in the teaching profession, how much they have developed and where they should reach.

Another component of reflection-based TE is teacher portfolios. The use of portfolios in TE has become widespread, especially as a result of performance-based evaluation approach. Portfolios are alternative assessment tools to determine what and how much TCs have learned by showing evidence and to what extent they are ready for the profession (Stolle et al., 2005). However, portfolios are not only assessment tools but are also a development tool in which TCs reflect on their self-evaluation, and they are even used for accreditation processes of TE programs (Ntuli et al., 2009).

There are usually two types of portfolios in TE. The first is called "learning portfolios" (Strudler & Wetzel, 2011). Learning portfolios, as a result of the constructive approach, are unstructured portfolios in which TCs choose and evaluate the components to be included. In these portfolios, TCs are able to showcase their individual education philosophy, lessons they have prepared, materials they have designed, examinations they have developed, and their applications towards students with special education needs or student products, and they reflect on these. The purpose of this application is to make the invisible visible for TCs (Strudler & Wetzel, 2011) and it is one of the key principles of both CTE and CR. The second type of portfolio are "assessment portfolio." These portfolios are used to assess the extent of certain competencies and qualities that TCs have gained within the framework of the criteria specified by the TE program. For instance, in Chile, portfolios are the primary tools used in the assessment of beginning competencies of teachers (Santiago & Benavides, 2009). In CTE, both performance and assessment portfolios are utilized. This is the requirement of clinical education to use formative assessment in every part of the program.

Seminar Courses

The reflection meetings of practice university teachers (advisors) and TCs are conducted at seminar courses at the university. In the seminar courses conducted after the practice week, TCs reflect on their previous applications, discuss the competency field they will target and the lesson plans they will apply next week, and take feedback. At times, the mentor teachers participate in seminar courses, which helps build a stronger school-university partnership; hence, mentor teachers feel a sense of ownership

of the program and establish more effective communication with TCs. Mentor teachers also have a word in the evaluation processes of TCs. In addition, seminar courses are conducted at practice schools at certain weeks to show that they are an integral part of the program. This kind of school-university partnership and mentor teachers' active role in the process has long been used in the USA and proved successful (Darling-Hammond, 2006).

In the practice-reflection cycle, TCs examine the generic competencies determined for a whole semester through seminar courses, and they are able to identify the extent of the competencies they are expected to have before the last semester in the final year of their four-year-education. Seminar courses create an appropriate environment and opportunity for TCs to gain clinical reasoning skills.

As a result of the applications explained above, before the final practicum in the last semester, TCs draw their own road maps with the guidance of their practice university teachers and become aware of the fields they need to develop themselves. This process also provides a data set for practice university teachers regarding the competencies of TCs. In short, before the final practicum, TCs are able to realize their strengths, weaknesses, and study accordingly within CTE based on reflection and evidence, and mentor teachers guide TCs in this process. The cycle in the first semester of the fourth year continues in the second semester and TCs enhance their professional development by experiencing teacher competencies. The final practicum applications become influential in determining the competencies of TCs.

Conclusion and Suggestions

Attempts to increase the quality of TE continue in Turkey as it does across the world. Since the republic period, different TE schools and various models have been implemented. During the period between the establishment of the republic and 1982, MoNE was responsible for TE. Under law no:2547 in 1981, the responsibility of TE was given to education faculties that were commissioned within universities, and since then, education faculties have been the only institution, training teachers. After the 1989-1990 education year, the duration of TE was raised to four years at all levels. In 1992-1993, with the establishment of the department of primary education at education faculties, the education of primary and secondary school teachers was gathered under a single roof.

The education faculties were restructured by Basic Education Support Project in 1997-1998. With the new regulation, the primary education departments of education faculties consisted of programs in primary school education, pre-school education, primary school mathematics and science teaching, and social studies education. After 2006-2007, the study periods of all departments, required and elective courses and their names were reorganized. In the course of the time, a variety of TE models have been implemented and these are; making minor application for primary schools teachers, increasing the study periods of branch teachers to 5-5.5 years at graduate degree and decreasing to four years again after 2014-2015, concurrent model (TCs take their general knowledge, subject-matter and professional teaching knowledge courses from the faculties they are enrolled in) and consecutive model (TCs complete their subject-matter knowledge at the faculties they are enrolled in and then they take professional teaching knowledge courses at education faculties).

When the abovementioned regulations are analyzed, it can be seen that they brought about only structural changes; therefore, most have been either given up or previous implementations were put into practice again. In fact, the radical changes to be implemented in TE cannot be actualized solely by structural regulations such as reorganizing the study periods and names of the courses. The current programs and courses at education faculties are not so different from TE programs abroad. For this reason, what needs to be done is a change of mentality and philosophy. This can be realized through a meta-philosophical approach and a unique system appropriate to the conditions of Turkey rather than shaping programs according to the doctrines of a particular teaching philosophy.

Research shows that TE in Turkey is theoretical even though the practicum periods were increased (Alan, 2019). In addition, increasing practicum periods will not be sufficient alone. This refers to *teacher education 2.0* which is explained in the first part, and it is not enough to bridge the gap between theory and practice. What matters for TCs is engaging with meaningful activities, establishing constructive and effective communication with mentor teachers and colleagues, and being equipped with necessary competencies by determining the strengths and weaknesses before graduation. Besides, all field studies should be associated with the courses given at education faculties. TCs should internalize all faculty courses at application, develop their own theory and subjectify the instruction based on core and generic competencies. One optimal way to actualize this aim is the "realistic approach." TCs should be able to explore the knowledge of "how" with "what" deriving from their individual experiences in authentic environments.

For this reason, TCs need a TE approach in which they are able to reflect on their university education and in-depth field studies starting from the first year to realize which decisions are taken under which circumstances and which visible-invisible factors are influential on these decisions to continue their professional development according to this mentality. When the literature is analyzed, it is seen that the TE model conducting this kind of approach in the most effective way is CTE. Implementing a TE model in which theory and practice are taught concurrently, similar to the medical education that is based on reflection and evidence, will enhance the quality of TE in Turkey. In the CTE model based on competency and reflection depending on an evidence-based approach, more qualified and experienced teachers will be trained. CTE and CR aiming at developing clinical reasoning skills and practical wisdom of TCs facilitate to gain the necessary teaching knowledge, skills, values and attitudes at the earliest and most effective way. At the same time, this model guarantees students' quality education rights.

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Statement of Responsibility

The authors made equal contribution to this study. Therefore, each author is equally responsible.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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Organizational Gossip and Teachers: Threat or Opportunity?

Örgütsel Dedikodu ve Öğretmenler: Tehdit mi Fırsat mı?

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ABSTRACT: This research examines teachers' perceptions of gossip in schools. The research employed an explanatory approach of mixed methods. Quantitative data were obtained through the "Organizational Gossip Scale" and qualitative data were obtained through the semi-structured interview form. Quantitative data were collected from 302 teachers selected by simple random sampling method in secondary schools in Turkey. Qualitative data were collected from ten teachers chosen by the maximum variation sampling method. The research first revealed that gossip is a frequently used communication mechanism in schools, although participants have different perceptions of gossip. In addition, the results showed that gossip might be seen as an opportunity in school, given its functions of having information and developing relations. However, in terms of harmful effects such as poor performance and burnout in the qualitative results, gossip will be a threat to the school's stakeholders. Still, it can also be a threat in terms of organizational harm. In conclusion, gossip's significance in informal processes in schools was emphasized. Implications were made to practitioners and researchers that the threat aspect could be turned into an opportunity.

Keywords: Organizational gossip, teacher, threat, opportunity.

ÖZ: Bu araştırma, öğretmenlerin okullardaki dedikoduya ilişkin algılarını incelemektedir. Araştırmada, karma yöntemin açıklayıcı deseni kullanılmıştır. Nicel veriler "Örgütsel Dedikodu Ölçeği" ile toplanırken, nitel veriler ise yarı yapılandırılmış görüşme formu aracılığı ile toplanmıştır. Nicel veriler, Türkiye'deki ortaokullarda basit tesadüfi örnekleme yöntemiyle seçilen 302 öğretmenden elde edilmiştir. Nitel veriler ise, maksimum çeşitlilik örnekleme yöntemi ile seçilen on öğretmenden toplanmıştır. Araştırma bulguları ilk olarak, katılımcıların dedikoduya ilişkin farklı algıları olmasına rağmen, dedikodunun okullarda sıklıkla kullanılan bir iletişim mekanizması olduğunu ortaya çıkarmıştır. Bununla birlikte bulgular, haberdar olma ve ilişki geliştirme işlevleri göz önüne alındığında, dedikodunun okulda bir fırsat olarak görülebileceğini göstermiştir. Ancak nitel sonuçlarda, düşük performans ve tükenmişlik gibi zararlı etkiler açısından düşünüldüğünde, dedikodu okul paydaşları için bir tehdit oluşturacaktır. Diğer taraftan dedikodu, okullarda örgütsel zarar boyutu açısından da bir tehdit olabilir. Araştırma sonucunda, okullardaki informal süreçlerde dedikodunun önemi vurgulanmıştır. Dedikodunun tehdit boyutunun, okullarda bir fırsata dönüştürülebileceğine ilişkin uygulayıcılara ve araştırmacılara yönelik çıkarımlarda bulunulmuştur.

Anahtar kelimeler: Örgütsel dedikodu, öğretmen, tehdit, fırsat.

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Communication, one of the administrative processes, is a crucial component of the organizational structure. The quality of communication influences the quality of bilateral relations between people (Roberts, 1984). Since educational organizations are human-intensive, the school process occurs through person-to-person interaction (Sergiovanni & Starratt, 1988). For the school organization to function effectively, communication networks in schools with a complex structure must be understood (Campell et al., 1983) because well-functioning communication is considered a prerequisite for effective school cooperation processes (Schad, 2017). It is even suggested that educational relationships are communicative (Fritzell, 1996). Communication can take various forms in schools, such as organized meetings, informal conversations, bulletin boards, notes, and handbooks (Eden, 2001). Communication in organizations occurs not only through official communication channels such as official meetings and procedures but also through informal channels such as gossip (Rauschenberg, 1988).

Many researchers have called gossip a ubiquitous phenomenon in the workplace and an inevitable part of organizational behavior (Grosser et al., 2010; Wert & Salovey, 2004). According to research conducted by Grosser et al. (2010), it was concluded that more than 90% of employees participated in gossip activities in an organizational environment. On the other hand, De Mare's (1989) research showed that 70% of all organizational communication occurs at the informal level. It is clear that gossip is widespread and influential as informal communication. However, due to a limited number of studies, understanding its nature in organizations is still very uncertain.

Researchers note that gossip can serve either a positive or a negative function (Foster, 2004; Wert & Salovey, 2004). When the first studies on gossip in organizations are examined, it is seen that they mainly focus on recommending strategies to discipline the workforce and manage and eliminate gossip in the workplace (Mishra, 1990). However, it has recently been accepted that gossip has positives (Michelson & Mouly, 2004). In general, it is stated that organizational gossip has positive aspects such as information, social bonding, entertainment, and influencing others (Stirling, 1956). Although the researchers have shown that gossip has its positives, it is seen that talking about people who are not in the environment will continue to be a social problem (Litman et al., 2009), especially when it crosses ethical and legal lines. Although researchers were encouraged to do more research on the benefits of gossip (Noon & Delbridge, 1993), studies have been limited to gossip in an organizational environment.

Studies in schools dominated by informal structure (Hoy & Miskel, 2010) were also limited. These studies are related to the results of the gossip (Himmetoğlu et al., 2020), management of gossip in schools (Levent & Türkmenoğlu, 2019), how and why gossip was made (Algharabali et al., 2014), reactions to the gossip (Arabacı et al., 2012), where gossip appeared (Hallett et al., 2009), and how gossip spread among students in American schools (Lind et al., 2007). It has been observed that teachers are the focus of the studies on the gossip mechanism in schools. On the other hand, the studies were carried out mainly by qualitative method, and the improved scales related to organizational gossip (Han & Dağlı, 2018; Lee et al., 2016; Wu et al., 2018) can be explained by its small number. Furthermore, research on gossip in schools has shown that gossip does not focus on the causes of results based on different personal variables.

Studies on gossip in schools show that gossip has both positive and negative functions, as indicated above. However, there is no clear understanding of why teachers gossip. In addition, it was considered an essential element that the studies did not have precise results on the conditions under which gossip appeared and when it was beneficial for teachers. The current situation shows the difficulty of understanding the reflections of gossip in schools, which has a complex structure in its perception and effects. In particular, this research reinforces the importance of research that gossip can be seen as a threat or an opportunity for educational organizations. This research aims to establish whether gossip can be considered a threat or an opportunity in schools based on teachers' perceptions of the gossip mechanism in schools and whether these perceptions differ according to various variables. Since the research was done by mixed methods, the first and third research questions were created as positivist, and the second and fourth questions were created below with the constructivist paradigm:

1. What is the level of perception of teachers regarding organizational gossip?
2. What are the reasons for the results of teachers' perception levels regarding organizational gossip?
3. Is there a significant difference in gender, marital status, professional seniority, and school size among the teachers' perceptions of organizational gossip?
4. What are the reasons for significant differences in gender, marital status, professional seniority, and school size variables among the teachers' perceptions of organizational gossip?

Organizational Gossip

We defined gossip in this study as "the process of informally communicating value-laden information about members of a social setting" (Noon & Delbridge, 1993, p. 25). The concept of gossip, which is explored in different fields such as anthropology (Dunbar, 2004), psychology (Rosnow, 1977), sociology (Bergmann, 1993), and organizational communication (Mills, 2010), has recently been examined in the field of organizational behavior under the name of gossip or organizational gossip in the workplace. The fact that it was the subject of research in different areas was seen as an indication of the importance given to gossip (Kurland & Pelled, 2000).

Gossip has positive and negative functions in the organizational environment. In the information exchange process (Foster, 2004), individuals in the organization can often learn information about individuals through gossip without meeting other individuals. Through gossip, information can be transmitted more quickly to those in the organization (Ribeiro & Blakeley, 1995). In addition, it is possible to learn information that is difficult to understand within the scope of official procedures through gossip. Organization managers can use the information exchange function of gossip to get employees' reactions related to new policies and exchange processes (Michelson & Mouly, 2004). Most of the time, managers can go out of their way to pass on official information primarily to those in the organization through gossip. Thus, the coordinated progress of official processes can be achieved (Noon & Delbridge, 1993). Because in this way, employees will have the opportunity to convey their opinions to their managers through gossip, preventing disruptions in official processes.

Another function of gossip is considered social attachment (DiFonzo & Bordia, 2007), which involves establishing and maintaining social relationships. Gossip connects the members of the organization and creates social networks between them. Knowing what behaviors are required to maintain group membership contributes to group compatibility, strengthening group identity (Ribeiro & Blakeley, 1995). Moreover, it is suggested that gossip is an "informative and rich tool" to learn the secret social norms of the organization (Gabriels & Backer, 2016, p. 684). It can be said that the group members are informed about what they can do or what they should stay away from, thanks to gossip. For group members who act outside the group's norms, it is also suggested that gossip has an exclusionary function. In other words, it will be inevitable that the members of the group, who are in a position that does not concur with the norms of the group, will be pushed out of the group by being subjected to the gossip (Noon & Delbridge, 1993). Research by Vaidyanathan et al. (2016) found that academics use gossip to warn colleagues who violate norms and believe that gossip can be used as an audit tool in organizations.

Gossip also has a function of fun (Ribeiro & Blakeley, 1995). Gossip can be a way for employees to get rid of the routine at work (Noon & Delbridge, 1993). Crampton et al. (1998) found that employees resort to gossip when they feel threatened and stressed. It is thought that employees can resort to recreational gossip to reduce the pressure on them, especially during breaks or while waiting for the end of the working hours. Gossip also influences social status (Hom & Haidt, 2001). Spreading gossip can elevate a person's social group because it can be said that the people who spread the gossip have special knowledge or understanding (Baumeister et al., 2004), thus increasing their power within the organization (DiFonzo & Bordia, 2007). Kurland and Pelled (2000) suggested that gossip may do with power typology. Thus, individuals can use gossip to compete with the power derived from gossip and improve performance. However, obtaining the potential ability may negatively motivate some individuals to use gossip (Foster, 2004). It can also be said that the positive dissemination of information will positively affect the organization (Watson, 2011). With the power to obtain from gossip, gossip can become more competitive in the organization, and their performance can increase (Grosser et al., 2010). Besides its positive functions, gossip discredits and damages people and organizations (Van Iterson & Clegg, 2008), wasting time, low productivity, lowering team member morale, and creating a climate of insecurity (Michelson & Mouly, 2004).

The current study focuses on the positive and negative functions such as having information, developing relations, and organizational harm (Han & Dağlı, 2018). "Having information" means to be informed about what is going on in the organization through gossip. "Developing relations" is one of the positive functions of gossip, like "having information" and helps those in the organization improve their social relations. Unlike the first two dimensions, "organizational harm" refers to the negative functions of gossip. Among the negative functions that come to the forefront, especially due to destructive gossip that does not reflect the truth, are the demoralization of those in the organization and the decrease in their motivation.

Method

Model

In the study, the explanatory approach of mixed methods was employed. The quantitatively weighted research in this model is supported by qualitative data (Creswell et al., 2003). The use of mixed methods is that quantitative data related to gossip, which has a complex structure, explains the general picture of the problem. In contrast, qualitative data provides a deeper understanding of the causes of quantitative data. In this context, the scale was applied to the research sample, and semi-structured in-depth interviews were conducted with the working group of qualitative research as a result of the results obtained. While the descriptive survey design was employed in the quantitative section of the research, the phenomenology design was used in the qualitative section.

Participants

The study sample consisted of 302 teachers selected by simple random sampling method at 28 public secondary schools in a southeast province of Turkey. We reached the names of all teachers and randomly selected those who would participate in the research from the list. 88.1% of the teachers who participated in the study were undergraduates, and 11.9% were graduates. 22.5% of the participants have seniority of 1-5 years, 26.5% 6-10 years, 26.2% 11-15 years, 15.6% 16-20 years, and 9.3% 21 years or more. 58.3% of the participants were female, and 41.7% were male. 77.5% of teachers are married, and 22.5% are single. 48.3% of the participants work in small school (SS), 10.6% in medium-sized schools (MSS), and 41.1% in large schools (LS). When determining the school size, the classification made by Jones (1997) was based. Schools with 1-28 teachers are small, 29-39 are medium-sized, and schools with 40 or more teachers are large. The working group in the qualitative part of the study consisted of ten teachers who represented different features with the maximum variation sampling method. The nicknames and demographics of those in the study group are given in Table 1. School names were not given to prevent revealing teachers' identities.

Table 1

Demographic Characteristics of the Study Group

Teacher Code	Seniority	Gender	Marital Status	Age	Educational Level
T1	10	Male	Single	38	Undergraduate
T2	5	Female	Single	26	Graduate
T3	8	Male	Married	29	Graduate
T4	11	Female	Single	29	Undergraduate
T5	12	Female	Married	35	Undergraduate
T6	7	Female	Single	26	Undergraduate
T7	9	Male	Married	30	Undergraduate

T8	4	Female	Single	26	Undergraduate
T9	15	Male	Single	30	Undergraduate
T10	17	Male	Married	40	Undergraduate

Data Collection Tools

In the research, "Organizational Gossip Scale (OGS)" developed by Han and Dağlı (2018) was employed. The scale consisted of 3 factors (having information, developing relations, organizational harm) and 24 items. Sample items from the scale include that "I learn many things about my colleagues at my school through gossips" for the having information dimension; "I try to relax by gossiping with my colleagues at my school" for the developing relations dimension; and "The gossips in my school cause disagreements among us" for the organizational harm dimension. The scale is rated as a 5-way Likert as "1: Totally Disagree "-"5: Totally Agree". We used the formula (5-1)/5 in the interpretation of the scale items; the mean values are in the range of 1.00-1.79 "Totally Disagree", 1.80-2.59 "Disagree", 2.60-3.39 "Partly Agree", 3.40-4.19 "Agree" and 4.20-5.00 "Totally Agree. "In the quantitative part of the study, the fit indices obtained in confirmatory factor analysis (CFA) for the validity of the data ($\chi 2/df$=4.84, GFI=.89, CFI=.91, RMSEA=.08) were acceptable (Schermelleh-Engel et al., 2003). Cronbach's alpha coefficients calculated for reliability (ranged .81-.95) are sufficient (George & Mallery, 2003).

A semi-structured interview form was used as a qualitative data collection tool. In the process of developing the form, first of all, a comprehensive literature review was made, and the framework was determined. The interview form was created based on the experiences of the participants and quantitative findings. A draft interview form was prepared, and the draft form was finalized after receiving peer debriefing (Creswell, 2013). In the interviews, we asked the teachers thirteen open-ended questions. We asked additional questions when there were unclear questions or for teachers to elaborate on their views. After analyzing the data obtained to ensure internal validity in the qualitative part of the research, the teachers' opinions were presented, and member checking was provided. The research process and what is done in this process are explained in detail to increase external validity. In order to improve reliability, all of the qualitative results were given directly without comment; researchers examined each form during the editing phase of the data, compared and in case of difference, the data collection tool was reviewed and revised, and resolved together (Patton, 2005).

Procedure and Data Analysis

The data were collected in the 2020-2021 academic year. Participation was based on voluntary. Teachers have been informed about protecting their identities and how they can be withdrawn without prejudice to ensure anonymity and confidentiality. The interviews were videotaped with Zoom software and lasted between 32-50 minutes. The video was recorded with the participants' permission, and the data were converted into writing.

Quantitative data of the study were analyzed using SPSS software. The data is primarily interpreted by descriptive statistics. The skewness coefficients of the OGS range from -1.80-1.24 and the kurtosis coefficients to -.47-1.72. T-test and ANOVA

were used from parametric tests to test the difference between group means because the data were distributed close to normal (Kline, 2011). LSD was applied to determine the source of the difference in ANOVA. The effect size (Green & Salkind, 2005) was also examined. CFA was made using AMOS software for the construct validity of the OGS. Qualitative data were analyzed by descriptive analysis method. We performed the descriptive analysis in four stages (Yıldırım & Şimşek, 2013). First, we created a framework for descriptive analysis. Next, we processed the data according to the thematic framework. After describing the findings, we finally interpreted the findings. Direct citations were used to add a remarkable feature to the participant's opinions. The data collected by video recordings have been written and edited. Qualitative results supported by direct quotations. When quoting directly, the teachers in the working group were encoded and given their opinions. Coding was carried out as T1-T10 (see Table 1).

Ethical Procedures

Ethics Committee of Mardin Artuklu University has granted ethical approval for this study with the number 2021/2-2.

Results

In this section, quantitative results are presented in tables, and qualitative results are included immediately after the quantitative results.

Results regarding the First Two Research Questions

Quantitative results regarding the dimension of having information are presented in Table 2.

Table 2

Results regarding the Dimension of Having Information

Dim.	Items	Mean	*SD*	Level
Having Information	1. "I learn many things about my colleagues at my school through gossips."	3.79	1.03	Agree
	2. "I learn some colleagues' thoughts in my school in gossip environments."	3.70	.98	Agree
	3. "Through gossips, I learn a lot of information about newcomer colleagues at my school."	3.62	1.03	Agree
	4. "I learn about the experiences of my colleagues in gossip environments at my school."	3.76	.99	Agree
	5. "I hear the information about my colleagues at my school through gossips before formal communication channels."	3.61	1.10	Agree
	6. "I learn many things about my colleagues through gossip, which I cannot learn from their own."	3.66	1.01	Agree
	7. "I hear gossips about some incidents that are tried to be covered up in my school."	3.85	.93	Agree
	Dimension	3.71	.90	Agree

In Table 2, it was observed that all item means were at the level of "agree". Considering the results, teachers were asked, "What kind of information is learned through gossip?" We understand from this teacher's opinion that teachers learn all kinds of information through gossip, and the subject of the information may differ from school to school.

> "In general, information about the courses, profiles of students, the working environment at the school, etc., may even have a scientific side. In addition to this information, information about the characters of the individuals, about the administration, about the parents can be obtained." (T1)

Quantitative results regarding the dimension of developing relations are presented in Table 3.

Table 3

Results regarding the Dimension of Developing Relations

Dim.	Items	Mean	*SD*	Level
Developing Relations	8. "Gossiping with my colleagues at my school increases our sincerity."	3.80	.96	Agree
	9. "I share my opinions freely in gossip environments in my school."	3.81	.97	Agree
	10. "I try to relax by gossiping with my colleagues at my school."	3.73	.98	Agree
	11. "I express my thoughts comfortably in the gossip environments of my school."	3.80	.94	Agree
	12. "I make new friends in gossip environments in my school."	3.57	1.02	Agree
	13. "Gossip environments in my school strengthen my friendship."	2.02	1.03	Disagree
	14. "I am having fun by gossiping with my colleagues at my school."	1.90	.97	Disagree
	Dimension	3.23	.67	Agree

In Table 3, it was observed that the means of items related to strengthening friendship ties and having fun were at the level of "agree". Accordingly, teachers were asked, "What are the reasons for gossip?" It is understood from the following teacher's opinions that the reasons were inability to attract, unfair practices, not to offend the other, to relieve stress, to have fun and jealousy.

> "I know people who do not enjoy life when they don't gossip. They are having fun in the process. It wouldn't be so common if it weren't for a type of entertainment." (T1)

> "There can be many reasons for gossip. Sometimes it can lead to inability to suffer, and sometimes it can lead to gossip, such as the desire to share your admiration or just want to get rid of loneliness and strengthen social relations by sharing information." (T2)

> "Teachers' gossip about governance is famous. If the school board is not transparent enough and does not consider the teachers' opinions, this will be revealed in a gossip environment. The attitudes of the school administration towards teachers are among the reasons why teachers feel they love them or do not consult teachers' opinions or apply what they know." (T3)

> "He may be afraid of breaking, he may be afraid of management, he may not like the other people. Therefore, he considers it more appropriate to speak behind his back." (T5)
>
> "It could be jealousy. Not feeling completely alone, looking for followers, results in people who share the same thoughts or identify negative thoughts…" (T7)

The second question posed to teachers in the dimension of "developing relations" is the question "Does gossip increase intimacy?" It is understood from the following teacher opinions that teachers can develop intimacy through gossip, but not much should be expected from the intimacy that develops through gossip.

> "It has to have an impact on friendship relationships. You only gossip when you are sincere, which increases your intimacy with your friends." (T5)
>
> "It would be wrong to expect positive things from something that develops through gossip. If intimacy is based on gossip, nothing is expected." (T6)

Another question posed to teachers in the dimension of "developing relations" is "To what extent do you trust gossip environments?" They stated that they do not have general confidence in gossip environments and that the most important factor in trusting is the credibility of the person being gossiped about.

> "I don't trust these environments because there's a thought that there's going to be a job behind the back of what's going on." (T4)
>
> "I don't trust you, to be honest... In general, we see each other in a school setting, or you can gossip with people with whom you are intimate. Something happens and you lose that intimacy. If it's someone we've shared a lot with, I can't afford it." (T6)
>
> "The place of the resource in me is an important issue... I'll see if the source is independent or not. For example, if he is involved in something related to governance, your perspective will be a little different." (T7)

The last question posed to teachers in the dimension of "developing relations" is the question "Are there any positive aspects of gossip personally?" Teachers stated that they could socialize by gossiping, relaxing in situations of anger, stressing out, and having fun in gossip aimed at ridicule.

> "Gossip can be useful in environments where there are small groups. In terms of getting used to the newly entered environment, it can positively affect socializing the person and strengthening relationships. At the same time, acquiring information about the environment makes it easier to get to know and familiar with the environment and people in this way, speeding up this process. Contributes to the development of intimacy." (T2)
>
> "Scientifically, it has been proven to relieve stress, and I know it causes relief. For example, an angry person can go to a friend he is intimate with and count on the person he's mad at. People have fun doing it; of course, you will see more people gossiping about it to make fun of it." (T5)

Quantitative results regarding the dimension of organizational harm are presented in Table 4.

Table 4

Results regarding the Dimension of Organizational Harm

Dim.	Items	Mean	*SD*	Level
Organizational Harm	15. "The gossips among my colleagues at my school demoralize me."	1.96	.96	Disagree
	16. "The gossips in my school cause disagreements among us."	1.89	.93	Disagree
	17. "I see it as a waste of time to be in the gossip environments at my school."	1.75	.83	Totally Disagree
	18. "The gossips at my school cause groupings among my colleagues."	2.42	1.03	Disagree
	19. "I lose my confidence in my colleagues who gossips at my school."	2.48	1.00	Disagree
	20. "The gossips among my colleagues at my school reduce my motivation."	2.23	.88	Disagree
	21. "I am reluctant to go to school at times when gossips are common in my school. "	2.27	.86	Disagree
	22. "The gossips about my colleagues in my school cause me to misunderstand them."	2.25	.91	Disagree
	23. "The gossips about my colleagues at my school create prejudice against them."	2.17	.91	Disagree
	24. "I keep distance with my colleagues who gossip about me in my school."	2.24	.97	Disagree
	Dimension	2.17	.70	Disagree

In Table 4, it was observed that teachers' perceptions of organizational harm were very low. Accordingly, teachers were asked, "Are there any personal negative aspects to gossip?" Teachers have expressed that they are very negatively affected by the gossip. Just as teachers questioned the accuracy of the gossip about themselves by making a "self-criticism", it was emphasized that it was also important who made the gossip. Teacher opinions on the results are as follows.

> "Yes, there is. It can cause prejudices, exclusion, and anger if it reaches advanced dimensions. In many ways, I was negatively affected by slander-sized gossip, false rhetoric, or sharing information I did not want. My trust in my colleagues would be undermined, I would become increasingly isolated, and after a while, working in such an insecure, insincere, empathetic environment would probably turn into torture." (T2)

> "At the point of gossip about me, I look at myself first. If I am short on teaching, I'll try to fix it. If the administration is not happy with my work, I can speak out and wait for the administration to come and warn me. But I think it is just jealousy for my friend to gossip that I have the same status." (T6)

In the dimension of "organizational harm" teachers were asked, "Is there a positive aspect of gossip in school?" It has been demonstrated that gossip has positive effects on the subjects that are tried to develop within the school culture. In addition, it has been emphasized that the positive contributions of teachers can be appreciated and make positive contributions to the school culture both in honoring the teacher and creating role models. Teacher opinions on these results are as follows.

> "From the students' point of view, it is possible to learn information about some students that we would not normally have through gossip." (T2)
>
> "It has a positive effect. When it is a positive topic, for example, if a guidance counselor goes to class and teaches and is talked about by this administration, the gossip of it is comforting, people are not robots, people are emotional beings." (T7).
>
> "If the principal and the assistant principal speak among themselves without having the teachers present, and they make the issues that they think will benefit the school transparent and pass them on to the teachers, it can help. Teachers can also be equally useful if they gossip among themselves and then pass it on to the administration." (T8)
>
> "There are usually groupings in our school... Teachers who enter the teachers' room in the morning and do not say good morning can immediately join the gossip environment and get in touch. In this respect, teachers can contribute positively to communication." (T10)

Another question posed to teachers in the dimension of "organizational harm" is, "Are there negative aspects of gossip in school?" It is understood that gossip has many adverse effects on school culture, from the following teacher opinions.

> "It can cause feelings of jealousy among teachers. This kind of gossip and unsafe environment that is swirling around the school can also be heard by the environment and negatively affect the school profile." (T2)
>
> "There are too many of the negatives to counting. It's not something we approve of; I try not to. It may have a unifying feature among teachers and a parsing feature." (T10)
>
> "Groupings between teachers, negative events among those who work for no reason, disrupting the work to be done together, creating a psychologically unsettling working environment." (T9)

The last question posed to teachers in the dimension of "organizational harm" is the question "In what periods is the most intense gossip in the school environment?" The teachers' opinions are as follows.

> "I rarely see gossip in my school. And that is because I think the conditions don't happen very often. Since the number of teachers is quite small, groupings do not occur much, and gossip is rarely done outside certain periods. The periods I mentioned are usually when education starts and ends, i.e., seminar periods, when curriculums are prepared, and various meetings are held." (T2)
>
> "For example, when there will be a workload, when the job distribution will be made, when the distribution is unfair." (T6)

Results regarding the Third and Fourth Research Questions

T-test results regarding the gender are presented in Table 5.

Table 5

Results regarding the Gender

Dimension	Gender	*N*	Mean	*SD*	*df*	*t*	*p*
Having Information	1. Female	176	3.59	.98	300	-2.86	.00*
	2. Male	126	3.88	.74			
Developing Relations	1. Female	176	3.25	.76	300	.39	.69
	2. Male	126	3.22	.54			
Organizational Harm	1. Female	176	2.24	.66	300	2.22	.02*
	2. Male	126	2.06	.74			

$*p < .05$

As seen in Table 5, there was a significant difference in the sub-dimensions of "having information" and "organizational harm" (t(having information) = 2.86, t(organizational harm) = 2.22, $p < .05$). Calculated effect sizes ($d_{\text{having information}} = -.33$, $d_{\text{organizational harm}} = .25$) indicate that the differences are moderate. Accordingly, it can be said that male teachers in the sub-dimension of "having information" have a higher perception than female teachers, and female teachers in the lower dimension of "organizational harm" have a higher perception than male teachers. In this context, the question posed to teachers is, "do female teachers gossip more in school or male teachers?" It has been emphasized that this is not a gender-related issue but that both sides can gossip. Teacher opinions on these results are as follows.

> "Contrary to popular belief, I don't see any gender difference. The difference is only felt in the subjects spoken." (T2)
>
> "I think it is in women's personalities. Men usually gossip about work, but women have a wider range... For example, clothing comes into play, and love comes in, hair, makeup..." (T1)
>
> "I am against gender. My old school was a school of 60 or 70 people, and you cannot imagine the extent of the gossip there, and it was the married male teachers who did it. Women can do that a lot; men can do that. At my old school, boys were doing more; it is wrong to tie it to a gender..." (T4)
>
> "Women do it a little more. Because they think more thoroughly and differently, for example, the female teacher, the principal didn't say hello in the morning; it can happen." (T5)
>
> "Contrary to popular belief, I think men gossip more. It is known that gossip that can be considered degrading based on making opinions about people's private lives revolve among men. Women's gossip is a little more innocent than what men do. I think that men's interests are sexuality and women are usually physical appearances or emotional situations." (T9)

T-test results regarding the marital status are presented in Table 6.

Table 6

Results regarding the Marital Status

Dimension	Marital Status	*N*	Mean	*SD*	*df*	*t*	*p*
Having Information	1. Married	234	3.76	.78	300	1.39	.16
	2. Single	68	3.55	1.21			
Developing Relations	1. Married	234	3.29	.57	300	2.16	.03*
	2. Single	68	3.03	.93			
Organizational Harm	1. Married	234	2.16	.68	300	-.39	.71
	2. Single	68	2.20	.78			

$*p < .05$

Given in Table 6, a significant difference was observed in the sub-dimension of "developing relations" (t = 2.16, $p < .05$). The calculated effect size (d = .29) indicates moderate difference. It can be said that the perceptions of married teachers are higher than that of single teachers. Regarding the "marital status" variable, teachers were asked, "Does the marital status affect gossip? Why?" His marital status can lead to groupings at the point of gossip, but this does not happen in small schools. It has been emphasized that single teachers have a lot of free time due to not having as much

responsibility as married teachers, leading to more gossip. It has been stated that married teachers can gossip more due to years of experience. Another result of the research is that single teachers develop more intimate relationships with the convenience of being single, and these relationships can be turned into gossip material. Teacher opinions on these results are as follows.

> "Singles gossip more. Married people are a little more orderly, busy with the troubles of their own home... A little more emotional relationships are at the forefront of singles... Single teachers are a little younger and do not know the school culture, so there's a little more gossip to learn, and as you experience it, it disappears." (T1)
>
> "Perhaps the effect of marital status on friendship relationships may be in the direction of grouping. However, this does not happen much in small-population schools. Married people can group and gossip in terms of the similarity of their subjects, leading to them getting close to those people. But I think it's personal, too. I have observed that some people can strike that balance. Some have the same sincerity as their married friends and single friends and share similar posts." (T2)
>
> "Married people gossip more. Single people dress like teachers because they are new to the profession; they want me to be stylish, to raise good students. Middle-aged married teachers have seen things, teachers who have seen things, their jaws open more, do not gossip more, they steal everything drier." (T5)
>
> "Single teachers can find more time. It can be more intimate among themselves, leading to more gossip." (T6)

ANOVA results regarding the professional seniority are presented in Table 7.

Table 7

Results regarding the Professional Seniority

Dim.	*	*N*	Mean	*SD*	Homogeneity		Source of Variance	Sum of Squares	*df*	Mean Square	*F*	*p***	Dif.
					Levene	*p*							
Having Information	1	68	3.60	.97			Between G.	16.81	4	4.20			
	2	80	3.41	1.06			Within G.	227.93	297	.76			2-3
	3	79	3.81	.71	5.11	.10	Total	244.75	301		5.47	.00	2-4
	4	47	4.02	.56									2-5
	5	28	4.07	.87									
Developing Relations	1	68	3.07	.80			Between G.	6.36	4	1.59			1-3
	2	80	3.11	.84			Within G.	132.48	297	.44			1-4
	3	79	3.34	.45	7.22	.20	Total	138.84	301		3.56	.00	1-5
	4	47	3.40	.41									2-3
	5	28	3.42	.56									2-4
													2-5
Organizational Harm	1	68	2.10	.61			Between G.	.82	4	.20			
	2	80	2.16	.78			Within G.	149.86	297	.50			
	3	79	2.23	.60	3.09	.21	Total	150.69	301		.41	.80	-
	4	47	2.12	.72									
	5	28	2.23	.91									

*1:1-5 years, 2:6-10 years, 3:11-15 years, 4:16-20 years, 5:21 years and above

***p*<.05

Table 7 showed a significant difference in the sub-dimensions of "having information" and "developing relations" (p<.05). Calculated effect sizes ($\eta^2_{\text{having information}}$=.06, $\eta^2_{\text{developing relations}}$=.04) indicate that the differences are moderate. The difference occurs with 6-10 years, 11-15 years, 16-20 years, and 21 years and above in the dimension of "having information"; 1-5 years, 11-15 years, 16-20 years, 21 years and above in the dimension of "developing relations"; 6-10 years, 11-15 years, 16-20 years, 21 years and above in the dimension of "professional seniority". As professional seniority increases, it can be said that the perception of the dimensions of having information and developing relations increases. Accordingly, we asked the teachers, "Does professional seniority affect gossip? Why?" As teachers' seniority increases, their experience and experience increase, and therefore their tendency to gossip increases as follows.

> "Yes, it can be. Senior teachers can share and exchange ideas more comfortably due to their experience and self-confidence. Teachers who have just started work prefer to remain silent for at least a while due to some concerns and lack of experience. They take care to be cautious. The following factor is also effective; experienced teachers have more time to chat and exchange ideas than less experienced teachers in school because they are practical, planning for course processing, etc. Likewise, senior teachers communicating more and sharing information for reasons such as guiding younger friends may lead to an observation that they gossip more." (T2)

> "I certainly do. So after ten years, you start complaining about something. I know it from myself. At the first school, I started, I was just trying to do my job properly. There were teachers with a lot of seniorities; they were calling. I was sitting there listening. But now it's so different... After ten years, you cannot keep your mouth shut." (T5)

ANOVA results regarding the school size are presented in Table 8.

Table 8

Results regarding the School Size

Dim.	*	*N*	Mean	*SD*	Homogeneity		Source of Variance	Sum of Squares	*df*	Mean Square	*F*	*p***	Dif.
					Levene	*p*							
Having Information	1	146	3.91	.84	4.15	.16	Between G.	11.76	2	5.88	7.54	.00	1-2 1-3
	2	32	3.35	1.12			Within G.	232.98	299	.77			
	3	124	3.58	.85			Total	244.75	301				
Developing Relations	1	146	3.33	.65	2.75	.14	Between G.	4.65	2	2.32	5.18	.00	1-2 2-3
	2	32	2.92	.82			Within G.	134.19	299	.44			
	3	124	3.20	.64			Total	138.84	301				
Organizational Harm	1	146	2.07	.69	3.12	.15	Between G.	2.71	2	1.35	2.74	.06	-
	2	32	2.23	.83			Within G.	147.97	299	.49			
	3	124	2.26	.68			Total	150.69	301				

*1: Small school, 2: Medium-sized school, 3: Large school

**p < .05

When Table 8 was examined, there was a significant difference in the sub-dimensions of "having information" and "developing relations" ($p < .05$). Calculated effect sizes ($\eta^2_{\text{having information}} = .04$, $\eta^2_{\text{developing relations}} = .03$) indicate that the differences are moderate. The difference is with SS in the dimension of "having information"; MSS and LS; MSS in "developing relations"; it appears to originate between SS and LS groups. It is understood that the perception of gossip in SSs is higher. Accordingly, we asked the teachers, "Does the school's size affect gossip? Why?" It has been stated that school size is effective, different gossip groups are formed in large schools, and gossip is more about work intensity. It was emphasized that ideological ideas and trade unions were influential in forming these groups. Teacher opinions on these results are as follows.

> "Yes, there is. As the number of teachers increases, so do the groupings and, naturally, the diversity of subjects. There will also be more people and situations to talk about. At the same time, teachers are more likely to come together in crowded schools. This inevitably means more gossip." (T2)
>
> "Different groups are formed in large schools. Ideological thoughts are very effective in establishing these groups. More gossip is done with people with whom they agree. You gossip with people who think like you." (T1)
>
> "Diversity is increasing, of course... It creates groupings. Ideological thoughts and trade unions are also causing discrimination. In particular, the union is leading the way." (T5)
>
> "It is a little more about the environment... A little more private life is at the forefront of a small school. When the number of teachers increases, this evolves towards a little more work intensity." (T7)

Discussion

We examined teachers' perceptions of the gossip mechanism in schools, and we discussed the results within the scope of the relevant literature. The study found that the highest mean was in the dimension of "having information". The qualitative results of the study also support quantitative results, where teachers can access all kinds of information through gossip. In the research of Han (2019), it was observed that the size of "having information" was at the level of "disagree". In the study carried out by Himmetoğlu et al. (2020) for school administrators, it was determined that the information carried out by the gossip network in schools was mainly focused on the management of the school, other teachers, personal rights, students, and political issues. Some research results show that "having information" of gossip is low. In the research results of Arabacı et al. (2012), it was observed that nearly all of the teachers who participated in the study believed that gossip existed in educational organizations. This result reveals the existence of gossip in schools despite the presence of different perceptions and definitions of gossip.

The results of "developing relations" showed that gossip has positive consequences but does not strengthen or entertain friendship bonds. In the qualitative results of the study, the results that teachers can socialize by gossiping, relaxing in cases of anger, and relieving stress support quantitative results. However, contrary to quantitative results, it has been concluded that teachers are having fun in their mockery gossip. Guerin and Miyazaki (2006) showed that one of the important functions of gossip is to entertain the listener. Research by Brondino et al. (2017) found that women in gossip environments had significantly higher levels of happiness hormones than those

not in the gossip environment. The qualitative results of the study may be explained by the low levels of perception of teachers' entertainment function. Another reason may be that the participants do not adequately understand the substance. For example, treating the substance with a similar phrase as "fun in mockery gossip" could better understand the substance. The fact that the same article was seen at the level of "disagree" in Han's (2019) study can be considered as proof that the participants do not adequately understand the substance. Although the quantitative results of the study found that teachers expressed their opinions freely in gossip environments, the qualitative results of the study showed that teachers did not have general confidence in gossip environments. Although different results have been obtained regarding this substance, the results intersect at the point of "trust". It can be said that opinions are expressed freely in gossip environments where "trust" is heard in both dimensions of the research. Tekgöz's (2013) research results support these results, and the sharing between individuals is limited, and individuals are often timid about gossiping when they do not know each other enough and are not sincere enough, come together only to respond and often when the material gain is at the forefront.

While the quantitative results of the study found that gossip increases intimacy and helps make new friendships, qualitative results suggest that intimacy may develop through gossip, but not much should be expected from the intimacy that develops through gossip. Likewise, in Han's study (2019), the dimension of "developing relations" was at the level of "disagree", and it can be said that the function of developing relations that are capable of potentially contributing to the development of social relations is not sufficiently operated in schools. In some research results, it can be said that the results that gossip cannot develop relationships are because relationships have not set in a trusted environment. It has been observed that many situations cause teachers to gossip; one of them is the inability to attract unfair practices, not to break the other one, relieve stress at the moment of anger, have fun, and have free time., The research of Arabacı et al. (2012) indicated that the most effective situations among the causes of gossip were jealousy, inability to attract, skepticism, lack of self-confidence, lack of self-esteem, and aimlessness-leisure excess, ego satisfaction, social acceptance. In another research, jealousy and boredom came to the fore among the causes of school gossip (Yavuz & Levent, 2021). Han (2021), in his research on the sources of gossip at school, found that individual characteristics such as jealousy, envy, unethical behaviors, curiosity, smugness, and aimlessness are the most common sources of gossip in schools. It can be said that gossip, no matter why it is done, has positive psychological effects on the person, even at that moment.

The quantitative results regarding the "organizational harm" dimension indicated that gossip has no adverse consequences. Contrary to the quantitative results, teachers were negatively affected by the gossip made against them. For instance, they were demoralized, their trust in colleagues gossiped about them was shaken, their performance and motivation decreased, and they were reluctant to go to school. Arabacı et al. (2012), has been concluded that teachers who have been subjected to gossip have feelings such as sadness, anger, distancing from the organization, moral erosion, disregard, feeling victimized, shame. In the face of the gossip, the teachers questioned the accuracy of the rumor with "self-criticism" and who made the rumor. Yavuz and Levent (2021) reported that teachers exposed to gossip experienced deep sadness and

had to cope with psychological problems as a result. Tekgöz's (2013) study showed that individuals who gossip feel similar feelings after gossiping. It shows that gossiping includes contrasting situations for the person. While gossiping, people have feelings such as relaxing, stressing, having fun; gossiping about them has been seen to bring about conditions that upset people. This can also indicate that teachers do not empathize enough when gossiping. It has been observed that gossip can positively affect school and the environment when it is aimed at an integrative purpose. However, it has been observed that gossip about segregation and groupings can negatively affect the school and its environment. Han (2019) also showed that the level of "organizational harm" was at the level of "agree" and it was determined that the organizational harms of organizational gossip were seen at a high level in schools. A study conducted by Wang et al. (2020) on middle school students found that negative gossip at the school increased suicidal intentions. Based on this result, it is possible to say that the adverse effects of gossip are more severe in lower age groups.

Michelson and Mouly (2004) argue that gossip has a lot of harm to organizations but stresses that it can be helpful. In their research with school administrators, Himmetoğlu et al. (2020) found that gossip has positive results in improving performance in the school environment, providing information about norms, strengthening communication, and raising awareness of employees who may be malicious. He also said that school administrators should not be able to hear the gossip. It has been determined that they prefer informal communication to increase success, strengthen school culture, participate in decisions, socialize school members, and increase motivation. These results can be considered necessary to show that gossip can be used positively in the school environment, contrary to the widespread view that gossip has only negative consequences. On the other hand, it has been found that the periods when gossip is most intense in schools are seminar periods held at the beginning and end of the academic year, after the meeting, and periods when there is a workload. From this point of view, the periods when gossip is most intense are the periods in which teachers interact.

In the "having information" dimension, male teachers had a higher perception than female teachers, whereas, in the "organizational harm" dimension, female teachers had a higher perception than male teachers. Leaper and Holliday (1995) also suggest that women may be more inclined to gossip than men. In the qualitative results of the study, it was concluded that, contrary to quantitative results, gender does not affect gossip. Tekgöz's (2013) results also support the qualitative results of this study. It has been concluded that gossip is not unique to a species, it is wrong to treat it only as a woman, men gossip, and the only thing that varies between male and female gossip is the content of gossip. When the qualitative results of the study were examined, it was observed that gossip is not actually related to gender, that both sexes can gossip, but that the purposes of gossiping, the way gossiping, and the topics of gossip may differ. Some study results support this result. For example, a study by McAndrew (2014) concluded that women use gossip more competitively than men. In his research, Anthony (1992) discovered that men spread gossip to more people, while women gave more details to the people they gossiped with. Another study (Nevo et al., 1993) examined the gossip tendencies of men and women and found only a significant difference between men and women in favor of other people's physical appearance. There was no difference in

success and social relations in the same research. These results of the study are not only integrated with women within the social structure but can be considered as evidence of the rethinking and construction of the concept of gossip. Contrary to the research results, Han's (2019) research results found no significant difference in any dimension by gender. Different results can be explained by the need not treat gossip as "sexist".

In the "developing relations" dimension, the perceptions of married teachers were higher than those of single teachers. In the qualitative results of the study, it was observed that the marital status of teachers could lead to groupings. At the same time, it has been observed that single teachers have a lot of free time due to having less responsibility than married teachers, which can lead to more gossip. It has been observed that single teachers develop more intimate relationships with the convenience of being single, and these relationships can become gossip material. Han's (2019) research results did not see any significant difference in marital status. It is possible to say that the effect of marital status is related to the norms of the connected society. By explaining this situation with gender culture, Türköne (1995) refers to a wide range of areas in the community, including definitions of men and women, images of them, behavioral patterns, gender identities, relationship patterns of the sexes towards each other, attitudes, marriage customs, family types, beauty understandings, clothing. Within this area, the roles that society assigns to married and single individuals can play a decisive role in the influence of marital status variables. For example, in a community, when a married person is expected to behave as a faithful individual in friend relationships, conversations, behaviors, the same things may not be expected of a single person. Therefore, different results can be seen in the research involving other groups.

The highest means in the "having information" and "developing relations" dimensions of the OGS were seen in small schools. The result can be explained by the more intense relationships in small schools. The study conducted by Karakütük et al. (2014) concluded that small schools are superior to other schools in terms of communication and human relations. In the qualitative results of this study, it was observed that the size of the school affected gossip, while in small schools, there was a gossip group, while in large schools, there were multiple and different gossip groups. In the formation of these groups, ideological ideas and trade unions were seen to be influential. Han's (2019) research found a significant difference in the dimensions of "developing relations" and "organizational harm" according to school size. Still, it was found that teachers working in small schools had a lower perception of gossip for developing relations and organizational harm functions. The difference may be due to the different levels at which the research is carried out.

Conclusion and Implications

One of the most important results of the research is that although there are different perceptions of gossip, the existence of gossip in schools is revealed. The study concluded that the extent of having information of gossip has an essential function for the school. In this context, school administrators can take responsibility for developing open communication routes by adopting an open and transparent management style in school-related matters. Considering that male teachers also have high levels of knowledge through gossip, the rapid transfer of official information to teachers and the fast learning of teachers' reactions reinforce the importance of the gossip's function of

having information. Another research conclusion is that the developing relations dimension has a vital role. In cases where teachers resort to gossip to develop relations, relax in adverse situations, and sometimes for fun purposes, it is seen that gossip has important functions. Still, it has been concluded that trust is the basis of gossip. Therefore, it is important to manage gossip effectively by creating a trust-based school climate rather than preventing gossip by school administrations.

Gossip may be seen as an opportunity in school, given its functions of having information and developing relations. However, in terms of harmful effects such as poor performance and burnout in the qualitative results, it can be stated that gossip will be a threat to the school's stakeholders. Teachers and group heads with high professional seniority, especially school administrators, can play important roles in turning this threat into an opportunity. While school administrators are trying to provide an environment based on trust, open and transparent, increasing success, strengthening school culture, participating in decisions, ensuring the socialization of school members, and increasing motivation; senior teachers and group heads can support the process as a unifying, integrative, guiding and role model. On the other hand, during periods of high work intensity, an open, transparent, and fair regulation of work can help minimize the adverse effects of gossip.

Although the research has achieved its goal, it has some limitations. The first is that the work is done with secondary school teachers and in a city. It is thought that future research will be helpful in comparing and diversifying the study results with the participation of teachers at different school levels and cities from other regions. The second concerns how gossip perceived as a threat can be turned into an opportunity. Future research should focus on this. Third, it concerns the validity and reliability of qualitative negotiations. Due to the Covid-19 pandemic, the interviews were videotaped remotely. Conducting interviews in the same environment as the study group will help the researcher control his biases (Holloway & Wheeler, 1996) by providing long-term interaction. However, the risks prevented the negotiations in the same environment.

Statement of Responsibility

First Author: Conceptualization, methodology, software, validation, formal analysis, investigation, resources, data curation, writing-original draft, writing-review&editing, visualization. Second Author: Investigation, resources, data curation, writing-review&editing.

Conflicts of Interest

The authors declare that there is no conflict of interest.

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Effect of Creative Drama Method on the Success in Basic Language Skills, Grammar and Vocabulary Teaching Fields in Turkish Lesson: Meta-Analysis Study

Yaratıcı Drama Yönteminin Türkçe Dersindeki Temel Dil Becerileri, Dilbilgisi ve Sözcük Öğretimi Alanlarındaki Başarıya Etkisi: Meta-Analiz Çalışması

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ABSTRACT: The purpose of this study was to determine the effect of the creative drama method on the success in basic language skills (listening, reading, speaking, writing), grammar, and vocabulary teaching fields in Turkish lessons by using the meta-analysis method. 37 Effect sizes within 24 different studies were reviewed. Publication type, class level, skill areas, practice time were used as moderator variables in this research. Comprehensive Meta-Analysis 2 (CMA 2) was utilized to analyze the studies determined in the research. According to the results, the creative drama method creates positive (significant) impacts on basic language skills, grammar, and vocabulary teaching fields (z=9.959; p=.000). As time increases in creative drama applications, the effect of application increases at the same time. However, it is also found that the effect of the creative drama method on students' success does not significantly vary by publication type and class level. Moreover, the effect of creative drama on students' success varies by skill areas while the highest effect size is in speaking skill and the lowest effect size is in vocabulary teaching.

Keywords: Creative drama, meta-analysis, Turkish education, language skills.

ÖZ: Araştırmanın amacı, yaratıcı drama yönteminin Türkçe dersindeki temel dil becerileri (dinleme, okuma, konuşma, yazma), dilbilgisi ve sözcük öğretimi alanlarındaki başarıya etkisini meta-analiz yöntemiyle belirlemektir. Araştırmada 24 farklı çalışmada yer alan 37 etki büyüklüğü incelenmiştir. Araştırmada moderatör değişkenler olarak yayın türü, sınıf düzeyi, beceri alanları, uygulama süresi ele alınmıştır. Araştırmada belirlenen çalışmaların analizi için Comprehensive Meta Analysis 2 (CMA 2) programı kullanılmıştır. Araştırma sonuçlarına göre yaratıcı drama yönteminin temel dil becerileri (okuma, dinleme, konuşma, yazma becerileri), dilbilgisi ve sözcük öğretimi alanlarındaki başarı üzerinde olumlu (anlamlı) bir etkiye sahip olduğu tespit edilmiştir (z=9.959; p=.000). Yaratıcı drama uygulamalarında süre arttıkça uygulamanın etkisinin arttığı belirlenmiştir. Ancak yaratıcı drama yönteminin öğrenci başarılarına etkisinin yayın türüne ve sınıf düzeyine göre anlamlı bir farklılık göstermediği bulunmuştur. Yaratıcı dramanın öğrenci başarılarına etkisinin beceri alanlarına göre anlamlı bir farklılık gösterdiği, en yüksek etki büyüklüğü değerinin konuşma becerisinde, en düşük etki büyüklüğü değerinin ise sözcük öğretiminde olduğu belirlenmiştir.

Anahtar kelimeler: Yaratıcı drama, meta-analiz, Türkçe eğitimi, dil becerileri.

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The primary way to express oneself is to use the native language effectively. Improvement of native language starts with listening skills and continues with becoming skillful at speaking skills. Reading and writing skills are accompanied by school life (Burns & Siegel, 2017). Much as the individual has trained in all the language skills, the improvement and the way of using the native language effectively are provided by training on language skills after primary school. Again, the individual who uses his native language well will succeed in other fields and communicate effectively at the same time. Similarly, it is explained that the improvement of language skills in the Turkish Course Curriculum affects learning, personal, social, and professional competencies in other fields (Ministry of National Education [MoNE], 2019, p. 8).

Methods and techniques for different teaching levels are utilized for native language teaching from preschool to higher education. Using different method and techniques make the teaching process more effective and productive (Küçük-Avcı et al., 2019; Yücer, 2011). It must be noted that using different methods and techniques is vital for four main language skills in the Turkish Course Curriculum (MoNE, 2019, p. 8)

Today, it is aimed for students to attend the lesson actively and learn through experience via different methods and techniques. The student, in this way, will attend the lesson by becoming aware of his own learning process, and also the teacher guide him during this process (Cornelius-White, 2007; McCombs, 2012). One of the most frequently used methods that allow the student to be active in the lesson during native language teaching processes is creative drama. Words which are the most important elements of language teaching and also creative drama which uses body language as a tool are frequently used in language teaching thanks to these relevant properties (Eski, 2019). Therefore, there have been conducted different studies reviewing the use of creative drama in Turkish lessons and also its effects on students' knowledge and skills. For findings of relevant studies, using the creative drama method in lessons affects language skills (Brouillette, 2012; Haruyama, 2010; Rose et al., 2000; Türkel, 2011), vocabulary knowledge (Yumurtacı & Mede, 2021) and grammar skills (Boudreault, 2010) positive. Morgül (1999, p. 38) expressed that proper ambiance for teaching language skills can be provided by creative drama. In language teaching, grammar structures and words can be taught thanks to creative drama without the need for memorization (Kütükçü, 2010, p. 57). Concerning the results of studies in literature, we can mention that creative drama is an effective and current method for language teaching. This paper discussed the creative drama method because the reasons that relevant method is frequently used in lessons and there are many studies conducted about different skills. The meta-analysis method, based on combining the results of studies conducted in different places and times (Çelebi-Yıldız, 2002), was utilized to reveal the effect of the creative drama method in the skill areas related to Turkish lesson.

Theoretical Framework

Drama word that is lexicalized from the root of 'dran' in Greek means to do, to act; this word has also been used for presentations with specific messages intended for the audience since the ancient theater period. Aristoteles defines drama as the re-creation of a situation or movement in life. Drama is not transferring the reality in life as

it is, but reflecting it through different people or events (Nutku, 1990; Lehman, 1986, as cited in San, 1990). Events in life are reviewed under the guidance of the teacher and within the group interaction processes (Polisini, 1993) within the creative drama, which is explained as a process in which imaginary thought turns into action and expands the life experience without being on the stage (Courtney, 1989; Heathcote, 1984).

Creative drama is a versatile teaching method to bring in cognitive, affective, and psychomotor skills; field of education in creating an understanding of art to provide an opportunity to be used and educated all the senses; a discipline with description, explanation, and control processes (Üstündağ, 1996). The development of creative drama in Turkey dates back to the first period of the republic. The foundations of creative drama were laid by combining the dramatization technique used in the education process in the period before the Republic with İsmail Hakkı Baltacıoğlu's understanding of theater at school. However, the emergence of modern creative drama was in the 1980s. There can be developed active learning, cooperation, and solidarity process if drama which is a separate discipline on its own is used in education (Calp et al., 2016). Creative drama practices are interactive and learner centered. It facilitates the learning processes of students by developing creativity. The student, in creative drama, has the advantage to make practicing in physical, emotional, and cognitive dimensions through different situations examples (Maden, 2010). The creative drama that holds peer learning and learning by doing is based on a constructivist approach that depends on collaboration. Creative drama, in language teaching, stirs emotions and brings a rich learning experience. Since students actively participate in the process with peers based on collaboration, they improve affective characteristics such as self-esteem, and self-efficacy (Williams & Burden, 1997; Zafeiriades, 2009).

Since more than one sense is used in creative drama applications, the learning process accelerates, and the permanence of the learned information increases. Creative drama is based on conveying feelings and thoughts with gestures and facial expressions; namely, learning by doing. Therefore, students' comprehension and expression skills will also improve with creative drama applications. The use of creative drama in Turkish lessons, which is based on comprehension and expression skills, will contribute to students' development of their existing first language knowledge and transforming this knowledge into a skill (Karadağ & Çalışkan, 2005; Uysal, 2014). It is possible for students to actively participate in the teaching-learning processes and to develop their speaking skills with appropriate teaching, methods, and techniques. Students can actively participate in the lesson, accompanied by improvisation and animations, through the creative drama methods used in Turkish lessons. Versatile individuals who can speak, write, research, question, and think critically can be raised through creative drama activities in the classroom (Aykaç, 2011). Creative drama is accepted as a powerful and effective method in teaching language skills because it enables the development of imagination for writing, listening, and speaking and it also provides easier analysis and assembly of a text (Harrison, 1999). It is necessary to use a method that gives skill and behavior by doing and living like creative drama in Turkish teaching, focusing on acquiring skills rather than knowledge transfer. Creative drama activities include listening, speaking, reading, and writing skills. Spelling, punctuation, and grammar topics can be taught by supporting these skills, in direct and indirect contact with each other, with creative drama practices (Kavcar et al., 1995).

Different themes can be discussed via creative drama. Skills can be developed during applications with various practices in different areas such as communication skills, empathy, self-knowledge, communication with the environment, physical and mental relaxation, creativity, working with a group, attention, and focus, effective observation, and control of senses and emotions (Oruç, 2013, p. 41). This is because it can be emphasized that creative drama is a set of versatile applications that allow the development of more than one skill.

The benefits to be used creative drama in the teaching process are aligned as follows:

- Since more than one sense organ is used in the creative drama process and active participation is ensured, students learn the subjects faster and easier.
- The student learns permanently by doing and living the knowledge thanks to creative drama.
- Comprehension levels increase as students participate directly in the learning experience.
- Drama activities increase motivation, keep attention alive and enable students to use their creativity and imagination.
- Intellectual skills, as well as language skills, develop.
- During the creative drama, the brain's right hemisphere, which is associated with creativity, is used, and thus, abilities in the field of imagination, art, and thought are developed.
- It helps students to gain values such as self-esteem, empathy, and helpfulness (Adıgüzel, 2021; Ulaş, 2008; Wagner, 1976; Wessels, 1987; Yalçın & Aytaş, 2006).

Different students explain that creative drama applications in language education contribute to the teaching process. According to Maley and Duff (1984), the use of creative drama applications in language education provides students with a fun teaching process with realistic applications. Creative drama practices improve students' reading skills (Booth, 1985; McMaster, 1998; Rose et al., 2000), speaking skills (Haruyama, 2010; Wiyanti et al., 2018), writing skills (Bal-İncebacak, 2017; Schneider & Jackson, 2000; Türkel, 2011), listening skills (Brouillette, 2012; De la Cruz et al., 1998; Prendiville & Toye, 2007; Yavuz, 2017). Moreover, there also are studies that mention that creative drama is beneficial in grammar teaching (Boudreault, 2010; Bush, 1985; Even, 2011) and vocabulary teaching (Abdinazarov, 2021; Demircioğlu, 2010; Yumurtacı & Mede, 2021). However, in these studies, the effect of the creative drama method was examined in certain skill areas, and the meta-analysis method, which is based on combining the results of studies conducted in different places and times (Çelebi-Yıldız, 2002), was not used.

It is seen when the meta-analysis studies on skills associated with Turkish lesson are analyzed that there are meta-analysis studies reviewing listening skill (Kansızoğlu, 2017a), writing skill (Atasoy, 2021; Graham et al., 2021; Kansızoğlu & Bayrak Cömert, 2017; Özkaya, 2020; Şahin, 2019; Sidekli & Uysal, 2017), reading skill (Doğan, 2017; Sidekli & Çetin, 2017; Sur, 2022), grammar teaching (Kansızoğlu & Sulak, 2019;

Özkaya, 2020) and vocabulary teaching (Kansızoğlu, 2017b). However, the creative drama method was not reviewed in the studies above.

There are meta-analysis studies on creative drama methods in different fields in literature. It is seen when the literature is scrutinized that studies are focusing on creative drama and educational processes. Conard and Asher (2000) analyzed eight studies and found that creative drama did not affect primary school children's self-concept under various conditions. Batdı and Batdı (2015) examined 40 studies in their meta-analysis study and expressed that creative drama had a significant and positive effect on academic achievement. 47 studies were included in the study belonging to Lee et al., (2015); for their results, drama-based pedagogy had a positive and significant effect on successful outcomes. Moreover, there have also been found positive effects on psychological and social outcomes Ulubey and Toraman (2015) analyzed 65 studies and concluded that creative drama increases academic success. Akdemir and Karakuş (2016) analyzed 27 thesis studies and determined that the creative drama method had a positive effect on academic success. Another meta-analysis study was conducted by Cantürk-Günhan (2016). According to his findings, the creative drama method used in mathematics teaching is successful compared to continuing education and the average effect size is at a strong level. Toraman and Ulubey (2016) performed a survey and according to the results of the meta-analysis of 30 studies, the creative drama method positively affected the attitudes of the students towards the lessons. Biçer (2017) scrutinized 22 studies and found that the creative drama method had a great effect on the academic achievement of students. Moreover, it was observed that student-centered methods in Turkish lessons are effective on students' academic success. Ulubey (2018) included 63 studies in his research and revealed that creative drama positively affected students' social skills, basic language skills, and higher-order thinking skills. 61 postgraduate theses were reviewed by Özbey and Sarıkaya (2019); for their results, the drama method had a positive and strong effect on academic achievement, permanence, motivation, and social skills, and a positive and moderate effect on attitude. Alacapınar and Uysal (2020) researched 23 postgraduate theses and found that the effect size of creative drama used in mathematics education is high for academic success and retention; it also is moderate for attitude at the same time. Batdı and Elaldı (2020) included 24 studies in their meta-analysis and highlighted that drama has a positive effect on social communication skills. Er-Türküresin (2020) researched 19 studies and observed that the creative drama method had a very high effect size on the success of the social sciences course. 32 studies were examined in the study conducted by Lee et al. (2020). According to the results, drama-based pedagogy had a significant and positive effect on achievement, attitudes, 21st-century skills, drama skills, and motivation. Özdemir-Şimşek and Karataş (2020) examined 16 postgraduate thesis and found that creative drama in science education has a significant effect on science achievement. The effect of creative drama on success in different courses is discussed in the meta-analysis studies in the literature. Relevant studies evaluated the effects of creative drama practices on academic achievement, development of basic language skills, affective and social skills. However, it is seen that there are no meta-analysis studies that can cover the entire Turkish course. For this reason, experimental studies examining the effects of the creative drama method on different areas in Turkish lessons (listening, reading, speaking, writing, grammar, vocabulary teaching) were reviewed

with the meta-analysis method. One or more of the teaching areas within the scope of the Turkish course were discussed in these studies examining the effectiveness of the creative drama method with the meta-analysis method. The lack of meta-analysis studies covering the whole field of Turkish education and dealing with the creative drama method is a great loss for the literature. Therefore, this study conducted a comprehensive meta-analysis research that revealed the effectiveness of the creative drama method in Turkish teaching and addressed language skills, vocabulary teaching and grammar.

In this manner, the purpose of this study was to determine the effect of the creative drama method on the success in the fields of basic language skills, grammar, and vocabulary teaching in Turkish lessons by using the meta-analysis method. For this purpose, answers to the following questions were sought in the study:

1. What is the effect of the creative drama method on the success of basic language skills, grammar, and vocabulary teaching in Turkish lessons?
2. Is there a significant difference between the effect sizes of the studies according to the publication type of the studies?
3. Is there a significant difference between the effect sizes of the studies according to the class level in which the studies were conducted?
4. Is there a significant difference between the effect sizes of the studies according to the skill field in which the research is conducted?
5. Is there a significant difference between the effect sizes of the studies according to the implementation period of the studies?

Method

Research Model

This research used the meta-analysis method. Glass (1976, p. 3) interpreted meta-analysis as the ‘analysis of analyses’. More clearly, meta-analysis is a “statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings” (Glass, 1976, p. 3). Meta-analysis means the statistical synthesis of results in study series (Borenstein et al., 2019). According to Dinçer (2014, p. 4), meta-analysis is “classifying similar studies on a subject, theme or field of study under certain criteria and interpreting the quantitative findings of these studies by combining them.”

Meta-analysis provides some different advantages over other classical review methods in research synthesis. Some of the relevant advantages are as follow: each step is reported in a disciplined and clear way so that the process is open to review and repetition, the main findings of the study can be summarized effectively, the effect size can be calculated, unlike other methods, and it offers the opportunity to deal with many research findings in an organized manner (Lipsey & Wilson, 2001, as cited in Üstün & Eryılmaz, 2014). In this direction, the results of experimental research in the field were evaluated to review the effect of the creative drama method on some skills in Turkish lessons in terms of different variables. The application steps followed in the study for this evaluation are as follows.

Research Process

The first step of the research process is to determine the problem. After determining the research problem, similar studies (Batdı & Batdı, 2015; Batdı & Elaldı, 2020; Biçer, 2017; Cantürk-Günhan, 2016; Er-Türküresin, 2020; Özbey & Sarıkaya, 2019; Toraman & Ulubey, 2016; Ulubey, 2018; Ulubey & Toraman, 2015) regarding the topic were reviewed to specify the keywords for scanning. Relevant keywords are: "drama," "creative drama," "dramatization," "drama" and "language skills", "drama" and "Turkish," "drama" and "reading," "drama" and "writing," "drama" and "listening," "drama" and "speaking," "drama" and "grammar," "creative drama" and "Turkish," "drama" and "language skills."

The third process of the research is to determine the databases to scan. "Council of Higher Education National Thesis Center," "Google Scholar," "Ulakbim TR Index," and ERIC databases were scanned in this study. In the determined databases, 10 doctoral dissertations, 39 master's thesis, and 32 articles on the subject were reached. In addition, the reference lists of similar studies were examined to see if there was a missed study. The last scan was done on February 17, 2021. The criteria to be considered in determining the studies to be included in the meta-analysis were determined in the fourth step of the study. These criteria are as follows:

1) The study was conducted in an experimental/quasi-experimental design with a pretest-posttest control group,
2) The study was performed to scrutinize the effect of the creative drama method on developing one or more of the Turkish language skill areas (reading, listening, speaking, writing, grammar, vocabulary teaching),
3) Experimental and control groups were included in the study. The students in the experimental group received training with the creative drama method and the control group with the traditional method.
4) Statistical analysis results for the experimental and control groups give the post-test measurements, arithmetic mean, standard deviation, and significance values,
5) Teaching level, experimental application period, publication type, skill type, and sample number are clearly stated in the study,
6) The study was conducted and published in Turkey,
7) The study is a master's/doctoral thesis, or a scientific article published in printed/electronic journals,
8) The tests used in the study are those that meet the normality assumption,
9) The study was conducted on primary and secondary school students in Turkey.

In consideration of relevant criteria, studies with the following characteristics were not included in the meta-analysis:

1) Studies researching the effect of creative drama on social and/or affective skills,
2) Studies in which the skill area whose success is measured is not fully determined (measuring more than one skill in a complex with a measurement tool under the title of "Academic success"),
3) Studies in which the measurement tool used in the study is insufficient in terms of validity and reliability,

4) Studies in which an application/achievement test is used for a theme in the textbook, not a skill,
5) Studies providing training to the group determined as the control group too,
6) Studies in which two skills (e.g., reading and listening) are measured with a single measurement tool,
7) Studies providing education on subjects within the scope of a high school literature lesson,
8) Studies without the necessary statistical data and application time,
9) Studies on Turkish teaching to foreigners,
10) Studies using qualitative research methods,
11) Studies in which post-test data for the experimental and control groups were not presented,
12) Studies that train experimental groups with other methods in addition to creative drama,
13) Experimental studies with single groups,
14) Studies with university students.

Moreover, the article was included in the meta-analysis if there are sufficient results in the articles produced from master's and doctoral dissertations. However, the thesis was included in the meta-analysis when sufficient findings could not be obtained from the article. In addition, the data of the thesis were included in the analysis, not the articles published separately in the thesis in which two different skills were investigated.

The meta-analysis was conducted with 24 studies, 4 of which were doctoral dissertations, ten master's thesis, and ten articles at the end of eliminations. A total of 37 effect sizes were calculated for the studies in the meta-analysis. Because statistical test results for the effect of creative drama in more than one skill area were presented in some studies. Under the circumstances, the result of each skill area was evaluated as a separate study to compute the effect size.

Coding Data and Ensuring Validity-Reliability in Coding

We, within the scope of the research, established a form to code the studies to be included in the meta-analysis. The variables to be coded were determined by reviewing the moderator variables in similar studies (Batdı & Batdı, 2015; Batdı & Elaldı, 2020; Biçer, 2017; Cantürk-Günhan, 2016; Er-Türküresin, 2020; Özbey & Sarıkaya, 2019; Toraman & Ulubey, 2016; Ulubey, 2018; Ulubey & Toraman, 2015) and considering the purpose of the research. Moreover, statistical test results required for effect size calculations were clarified. An expert opinion which makes meta-analysis studies were taken for the variables and statistical test results. In this way, content validity was tried to be provided. The author(s) of the research, publication year information was recorded. The variables of publication type, grade level, skill area, application time and the values of sample size, arithmetic mean and standard deviation were coded.

Inter-rater reliability was controlled to ensure reliability in coding. The coding of the two authors was compared by separately coding relevant studies by the authors of the study. Miles and Huberman's (1994) Reliability = Consensus / (Consensus + Disagreement) formula was utilized to calculate the reliability coefficient. The

reliability rate was found as .81 percent. This ratio shows that the encodings are reliable. Table 1 shows descriptive statistics for the studies whose effect size was calculated:

Table 1

Descriptive Statistics for Studies with Calculated Effect Sizes

Variables		*f*	%
Publication Type	Master's Thesis	12	32.43
	Doctoral Dissertations	11	29.73
	Article	14	37.84
Grade Level	3rd grade	3	8.11
	4th grade	7	18.92
	5th grade	9	24.32
	6th grade	10	27.03
	7th grade	7	18.92
	8th grade	1	2.7
Skill Area	Reading skill	7	18.92
	Listening skill	5	13.51
	Speaking skill	8	21.62
	Writing skill	10	27.03
	Vocabulary teaching	4	10.81
	Grammar	3	8.11
Application Time	1-4 weeks	2	5.41
	5-8 weeks	17	45.95
	9-12 weeks	13	35.14
	13 weeks and above	5	13.51

As is seen in Table 1, studies in meta-analysis consisted of master's thesis by 32.43% (*f*=12), doctoral dissertations by 29.73% (*f*=11) and articles by 37.84% (*f*=14). Most of the research on the subject was done in the type of articles. 8.11% (*f*=3) of studies was conducted at 3rd class level while 18.92% (*f*=7), 24.32% (*f*=9), 27.03% (*f*=10), 18.92% (*f*=7) and 2.7% (*f*=1) of them were respectively done at 4th, 5th, 6th, 7th and 8th class levels. Most of the research is done at 6th grade and at least 8th-grade level. Distribution by skill areas are as follows: 18.92% (*f*=7) of them was about reading skill while 13.51% (*f*=5), 21.62% (*f*=8), 27.03% (*f*=10), 10.81% (*f*=4) and 8.11% (*f*=3) of them were respectively about listening, speaking, writing skill, vocabulary teaching,

and grammar. It is seen that there are more studies on speaking and writing skills regarding productive language skills, while there is a limited number of studies regarding vocabulary teaching and grammar. We can see when the studies are scrutinized in terms of application time that 5.41% (*f*=2) of them took 1-4 weeks, while 45.95% (*f*=17), 35.14% (*f*=13), and 13.51% (*f*=5) of them respectively took 5-8 weeks, 9-12 weeks and 13 weeks and above.

Effect Size

Effect size is the basic unit of a meta-analysis study and also a value reflecting the size of the application effect or the relation between two variables (Borenstein et al., 2019, p. 3). The Comprehensive Meta-Analysis 2 (CMA 2) program was utilized to analyze the studies in this research. The general run of meta-analyses was conducted by fixed effect model or random-effects model (Borenstein et al., 2019, p. 63). Heterogeneity should be considered to decide which model to be used (Dinçer, 2014). Heterogeneity test reviews whether the observed variance in effect sizes significantly differs from the expected variance due to sampling error (Cooper, 2010, as cited in Kanadlı, 2019, p. 23). The effect sizes of the studies are heterogeneous, and the random-effects model is chosen if the heterogeneity test is significant at the 95% confidence level ($p<.05$). The studies are homogeneous, and the fixed effect model is preferred if the test result is not significant at the 95% confidence level ($p>.05$) (Kanadlı, 2019, p. 23). The effect sizes of the studies included in the meta-analysis as a result of the heterogeneity test are statistically significant ($p<.05$). In addition to all these, I^2 value was calculated as 89.039%. According to Higgins et al., (2003), the I^2 value is interpreted as low heterogeneity up to 25%, moderate up to 50%, and high up to 75% (as cited in Kanadlı, 2019, p. 24). The result in the study shows a high level of heterogeneity. Therefore, the random-effects model was used to compute the effect size.

The post-test point averages, sample sizes, and standard deviation values of the experimental and control groups were considered in the calculation of the effect size. However, the pre-test mean scores were also considered in case of a significant difference between the pre-test mean scores of the experimental and control groups (see. Dinçer, 2014, p. 25). In this regard, since the pre-tests are not equalized in the studies belonging to Uysal (2014) and Erkan and Aykaç (2014), there was performed an analysis based on correlation values. However, in the study of Uysal (2014), the correlation value was calculated only for the data in speaking skills. Cohen d (Std diff in means) index was preferred to compute the effect size. Classification of Cohen et al. (2007) was considered to interpret the effect sizes.

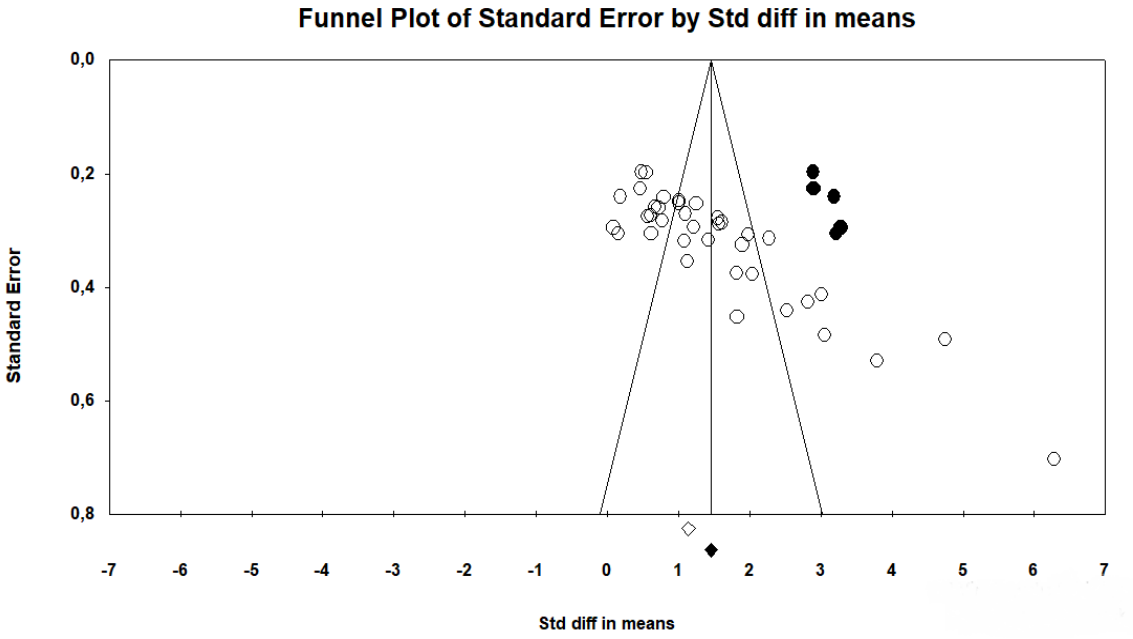
Publication Bias

Publication bias can be seen if studies in meta-analysis do not represent the relevant studies sufficiently or the studies that gave negative results are not published (Duval & Tweedie, 2000; Jin et al., 2015). Moreover, we can say that publication bias has some reasons, such as language bias, availability bias, cost bias, familiarity bias, and repetition bias (Borenstein et al., 2019). If the studies in a meta-analysis are biased, the validity of the results of the meta-analysis are under threat (Rothstein et al. 2005, as cited in Üstün & Eryılmaz, 2014, p. 14). There are several methods to detect publication bias. This study used Funnel Plot, Rosenthal's fail-safe N, and Duval and Tweedie's

trim and fill to detect the publication bias. In addition, two studies (Çer, 2017; Çöklü-Özkan, 2018) that were found as extreme value at the end of the analysis were excluded from the analysis because of their effect on publication bias and the effect size. Funnel plot is as follows:

Figure 1

Funnel Plot of Studies within Meta-Analysis



According to Funnel Plot, studies within a meta-analysis are distributed around the vertical line and display a nearly symmetrical appearance. This situation is proof that there is no publication bias in studies. Table 2 shows the results of Rosenthal's fail-safe N test:

Table 2

Results of Rosenthal's fail-safe N test

Bias Status	Value
Z-value	26.46
p-value	.00
Alpha	.05
Direction	2
Z value for Alpha	1.959
N	37
Fail safe number	6707

According to the analysis, 6707 studies with a zero effect size should be added to the meta-analysis to statistically invalidate the result of the study. "Although there is no strict rule about how large the FSN should be to avoid publication bias far enough,

Mullen et al. (2001) concluded based on Rosenthal's suggestion that if the $N/(5k+10)$ (k is the number of studies included in the meta-analysis) value exceeds 1, the results of the meta-analysis appear to be sufficiently robust for future studies" (Mullen et al., 2001, as cited in Üstün & Eryılmaz, 2014, p. 18). For the formula, the value obtained from the study is 34.39. In this case, it can be said that there is no publication bias, and the results of the study are reliable. Moreover, Duval and Tweedie's confidence test results can be seen in the Table below:

Table 3

Results of Duval and Tweedie's Confidence Test

Confidence Test	Data	
Duval and Tweedie's trim and fill	Number of Trimmed studies	5
	Observed effect size value	1.49
	Reviewed effect size number	1.71
	Direction of trimmed studies	Right

According to Table 3, the number of trimmed studies is 5, while the direction of trimmed studies is on the right side. This situation shows that the publication bias will be eliminated if five studies are added to the relevant study. Due to the small number of studies to be added, it can be said that the publication bias in the study is quite low. In addition, the fact that the observed effect size and the adjusted effect size are relatively close to each other may indicate that the publication bias is low.

Ethical Procedures

Since this research is a meta-analysis study, ethical committee approval is not required.

Results

Effect sizes in the study were determined based on the random-effects model. Findings were interpreted in line with the research questions. Findings regarding the effect sizes of studies reviewed are as follows:

Table 4

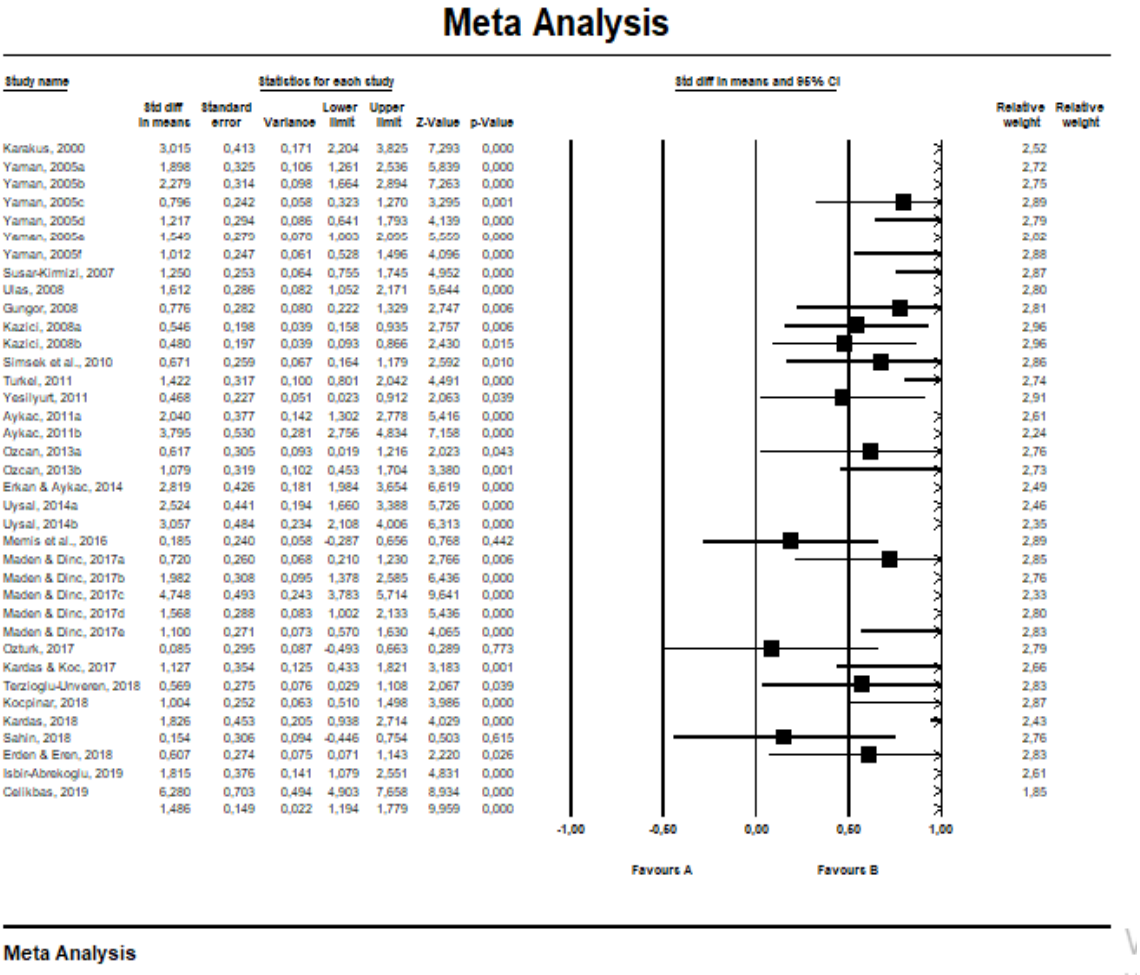
Findings regarding Effects Sizes of Studies Based on Random Effects Model

Average Effect Size	*N*	Standard Error	Variance	*Z*	*p*	95% Confidence Interval for Effect Size	
						Lower Limit	Upper Limit
1.486	37	.149	.022	9.959	.000	1.194	1.779

As is seen in Table 4, the general effect size value of studies was found as 1.486 by .149 error based on the random-effects model. This value, according to the classification belonging to Cohen et al. (2007), is an effect at a strong level. For the random-effects model, the lower limit of effect size within 95% confidence interval is 1.194, while the upper limit is 1.779. Values of effect sizes are statistically significant (z=9.959; p=.000). These findings show that the creative drama method has a positive impact on basic language skills, grammar, and vocabulary teaching in Turkish lesson.

Figure 2

The Forest Plot of Effect Sizes Based on the Random-Effects Model



The black squares in Figure 2 show the effect size of the study, and the lines next to the squares show the lower and upper limits of the effect size at the 95% confidence interval. The weight percentage given in the right part of the forest plot also numerically shows the effect share of each research on the meta-analysis result. It is seen when the effect sizes of the studies included in the research are examined that the smallest effect size value belongs to Öztürk (2017) with .085 and the highest effect size value belongs to Çelikbaş (2019) with 6.280. All the studies have a positive impact. Regarding the analysis of weights of studies, the research conducted by Çelikbaş (2019) had the smallest (1.85%), and the research conducted by Kazıcı (2008) had the largest (2.96) weight percentage.

Moderator Analyses

Findings regarding effect sizes of studies reviewed by the variable of publication type are as follows:

Table 5

Findings Regarding the Effect Size of the Publication Type of the Research

Publication Type	Frequency (*n*)	Effect Size	Standard Error	95% Confidence Interval for Effect Size		*Q* value	*p* value
				Lower Limit	Upper Limit		
Doctoral dissertation	11	1.876	.235	1.416	2.336		
Master's thesis	12	1.318	.274	.782	1.855		
Article	14	1.322	.238	.856	1.788	3.536	.171

As is seen in Table 5, the effect size value of doctoral dissertations is 1.876, master's thesis are 1.318 and articles is 1.322. The type of publication with the highest impact value is doctoral dissertations, and the type of publication with the lowest impact value is master's thesis. According to the findings, the effect of creative drama on student achievement does not show a significant difference based on the type of publication in which the study is reported (Q_b=3.536; p>.05).

The findings regarding the effect sizes of the studies examined according to the grade level variable can be seen in the Table below:

Table 6

Findings Related to the Effect Size of the Class Level in which the Research was Conducted

Grade Level	Frequency (*n*)	Effect Size	Standard Error	95% Confidence Interval for Effect Size		*Q* value	*p* value
				Lower Limit	Upper Limit		
3rd grade	3	1.123	.715	.278	2.524		
4th grade	7	2.059	.545	.992	3.127		
5th grade	9	1.421	.234	.963	1.879		
6th grade	10	1.254	.270	.724	1.783		
7th grade	7	1.649	.306	1.049	2.249		
8th grade	1	1.422	.317	.801	2.042	2.435	.786

As is seen in Table 6, the highest effect size is 2.059 at the 4th class level while the lowest effect size is 1.123 at the 3rd class level. When the findings are examined, the effect of creative drama on students' academic success does not significantly vary by grade level (Q_b=2.435; p>.05).

The findings regarding the effect sizes of the studies examined according to the skill area variable are presented in the Table below:

Table 7

Findings Related to the Effect Size of the Skill Area in Which the Research was Conducted

Skill Area	Frequency (n)	Effect Size	Standard Error	95% Confidence Interval for Effect Size		Q value	p value
				Lower Limit	Upper Limit		
Grammar	3	.725	.185	.363	1.087		
Listening	5	1.678	.290	1.111	2.246		
Vocabulary Teaching	4	.562	.150	.267	.857		
Speaking	8	1.996	.499	1.017	2.974		
Reading	7	1.169	.228	.721	1.617		
Writing	10	1.969	.385	1.213	2.724	26.771	.000

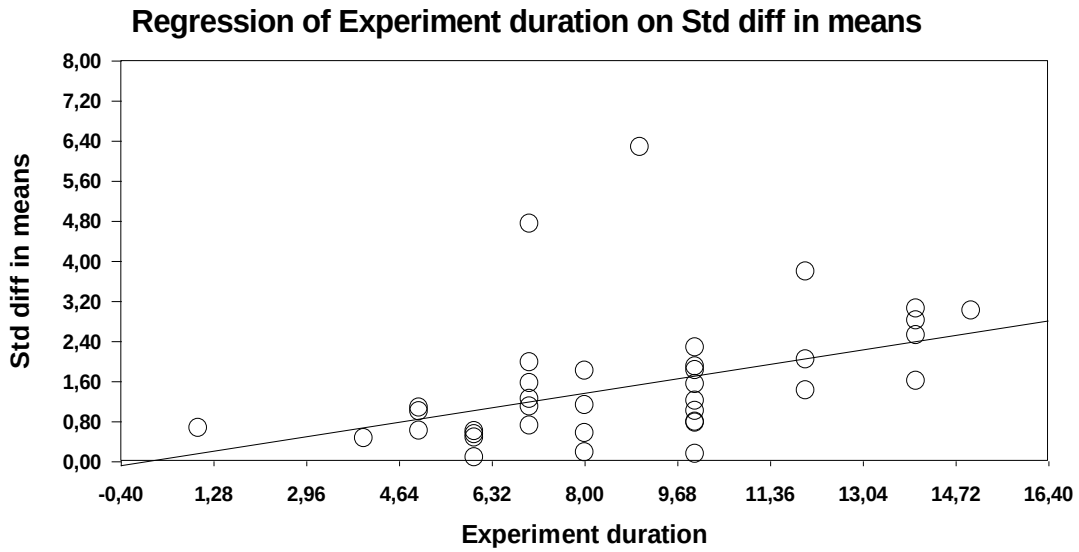
As is seen in Table 7, the highest effect size value is 1.996 for speaking skills. The lowest effect size is .562 in vocabulary teaching. When the findings are examined, the effect of creative drama on students' academic success significantly varies by the skill areas (Q_b=26.771; p<.05).

Regression Analysis

The graphic and Table below show the findings regarding the effect sizes of studies that were reviewed by the variable of application time.

Figure 3

Meta-Regression Analysis of the Effect Sizes of the Application Time



It is seen in Figure 3 that there is a linear relation between application time and effect sizes. Table 8 shows findings to understand whether this relationship is significant.

Table 8

Findings Regarding Effect Size of Application Time

	Point Estimate	Standard Error	95% Confidence Interval for Effect Size		*Z*	*p*
			Lower Limit	Upper Limit		
Experiment Duration	.17202	.04174	.09021	.25383	4.12111	.00004
Intercept	-.01721	.38249	-.76688	.73247	-.04499	.96412

$T^2_{unexplained}$= .52851

As is seen in Table 8, the model that we tried to explain the effect sizes with the application time is significant (p<.05). Unexplained variance is .52851. The total variance between studies is .713. The variance explained as a result of the calculation made to determine how much of the variance in the effect sizes of the application duration variable explains is .258. Under the circumstances, application time explained 26% of the variance between studies.

Discussion and Conclusion

In this study, the effect of the creative drama method on the success in basic language skills (listening, reading, speaking, writing), grammar, and vocabulary teaching in Turkish lessons through 37 effect sizes in 24 different studies. For research

results, the general effect size of studies was found as 1.486 by .149 error based on the random-effects model. Values of effect sizes are statistically significant (z=9.959; p=.000). Therefore, the creative drama method has a positive impact on basic language skills (reading, listening, speaking, writing skills), grammar, and vocabulary teaching. Concerning this result, we can say that the creative drama method contributes positively to academic success levels in different skill areas in Turkish lessons. Similar results have been obtained in different studies in the literature. It can be expressed when the meta-analysis studies regarding creative drama in literature are reviewed that studies show the positive impact of creative drama on academic success (Akdemir & Karakuş, 2016; Batdı & Batdı, 2015, Kardash & Wright, 1986; Lee et al., 2020; Ulubey & Toraman, 2015). Moreover, there are different meta-analysis studies (Alacapınar & Uysal, 2020; Biçer, 2017; Cantürk-Günhan, 2016; Lee et al., 2015; Özbey & Sarıkaya, 2019) showing the high-level effect of creative drama on academic success. It is an important finding that the creative drama method affects academic success in different fields.

It is found that the effect of creative drama on student success does not significantly vary by the publication type in which the study is reported (Q_b=3.536; p>.05). The publication type with the highest effect value is doctoral dissertations while the publication type with the lowest effect value is the master's thesis. In contrast to this result, Ulubey (2018) and Cantürk-Günhan (2016) emphasized that the effect of creative drama on students' success significantly varies by publication type. On the other hand, for the results of the same study, the effect value of doctoral dissertations and master's thesis are at a higher level compared to other studies. It can be thought that the relevant result is in association with features such as lesson, sample difference, and research duration.

It is also found that the effect of creative drama on students' success does not significantly vary by class level (Q_b=2.435; p>.05). The highest effect size is 2.059 at a fourth class level, while the lowest effect size is 1.123 at the third class level. This result shows that using creative drama method in Turkish lessons does not change the academic success by class level. There are studies in literature expressing that class-school level does not significantly vary in terms of the effect of creative drama on students' success (Batdı & Batdı, 2015; Cantürk-Günhan, 2016; Kardash & Wright, 1986; Podlozny, 2000; Ulubey & Toraman, 2015). The results of these studies jibe with the results of this paper. However, there also are different studies (Akdemir & Karakuş, 2016; Conard, 1992; Toraman & Ulubey, 2016; Ulubey, 2018) expressing that class-school level establishes a significant difference in terms of the effect of creative drama on students' success. Since the effect of creative drama in Turkish lessons was reviewed in a relevant study, studies at the 3rd-8th class level were analyzed. This result may be due to the fact that studies at different education levels (preschool, primary, secondary, high school, and university) were not considered in the research. The creative drama method is effective in all the fields of language teaching (Kütükçü, 2010; Morgül, 1999). This is because developed knowledge and skills related to language are possible in classrooms where creative drama practices are performed. The reason no significant difference was found in terms of grade level in the study may be that the creative drama practices conducted in Turkish lessons are an effective method at all grade levels.

According to research results, effect of creative drama on students' success significantly varies by skill areas (Q_b=26.771; p<.05). The highest effect size value is 1.996 in speaking skills while the lowest effect size is .562 in vocabulary teaching. In terms of language skills, Batdı and Elaldı (2020) determined as a result of the meta-analysis research that creative drama positively affects social communication skills. There are studies in the literature about creative drama express that creative drama positively affects reading (Booth, 1985; DuPont, 1992; McMaster, 1998; Rose et al., 2000), speaking (San, 2010; Stabler, 1980; Uşaklı, 2011), writing (Bal-İncebacak, 2017; Schneider & Jackson, 2000) and listening skills (Brouillette, 2012; Prendiville & Toye, 2007; Yavuz, 2017). The findings of the mentioned studies support the results of the research. However, Ulubey (2018) explains in his meta-analysis study that even though creative drama positively affects basic language skills, there is no significant difference according to skill type. It is seen when we analyze in terms of grammar and vocabulary teaching that creative drama is effective in grammar teaching (Boudreault, 2010; Bush, 1985; Even, 2011) and vocabulary teaching (Abdinazarov, 2021; Demircioğlu, 2010; Stabler, 1980; Yumurtacı & Mede, 2021). The findings of the mentioned studies support the results of the research. In the communication process, not only speaking skills but also gestures and, facial expressions, body language come into play in conveying messages. It is important to be used body language, gestures, and mimics in the creative drama method. Since these skills are also taken into consideration in the practices, the awareness of the students on this issue develops (Öztürk-Pat & Yılmaz, 2021).

Moreover, creative drama practices are group work. Students in the group use their speaking and listening skills more actively as they communicate with each other (Saraç, 2007). The fact that the highest effect size was calculated in speaking skills may be due to this situation. According to Kütükçü (2010), creative drama applications are effective in vocabulary teaching. However, Yumurtacı and Mede (2021) explained that since vocabulary teaching is more effective for early ages, creative drama is more effective for junior students to improve their vocabulary skills. Similarly, Brown (1994) explains that applications for teaching vocabulary at an early age yield more effective result. 3rd-8th class-level studies were discussed because the effect of creative drama in Turkish lessons was examined in the study. The fact that the lowest effect size was calculated in vocabulary teaching may be due to the fact that the applications in the younger age group were not included in the research. Moreover, it is also possible that the effect of creative drama on vocabulary teaching is less than in other skill areas. Much as vocabulary teaching is a field that does not differ from other language skills, it is discussed in a process in which different teaching methods and techniques peculiar to the subject are studies in the lessons. The fact that creative drama studies prepared and applied based on vocabulary teaching are not suitable for teaching vocabulary and are not prepared under the subject may affect the efficiency of creative drama applications.

Research results show a linear relationship between application time and effect sizes. The model that explains effect sizes by the application time is significant (p<.05). Application time explains 26% of the variance among studies. As the application time increases, the effect of the application increases at the same time. Toraman and Ulubey (2016) and Ulubey (2018) express that application time affects effect size, while Conard (1992) states that applications that take more than 12 weeks are more effective. Moreover, for Lee et al. (2015), the effect level of creative drama applications in meta-

analysis studies for more than 6 hours is more positive than the applications for 5 hours or less. However, with reference to different studies (Cantürk-Günhan, 2016; Kardash & Wright, 1986), application time has no effect. Nearly half of studies (*f*=10) in research have application time as 10 weeks and over. The reason for this result may be different application times of the studies included in the research.

Limitations

37 effect size values from 24 different studies were included in the study. Studies conducted according to the experimental and quasi-experimental model were included in the research. Twenty-two studies were conducted in a quasi-experimental design, while two studies were performed in a real-experimental design. Groups were formed by randomly assigning students to the experimental and control groups in studies conducted in experimental design. Three studies did not clearly state how they formed the experimental and control groups; two studies formed groups with criterion sampling; finally, 1 study formed groups with purposive sampling in the studies with the quasi-experimental design. Regarding other studies, the experimental and control groups were randomly assigned from the existing classes as the experimental and control groups. Moreover, the number of students in the experimental and control groups is different from each other in all of the studies included in the research. This situation may have affected the research results. In-depth qualitative research results may also need to be considered to evaluate the use of creative drama in language skills and its effect on success from a wider perspective, but these cannot be included in meta-analysis studies.

Twelve of the examined studies were master's thesis, 11 were doctoral thesis and 14 were articles. Thesis studies are studies that spread over a more comprehensive process. It can be thought that the majority of thesis studies in the present study will affect the result. However, there is no significant difference based on the type of publication in which the study was reported in the moderator variable analysis. In addition, we can think that the quality of the studies conducted, albeit in different types, and the characteristics of the participants affect the results of the study.

Since the Turkish lesson was discussed within the scope of the research, the grade levels in which the research was conducted are the 3rd and 8th grades. The highest number of research was conducted at the 6th-grade level, the least at the 8th-grade level. Since the number of studies is not evenly distributed according to grade levels, this may affect the results of the study. However, there is no significant difference in the moderator variable analysis based on the grade level. In addition, the absence of stages such as preschool, high school and university may also affect the results.

The application times in the studies vary. Much as the application period is determined based on the subject of the study, it is likely that the results of the analysis based on the application period in meta-analysis studies will be affected by this situation. It is determined in the study that there is a linear relationship between the application time and the effect sizes. This means that the results differ significantly according to the application time.

It can be seen when the distribution for analyzes based on learning areas is examined that creative drama-based studies were found mostly in writing skills and

least in grammar. This may have affected the results based on learning domains in the moderator analysis section. As a matter of fact, there is a significant difference in the moderator variable analysis according to skill areas.

Since this study reviewed the effect on success in Turkish lesson skills, the results of the development of skills, learning processes and the effects of affective factors related to skills on success were not discussed. These variables may also change the results and interpretations regarding the effect of the method.

The results obtained from the study are generally valid for primary and secondary school students. The results of students with different achievement levels, learning difficulties in different fields, or gifted students in different fields were not included. Student characteristics may change the study results.

Implications

The following recommendations can be made based on the results of the research:

- Meta-analysis studies can be conducted to examine the effect of the creative drama method on Turkish learning areas at different education levels.
- There can be made analyses to see the effect of the creative drama method on affective/emotional skill areas related to Turkish lessons.
- Meta-analysis studies should be performed in which the effect of creative drama on Turkish learning areas is examined with different moderator variables.
- Mixed studies can also be made that support meta-analysis studies examining the effect of creative drama on Turkish learning areas with qualitative findings.

Statement of Responsibility

Fidan Geçici; data collection and analysis, writing method and findings section, reviewing. Nahide İrem Azizoğlu; writing abstract, introduction, conclusion parts, and reviewing.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Using Case-Based Science Scenarios to Analyze Preservice Teachers' Analytical Thinking Skills*

Vaka Temelli Fen Senaryoları Kullanılarak Öğretmen Adaylarının Analitik Düşünme Becerilerinin Analiz Edilmesi

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ABSTRACT: Any science teacher must first acquire analytical thinking skills in order to give their students the ability to think analytically. Therefore, the candidacy period is important for teachers to develop and transform this skill into professional knowledge. Based on this idea, the current research aims to determine the ability of third-grade preservice science teachers to use analytical thinking skills. An Analytical Thinking Test is used in the research conducted survey method. This test consists of twenty case-based science scenarios in total from four different learning fields. These scenarios are designed according to the analytical thinking skill dimensions of Marzano's Taxonomy. Preservice science teachers (*N*=158) from two public universities have participated in the study. It was determined that the majority of preservice science teachers weakly used their analytical thinking skills. It was revealed that preservice science teachers had difficulties respectively in classification - specification - error analysis - generalization – comparison according to Marzano's taxonomy from most to least while solving scenarios. It is recommended that the science educators develop the designs to improve the analytical thinking skills of the candidates in the courses they conduct on the basis of the results of the research. In addition, science educators should pay attention to development in the dimensions of classification and specification by considering the alternative conceptions of the preservice science teachers.

Keywords: The case-based science scenarios, thinking skills, analytical thinking, Marzano's taxonomy.

ÖZ: Bir fen bilgisi öğretmeninin öğrencilerine analitik düşünme becerisini kazandırabilmesi için ilk olarak kendilerinin bu beceriyi kazanmış olmaları gerekmektedir. Bu yüzden öğretmenlerin bu beceriyi kazanmaları ve mesleki bilgiye çevirmeleri için adaylık dönemi önemlidir. Bu fikirden yola çıkarak mevcut araştırma, üçüncü sınıf fen bilgisi öğretmen adaylarının analitik düşünme becerisini kullanabilme durumlarını tespit etmeyi amaçlanmaktadır. Alan taraması yöntemiyle yürütülen araştırmada analitik düşünme testi kullanılmıştır. Bu test, dört farklı öğrenme alanından toplam 20 vaka temelli fen senaryosundan oluşmaktadır. Bu senaryolar Marzano'nun Taksonomisinin analitik düşünme becerisi boyutlarına göre tasarlanmıştır. Araştırmaya iki devlet üniversitesinden fen bilimleri öğretmen adayları (*N*=158) katılmıştır. Fen bilimleri öğretmen adaylarının çoğunluğunun analitik düşünme becerisini zayıf düzeyde kullandıkları tespit edilmiştir. Fen bilgisi öğretmen adaylarının senaryoları çözerken Marzano'nun taksonomisine göre en çoktan aza doğru sırasıyla sınıflama – özelleştirme – hata analizi – genelleme - karşılaştırma boyutlarında zorlandıkları ortaya çıkmıştır. Araştırmanın sonucuna dayanarak fen bilgisi eğitimcilerine yürüttükleri derslerde adayların analitik düşünme becerilerini geliştirmeye yönelik tasarımlar geliştirmeleri önerilmektedir.

Anahtar kelimeler: Vaka temelli fen senaryoları, düşünme becerileri, analitik düşünme, Marzano'nun taksonomisi.

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The type of people that the societies need termly varies. Therefore, the definition of qualified people varies according to the period. Especially, since the second half of the 19th century, it has been understood that skill is more important than knowledge in business circles (Inkeles, 1969). It is a necessity to raise individuals who can adapt to various jobs of this age and have high-level thinking skills in this century, in which we are experiencing the Industry 4.0 revolution (Ichsan et al., 2021). All the qualities sought in the current era are defined in the skills of the 21st century. Therefore, it is known that all developed countries, including Europe and USA, have revised their curricula in order to enable their students to gain 21st century skills for qualified work and qualified earnings (Green, 1986). According to the research report, which reveals the necessity of 21st century skills carried out with the participation of many institutions in the USA, it is determined that good education increases productivity in the workplace by 15-20 percent on average, while it increases the earnings of individuals by about 77 percent (Stuart, 1999). In general, these skills include collaboration, communication, digital literacy, citizenship, problem-solving, critical-analytical thinking, creativity, and productivity (Voogt & Roblin, 2012).

Having analytical thinking skills, one of the 21st century skills, is among the general competencies individuals should have (Prawita et al., 2019). Since the individuals with this skill do not have difficulty in solving the problems they encounter both in their daily life and their business life (Eckman & Frey, 2005), it is necessary to develop the analytical thinking skills of individuals who will just start their profession (Ratnaningsih, 2013). There is an important relationship between students' analytical thinking skills and their academic success (Bozkurt, 2022); therefore, analytical thinking affects students' success in many areas (Hyerle, 2008; Sebetci & Aksu, 2014). For example, analytical thinking skills are directly proportional to the development of scientific process skills (Irwanto et al., 2017) and creative thinking skills (Lestari et al., 2018; Lubart et al., 2013).

Due to the importance of the individual in school life, daily and business life, analytical thinking skills are among the skills expected to be acquired by secondary school students in the Science Curriculum in Turkey since 2013 (Ministry of National Education [MoNE], 2018). However, according to research, it has been determined that the level of analytical thinking skills of students at many levels, from secondary school students (Bozkurt, 2022; Mete, 2021) to university students (Akkuş-Çakır & Senemoğlu, 2016), is medium or low. Teachers have the most significant role in acquiring analytical thinking skills for students (Ennis, 1985). The fact that teachers do not give enough importance to such thinking skills in their classrooms causes low students' skill levels (Tanujaya, 2016). Teachers need to develop instructional designs more compatible with problem-solving teaching methods to gain this skill (Chinedu & Olabiyi, 2015; Ramdıah et al., 2018) and use such long-term designs (Siribunnam & Tayraukham, 2009). However, it is a well-known fact that a teacher who wants to teach or gain any skill must first have these skills. It has been determined that preservice teachers (Kala & Kirman-Bilgin, 2020) and even teachers (Anılan & Gezer, 2020) do not have professional competencies to teach their students analytical thinking skills. Knowing how much teachers use this skill during candidacy before starting the profession is essential. This is because preservice teachers gain most of their professional knowledge and skills during their candidacy. A candidate who does not

gain analytical thinking skills during the candidacy period may have difficulty acquiring this skill in his/her students in his/her career. Therefore, researching the analytical thinking skills of preservice science teachers is important in contributing to the relevant literature and structuring preservice teacher education programs. To examine preservice teachers' analytical thinking skills in-depth, first, the characteristics of this thinking skill should be well known.

Theoretical Background

Analytical thinking is a high-level thinking skill (Ichsan et al., 2021; Toledo & Dubas, 2016) and is in critical interaction with other thinking skills. Analytical thinking is associated with other thinking skills such as synthetic, systematic, and creative thinking (Amer, 2005). It is seen that analytical thinking is mostly done within the framework of the concept of analysis in the literature. Amer (2005) defines analytical thinking as dismantling the situation, thinking of an idea in a distinctive way, analyzing data to solve problems, and remembering and using information. Dewey (2007), on the other hand, thinks that analytical thinking is to first examine the parts that make up the objects separately and then reason how the parts interact with each other in order to make the system work. According to Sternberg (2002, 2006), analytical thinking is a) to break down a problem into parts and make sense of these parts, b) to explain the operation of a system, the reasons why something happens, or the steps to solve a problem, c) to compare two or more situations, d) to evaluate and criticize the properties of something. Although the general features of analytical thinking are seen in the current definitions, it is of foremost importance to know the systematic cognitive processes (indicators) of analytical thinking so that teachers can recognize this skill and integrate it into instructional designs.

One of the sources of cognitive processes of analytical thinking is chronologically the analysis phase of Bloom Taxonomy. According to Bloom et al. (1956), analytical thinking takes place in three interrelated cognitive processes: item analysis, relationship analysis, and organizational principles analysis. Behn and Vaupel (1976) have stated that analytical thinking takes place in five stages. These stages are thinking, subdividing, simplifying, specifying, and rethinking. An individual who implements these five stages in the thinking process has acquired the ability to think analytically. Anderson et al. (2001), who have revised the Bloom Taxonomy, state that the individual differentiates important parts of a message, organizes the ways in which parts of this message are edited, and characterizes the underlying purpose of the message in the process of analytical thinking. Therefore, the authors say that analytical thinking occurs in three cognitive processes: differentiating, organizing, and attributing. Marzano mentions five cognitive processes for analytical thinking: comparison, classification, error analysis, generalization, and specification. (Marzano, 2001; Marzano & Kendall, 2007). It is accepted that individuals who can systematically perform these five processes in their working memory think analytically. Analysis means more than just the illumination of the structure, unlike other taxonomies in Marzano's Taxonomy. The individual can also think analytically and produce new information that he does not already have in this taxonomy (Marzano & Kendall, 2007). It is decided that the analysis phase is in problem-solving and is put hierarchically under the creation immediately in the taxonomy proposed by Ichsan et al. (2021).

Analytical thinking is one of the high-level thinking skills as seen in the thinking taxonomies. One of the courses in which analytical thinking skills can be acquired most easily is the science course (Tsalapatas, 2015). Since science is a course intertwined with life, students' analytical thinking skills can be developed very easily in order to solve the problems in this course. However, the teachers must first have analytical thinking skills for students to overcome both science and daily life problems.

When the studies are examined, it is seen that the student's analytical thinking skills are low despite the significant importance of analytical thinking in our business and daily life (Gunawardena & Wilson, 2021; Husain et al., 2012; Irwanto et al., 2017; Thaneerananon et al., 2016). Although determining the level of thinking skill is particularly important, determining which element of the thinking process has a problem is more important in terms of developing instructional designs to eliminate existing problems. As mentioned in the top paragraph, some scientific studies examine the sub-cognitive processes of analytical thinking. In this study, data collection tools were developed based on Marzano's analytical thinking categories because the analysis category in Marzano's Taxonomy includes elements from at least three levels in Bloom's Taxonomy, namely "analysis, synthesis and evaluation" (Marzano & Kendall, 2007). In this respect, it is thought that Marzano's analytical thinking categories are more suitable for solving complex daily life problems. There are limited studies in the literature analyzing analytical thinking based on Marzano's Taxonomy (Fakhrurrazi et al., 2019; Yulina et al., 2019), but it is seen that multiple-choice test is used in these researches. In multiple-choice tests, since the student marks one of the derived information, it allows us to reach limited information about the individual's thinking processes. Case-based science scenarios were used in this research. A limited number of studies have been found in the literature in which case-based scenarios are used to improve students' inquiry skills (Cresswell & Loughlin, 2017) or to measure only their analytical thinking skills (Akkuş-Çakır & Senemoğlu, 2016; Olça, 2015). Case-based science scenarios were preferred in this study both because the student produces the knowledge directly and because it eliminates the chance factor in multiple-choice questions. In addition, since these scenarios are remarkably similar to the cases that the individual may encounter in his/her daily or business life, it is thought that results that are more reliable will be obtained on whether he/she can solve a complex case by thinking analytically in real life. In this context, the aim of the study is to determine the proficiency of third grade preservice science teachers in analytical thinking skills first and then to analyze their analytical thinking. Accordingly, it will also be possible to determine which element is executive for preservice science teachers in analytical thinking or why they cannot think analytically.

Method

This research is carried out by survey method. Survey studies are a type of research carried out to determine the current situation. The ability of preservice science teachers to use analytical thinking skills is investigated in this study. The survey method prepares the necessary infrastructure for special case studies and provides the environment for the creation of the problem that will be investigated (Ruel et al., 2015). It is thought that the results of this research will form the basis of many studies that will be conducted.

Participants

The third year preservice science teachers (*N*=158) studying at two state universities in Turkey participated in this research. The reason for working with these participants is that the same teacher training program is implemented in all education faculties in our country. The preservice science teachers go through the same education process except for a few elective courses, even if they are in different universities. Related research is a product that emerges from an ongoing project. The researchers involved in this project work at two different universities. Therefore, the researchers preferred convenience and convenience sampling while determining the participants. Sixty-nine preservice teachers from one of these universities and eighty-nine preservice teachers from the other have participated in the research. Since the research aims not to compare the competencies of universities to provide preservice teachers with analytical thinking skills, the data obtained from the participants are not presented separately. It is decided to conduct the research with third-year preservice science teachers since they have taken all the field courses in the first three years in the Science Teacher Training Program at universities and have the necessary field knowledge to analyze a scenario. Participants have not taken any analytical thinking training courses before the research.

Data Collection Tools

The researchers of this study develop the Analytical Thinking Test (ATT) as part of the research to reveal the analytical thinking skills of preservice science teachers. Since the solution of the scenarios in ATT takes time and cannot be solved once in practice, it has been transformed into four worksheets. The scenarios in these worksheets are developed by considering the achievements in four different learning fields in the secondary school Science Curriculum (SC). Therefore, the scenarios are designed to cover four different learning fields (Living Beings and Life, Physical Events, Matter and Change, Earth and Universe) and Marzano's five analytical thinking skills (comparison, classification, error analysis, specification, and generalization). Each worksheet contains five scenarios, one of which is from Marzano's entire analytical thinking category. Therefore, preservice science teachers have solved twenty case-based analytical scenarios within the scope of this research. The features of the developed scenarios are shown in Table 1.

Table 1

The Distribution of ATT Questions according to Learning Fields and Dimensions of Analytical Thinking Skills

Learning Fields	The Dimensions of Analytical Thinking Skills				
	Comparison	Classification	Error Analysis	Specification	Generalization
Living beings and Life	6	8	7	9	10
Physical Events	12	11	15	13	14
Matter and Change	3	2	5	1	4
Earth and Universe	19	17	16	18	20

The developed case-based science scenario examples and considerations while developing these scenarios are shown in Table 2.

Table 2

The Developed Case-Based Science Scenario Examples and Considerations while Developing These Scenarios

<table>
<tr><th>The Examples of Case-Based Science Scenarios</th><th>Related learning outcomes in SC</th><th>Learning Domains</th><th>The Dimensions of Analytical Thinking Skills</th></tr>
<tr><td>Ufuk teacher makes his students work in groups. The groups studying the solar system model have noticed that the Earth follows an elliptical orbit as it goes around the Sun, and the Earth’s axis in this orbit is also oblique. One of the questions stuck in the minds of the students is, “What would happen if the Earth did not have axial tilt?” Answer the question considering the seasons.</td><td>It makes predictions about the formation of the seasons.</td><td>Earth and The Universe</td><td>Error analysis</td></tr>
<tr><td>The teacher draws the following table about recycling on the board, the students in this process;
<table><tr><td>Domestic Solid Waste</td><td>Energy saving (GJ/ton)</td></tr><tr><td>Aluminum</td><td>222</td></tr><tr><td>Plastics(recycling by burning)</td><td>32.6</td></tr><tr><td>Plastics</td><td>0</td></tr><tr><td>Steel</td><td>12.6</td></tr><tr><td>Paper and cardboard</td><td>7</td></tr><tr><td>Glass</td><td>6</td></tr></table>**Ali:** We should definitely obtain aluminum from waste materials. Thus, we protect our resources and make a huge energy saving.
Betül: I agree. But we should not recycle plastics or we can just burn them for energy...
According to these conversations, if there is no profit in the process of obtaining plastic from waste plastics, what is/are the benefit/s of recycling this material? Explain the reasons.</td><td>It questions recycling in terms of the effective use of resources. The contribution of recycling facilities to the economy is emphasized.</td><td>Matter and Change</td><td>Comparison</td></tr>
<tr><td>Mert’s family has orchards with many types of fruits. Mert said to his mother one day, “Mom, we have many kinds of fruit trees. Only our goats and we eat these fruits. My cat does not want to eat.” How do you explain the situation that Mert has identified? Explain the reasons.</td><td>It gives examples of producers, consumers, and decomposers in the food chain.</td><td>Living Beings and Life</td><td>Classification</td></tr>
</table>

The scenarios developed within the scope of Table 2 are designed by the researchers and are subjected to validity studies by two science educators. The revised questions are applied to twenty preservice science teachers within the feedback framework. The reliability studies are completed within the framework of the data obtained from the senior preservice science teachers, and the ATT is finalized. Since the ATT consisted of open-ended questions, the reliability coefficient was not calculated. However, the researchers of this study examined the answers given by the preservice science teachers and checked how many of the expected answers were given.

Data Collection Process

The data are applied at separate times. The questions with two learning fields are applied one day, the questions with other learning fields are applied the next day, and the data are collected. There is no time limitation for the preservice science teachers while they are solving scenarios in the worksheets. The preservice science teachers who gave the data collection tool the earliest completed the questions in 45 minutes. The preservice science teachers who gave the data collection tool the latest completed the questions in 61 minutes.

Data Analysis

The data obtained from the ATT is analyzed on the basis of the criteria in Table 3 obtained by adapting the classification used by Marek (1986).

Table 3

The Analysis of the Data That Is Obtained from the ATT

Categories	Contents	Score
Complete Analytical Thinking	The answer that includes scientifically correct analytical thinking in particle size: To be able to detect the data related to the given problem, to divide the data into elements, to be able to process and solve the problem by using the dimensions of the ability to think analytically about the elements	3
Partial Analytical Thinking	The answer that indicates some of the ways you can think analytically at a macroscopic level or think correctly	2
Analytical Thinking with Alternative Concepts	Analytical thinking with alternative concepts that are not consistent with scientific knowledge	1
Inability to Think Analytically	The answers like “I don’t know” and meaningless answer	0
No answer	No respond	0

The categories are scored in Table 3 to calculate the participants’ average scores according to the dimensions of the participants’ analytical thinking skills and learning fields and to interpret more deeply how much the candidates can use their analytical thinking skills. When the data obtained from the ATT are scored within the scope of Table 3, a candidate receives a maximum of “60” points and a minimum of “0” point from the aforementioned test. According to the answers given by the preservice science

teachers to the ATT, it is based on the evaluation style proposed by Kala (2019) to interpret how much they use this skill in general. This form of evaluation is shown in Table 4.

Table 4

The classification that is used in the analysis of data that will be obtained from ATT

Score Interval	Analytical Thinking Level	Code
0 - 19	Analytical thinking skills are at a level that needs to be improved.	A
20 - 39	Analytical thinking skills are weakly acceptable.	B
40 - 51	Analytical thinking skills are moderately acceptable.	C
52 - 60	Analytical thinking skills are well acceptable.	D

According to Kala (2019), an individual's analytical thinking level is in the A (analytical thinking skills are at a level that needs to be improved) code between 0-0.99 points, B (analytical thinking skills are weakly acceptable) between 1-1.99 points, C (analytical thinking skills are moderately acceptable) between 2-2.59 points, and D (analytical thinking skills are well acceptable) between 2.6-3 points out of 1 question. ATT has twenty scenarios. When the coefficients proposed by Kala (2019) are multiplied by twenty, the score intervals in Table 4 and the analytical thinking levels that correspond to these score intervals appear.

Ethical Procedures

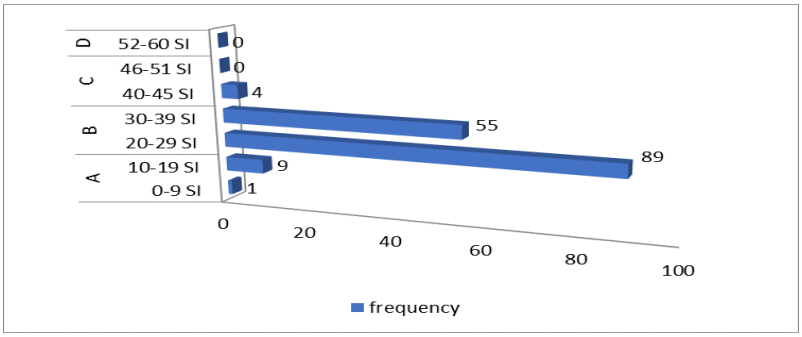
Ethical approval and written permission were obtained from Kafkas University Social and Human Sciences Ethics Committee with the decision dated 06.09.2017 and numbered 05/01. The research was carried out following ethical rules at every stage. Participation of the candidates in the research took place on a voluntary basis.

Results

The findings obtained from the ATT used to reveal the preservice science teachers' use of analytical thinking skills are demonstrated in Figure 1.

Figure 1

The Findings of Preservice Science Teachers' Use of Analytical Thinking Skills

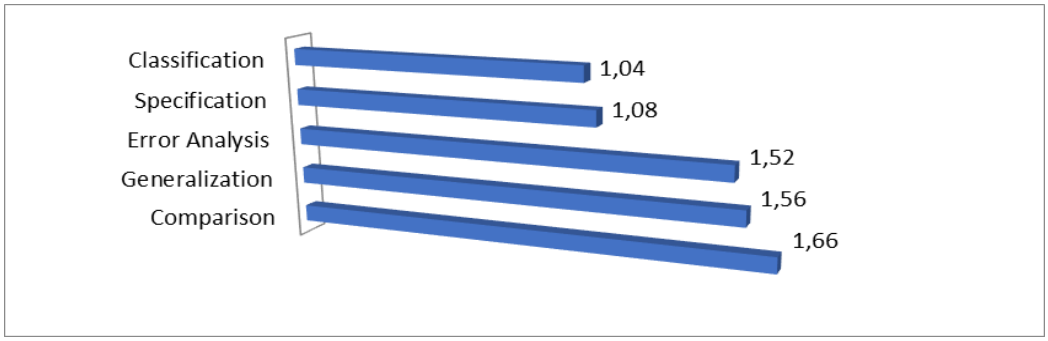


A: Analytical thinking skills are at a level that needs to be improved. B: Analytical thinking skills are weakly acceptable. C: Analytical thinking skills are moderately acceptable. D: Analytical thinking skills are well acceptable. SI: Score Interval

When Figure 1 is examined, it is noteworthy that the ability of ten preservice science teachers to use the relevant skill within the scope of the ATT is at a level that needs to be improved. It is seen that there are 144 preservice science teachers who can use analytical thinking skills at a poorly acceptable level and four who can use them at a moderately acceptable level. It is noteworthy that there is no preservice science teacher who can use it at a well acceptable level. The general test averages of the candidates according to the dimensions of analytical thinking are as in Figure 2.

Figure 2

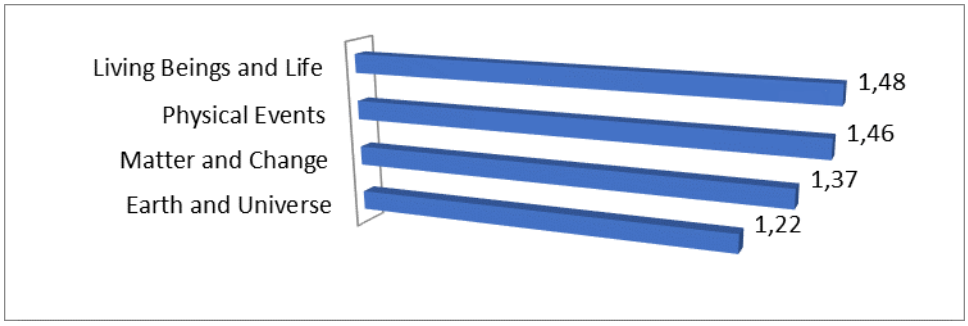
The Findings of General Test Averages According to the Dimensions of Analytical Thinking



When Figure 2 is examined, it is seen that the test average (1.66) obtained from the questions belonging to the comparison dimension of the ATT of all preservice science teachers participating in the research is higher than the other dimensions. It is noteworthy that the test averages obtained from the classification (1.04) and specification (1.08) dimensions are lower than the other dimensions. The overall test averages obtained according to the learning fields of the candidates are shown in Figure 3.

Figure 3

The Findings of General Test Averages According to Learning Fields



When Figure 3 is examined, it is seen that the ATT of preservice science teachers is lower than the test average (1.22) obtained from the Earth and Universe learning field compared to other dimensions. It is noted that the test average (1.48) obtained from the Living Beings and Life learning field is higher than other dimensions. The alternative concepts that emerged within the framework of the ATT of preservice science teachers are stated in Table 5.

Table 5

The Findings of Alternative Concepts Obtained from the ATT

Question No	Alternative Concepts	*f*
1	Since the density of the water is high, the upper surface is frozen, since the density of the olive oil is low, it freezes from the bottom.	33
	The water is frozen because it is pure.	2
	Dense substances are more difficultly frozen.	2
	The surface of the water is frozen because of the specific heat difference.	1
4	The water droplets in the laundry freeze and separate from the laundry, so the laundry dries.	9
8	Cats cannot eat fruit.	1
	Cats do not need vitamins in fruit.	1
9	Horses may have died of exhaustion because they have too much muscle.	4
	The horses may have died because of carbon dioxide in their bodies.	3
	Horses die of exhaustion because they do not convert lactic acid into glucose.	1
10	The deep cut may have devastated the veins.	4
	In the first case, it reduces pain as the blood clots.	1
12	The distance the laser beam takes in the space is too high.	2
	The laser beam is at the speed of light, the lantern light is slower.	1
16	If there were no axial tilt, the seasons would be reversed.	1

When Table 5 is examined, it is seen that preservice science teachers mostly have alternative concepts in the fields of matter and change, living beings, and life learning. It is noted that more alternative concepts have been identified in the field of matter and change learning field than other questions within the scope of question 1 on the specification dimension.

Discussion and Conclusion

The way that secondary school students can use or acquire analytical thinking skills in science lessons is related to how much science teachers include activities that will enable students to think analytically in their learning environments (Ichsan et al., 2021; Tanujaya, 2016). A science teacher is expected to have analytical thinking skills in order to design such learning environments (Ennis, 1985). They need to gain this skill in the process of preservice training, which they must combine with teaching professional knowledge and skills and improve themselves with supportive training while performing their professions. Based on this idea, the current research aims to reveal the situations in which preservice science teachers use analytical thinking skills. The data obtained from the ATT used within the research scope shows that most preservice science teachers can weakly use their analytical thinking skills (Figure 1). This may be because preservice science teachers have not been trained to develop these skills in their learning life until the research. This is because analytical thinking skills have been added to our country's curriculum only to be developed at the secondary school level since 2013. It is thought that since the students do not receive an education

aimed at gaining analytical thinking skills, it causes them to have problems while interpreting a non-routine problem or a socioscientific situation. It has been determined that the students have more difficulty solving conceptual problems based on interpretation than operational problems in many studies conducted in our country (Bekdemir et al., 2010; Kaya & Keşan, 2012). Preservice science teachers could not both think analytically and had difficulties interpreting conceptual questions. As a result of this situation, their test averages were low. To sum up, the preservice science teachers participating in the research have not gone through a training process focused on improving their analytical thinking skills. The fact that they have not taken a vocational course for this skill during the candidacy process can also be seen as one of the reasons for the results of this research. However, higher education institutions are required to produce graduates with analytical thinking skills (Kwok, 2018).

Another research result obtained from the ATT is that the test averages of preservice science teachers are low according to the dimensions of analytical thinking skills. It is revealed that the preservice science teachers have more difficulty in classifying and specifying the data compared to other dimensions within the framework of the dimensions of analytical thinking skills. It is seen that they have less difficulty in making comparisons compared to other dimensions. Yulina et al. (2019) find that they are able to think analytically at a low level in their study with fifteen preservice chemistry teachers. Yulina et al. (2019) find that the candidates have already been struggling in the dimensions of error analysis, generalization, specification, comparison, and classification from most to least in terms of the dimensions of analytical thinking skills. Fakhrurrazi et al. (2019) state that they have difficulties matching, generalizing, classifying, analyzing errors, and specifying categories in biology subjects from most to least in their study. Preservice science teachers have difficulties respectively in classification, specification, error analysis, generalization, and comparison from most to least in the current study. As can be seen, the results of these three studies are quite different from each other. This may be due to the differences in the contents of the questions used in the three studies. This study revealed that preservice science teachers have more difficulties in solving problems related to the learning fields of Earth and Universe, Matter, and Change by using analytical thinking skills in the current study and they have less difficulty in solving problems related to physical events, living beings, and life learning fields by using their analytical thinking skills compared to other dimensions. The reason for this situation is that it is necessary to have conceptual learning in the field of knowledge learning to gain analytical thinking skills (Hyerle, 2008).

It was determined that preservice science teachers had the greatest number of alternative concepts in the field of Matter and Change and the least in the field of Earth and the Universe within the scope of ATT. The emerging alternative concepts were seen as density, dietary patterns, fermentation, digestive system, nervous system, light, and Earth. However, the subject in which the preservice science teachers had the greatest number of alternative concepts is density. The reason for the emergence of alternative concepts within the scope of the concept of density may be due to the insufficient conceptual knowledge of the candidates about the particulate structure of matter (Barker & Millar, 1999; Kirman-Bilgin & Yiğit, 2017). From a general perspective, both the high level of misconceptions and low understanding of Matter and Change, and Earth

and Universe areas can be explained by the fact that preservice science teachers have received less education in these areas until now. For example, when the number of achievements in the four areas of the Science Curriculum is listed, there is a ranking similar to Figure 3 (MoNE, 2018). It can be said that the courses related to Matter and Change, and Earth and Universe in high school and Science Teacher Training programs in our country are fewer than the courses in the other two fields. Furthermore, considering that the overall test averages of the problems related to these two fields are low (Figure 3), it can be said that the lack of conceptual knowledge of preservice science teachers negatively affects analytical thinking processes. This is because it is necessary to have theoretical knowledge about that case as well as analytical thinking skills in order to be able to analyze a science-based scenario or case. Bozkurt (2022) determined that content knowledge has a profound effect on the solution of a science-based scenario.

When the findings obtained from the research are evaluated in general, the following main conclusions are reached. It is found that the majority of preservice science teachers use analytical thinking skills at a poorly acceptable level, and the candidates have difficulties respectively in classification - specification - error analysis - generalization – comparison from most to least while solving problems. This research is found that preservice science teachers have difficulties in learning fields, respectively the Earth and Universe - matter and change - physical events - living beings and life from most to least while solving problems. Finally, it was determined that the preservice science teachers had alternative conceptions for each learning area, but mostly about density.

Implications

This research revealed the status of preservice science teachers' analytical thinking skills according to their learning areas. The result of the research provides the opportunity for science educators to design their learning environments according to the needs of the preservice science teachers. It can be suggested to science educators to conduct the critical and analytical thinking course, which is among the vocational elective courses in the undergraduate course content of science teaching on the basis of the results of the relevant research. Moreover, science educators may be advised to use this skill by comparing them with case-based science scenarios based on problem-solving in their courses. The learning environment to improve the analytical thinking skills of preservice science teachers can be designed using the current research results, and its effectiveness can be investigated. Science educators should pay attention to development in the dimensions of classification and specification by considering the alternative conceptions of the preservice science teachers. In addition, science educators should strive to develop more analytical thinking skills in the learning areas of matter and change and the Earth and Universe.

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Statement of Responsibility

Arzu Kirman-Bilgin and Nesli Kala contributed equally to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

Conflicts of Interest

The authors declare that there is no conflict of interest.

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How Real is Augmented Reality in Pre-school? An Examination of Young Children's AR Experiences*

Artırılmış Gerçeklik Okul Öncesinde Ne Kadar Gerçek? Çocukların AG Deneyimlerinin İncelenmesi

Hacer BÜLBÜL** **Fatih ÖZDİNÇ*****

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ABSTRACT: The research aims to examine augmented reality (AR) technology during the pre-school years. For this purpose, we created activities with AR cards and compared them to activities with other materials. We designed the study as a case study, a qualitative research model. We used the convenience sampling method to select the study group and the criterion sampling method from the selection methods. The study group consists of eighteen children, ten boys, and eight girls attending kindergarten. Children are between 54 and 77 months. We gathered data through semi-structured interviews, observation, and audio and video recordings. We used the content analysis method to analyze the data, creating codes and themes. Findings show that using AR technology in the pre-school period attracts children's attention, gives them a sense of reality, embodies the content, supports peer relationships positively, and allows children to participate in activities willingly and focus on the activity. Furthermore, we have seen that AR technology can be a distraction. When comparing AR technology to other materials, we discovered that children prefer materials that directly connect to real life. They prefer materials that contain AR to materials that do not. We presented recommendations for the use of AR in the pre-school period and future research.

Keywords: Pre-school, technology in pre-school, augmented reality, augmented reality in pre-school.

ÖZ: Bu çalışmanın amacı, artırılmış gerçeklik teknolojisinin okul öncesi dönemde kullanımını incelemektir. Bu amaçla artırılmış gerçeklik kartları kullanılarak etkinlikler geliştirdik ve bu etkinlikleri diğer materyal kullandığımız etkinliklerle kıyasladık. Çalışmayı, nitel bir araştırma modeli olan durum çalışması şeklinde desenledik. Çalışma grubunu uygun örnekleme yöntemiyle seçtik, seçim yöntemlerinden ise ölçüt örnekleme yöntemini kullandık. Çalışma grubunu anaokuluna devam eden onu erkek sekizi kız olmak üzere toplam18 çocuk oluşturmaktadır. Çocuklar 54-77 ay aralığındadır. Uygulama süreci dört hafta sürmüştür. Verileri, yarı yapılandırılmış görüşme, gözlem, ses ve video kayıtları yardımıyla topladık. Verileri, kod ve temalar oluşturularak içerik analizi yöntemi ile analiz ettik. Çalışmanın sonuçları, artırılmış gerçeklik teknolojisinin okul öncesi dönemde kullanılmasının çocukların ilgisini çektiği, çocuklara gerçeklik hissi yaşattığı, içeriği somutlaştırdığı, akran ilişkilerini olumlu yönde desteklediği, çocukların etkinliklere istekli katılmalarını ve etkinliğe odaklanmalarını sağladığını göstermektedir. Bunun yanında artırılmış gerçeklik teknolojisinin, bazen dikkat dağıtan bir araç olabildiğini gördük. Ayrıca, artırılmış gerçeklik teknolojisini diğer materyallerle kıyaslandığımızda, çocukların doğrudan gerçek yaşamla bağlantısı bulunan materyalleri tercih ettiğini, gerçek yaşamla doğrudan bağlantısı bulunmayan materyallerde ise artırılmış gerçeklik teknolojisi içeren materyalleri tercih ettiğini gördük. Çalışmanın sonunda artırılmış gerçeklik teknolojisinin okul öncesi dönemde kullanımına ve gelecek çalışmalara yönelik öneriler sunduk.

Anahtar kelimeler: Okul öncesi, okul öncesinde teknoloji, artırılmış gerçeklik, okul öncesi artırılmış gerçeklik.

* This study is based on Hacer (Kuzgun) Bülbül's master dissertation titled "*Utilization of augmented reality in early childhood: A case study*".

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Content-rich pre-school education necessitates a solid and systematic structuring process and supports children's developmental areas (Sayan, 2016). In this case, it is critical to use rich content materials that support children's developmental areas during the pre-school education period while being appropriate for their developmental levels. Technology that appeals to multiple senses is also content-rich material in learning (Kol, 2012). By giving more space to technological materials that are appropriate for pre-school education environments and can attract children's attention, a content-rich learning environment can be offered to children in every aspect. Because technology has become an integral part of our lives, it is necessary to provide learning environments that include situations and tools relevant to their interests, given that the interests of new generation children differ. In response to this need, we believe AR technology will help pre-school children learn in an environment tailored to their interests by providing various experiences.

Although AR is not a recent technology, it has been used in education since the 2000s. Its use in education has increased and become popular and is widely used in many other sectors. According to Parhizkar et al. (2011), children nowadays find traditional learning methods dull and boring due to the widespread use of digital media and communication technologies. When traditional materials alone are insufficient, it is unavoidable to use technological materials to make the lesson more effective. AR technology, which is used as one of the technological materials in education, benefits students in several ways and provides significant gains (Bacca et al., 2014; Özsevgeç & Eroğlu, 2017; Radu, 2014). AR technologies can be used in both the classroom and outdoor learning at all levels of education.

AR technologies, developed for educational environments, use multimedia materials such as 2D or 3D animation, 3D objects, pictures, sound, and video, depending on the educational goal (Wei et al., 2015). It is well known that such technologies aid in the concretization of content and the understanding of complex subjects by visualizing structures that are not present in the real world but must be visualized in 3D (Wu et al., 2013). The fact that the contents are embodied by AR technology is seen as a benefit. According to the literature, AR technologies are widely used in educational settings (Abdüsselam & Karal, 2012; Fonseca et al., 2014). Interaction is ensured when 3D content is materialized and viewed from various angles, and it increases students' interest and motivation while also improving their spatial abilities (Cheng & Tsai, 2012; Hsiao & Rashvand, 2011; Kerawalla et al., 2006). At the same time, AR technology provides instant feedback thanks to the real-time interaction it contains, allowing students to control their learning processes (Bujak et al., 2013; Yuen et al., 2011). With these aspects, AR technology used in education can make learning enjoyable by enabling students to learn the subjects desired to be learned more easily. Yuen et al. (2011) emphasized the importance of AR technology, stating that it could help gain different perspectives on subjects, enable collaborative work, and realize the student's own learning pace. The following factors must be considered in order for AR technology to be used in education most effectively and beneficially: it must be compatible with the curriculum, the process must be balanced, and appropriate interactions must be created (Hsiao et al., 2010).

The literature discusses the benefits of AR technology for children. As a result of this situation, numerous AR applications have been released. The majority of AR

products on the market suffer from either a lack of theoretical support or a lack of ability to depict entertaining learning interactions (Yang & Wang, 2017). Besides, the relationship between developmental changes and AR designs for young children is important (Radu & MacIntyre, 2012), and teachers' and parents' decisions over which augmented reality applications to use are crucial. As a result, it is critical to examine children's learning processes using AR technology and identify opportunities and threats.

This study aims to examine children's reactions to AR technology, how AR technology affects the efficiency of activities, the effect of AR technologies on peer relations, in short, the use of AR technology in the pre-school period. Simultaneously, we investigated children's material preferences in AR activities and the problems that may arise when using AR technology. For these purposes, we sought answers to the following research questions:

1. How do children react to AR technology?
2. How are the peer relationships of children in activities using AR technology?
3. What are the material preferences of the children in the activities?
4. What kinds of problems do children have when they use augmented reality technology?

Literature Review

According to studies on developing materials supported by AR technology and the achievements brought by AR technology, AR technologies provide high motivation and a collaborative learning environment among children, bringing interaction while also assisting children in learning simple concepts (Haughland, 2000; Parette et al., 2000). Campos et al. (2011) concluded that play with AR technology effectively maintains high motivation and cooperative learning among children, particularly when feedback is used. It can also help children teach simple concepts. According to Chen et al. (2007), the AR learning material demonstrated to kindergarten children a new way of assisting them with Chinese pronunciation and memorization while motivating and attracting their attention. Yılmaz (2016) found that children prefer educational magic toys that include puzzles and flashcards to teach fruit, vegetables, occupations, color, animal, vehicle, number, and shapes using AR in his study for pre-school children.

Gecu-Parmaksiz and Delialioğlu (2020) examined the effect of AR technology, which was developed to teach geometric shapes to improve the spatial skills of pre-school children. The study results revealed that there is a significant difference in favor of the experimental group in the spatial ability test scores of pre-school children. In another study, Çevik et al. (2017) stated that the use of AR technology increases the desire to learn and the level of success in their study, in which they examined the effect of AR technology applications on the success of pre-school children in learning English words. Cascales, Pérez-López, and Contero, (2013) found that AR-supported content provides motivation and encouragement for children and can be used as a valuable tool in the learning-teaching process for children aged 4-5. Simultaneously, it is claimed that AR technology activities become more enjoyable for both pre-school children and their teachers and positively impact both teachers and children. According to Safar et al. (2017), the use of AR in the pre-school period has a positive effect on students'

academic achievement and motivation. However, in the long-term use of AR technology, students become bored and feel uncomfortable with the technological tools' weight.

Related research indicates that AR technologies used in the pre-school period effectively maintain high motivation and collaborative learning processes, attract attention and active participation among children, and increase the desire to learn and the level of success when feedback is used. The number of studies on the use of AR technology in the pre-school period is quite limited (Çevik et al., 2017; Koç, 2021). This may be related to the belief that technology used in the pre-school period will harm children, as it can become a problem when planned and applied without considering children's developmental levels and needs. The study is significant because it combines the pre-school period and technology, and there are few studies in the pre-school period that use AR technology (Aydoğdu, 2022; Cascales, Laguna, Pérez-López, Perona, & Contero, 2013; Gecu-Parmaksiz & Delialioğlu, 2020; Yilmaz et al., 2017).

Method

Research Design

We designed the study as a case study to investigate the use of augmented reality technology during the pre-school period using a qualitative research model. A case study is an empirical research method used when (1) the current issue is studied in its real-life context, (2) the lines between fact and content are blurred, and (3) more than one source of evidence or data is available (Yin, 2009). We designed this study as a case study because augmented reality studies are new in the pre-school period and data were collected with observation interview techniques. We used the holistic multiple-case design in the study, one of case study designs. The research consists of three different cases in three weeks.

Participants

We combined the purposive sampling methods, convenience and criterion sampling methods, to identify the participants of this study. We determined a public kindergarten in Afyonkarahisar, a city in western Turkey in line with the criteria of the school to be implemented, the socio-economic status of the families being at a moderate level, having a separate class where the participants can practice outside their classrooms, and having internet access.

The study group consists of eighteen kindergarten students ranging in age from 59 to 72 months who attend an independent kindergarten. The distribution of the participants by gender and age is shown in Table 1.

Table 1

Distribution of Children by Month and Gender

Gender – Age (month)	59-65	66-72	*N*	%
Girls	2	6	8	44
Boys	3	7	10	56
Total	5	13	18	100

The participants consist of eight girls (44%) and ten boys (56%). Five of the children are between the ages of 59 and 65 months, and thirteen are between the ages of 66 and 72 months. In the study, children were coded as C1, C2 ... C18.

Instruments

Diversity in data collection methods is an important aspect used to ensure validity and reliability in qualitative studies (Patton, 1990). For this purpose, the researcher and co-observer audio-recorded and analyzed the children's opinions about AR technology. The implementation process was video recorded. The researcher and co-observer kept observation notes during the application. Two pre-school teachers were involved in the implementation process in terms of the validity and reliability of the data collection process. One of them acted as a co-observer and the other as an assistant teacher during the process.

We created the semi-structured interview form. The interview form consists of nine questions. Following the preparation of the interview questions, we asked for feedback of two pre-school education experts to determine the content's suitability and intelligibility by children. In accordance with the suggestions, we completed the interview form. The following are two of the interview questions:

> "Did you enjoy the activity with the photograph occupation cards or the activity with the animated occupation cards?"
>
> "Would you prefer to do this activity with animated cards or non-animated cards if we did it again?"

We recorded the interview and took notes from time to time during the interview. One of us was in the research environment, observed and took notes on the participants' behavior.

We gathered information about the children and the activity process during the preliminary interviews. With the recommendation of an expert in pre-school education, we conducted separate interviews with the children the day after the implementation, which was held every week. Children were interviewed one at a time to ensure that the responses of the children involved in the implementation process during the interview were not influenced by one another.

Throughout the implementation, we observed children's behaviors, reactions, and thoughts toward activities and AR technology and how AR technology influences their peer relationships. As participant-observers, we took part in the implementation process. Children's reactions to the materials used in the activities, their reactions to AR technology, peer relationships and the types of behaviors they exhibit, and so on. We and the co-observer each observed and recorded the situations separately. The children's reactions to the activities, the materials used in the activities, their reactions to AR technology, peer relationships, and the kinds of behaviors they exhibit were all observed. We spent much time with the participants in their daily lives to better understand their behaviors, values, and social relationships in the social context because we were involved in the implementation process for a long time.

Implementation Environment and Materials

Physical Environment

The physical environment and layout of the implementation were created so that the students could sit at the tables in groups and gather around the table according to the content of the activities. The physical environment in which the children participated in the activities by participating in the implementation is given in Figure 1.

Figure 1

The Physical Environment Used in the Implementation Process

When deciding where the implementation would be developed, we looked for an environment where children were constantly engaged in their activities. We conducted the implementation in the children's natural environment in order for the study's data to reflect reality more closely and for the children to feel more at ease in the environment where the application will be made without being affected by the physical environment.

The AR Cards

To begin, we have compiled a list of AR applications that can be used inside the research aim. In terms of answering the research questions and being integrated with the activities, the applications we listed were reviewed by a total of two experts, one in the field of pre-school and one in the field of technology.

As a result of the evaluation, the "3D Magic Educational Cards" application contains objects in three different categories in terms of content. Besides, the "Octaland 4D+" application was chosen to be used because it is different from digital learning environments and, at the same time, is related to daily life. Figure 2 shows a 3D Magic educational card displayed in 3D.

Figure 2

3D Magic Educational Card 3D View

We used this set in the animals and fruits activity of the training given with AR support. When the camera detects the card, animals or fruits can be displayed in 3D and the displayed objects move when the user touches the screen.

We used the Octaland AR card set in the occupations activity. Octaland 4D+ is made up of characters who represent various occupations. Twelve occupation cards were chosen based on the judgments of two experts to be used in the activity. Figure 3 shows the cards relating to the various occupations.

Figure 3

3D Representation of Octaland 4D+ Cards

When the camera detects the cards, the characters specific to the professions are displayed in 3D, and the characters move when the screen is touched. As seen in Figure 3, more than one card can be played at the same time.

Other Materials

Animal toys are another material we use in the implementation process. Two experts' opinions were used to determine the toys used in the implementation, which took into account the activity's content. At the same time, other materials used in animal-related activities are platforms that resemble animal living spaces. Forest, sea, glacial, and glacial sea are among these habitats.

We used twelve cards with real-life photographs of occupations for the occupation-related activity, which is the last step in the application process. We sized the photos to fit other cards with AR technology used in the event and pasted them on the background cardboard.

Role of the Researcher

As a participant observer, the researcher took part in the procedure. The researcher guided the children's AR activities while also observing them. Because the researcher was not a natural member of the group previously, the researcher's role is observer as participant (Ahola & Lucas, 1981).

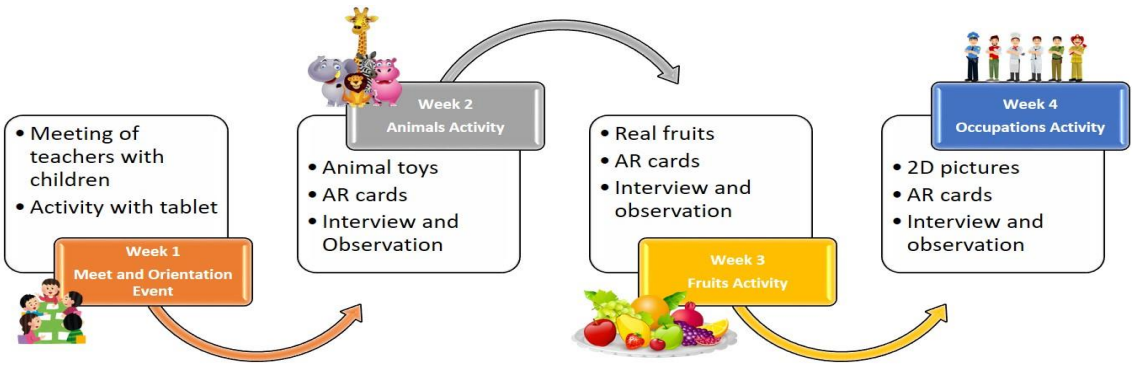
Teachers who participated as observers and the researcher both had appropriate expertise in technology use. They have previously used augmented reality (AR) and other technology-supported learning activities at the pre-school level. They also used the AR cards and tablets that had previously been used in this research.

Procedure

The procedure took four weeks. The contents of the activities in the implementation process according to the weeks are given in Figure 4.

Figure 4

Activity Contents by Week



The activities were first carried out without using AR cards, then animated using AR cards. Only during animated events are tablets distributed. Every week before the procedure, physical materials and digital learning environments were prepared in the kindergarten. Each week, the activity lasted for two hours. The children all took part in the first meeting. The second week's activities included fourteen children, the third week's activities included twelve children, and the fourth week's activities included eleven children.

First Week – First Meeting and Orientation

In the first week of the study, we held a meet and orientation activity to help the children get used to the researcher and teacher. They will perform the application to ensure reliability in the data collection process. Children were taken to the practice room in small groups and played with tablets in this activity.

Second Week - Animals Activity

This activity is aimed to examine whether 3D toys or visuals that become 3D in the virtual environment with the AR application attract more attention, which material the children prefer in such a situation, and whether the children are interested in the relevant AR material in the animal activity. We asked the students to place two different materials containing animal content in relevant habitats in the activity. Figure 5 depicts an animal-related activity performed without and using AR technology.

Figure 5

Animals Activity

Children with animal toys are seated around a table. Each child was asked to select two animals. Following the selection of the animals, the children are asked questions such as “Where do these animals live?” and “What do you know about these animals?” interacting with children through questioning.

After collecting the animals left in the living areas, the children were seated around the table again. We gave the children the AR cards with the backs visible and asked them to choose two cards from them. “How do the animals on the card you are holding sound?” inquire the children. We asked them to guess the animal sounds and make the corresponding sound. We asked the children to place their animal cards in appropriate animal habitats. Then, we animated the AR animal cards using the tablet and showed them to the kids. We gave each child a tablet and asked them to draw the animals they had placed in their space.

Third Week - Fruits Activity

We divided the children into small groups and had them sit around a table. The assistant teacher asked the children to guess the answers to the riddles by asking them fruit-related riddles and providing hints as needed. The children did positioning exercises with commands such as “under”, “above”, “between”, and fruits.

The visual of the activity related to the fruit, which was conducted with and without the use of AR cards, is given in Figure 6.

Figure 6

Fruits Activity

The children were asked to follow the instructions given with the AR cards in their hands by giving the same instructions in the activity content of real fruits. At each instructional stage, the teacher animated the AR fruit cards using a tablet and showed them to the students in the same manner. “Where is the fruit on the plate right now?” asks the process. By asking the question, she was able to discuss location concepts with the children.

Fourth Week – Occupations Activity

The teacher placed the occupation cards with real photos prepared for the activity on the table and discussed with the children which images on the cards represented occupations. She then instructed each child to select four occupation cards. She talked by asking questions like, “What do people with this occupation do?” “Where do they work?” “What tools do they use while doing their occupation?” and “Have you ever seen someone who does this profession in real life?”

The event was also conducted using AR cards. The teacher animated the profession cards created with AR technology and showed them to the children, and the children played the profession cards on the tablet in the same way. Children were allowed to interact with the visual, which became 3D, and working environments were allowed to be seen even in the virtual environment, and “Have you ever been to a place where anyone working in this profession?” Children were given the opportunity to connect with their daily lives by asking such questions. The visual of the activity related to the occupations performed with and without the use of AR cards is given in Figure 7.

Figure 7

Occupations Activity

The event was also conducted using AR cards. The teacher animated the profession cards created with AR technology and showed them to the children, and the children played the occupation cards on the tablet in the same way. We allowed children to interact with the visual, which became 3D, and to see their work environment even in a virtual environment. The teacher questioned the children about their portrayed occupations, asking, "Have you been to a place where anyone is working in this occupation?" and "Did you see someone doing this occupation?"

Data Analysis

We used the thematic and content analysis methods to analyze the data. We began by transcribing the audio-recorded data from the interviews. Then, we converted the data into code and themes. Another expert examined 10% of the themes and sub-themes we chose randomly. The expert and we discussed the points of contention about the themes and sub-themes and made the necessary arrangements.

We determined that there was 85% agreement using the reliability formula proposed by Miles and Huberman (1994) for calculating the reliability of the codings. The fact that the reliability calculations were greater than 70% indicated that the research was trustworthy. We compared the video recordings to the observation notes before analyzing and interpreting the data. We obtained the study's findings by organizing and interpreting the data, which was analyzed in accordance with the thematic framework.

Ethical Procedures

This study, in which we collected data from young children, was approved by an ethical committee. In its meeting dated 27.10.2017 and numbered 06, the Afyon Kocatepe University Science and Engineering Scientific Research Publication Ethics Committee found no ethical objections to the conduct of this study.

Results

Children's Reactions to AR Technology

Table 2 shows the themes and sub-themes that emerged from observations and interviews about how children react to AR technology used in pre-school.

Table 2

Children's Reactions to AR Technology

Theme	Sub-Themes
Reactions to AR technology	Surprised
	Sound effect
	Entertainment
	Willingness to possess
	Loss of effect of AR technology over time
	Animation effect
	Sense of reality
	Generalizing the animation

The data presented in Table 2, children's reactions to AR technology, "surprise," "sound effect," "interaction", "entertainment, desire to possess", "loss of effect of AR technology over time", "animation effect", "sense of reality", and "generalization of animation" shows that they are grouped under the sub-themes.

We observed that the children were surprised by the reanimated character and wanted more cards to portray them out of curiosity. To the animated characters, C1 said, "Oh, the nurse came out on this one." and C15 said, "Oh, the builder is out."

It is interesting to see how children react to the sounds in the applications. While some of the children felt the need for a sound, others did not like it, and some repeated it. In the event of the occupation, C11 made the sound of water by saying "puff" while portraying the firefighter, C3 made a scissors sound like "ktktktkt" on the hairdresser card, and C1 made a siren sound while portraying the police character.

When most children see the tablet later in the activity, they say, "Give it to me, give it to me, start with me first." Some of them refused to let go of the tablet, patiently waiting impatiently for it to come to them. Some of the kids wanted to take the AR cards home with them. This situation revealed a sub-theme of the desire to own AR-enabled materials.

We observed that the AR technology used in the activities initially drew children's attention and captivated their interest in AR technology. In the latter stages of some activities, we observed that some children exhibit behaviors such as putting the tablet aside from time to time, claiming boredom, and experiencing distraction. We noticed that AR technology could not maintain its effect at the start of the event over time and eventually lost its effect during the event.

C3 sat on the sidelines of the animals activity after leaving the tablet in his hand for a while. C3 refused the instructions by putting the tablet aside after a while in the fruit-related activity.

The children perceived the 3D images created on AR cards as accurate. "Let me catch you," he said, running his hand over the card as a seventeen participant in the Professions event. C3 participant expressed an opinion, saying, "It feels real." Similarly, while performing the animation process, participants C1, C3, C5, C6, and C10 in the activities took the tablet aside and looked at the AR cards to see if there was anything there. Throughout the AR activities, the children were continuously conversing and interacting.

When the three-week activity ended, it was clear that the children attempted to animate each object by generalizing the animation work. C8 held the tablet up to the light during the Fruits event and said, "I will make the light come alive." Similarly, after the C17, tablet, and cards were dealt, he turned the back of the AR-enabled cards and declared, "I will play the clown." He attempted to bring it back by placing the tablet on top of the clown.

Similarly, participant C17 turned the back of the AR-enabled cards and said, "I will portray the clown," before attempting to revive it by holding the tablet over the clown. All of the children participating in the occupations activity attempted to illustrate the 2D occupation cards used as physical material by holding the tablet.

Peer Relations in the Process of Using AR Technology

Table 3 shows the themes and sub-themes that emerged from observations and interviews about how peer relations.

Table 3

Children's Reactions to AR Technology

Theme	Sub-Themes
Peer relations	Helping each other
	Communication
	Wonder

Some children helped each other animate the characters during the AR technology activity. For example, while C19 was attempting to complete the animation, C18 attempted to help his friend by saying, "No, you will do it slowly." Similarly, C17 supported C5, who was struggling with animation, and assisted him in playing the character by guiding his friend by saying, "You will pull the tablet up a little bit, okay, okay."

It was observed that the children were conversing during the AR activities. Most of the children looked at each other's animated characters during the activities and attempted to animate them in AR activities. In the occupations activity, participant C17 animated her friend's card by saying, "I was inquisitive about food," C18 called her friends to her by saying, "Look guys, this is very nice." C11 asked his friends after reanimating his own character, "Mine is coming back. What is yours doing?"

Children's Material Preferences

Table 4 shows frequency and percentage values derived from the interviews about the children's material preferences.

Table 4

Children's Material Preferences

Activity	Preference	*f*	%
Animals Activity	AR cards	12	86
	AR cards and other material	2	14
Fruits Activity	Real fruits	9	75
	AR cards	2	17
	AR cards and real fruits	1	8
Occupation Activity	2D pictures	4	36
	AR cards	6	55
	AR cards and 2D pictures	1	9

Twelve (86%) of the fourteen children who participated in the animals activity said they preferred materials with AR technology, while two (C1, C11) said they preferred both. Regarding their material preferences, the children said the following:

C1: "Because the animated one was exciting, the toys were fun and they looked nice.",

C11: "Sometimes I want to do it with animation and sometimes without animation because you do it more comfortable when you are without animation, you act more easily when you are constantly animated, you get bored.",

C17: "Because it is very nice to animate".

Nine (75%) of the twelve children who participated in the activity of the fruits said they preferred real objects, two (C6, C17) preferred materials containing AR technology, and one (C9) preferred both. Regarding their material preferences in the fruit activity, the children stated:

C10: "Because I want to eat well.",

C11: "Man with and without animation gets bored. It is boring to just animate. I have come to eat the fruits."

C16: "I also like animation, but I like fruits more this time. Because the fruits are real.",

In the occupations activity, six out of eleven children (55%) said they preferred materials with AR technology, four (8, 11, 13, and 18) said they preferred 2D real painting materials, and one (15) said they preferred both. The children were questioned about why they preferred the relevant material. The following are the children's responses to the question:

C5: "Animation is more fun. I like the activities we animate more.",

C10: "Because I love it, animated cards are more fun.",

C11: "Both of them are fun because this is real and animated. But the real picture is more fun."

Problems Encountered While Using AR Technology

Table 5 shows the themes, sub-themes, and codes developed as a result of our observations and interviews about the problems encountered when using AR technologies in pre-school.

Table 5

AR Usage Problems

Theme	Sub-Themes
AR Usage Problems	Unable to move tablet
	App response time
	Hand-eye coordination
	Technical issues

Usage problems with AR technology are classified into sub-themes such as tablet weight, waiting time, hand-eye coordination, and technical difficulties.

During the activities, some of the children used the tablet by leaning against something for support, had difficulty grasping the tablet, and tended to leave the tablet on the table from time to time, even for a short period. In the interviews, the children expressed their feelings about these situations, saying, "I didn't like the animation because my hands were tired," and "Animation was not that easy because my hands

were tired." Due to a lack of hand-eye coordination, some of the children covered the camera with their hands. Similarly, the tablet's camera had difficulty detecting the card due to reflections of light in the environment on the card, and some of the children took their time performing the animation process. The children's reactions to this situation were as follows:

C9: "I said scan, scan, scan, scan, scan, scan,"

C14: "Why doesn't it come alive?"

C3: "This isn't playing, I'm bored," C11: "I don't like this tablet either."

In this situation, we observed that the teacher had problems with classroom and time management while using AR technology in the pre-school period. She had difficulty gathering all the children around a single tablet in groups where the tablet was insufficient.

Discussion and Conclusion

This study found that using AR technologies in the pre-school period allows children to participate in activities willingly and focus on the activity by attracting the child's attention, concretizing the content, presenting information colorfully and visually, and providing a fun environment. In line with the study's findings, Yusoff and Dahlan (2013) found that AR technologies capture children's attention. As a result, students are willing to use AR materials and participate in the lesson. In their study on kindergarten children, Chen et al. (2007) emphasized that AR technologies demonstrated a new way of motivating and attracting children's attention. Casscales et al. (2013) reported that using AR technology makes activities more enjoyable for both pre-school children and their teachers and has a positive effect on both teachers and students. According to Çevik et al. (2017), and Huang et al. (2016), AR technologies increase attention and active participation, the desire to learn, and the level of success.

We concluded in this study that children who are not interested in the content of the activity or do not want to participate in the activity participate in AR-enabled activities that attract their attention, calm them down, and focus on the activity by beginning to deal with the content of the activity. According to Özsevgeç and Eroğlu (2017), AR technology applications drew students' attention and interest because they were technology-based. It is well known that children engage in AR-related activities for a more extended period and more frequently (Bai et al., 2013). In this case, AR technologies used in the pre-school period arouse children's desire to participate in activities and provide an interactive and fun learning environment. Hsieh and Lee (2008) state that children learn by having fun and interacting more with their teachers when teaching with AR technology. Children have fun, their interest and attention are drawn, their success increases, they provide interactive and active participation, and they support cooperation with the media in activities involving AR technology, according to the literature (Cascales, Laguna, Pérez-López, Perona, & Contero, 2013; Çevik et al., 2017; Han et al., 2015). As a result, the results of this study are consistent with the result of other studies in the literature. Most of the children, when they saw the animated characters for the first time, gave various reactions such as liking, surprised, excited, happy, curious, and having fun by interacting with the content that became 3D at the end of the application process, all of the children stated that they had fun in activities containing AR technology. We think that children's reactions to AR

applications may be caused by the novelty effect and the appearance and movement of content not in the natural environment on the tablet screen. Indeed, Di Serio et al. (2013) states that AR technologies are new and can create a novelty effect when used in the learning process. Kuru (2015), on the other hand, stated that users are familiar with the product after they start using a product, and the user's perception of the product begins to change after the initial novelty effect wears off.

When AR technologies are used considering the developmental characteristics and needs of children in the pre-school period; we can say that it can reveal student-student interaction and support collaborative learning in activities involving AR technology by creating a desire to arouse curiosity, and engage in dialogue and help each other. AR technologies used in the learning process are viewed as adequate to support individual interaction and participation in the literature.

It is claimed that the use of AR technologies in education ensures individual interaction (Azuma, 2004; Bujak et al., 2013; Ivanova & Ivanov, 2011; Kamarainen et al., 2013; Kerawalla et al., 2006; Kesim & Özarslan, 2012; Wojciechowski & Cellary, 2013; Wu et al., 2013; Yılmaz, 2016). We think the interaction in the learning process will bring about collaborative learning. Ke and Hsu (2015) state that AR technologies can also be used in collaborative learning environments. In their study, Campos et al. (2011) concluded that they presented a game for kindergarten children that uses AR technology to support collaborative learning by providing motivation, fun, and curiosity, and that the game is effective in increasing their willingness to continue the high motivation and collaborative learning process with the feedback provided. In another study, Yuen et al. (2011) stated that AR technology could help gain different perspectives on subjects, enable collaborative work, and realize the student's own learning pace. Rasalingam et al. (2014) concluded in their studies that pre-school AR activities support cooperation and engage children in learning activities.

Except for the fruits activity, children preferred materials containing AR technology in all other activities within the scope of the study. According to McKenzie and Darnell (2003) and Wang et al. (2013), children have positive attitudes toward AR applications and find them more accessible and inspiring than traditional activities. Furthermore, research shows that students want to use AR applications again and are satisfied with AR learning materials (Gün, 2014). In the fruits activity, children preferred real fruits to AR and stated that they wanted to eat fruits. Coulthard and Sealy (2017), in their experimental research, concluded that sensory play activities (FV) with fruits and vegetables promote more FV tasting in pre-school children than non-food play or visual exposure. We think this preference is due to the children's desire to taste the fruits.

The children had some problems with the heavy tablet, the long waiting time, and their hand-eye coordination while using AR cards and the tablet. According to Munoz-Cristobal et al. (2015), students may have difficulty using AR technologies in their learning processes. During the activities, when the tablet uses the camera to capture the character on the card, the animation process is sometimes delayed due to the card reflecting ambient light. External factors such as image quality, light, and output can have a negative impact on applications and make it challenging to use AR in education (Yılmaz & Göktaş, 2018). In their study, Dunleavy et al. (2009) stated that technological, managerial, and cognitive difficulties arise during the application. In the

studies of Ibáñez et al. (2014), students who participated in the study during the application encountered issues due to the devices used. Chang et al. (2015) stated in their study that technical and ergonomic issues might arise when using AR technologies. Children whose characters' revival times were extended became bored over time, did not want to repeat the activity, tended to leave the environment, and their interest waned. The literature has documented that difficulties encountered during the learning process can negatively impact students' attitudes toward the process (Gündoğdu, 2014). We believe that this situation is related to pre-school children's short attention span. According to Radu and MacIntyre (2012), attention can be a problem in children's interaction with AR, and children should have fine motor, spatial, attention, logic, and memory abilities to interact with AR effectively.

Implications

The research found that animations and sounds in AR applications used in pre-school significantly impact children. As a result, it is essential to emphasize that AR applications for use in activities should be chosen to meet children's expectations in terms of animation, sound, and interaction.

When using AR technology, it is important to ensure the internet connection is strong and set up an order that is not affected by the environment's physical conditions (e.g., lighting, etc.). We recommend using tablet holder platforms in AR technology activities so that children do not have trouble using multiple materials.

AR is best used with pre-school children in small groups and additional materials. Students will not become bored with AR activities because they are not done sequentially and are spread out throughout the semester. We recommend in-service training on AR technologies for kindergarten teachers in the pre-school period.

Because they wanted to taste the fruits, the children preferred the activity with real fruits over the AR-supported activity. In future studies, we recommend that children's preferences for AR with real objects be thoroughly investigated using a variety of vegetables and objects.

Statement of Responsibility

Hacer Bülbül took responsibility in the processes of collecting data, planning the research, and creating the application materials. Hacer Bülbül ve Fatih Özdinç created measurement tools, conducted data analysis and reported the research.

Conflicts of Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

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Examining Science Teachers' Performances at Planning Geology Lesson through TPACK-based Argumentation Practices*

Fen Öğretmenlerinin TPAB temelli Argümantasyon Uygulamalarıyla Jeoloji Dersi Planlama Performanslarının İncelenmesi

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ABSTRACT: This study aims to reveal science teachers' performances in designing TPACK-based argumentation practices for teaching geology. This study used a holistic single case study design where thirty-two science teachers participated in a professional development program. All materials such as videos, etc. used by the teachers and the Pedagogical Reasoning Assessment Form (PRAF) were used as data collection tools. Descriptive analysis was conducted through the scoring rubric for lesson plans and content analysis for PRAF. Findings indicated that teachers successfully used TPACK indicators in their lessons. Findings also revealed that although teachers thought that formative assessment could be improved by learning from professional development programs, they did not use technology for assessment in their lesson plans. Related to the argumentation process, teachers tended to construct their arguments with one rebuttal, and they could not use warrants. Moreover, although teachers had high scores in the quality of claim, rebuttal, and backing respectively, they had some problems in presenting data and warrant for the claim. PRAF findings indicated that the TPACK-based Argumentation Practices Professional Development Program (TPACK-bAP PDP) enriched their lesson plans in some aspects.

Keywords: Argumentation, pedagogical reasoning, technological pedagogical content knowledge (TPACK).

ÖZ: Bu çalışma jeoloji öğretiminde TPAB temelli argümantasyon uygulamaları tasarlama konusunda fen bilimleri öğretmenlerinin performanslarını ortaya çıkarmayı amaçlamaktadır. Katılımcılarını mesleki gelişim programına katılan 32 fen bilimleri öğretmeninin oluşturduğu çalışmada bütüncül tekli durum çalışması deseni kullanılmıştır. Öğretmenler tarafından kullanılan video vb. tüm materyaller ile Pedagojik Akıl Yürütme Değerlendirme Formu (PADF) veri toplama aracı olarak kullanılmıştır. Ders planları için puanlama rubriği aracılığıyla betimsel analiz, PDAF için içerik analizi yapılmıştır. Bulgular öğretmenlerin TPAB göstergelerini derslerinde kullanma konusunda başarılı olduklarını göstermiştir. Bulgular ayrıca öğretmenlerin mesleki gelişim programında öğrendikleri ile süreç değerlendirmenin iyileştirilebileceğini düşündüklerini ancak ders planlarında değerlendirme için teknoloji kullanmadıklarını ortaya çıkarmıştır. Argümantasyon süreciyle ilgili olarak, öğretmenlerin argümanlarını tek bir çürütücü ile oluşturmaya eğilimli oldukları ve gerekçe kullanamadıkları bulunmuştur. Bununla birlikte, öğretmenler iddia, çürütücü ve destekleyici kaliteleri bakımından yüksek puanlara sahip olmalarına rağmen, veri sunma ve iddiayı gerekçelendirme konusunda bazı problemler yaşamaktadırlar. PADF bulguları, TPAB temelli argümantasyon uygulamalarının bazı açılardan ders planlarını zenginleştirdiğini göstermiştir.

Anahtar kelimeler: Argümantasyon, pedagojik akıl yürütme, teknolojik pedagojik alan bilgisi (TPAB).

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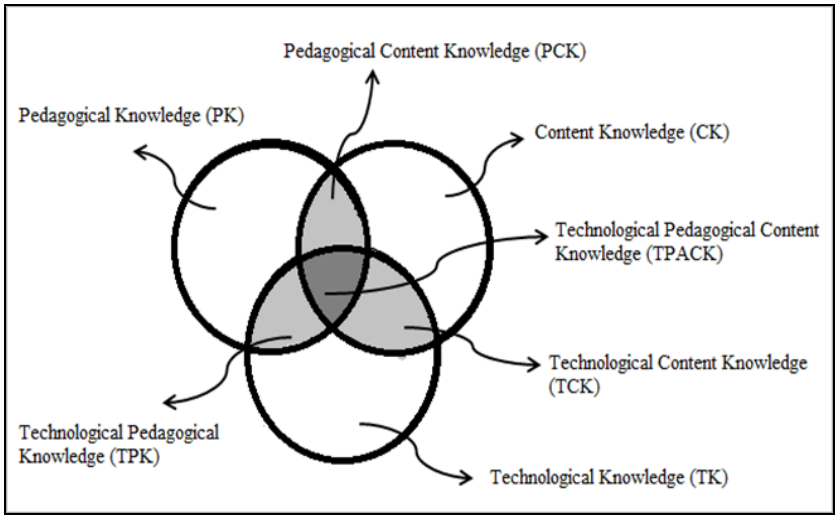
Technological Pedagogical Content Knowledge

Technology is everywhere in our lives. We use technology for banking transactions, ordering food, shopping, etc. It is inevitable that technology increases its impact on our lives day by day and, as a result, affects the learning environment. According to Trust (2018), the aim of technology integration into the learning environment should be the transformation of learning. In other words, technology integration should allow students to have new learning experiences. Here, the greatest role for effective integration of technology belongs to teachers, who are the designers of learning. With the thought of technology integration into the learning process, teachers should have both pedagogy and content knowledge (PCK) (Shulman, 1986) and technology knowledge. The technology integration into PCK constitutes technological, pedagogical content knowledge (TPACK), as Mishra and Koehler (2006) proposed. According to Dietrich (2018), TPACK requires the use of technology for both presenting and teaching the concept, facilitating concept learning, the knowledge about concepts, theories, approaches, etc., the use of technology effectively and productively in daily lives, and choosing appropriate instructional methods for teaching the concept.

Figure 1

Technological Pedagogical Content Knowledge Framework



Note. (Mishra & Koehler, 2006)

Here CK correspondences to teachers' knowledge of learning/teaching subjects. PK is teachers' knowledge of the learning/teaching process while TK is the knowledge of using all technological tools (Koehler & Mishra, 2009). PCK, which is one of the dual interactions in the TPACK framework, correspondences to using appropriate pedagogies for teaching a specific content (Shulman, 1986). Similarly, while TCK is the knowledge about using appropriate technological tools for teaching specific content, TPK is an understanding of how the use of technology affects learning. Since TPACK includes the interactions between three knowledge domains (Figure 1), researchers have investigated its nature. The nature of TPACK can be distinctive (Lee & Kim, 2014), and each knowledge domain can be a significant predictor of TPACK or integrative (Koehler & Mishra, 2009), which TPACK can be developed based on the complex interactions of three knowledge domains or transformative (Angeli & Valanides, 2008)

which contextual factors such as teachers' beliefs about school, learner, teaching, etc. besides the knowledge about three domains are effective on TPACK development. We believed that the interactions between three main knowledge domains could cause the development of TPACK, as the integrative view proposed.

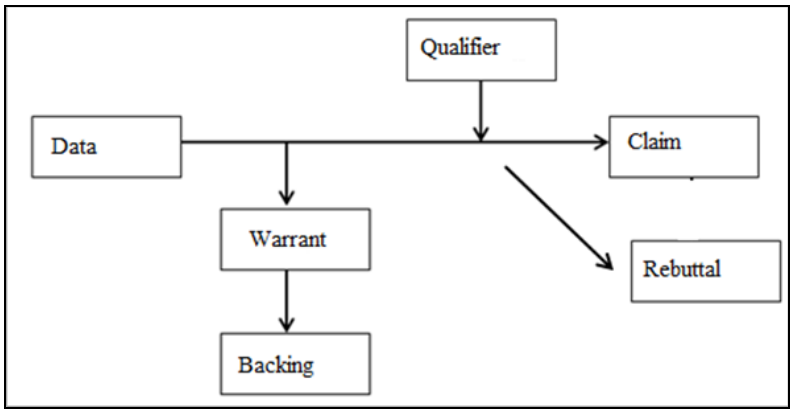
TPACK has been studied for many years and researchers have presented some evidence on the importance of having TPACK. They reported that TPACK has positive effects on concept teaching (Akkoc et al., 2012), selecting appropriate educational activities based on technology (Aktas & Ozmen, 2020), and classroom management (Saritepeci, 2021). Besides, it was reported that training on TPACK affected teachers' design beliefs (Chai & Koh, 2017; Koh et al., 2015). To sum up, TPACK serves as a key for effective technology integration into classes.

Argumentation

Argumentation can be defined as a knowledge justification and persuasion process individually or socially. Argumentation is seen as important, especially in science education. According to Jimenez-Aleixandre and Erduran (2007), argumentation supports the development of communication skills, scientific literacy, reasoning and epistemology, and the use of scientific language when writing and talking. Therefore, curriculums emphasize the integration of argumentation into the learning environment with the desire of promoting informed citizenship for the 21st century. In practicing argumentation, teachers should guide the students' inquiry process and encourage them to justify the knowledge and evaluate the arguments (Jimenez-Aleixandre, 2007). Researchers studying argumentation offered various approaches for practicing or assessing this process (Erduran et al., 2004; Kelly & Takao, 2002; Sandoval & Millwood, 2005; Toulmin, 1958; Zohar & Nemet, 2002). We, in this study, adopted Toulmin's Argument Pattern (TAP). TAP consists of six elements as data, warrant, backing, qualifier, rebuttal, and claim (Figure 2). According to Erduran (2007), a claim is an assertion of the problem at hand. Data and warrants serve as support for the claim. Here, data present facts to support the claim and warrants links between the claim and data. The backing which serves the support for warrants is the scientific generalizations. Rebuttals correspondence to the exceptional circumstances where the claim is not valid while qualifiers correspondence to the degree of reliance.

Figure 2

Toulmin Argument Pattern (TAP)



Note. (Toulmin, 1958)

TAP is used mostly in argumentation studies, but it has some disadvantages. One of the problems with TAP is that the definitions of TAP components (warrant, backing, etc.) are not clear (Kelly et al., 1998) and so analyzing students' argumentation is difficult. The other problem is that TAP could not assess the epistemic status of arguments (Erduran, 2007). Another one is that it allows analyzing the argument structure but does not give an idea about its trustworthiness (Driver et al., 2000). Although TAP has some criticism, we used TAP because it is useful in the short argumentation process (Kelly et al., 1998). It helps teachers to model argumentation and has a solid understanding of it (Simon, 2008). Another reason for choosing TAP is that it allows visualizing the thinking process through argument mapping, as shown in Figure 2. Argument mapping enables individuals to develop critical thinking skills (Dwyer et al., 2013; Kunsch et al., 2014) and their argumentation skills (Buzan & Buzan, 2000).

The results of the studies led us to use argumentation as the PK component of TPACK. The study by Sengul et al. (2020) showed that the increase in PK of argumentation caused the increase in teachers' epistemological belief levels and these teachers tended to use argumentation while teaching. Further, other studies reported that technological tools support and promote argumentation in classes (Bell, 2004; Clark & Sampson, 2007; Ozcinar, 2015; Yeh & She, 2010). With the thought of using the advantages of both technology and argumentation to create effective learning environments, we designed a professional development program (TPACK-bAP) for science teachers that integrate argumentation into the TPACK framework.

Geology Teaching

For our TPACK-bAP, there are some reasons for choosing geology for the CK component of TPACK. One reason is that learning geology is important for dealing with the challenges (global warming, ozone layer, sustainability, etc.) that we may face and taking precautions against them (National Research Council [NRC], 2012). Teaching geology enables students to become well decision makers. Since studying geology requires inference skills and spatial reasoning, it promotes the development of thinking skills (Orion, 2017). The other reason is that although its importance, geology education has not gotten enough attention. For example, in Turkey, geology content is embedded in the science units in middle grades and the geography units in high schools and there is no individual geology course until the university level (Kazanci et al., 2016). The situation seems similar across other countries. According to the results of the study by Kacovsky et al. (2021), the ratio of obligatory learning outcomes regarding geology was 4% in the Czech Republic, 3% in Estonia, and only 1% in Poland and Slovenia. Another reason is that although geology generally has a low number of learning gains, there are many misconceptions regarding geology. Francek (2013) examined the literature and found 502 misconceptions, of which over 40% of them belonged to middle or high school students, regarding geology such as plate tectonics, weathering/erosion, and historical geology.

Geology does not use controlled experiments as in biology or physics rather it draws conclusions based on the existing data and makes inferences from them. In other words, individuals construct geological knowledge by collecting evidence and evaluating them in the light of related theoretical knowledge. From this point of view,

argumentation is a well-established context for studying geology besides gaining basic science process skills such as formulating, hypothesizing, observing, making inferences, drawing conclusions, and the nature of science. Moreover, other studies reported that technology integration facilitated geology teaching and learning (Dolphin et al., 2019; Greer & Heaney, 2004; Wallace & Witus, 2013). Considering these points, relationships between geology-technology and geology-argumentation originated this study.

The Need and Originality of the Study

The main components of this study are TPACK, argumentation, and geology teaching. To highlight the need and originality of this study, we firstly presented a general look into the existing literature about TPACK, argumentation, and geology teaching and assessed the trends in them.

Studies about TPACK are heavily focused on determining the current status of students or teachers' TPACK (Archambault & Crippen, 2009; Chai et al., 2013; Schmidt et al., 2009; Yeh et al., 2015), pedagogical knowledge development for TPACK (Harris & Hofer, 2011; Khan, 2011; Wetzel et al., 2008) and technological knowledge development for TPACK (Jamieson-Proctor et al., 2010; Spaulding, 2016; Trainin et al., 2018). These studies pointed out that TPACK development studies mostly adopted the distinctive view of TPACK. Unlike these studies, we adopted the integrative view of TPACK. In our TPACK-bAP professional development program, teachers experienced argumentation as the PK component of TPACK, some technologies as the TK component, geological knowledge as the CK component, and some other activities which were based on PCK or TPK components of TPACK. After that, teachers were asked to design TPACK-bAP in a geology lesson that correspondences to the practice of the integrative nature of TPACK. The study by Ahadi et al. (2021) also reveals the significance of our study. The results of this study indicated that evaluation studies regarding teachers' professional development on technology use mostly reported teachers' new knowledge gain or affective factors and only a few of them analyzed teachers' teaching strategies (3%) and teaching quality (7%) after attending PDP. In our study, we shared the results of teachers' lesson plans to reveal the teachers' practices after attending PDP.

Besides, there are many argumentation studies in the literature. These studies are heavily on determining the effect of argumentation intervention on some variables, developing the argumentation skills, and determining the status of argumentation skills and focused mostly on physics and biology-related subjects (Bag & Calik, 2017). Further, most of them were conducted with students (Kahraman & Kaya, 2021). From the perspective of PK, studying argumentation with teachers and in the context of geology will provide an important response to the need in the relevant field and will especially contribute to the determination of teachers' thoughts in this process and the development and enrichment of geology teaching. From the point of view of TPK, this research will contribute to the elimination of the gap in the literature in terms of showing teachers how to integrate the use of technology into the argumentation process through a different topic. Because most technology-supported argumentation studies used software to support the argumentation process (Bell, 1997; McAlister et al., 2004; Pinkwart et al., 2006; Ranney & Schank, 1998; Schwarz & Glassner, 2007) or technological tools (Gordon et al., 2007; van Gelder, 2003) to visualize this process. We

presented different technologies in the TPACK-bAP professional development program rather than using only one software or technological tool to allow teachers to integrate the argumentation process with different technologies. From the TPACK perspective, studying argumentation also has importance. Although technology-supported argumentation studies were widespread, studies on argumentation from the TPACK perspective were rare. The pioneering study was conducted by Unal-Coban et al. (2016). In this study, in-service science teachers experienced TPACK-based argumentation training, which reflects the integrative view of TPACK, and results indicated that TPACK-based argumentation practices significantly affected their TPACK self-efficacy perceptions and views on argument quality.

Further, it was reported that participant teachers declared that they could use TPACK-based argumentation practices in their classes. In another study, Namdar and Salih (2017) investigated pre-service science teachers (PSST)' views about TPACK-based argumentation practices and found that PSSTs saw TPACK-based argumentation as important in terms of effective learning and teaching, generating scientific knowledge, personal development, and classroom management. In Korkmaz's study (2020), which integrates TPACK and argumentation in a mathematical context, pre-service mathematics teachers collected data through GeoGebra and then engaged in the argumentation process for reaching some generalizations in the context of analytic geometry. Although our study seems to share some common points with the study of Unal-Coban et al. (2016) such as participants as in-service science teachers and the use of TPACK-based argumentation practices, this study focuses on the practices of teachers after attending TPACK-bAP rather than evaluating the effectiveness of the professional development program.

Studies about earth science teaching, in which geology is one component of it, are mainly focused on PCK or TCK components of TPACK. In one of the PCK studies for teaching earth science, Folkomer (1981) compared the effectiveness of lecture method, laboratory-based lecture method, and field trips and found that field trips were the most effective method for teaching geology because they enabled students to remember facts. Supporting this, Elkins and Elkins (2007) indicated that field-trip-based geoscience teaching had significant effects on gaining and improving geoscience concepts. In another study, Anderson and Contino (2010) investigated the effect of web diagrams on earth science knowledge which have some common aspects with concept maps, but they begin from a central concept like mind maps and use of phrases or clauses to make radially connections between concepts. They found that web diagrams were effective for increasing students' networking capacity and their fluency in explaining scientific concepts. Besides, students had positive attitudes toward both using web diagrams and their usefulness in learning. Similarly, Apedoe et al. (2006) designed an inquiry-based geology course and they found that this method was successful in developing both inquiry skills and content knowledge. Other PCK studies also used argumentation in the context of earth science (Clayton & Gautier, 2006; Koffman et al., 2017; Short et al., 2020; Takao et al., 2002; Trend, 2009; Yoo et al., 2020). The common point of the studies above was that most of them used argumentation for teaching socio-scientific issues such as global warming in the context of earth science rather than focusing on geology content solely. One of the TCK studies for teaching earth science investigated the effect of technology integration on geology

teaching. This study offered virtual field trips comprising images by drone, 2-D photomosaic, and 3-D computer models. Researchers reported some student difficulties, such as having difficulties with the relationship between observation and inference about virtual field trips and they offered to teach the "how" aspect of geology (Dolphin et al., 2019). This study is important because it shows that technology integration into geology teaching should aim to teach not the "what" aspect of geology but also "how" and it emphasizes a well-designed learning environment for technology-supported geology teaching. In another study, software that can be used for organizing geospatial data was introduced (Dobush et al., 2004).

Similarly, another study reported the effectiveness of student response technologies in an introductory earth science course (Greer & Heaney, 2004). In another study, Wallace and Witus (2013) used iPads as an educational tool for teaching geology. They integrated iPads into both field-based and classroom-based courses. iPads served to visualize, display, and share spatial data and note-taking in the field-based course while they were used for digitalizing the materials and also taking notes in classroom-based courses. As seen in these studies, specific technological tools such as iPads or software were used for technology integration into geology teaching. Unlike these studies, we offered different technological tools teachers are already aware of, to use effectively in their lessons.

Other studies use TPACK in geology teaching. For example, Hesthammer et al. (2002) investigated the effectiveness of two technological tools in the context of problem-based learning. In their study, while one group used a field simulator to promote deep geological understanding, the other used a digital camera and PC. It was found that both approaches were effective for enhancing geology learning. In Totten's study (2008), an earth science course was designed for pre-service teachers to teach them how to incorporate earth science content with pedagogy. This course included PowerPoint presentations that aimed to probe pre-service teachers' current understanding, educational games, in-class activities which were based on inquiry method, video-case studies which aimed to show real cases to pre-service teachers, clicker assessments to assess pre-service teachers' understanding during the course period and some other additional resources (journal articles, web sites, etc.). Results of this study showed that pre-service teachers found this course useful, and their content knowledge and instructional practices improved. In a similar study, Doering et al. (2014) designed a TPACK-based professional development program for middle and high school geography teachers. This program consisted of geography for CK, inquiry-based learning for PK, and GeoThentic application for TK. The results of this study indicated that this program was effective on both teachers' TPK development and students' geographic inquiry skills. Another study reported the effectiveness of a one-day professional development program in integrating geographic information systems (GIS) into classes based on the TPACK framework. Middle and high school teachers experienced the use of GIS technically, teaching materials, and GIS for implementing inquiry-based learning (Oda et al., 2020). Studies using the TPACK framework in teaching geology generally focus on problem-based or inquiry-based learning as a PK component. However, Morgan (2006) introduced software, a computer-supported argumentation visualization for geography education. This study seems similar to our study, but we have some differences. Although both studies used argumentation for the

PK component, Morgan's study used only one software for the TK component and focused on teaching geography content. However, we introduced different technologies for integrating them into the argumentation process and focused on geology content, especially principles of geology.

This study is important for some aspects. Firstly, although there are geology learning gains, embedded into other courses such as science or geography, in middle and high school curriculums at the local level, there is not a professional development program for ensuring teachers develop their geological knowledge. Secondly, although there are professional development opportunities, especially for PK development related to inquiry-based learning and there are studies that integrate technology into geology teaching at the global level, there is not any study that uses only argumentation or TPACK and argumentation together in geology teaching. Therefore, this study aims to determine science teachers' performances in designing TPACK-bAP lesson plans for teaching principles of geology content. The research questions are as follows:

RQ1. What is the status of science teachers in designing TPACK-bAP lesson plans?

RQ2. What does science teachers' pedagogical reasoning tell us about TPACK-bAP?

Method

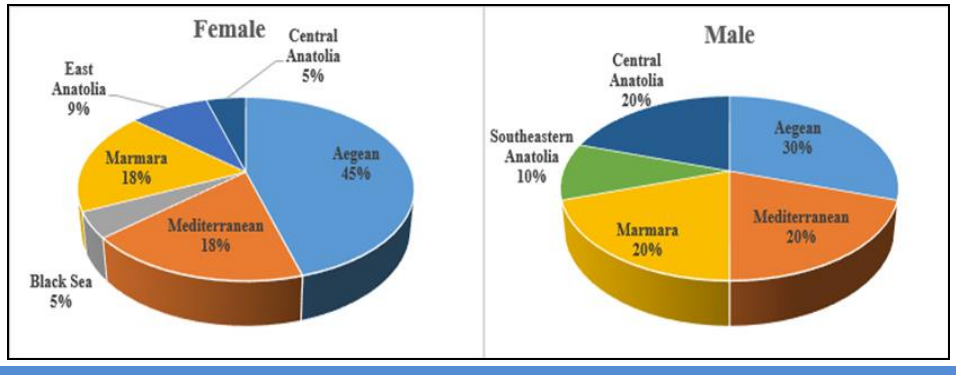
This study was on a holistic single-case study approach to reveal the extent of participant teachers' performances in designing TPACK-bAP lesson plans. In this approach, the single case, which can be critical, extreme/unique, revelatory, or longitudinal case representative, is described in detail from various perspectives (Yin, 2002). The single case in this study was science teachers who participated in TPACK-bAP professional development program.

Participants

The participants were thirty-two science teachers who were selected based on purposive sampling. This sampling technique was preferred to create a heterogeneous group. According to this, teachers having different years of professional experience and working in different regions of the country were selected. Further, it was also considered to have nearly equal distribution in terms of their gender. Information about participants is presented in Figure 3.

Figure 3

Teachers' Demographic Information based on Gender and Region



22 female (68.75%) and ten male (31.25%) teachers participated in this study. There were thirteen teachers from Aegean, six from both Mediterranean and Marmara, one from both the Black Sea and Southeastern Anatolia, two from East Anatolia, and three from Central Anatolia regions. Figure 3 shows the distribution of teachers according to their gender and regions in which they work.

Data Collection Tools

Lesson Plans

After completing the TPACK-bAP professional development program, teachers designed lesson plans based on their learning. All materials such as PowerPoint presentations, videos, and handouts that they used when preparing lesson plans generated the source of data.

Pedagogical Reasoning Assessment Form

Pedagogical reasoning can be defined as the decision-making process for teachers about which practices they do, how, and why. To determine teachers' pedagogical reasoning about TPACK-bAP to explain the tendencies in their lesson plan, Pedagogical Reasoning Assessment Form (PRAF) was developed by the researchers based on Shulman's (1987) six stages model (*comprehension of subject knowledge, transformation of subject knowledge into teachable representations, instruction, evaluation of students' learning and teacher performance, reflection, and new comprehensions*) and implemented to science teachers after the professional development program. The validity of the form was provided by expert views and revised accordingly. In the final form, there were six questions, each corresponding to Shulman's six stages model.

Application Process

To make sense of the application process, Table 1 was created.

Table 1

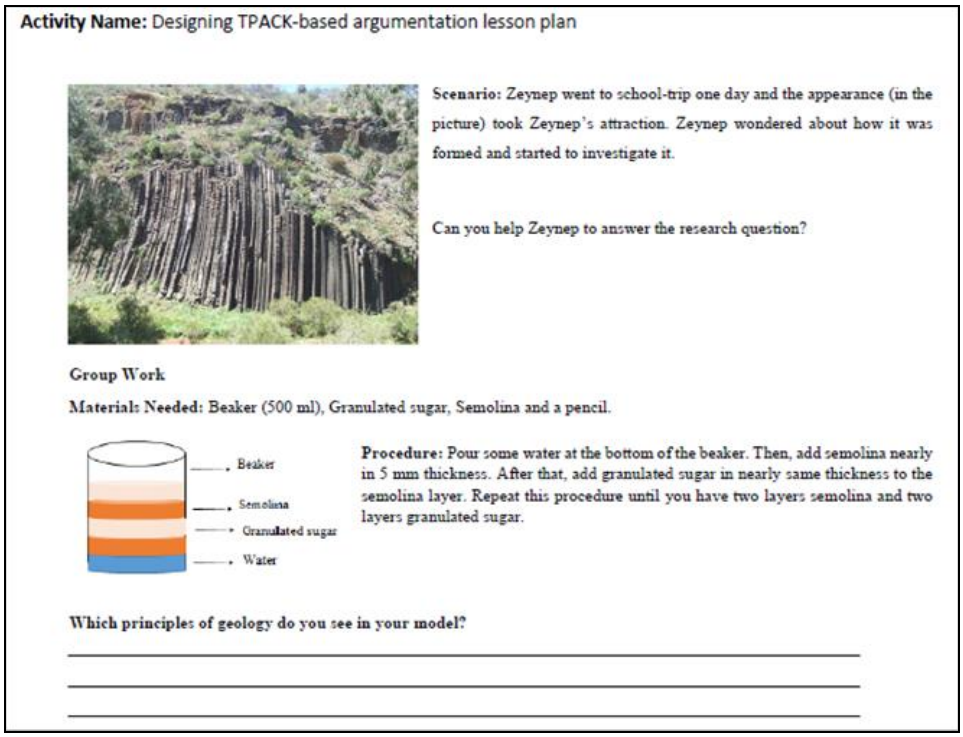
Summary of the Process

Criteria considered for the development of the application	According to Essam (2021), two main criteria should be considered when designing a PDP for technology integration. The first is that PDP should include activities in which appropriate technology and pedagogy are used for content. The second one is pedagogical use of technology should be based on teachers' needs. Supporting this, Irmak (2018) stated that for effective technology integration, how the technology and pedagogy integrate into each other should be explained explicitly. Based on these views, we designed TPACK-bAP professional development program by considering the integrative view of TPACK.
Purpose of the application	The purpose of the application process was to promote the development of teachers' TPACK knowledge; in this way, we aimed to encourage them to design a TPACK-based argumentation lesson plan without guidance.
Implementation process	We firstly ensured teachers develop their PK regarding argumentation. They learned what argumentation and its

	components were and how it was constructed and used as a teaching-learning tool or assessment tool. Secondly, teachers experienced technology activities for their TK development. They learned the effective use of word-processing programs, smart boards, and social media platforms for educational aims, creating videos, web 2.0 applications, creating virtual classes, and preparing animations and simulations. Thirdly, teachers experienced TPK, PCK, and TCK activities. For example, science teachers used digital measurement tools such as digital pH-meter, digital ampere meter, digital voltmeter, TDS-meter, lux-meter, etc. to answer scientific problems such as "determining the difference between seawater from salt water" or "creating the luminance map of the class" etc. in the context of TCK activity. Fourthly, teachers engaged in activities to develop their CK regarding geology. The geological activities aimed to enhance teachers' preparedness for the geological field trip. In the context of CK activities, firstly the lecturer presented the principles of geology (uniformitarianism, original horizontality, superposition, cross-cutting relationships, relative age, and stratigraphy), and then teachers modeled these principles with the help of play-doughs. After that, teachers engaged in a thematic game for learning the geologic time scale. The next day, teachers participated in a geological field trip. They were asked to take photos, videos, notes, etc., on the field trip. They observed the original horizontality and superposition principles in the curved argillaceous limestone layers and discussed why the layers curved and how the relative age could be determined in the curved layers in the first observation point. They observed the point of contact exposure between the curved argillaceous limestone layers and igneous rocks and discussed the relative ages of these rocks in the context of the superposition principle in the second observation point. In the third observation point, teachers observed limestone layers with large and little deformations and alluvium in the streambed at that time and discussed their relative ages based on the principles of geology. In the fourth observation point, teachers examined the laminated limestone and made inferences about the formation and relative age based on microfossils inside it. Then, they observed the point of contact exposure between laminated limestone and limestone with rudist fossils and they compared the relative ages of these two rocks in the context of the principle of inclusion. At the end of the field trip, teachers were asked to draw a stratigraphic column. On the last day of PDP, teachers designed TPACK-bAP in the context of geology based on the field trip's data (notes, photos, videos, etc.). For this, worksheets (Figure 4) which included learning scenarios that were following the learning in the field trip, were distributed to teachers, and they used their pedagogical, technological, and content knowledge to design this lesson plan.
Anticipated time	The program covered a week; each day, the studies lasted from 9^{00} am to 17^{00} pm. The activities took from 30 to 90 minutes or more. At the end of two or more activities, there was a coffee break or lunch.

Figure 4

Sections from the Sample Worksheets



Activity Name: Designing TPACK-based argumentation lesson plan

Scenario: Zeynep went to school-trip one day and the appearance (in the picture) took Zeynep's attraction. Zeynep wondered about how it was formed and started to investigate it.

Can you help Zeynep to answer the research question?

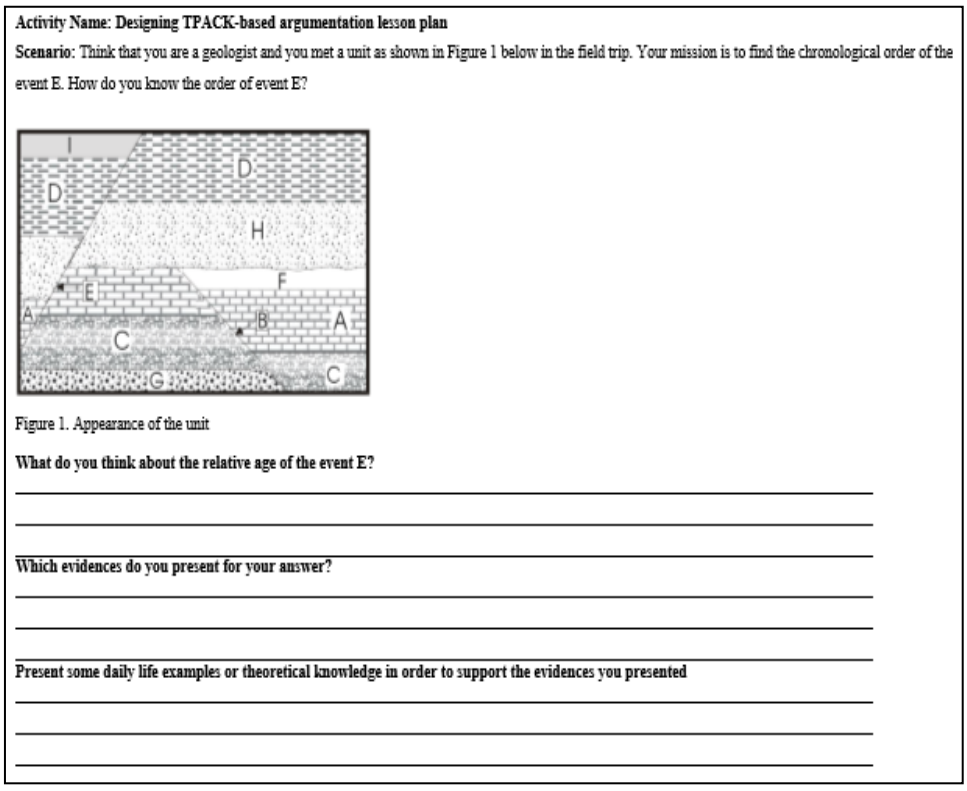
Group Work

Materials Needed: Beaker (500 ml), Granulated sugar, Semolina and a pencil.

Beaker
Semolina
Granulated sugar
Water

Procedure: Pour some water at the bottom of the beaker. Then, add semolina nearly in 5 mm thickness. After that, add granulated sugar in nearly same thickness to the semolina layer. Repeat this procedure until you have two layers semolina and two layers granulated sugar.

Which principles of geology do you see in your model?



Activity Name: Designing TPACK-based argumentation lesson plan

Scenario: Think that you are a geologist and you met a unit as shown in Figure 1 below in the field trip. Your mission is to find the chronological order of the event E. How do you know the order of event E?

I D D H F E A B A C G C

Figure 1. Appearance of the unit

What do you think about the relative age of the event E?

Which evidences do you present for your answer?

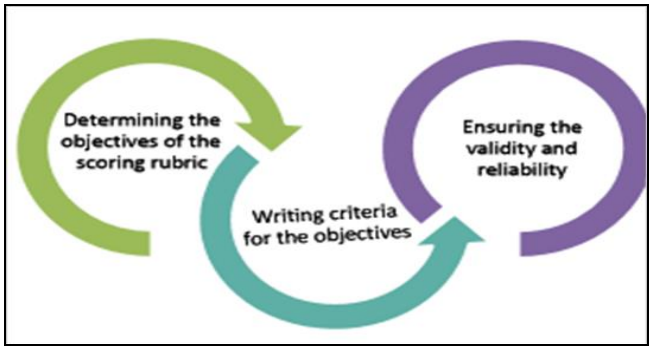
Present some daily life examples or theoretical knowledge in order to support the evidences you presented

Data Analysis

Content analysis was used for the analysis of PRAF. Two researchers coded and categorized the obtained data. Agreement on the categorization process was found as .93, which was accepted as reliable. Descriptive analysis was used for the analysis of lesson plans. For this reason, researchers developed *The Scoring Rubric for TPACK-bAP Lesson Plans (RuTbA-LP)*. The development process of the scoring rubric was conducted based on the steps proposed by Moskal and Leydens (2000).

Figure 5

Steps for Developing a Scoring Rubric



Note. (Created based on Moskal & Leydens, 2000)

The scoring rubric aimed to evaluate science teachers' lesson plans for TPACK-bAP. For this, existing scoring rubrics were examined first in stage Step 1. Literature review pointed out that knowledge and efficacy towards TPACK were the mostly measured factors through Likert-type scales (Akman & Guven, 2015; Sahin, 2011; Schmid et al., 2020) and other alternative data collection tools for examining TPACK in the classes were rare (Akyuz, 2018; Kirikcilar & Yildiz, 2019) and not suitable for our purpose. The literature review also indicated that there were scoring rubrics for argumentation and they were mostly on the quality of arguments, epistemological levels of arguments, and the construct of arguments (Aslan, 2014; Erduran et al., 2004; Kelly & Takao, 2002; Lawson, 2003; Sandoval, 2003; Sandoval & Millwood, 2005; Wilson, 2014; Zohar & Nemet, 2002). Although scoring rubrics about argumentation shared common components to be evaluated, their criteria were not sufficiently suitable for our purpose. Therefore, in the stage of Step 2, criteria regarding the TPACK dimension of RuTbA-LP were created based on studies that reported the use of TPACK in the classes and indicators of TPACK-based lessons (Hidayat, 2019; Ocak & Baran, 2019; Yeh et al., 2013) and criteria regarding argumentation dimension were created based on the studies of Aldag (2006), Erduran et al. (2004) and Wilson (2014). Criteria in RuTbA-LP are presented in Table 2.

Table 2

The Scoring Rubric for Designing TPACK-bAP Lesson Plans

		3 point	2 point	1 point	0 point
The use of technological pedagogical content knowledge	Using appropriate technologies for content knowledge	The use of technology is appropriate	The use of technology is appropriate but can be improved	The use of technology is not appropriate	No technology is used for content knowledge
	Creating technology-supported learning materials	More than one material that is suitable for both content knowledge and students' needs has been created	Only one material that is suitable for both content knowledge and students' needs has been created	Material (s) which is not suitable for content knowledge or students' needs	Any technology-supported material has not been created.

	Using technology for presentation	An interesting and visually appropriate presentation has been prepared	The presentation has some deficiencies in terms of noticeability or visual appropriateness	The presentation is not interesting or visually appropriate	No technology has been used for the presentation
	Using technology for assessing the learning	A technology-supported assessment tool that is appropriate for both content and students' characteristics has been used	The technology-supported assessment tool is not fully appropriate for content or students' characteristics	An appropriate technology-supported assessment tool has not been used	No technology-supported assessment tool has been used
	5 point	4 point	3 point	2 point	1 point
Components of argument	Includes claim, data, warrant, backing, qualifier, and more than one rebuttal.	Includes claim, data, warrant, backing, qualifier, and only one rebuttal.	Includes claim, data, warrant, backing, qualifier, and no rebuttal.	Lacks at least one component such as claim, data, warrant, backing, or qualifier.	Includes only claim.
		3 point	2 point	1 point	0 point
The quality of the argument	Claim	More than one hypothesis has been proposed related to the problem and one of them has been stated clearly as the claim.	Only one hypothesis has been proposed related to the problem and has been stated clearly as the claim.	A claim related to the problem but not stated clearly has been proposed.	No claim or a claim not related to the problem has been proposed.
	Data	Enough and related data has been stated clearly to support the claim	Related, but not enough data has been stated to support the claim.	Related but weak data such as personal experiences/observations, prejudices, etc. have been stated.	No data that is not related to the claim has been stated.
	Warrant	Related directly to both the claim and data, and stated clearly how the data could explain the claim	Related directly to both the claim and data, but stated unclearly how the data could explain the claim	The data has some details but could not explain the claim	No warrant has been stated
	Backing	Complete and correct scientific principles that could support the warrant have been stated.	Scientific principles that could support the warrant but have uncertainties (need more tests) have been stated	Correct scientific principles that could not support the warrant or wrong scientific principles that could support the warrant have been stated	No warrant has been stated

Qualifier	The cases that the claim is valid have been identified in detail and are scientifically accurate	The cases that the claim is valid and has been identified as scientifically accurate but not in detail	The cases that the claim is valid and have been identified based on personal experiences and prejudices	No qualifier has been stated
Rebuttal	Related directly to the claim and the cases where the claim is invalid have been identified in detail	Related directly to the claim, but the cases that could not ensure sufficiently the invalidity of the claim have been stated	Not related to the claim and the cases that could not ensure the invalidity of the claim has been stated	No rebuttal has been stated

In the stage of ensuring the validity and reliability, one researcher studying only technology integration to learning environments, one studying only supporting argumentation in classes, and one studying both TPACK and argumentation examined the RuTbA-LP according to the questions in Table 3. They all gave the same answers, "Yes" or "No" to questions and agreed on the content and construct validity of the scoring rubric.

Table 3

Questions for Ensuring the Validity of the Scoring Rubric

Content Validity	*Are the components to be evaluated appropriately? *Is there any component that is not related to content? *Does the criteria meet all aspects of the component? *Is there any criteria that are not related to the component?
Construct Validity	*Do all criteria meet the objectives of the scoring rubric? *Is there any criteria that are not related to the objectives of the scoring?

Reliability studies were also conducted for the scoring rubric. Two groups of teachers designed TPACK-bAP lesson plans, and then three raters evaluated them using the scoring rubric. Percentage of agreement, Kendall's coefficient of concordance (also known as Kendall's W), and intraclass correlation coefficient (ICC) were calculated for reliability. The percentage of agreement value was 72.72% for three raters. Kendall-W, which is used for determining the degree of agreement on measurement values between more than two raters (Karagoz, 2017), also showed that there was an agreement between three raters (Kendall's W=.859, p=.000<.05). Besides, ICC was calculated based on two-way random effects model to generalize the reliability results and consistency agreement and mean of k-raters as assessment basis. It was found as .956. Although there is no standardized value for interpreting ICC, Portney and Watkins (2000) proposed that values greater than .90 are the indicator of excellent reliability. In sum, RuTbA-LP meets the requirements for validity and reliability.

Ethical Procedures

This study was carried out with the approval of the Dokuz Eylül University Institute of Educational Sciences Ethics Committee (30.12.2016/12). Before the implementation, all participants declared that they voluntarily participated in the study by completing the voluntary participant consent form.

Results

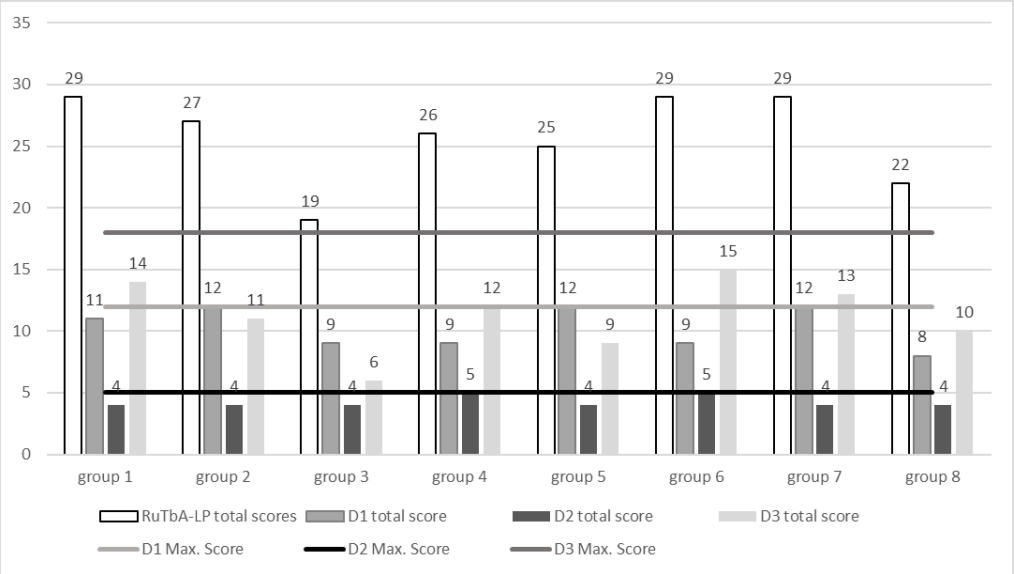
How Are the Status of Science Teachers in Designing TPACK-bAP Lesson Plans?

To answer the RQ1, the total scores and mean scores of each item in RuTbA-LP were calculated. Obtained results are presented in Figures 6 and 7, respectively.

Figure 6 indicated that groups' total scores of RuTbA-LP were generally high. They got an average of 25.75 points out of 35 and reached a success rate of 73.57% generally. According to dimensions, they got an average of 10.25 points out of 12 in the use of the TPACK dimension, 4.25 points out of 5 in components of argument dimension, and 11.25 points out of 18 in the quality of argument dimension. This showed that teachers had nearly the same success in both the use of TPACK 85.42%) and components of argument dimensions (85%) and relatively lower success in the quality of argument dimension (62.5%). Regarding the TPACK dimension, only three groups had the maximum score, which was 12. Related to the construction of the argument dimension, only two groups used more than one rebuttal in their arguments. None of the groups constructed a perfect quality argument related to the quality of the argument dimension.

Figure 6

Comparison of the Total Scores of RuTbA-LP

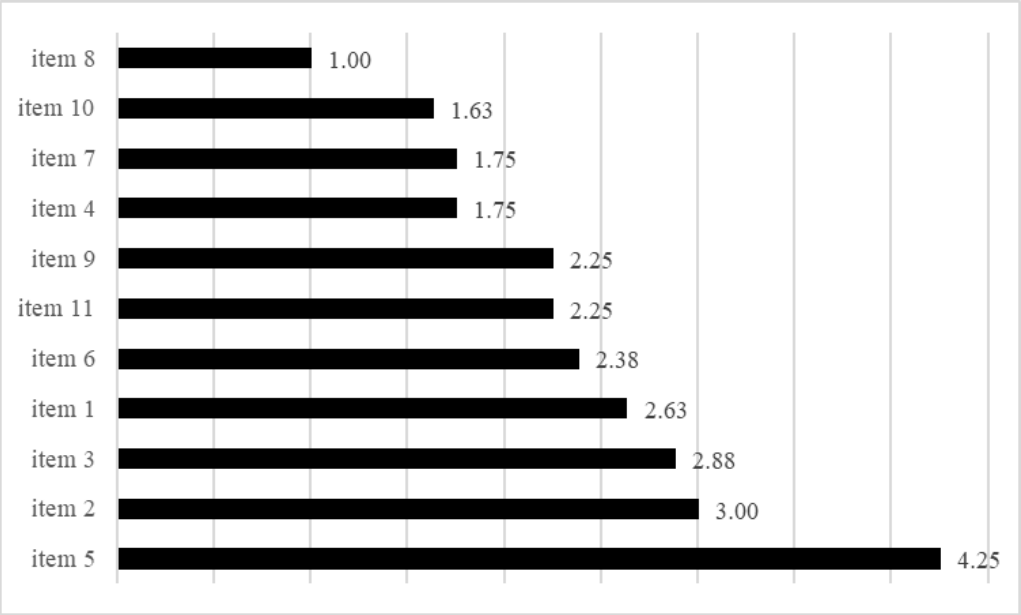


Note. D1: The use of TPACK; D2: Components of argument; D3: Quality of argument

In addition to total score analysis, mean scores for each item in RuTbA-LP were also analyzed.

Figure 7

Mean Scores for Each Item in RuTbA-LP



According to Figure 7, teachers got the highest score (X=4.25/5 points) in item 5, item 2 (X=3.00/3 points), and item 3 (X=2.88/3 points), respectively. Here, while item 5 was about components of argument, items 2 and 3 were related to the use of TPACK. However, they got the lowest score in item 8 (X=1.00/3points), item 10 (X=1.63/3 points), item 7 (1.75/3 points), which was about the quality of argument, and also item 4 (1.75/3 points) which was about the use of TPACK dimension. Apart from these, Table 4 was also created to examine teachers' scores on each item in detail.

Table 4

Teachers' Ability to Design TPACK-bAP Lesson Plan

		3 point		2 point		1point		0 point			
		f	%	f	%	f	%	f	%		
The use of TPACK	Item 1	5	62.5	3	37.5	-	-	-	-		
	Item 2	8	100	-	-	-	-	-	-		
	Item 3	7	87.5	1	12.5	-	-	-	-		
	Item 4	4	50	1	12.5	-	-	3	37.5		
		5 point		4 point		3 point		2 point		1 point	
		f	%	f	%	f	%	f	%	f	%
Components of argument	Item 5	2	25	6	75	-	-	-	-	-	-
		3 point		2 point		1point		0 point			
		f	%	f	%	f	%	f	%		
The quality of the argument	Item 6	5	62.5	2	25	-	-	1	12.5		
	Item7	1	12.5	4	50	3	37.5	-	-		
	Item 8	-	-	1	12.5	6	75	1	12.5		

Item 9	3	37.5	4	50	1	12.5	-	-
Item 10	2	25	3	37.5	1	12.5	2	25
Item 11	3	37.5	4	50	1	12.5	-	-

Table 4 showed that teachers were the most successful in creating technology-supported learning materials (such as videos, animations, etc.) (item 2) (100%), using technology for presentation (item 3) (87.5%), and using appropriate technologies for content knowledge (item 1) (62.5%) respectively. However, nearly half of them did not use technology for assessment (item 4). They showed a tendency to construct their argument with only one rebuttal (item 5). Furthermore, more than half of the teacher groups proposed alternative hypotheses for the research question and stated one of them as the claim (item 6). In their arguments, 37.5% of them used data from weak sources such as their observations, experiences, etc. (item 7). There was a similar situation for the warrant component. Most teachers used warrants that could not explain the claim (75%) (item 8). However, they were successful at proposing backings. They used correct but incomplete scientific principles to support the warrant (item 9). Besides, they were successful at proposing qualifiers and rebuttals. They proposed scientifically accurate qualifiers mostly but with a lack of detail for 37.5% of them (item 10). According to proposing rebuttal, most of them associated rebuttal with the claim, but 50% of them could not sufficiently ensure the claim's invalidity (item 11).

What Does Science Teachers' Pedagogical Reasoning Tell Us about TPACK-bAP?

In the first question, teachers were asked about how TPACK-bAP affected their educational aims, relationship with other courses, their contribution to students, and their content knowledge level regarding the learning gain they would teach. They stated that TPACK-bAP contributed to their planning skills, mostly regarding educational aims. They used expressions such as "*TPACK-bAP requires preliminary preparation so that my planning skills can enhance*," "*I was aware of planning technology for my lessons,*" etc. On the other hand, they thought that TPACK-bAP has the potential to make students participate actively in a lesson regarding contribution to students. They said that "*TPACK-bAP allows students to practice*," "*I can engage students in inquiry process*", "*I can promote students' active participation with technology use*" and "*I can prevent students from remembering facts by engaging them in the argumentation process*". Corresponding with relating science with other courses, teachers expressed the effect of TPACK-bAP on their efficacy gain. For example, they said that "*I can relate science with other courses when constructing argument components*". Teachers evaluated the effect of TPACK-bAP on content knowledge levels in terms of both students' conceptual knowledge and theirs. They used expressions such that "*I can ensure students' meaningful learning through argumentation*" and "*Argumentation requires a solid content knowledge especially for constructing backing, qualifier, and rebuttal components. I can keep my content knowledge fresh and develop it through the use of argumentation*."

In the second question, teachers were asked about how and why TPACK-bAP contribute to their lesson plans. Teachers gave answers in terms of classroom learning,

resource use, and evaluation process. Related to "classroom learning", teachers expressed that "*I can motivate students with different activities*," "*I can design activities for promoting argumentation*", "*I can plan the lesson effectively*", and "*I can promote the interactions in class*". Related to "resources use," teachers stated that they could use various resources effectively. Besides, they said that especially formative assessment could be improved with the learning from TPACK-bAP. For example, they used expressions such as "*I can use different assessment tools, this contributes to making more accurate formative assessments, and I will use my learning, especially in the evaluation process. I will use EDMODO*."

In the third question, teachers were asked how and why TPACK-bAP affects their teaching identity. They gave answers based on pedagogical interactions and content knowledge. For example, one teacher said, "My lessons were heavily teacher-centered but after I experienced the practices based on inquiry and technology, I will design my lessons *more student-centered*." Another teacher said, "*Although I have an understanding of student-centered learning, sometimes practicing this may be difficult. But I can teach effectively with the help of visual and digital resources*." As seen, teachers emphasized the active role of students in the learning process in the context of pedagogical interactions. Furthermore, teachers clarified that TPACK-bAP contributed to an increase in content knowledge and technology use for teaching content.

In the fourth question, teachers were asked whether TPACK-bAP would promote reviewing and re-examining their behaviors and instructional decisions when teaching. All teachers gave a "*Yes*" answer to this question and they explained that they asked questions to themselves regarding pedagogical and self-reflection questions. Related to pedagogical questions, teachers asked about how to evaluate students' arguments, how to find qualifiers and rebuttals to an argument, and how to enrich class activities. In the context of self-reflection questions, teachers mostly evaluated themselves among their colleagues.

In the fifth question, the potential effect of TPACK-bAP on gaining new knowledge and skills was questioned. All teachers clarified that they gained new knowledge and skills regarding pedagogy. For example, while one teacher said that "*I learned new method, argumentation and I would practice it in my class*," the other teachers explained "*I design my lessons emphasizing argument schema*", "*I have an opportunity about how to practice technology effectively*" and "*I had an awareness on the importance of using worksheets*".

In the last question, teachers' views about the practice and sustainability of TPACK-bAP were questioned. They expressed their views based on three categories: physical condition of class, using technology, and time. Related to the physical condition of the class, one teacher said, "*Although practicing TPACK-bAP is difficult in a crowded class, I will try it*." Related to using technology, it was stated "*Technology use is now a natural need, and it is required for adopting innovations*". Finally, related to time, teachers generally thought that using TPACK-bAP may be time-consuming in the beginning, but once students get used to it, it will be easier to practice.

Discussion and Conclusion

This study aimed to determine science teachers' performances in designing TPACK-bAP lesson plans for teaching principles of geology content. Two research

questions were considered. One was about how science teachers' status was about designing TPACK-bAP lesson plans and the other was about their pedagogical reasoning about TPACK-bAP.

Data regarding the first research question were obtained through the lesson plans and analyzed through RuTbA-LP. Results indicated that teachers showed a success rate of 73.57% in designing TPACK-bAP lesson plans and especially in the use of TPACK indicators in their lessons. They got an average of 10.25 points out of 12 in the use of the TPACK indicators dimension. "*Creating technology-supported learning material*" was the item that teachers were the most successful in this dimension. This may stem from the TPACK-bAP PDP during which teachers experienced activities for their technological knowledge (TK) development. They learned to create animations and simulations and prepare and rearrange the videos. In other words, an increase in their TK ensured them to create effective TPACK-based lesson plans. This result supports the study by Long et al. (2020), in which they stated that each TPK, TK, and PK was a strong predictor of TPACK. Further, this result follows the studies by Trainin et al. (2018) in which they reported that technology knowledge predicted technology integration frequency, and by Lehtinen et al. (2016) which it was stated that technological knowledge was associated with the usefulness of simulation and the views for integrating them into teaching. Moreover, teachers had high mean scores in "*using technology for presentation*" and "*using appropriate technologies for content knowledge*" items. The TPACK's positive effects on both teaching (Akkoc et al., 2012) and the selection of appropriate educational activities based on technology (Aktas & Ozmen, 2020) may lead us to gather these results.

Another important finding pointed out that teachers succeed less in "*using technology for assessing the learning,*" although they declared in PRAF that formative assessment could be improved by learning from TPACK-bAP. Nearly half of them did not use technology for assessment in their lesson plans. The reason for this may stem from their lack of experience and efficacy in using technology for assessment in classes. Other studies reported that teachers needed to be confident in using technology in assessment (Jordan & Mitchell, 2009; Ridgway et al., 2004). Another reason for this finding may be teachers' beliefs about their students. They may think that the use of technology in assessment can be difficult with inexperienced students. This view is supported by Borko et al. (2000), declaring that teachers want to change their assessment practices to reflect those advocated by any reformist message so long as it reproduces features of teaching and learning mandated for their classrooms. Therefore, although technology is somewhat seen as a reform, it is not widely used as a general assessment media as the main way of educational evaluation is based on the paper-pencil test country-wide. So, science teachers who participated in our research are reluctant to disrupt their routine in their classrooms; as Lee and William (2005) emphasized, the practice of formative assessment demands reconstructing the teaching practices that they have worked so hard to build. They conducted a case study to describe the process of teacher change and the development of formative assessment practices and found six factors that could be attributed to the significant changes in teachers' practices, namely; credible evidence that motivated teachers to change their practices, having practical ideas to implement in the classrooms immediately, continuous support from the researchers and professional learning community,

interventions to provide opportunities for reflection on immediate actions and further perspectives and insights, enough time to support teachers' slow pace of change, flexibility to use as many strategies presented to develop their formative assessment practice. As a result, teachers' motivation to change requires wider and systematical reform-like movements rather than a practice of a series of in-service training programs.

Another finding indicated that teachers had a success rate of 85**%** in the components of the argument dimension. This dimension was the second in RuTbA-LP that teachers had high scores. Findings related to this dimension pointed out that although some teachers used more than one rebuttal in their arguments, most of them tended to use only one rebuttal. This finding is consistent with the study by Zohar and Nemet (2002), even if the study groups are different. They found that students could propose rebuttals, but these rebuttals tended to be simple and included only one justification. According to Toulmin (1958), rebuttals serve as showing exceptional cases. Therefore, proposing a rebuttal requires solid content knowledge and evaluation of this. The reason for teachers' tendency to use only one rebuttal when constructing an argument may be related to the context. In our study, teachers studied principles of geology content. In geology, knowledge is generated based on inferences, as Ault (1998) said. Here, teachers devoted little time to gaining content knowledge about geology. They learned geology content intensely for about 1.5 days. Therefore, teachers' content knowledge may be insufficient for proposing more rebuttals. The other finding related to the quality of argument dimension supports this assumption. According to this, teachers could use correct but incomplete scientific principles to support the warrant. This finding also shows that teachers gained content knowledge with some deficiencies.

Findings about the quality of argument dimension in RuTbA-LP showed that teachers had relatively lower success. They got 11.25 points out of 18 and reached a success rate of 62.5**%**. Although teachers had high scores in the quality of claim, rebuttal, and backing respectively, they had some problems in presenting data and warrant for the claim. Most participants could not state enough data to support the claim or used weak data sources such as personal beliefs, prejudices, etc. This finding is consistent with other studies declaring that students could not use scientific evidence to support their claim and have enough understanding to explain how data is used as evidence (Sadler & Zeidler, 2004; Schimek, 2012) even if the study groups are different. The reason for this may be related to the content of the TPACK-bAP PDP. In training, teachers experienced the argumentation process as a teaching/learning and assessment tool, but they did not inform about what counts as data, evidence, or warrant, their similarities, and differences from each other. The lack of knowledge about the components of the argumentation process may cause this finding. Another reason may stem from the methodological problems of the Toulmin Argument Pattern (TAP), as Kelly and his colleagues (1998) said. TAP is useful for a solid understanding of the argumentation process; however, what counts as data, warrant, backing, etc., is not clear. This raises some difficulties, such as requiring a solid understanding of the language in the context of evaluating the argumentation process.

The findings about teachers' pedagogical reasoning indicated that all teachers agreed on the effect of TPACK-bAP on reviewing and re-examining the behaviors and instructional decisions. They stated that TPACK-bAP PDP enriched the lesson plans in

terms of classroom learning especially related to pedagogical interactions, resources use, and technology use for content knowledge, determining educational aim, and gaining new knowledge and skills. According to Mailhos (1999), pedagogical reasoning requires the capacity to select adequate content knowledge, plan and implement the most proper learning situations, and reflect and make a decision in the teaching/learning process. Based on this definition, the finding shows the contribution of TPACK-bAP to their pedagogical reasoning and is consistent with Cunningham's study (2007). Both studies revealed that teachers considered three main factors: student-related, structural factors such as resources, and teacher-related factors when they reason pedagogically. They also showed a tendency to practice and sustain the learning from TPACK-bAP in their classes. This may be related to preparing learning environments after TPACK-bAP PDP. According to Loughran et al. (2016), the most effective way to develop pedagogical reasoning is through reflection. In supporting this, Dewey (1933) declared that reflection is important for shaping practical knowledge through experiential learning. Therefore, teachers may develop their pedagogical reasoning when they design lesson plans for implementing TPACK-bAP learning.

Similarly, Pella's (2015) study clarified that the practice-based learning model, which comprises teachers' active participation in professional development, facilitated the development of pedagogical reasoning. Another reason for this finding may stem from the content of TPACK-bAP PDP. In this study, teachers experienced the argumentation method and how it can be blended with technology in the context of geology. According to Northfield and Gunstone (1997), modeling and promoting instructional ways being advocated is an effective way of developing pedagogical reasoning. Based on this view, teachers may use argumentation and technology in their classes.

In conclusion, this study showed that the TPACK-based argumentation practices training contributed to their lesson plan designs and the findings of pedagogical reasoning confirmed this. Teachers could use technology to teach content knowledge and create instructional media; however, they did not prefer to use it for assessment. They also made quality claims, backings, and rebuttals, but they had some problems with data and warrant for their argument, and they tended to use only one rebuttal when constructing it. Although teachers had some deficiencies with technology use and argumentation process, TPACK-bAP PDP was able to affect their pedagogical reasoning. It could motivate them to practice and sustain the learning from the training in their classes.

Implications

This study provides evidence that TPACK-bAP professional development affected teachers' pedagogical reasoning, and they could reflect their decisions about TPACK-bAP in their lesson plans. Our study contributed to the effectiveness of the TPACK framework in geology education. It also showed the potential of the professional development program for effective geology education. For this, we suggest further training studies on geology education with different pedagogies, technologies, and frameworks. Our study revealed that teachers were more successful in using TPACK indicators than argumentation in their lessons and constructing arguments with components than constructing them with quality. We thought that the reason for

teachers' problems with constructing quality arguments might stem from their epistemological views. Therefore, we suggest further training for the development of teachers' epistemological understanding. This study has also validated a scoring rubric for assessing the TPACK-based argumentation lesson plans. Other researchers can use this instrument to determine in-service or pre-service teachers' lesson designs based on TPACK-based argumentation.

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Statement of Responsibility

All authors have participated sufficiently in literature review, methodology, data analysis, data interpretation, writing and revisions of the manuscript.

Conflicts of Interest

We have no conflicts of interest to disclose.

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Analysis of Constructivist Learning Model's Effects on Student Outcomes: A Second Order Meta-Analysis

Yapılandırmacı Öğrenme Modelinin Öğrenci Çıktılarına Etkisinin İncelenmesi: Second Order Meta-Analiz

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ABSTRACT: The effects of the constructivist-learning model on student outcomes are analyzed in this research study. For this purpose, the results of 19 meta-analysis research focusing on the effects of constructivist learning models on student outcomes are combined with the second-order meta-analysis method. The research included in the process had been carried out between the years 2015 and 2021. At the end of the research process, it is determined that the effect of constructivist learning models on student outcomes is medium level. On the other hand, it is determined that the effect of constructivist learning models on student thinking skills and academic success is high-level. Besides, it is found that the effect of constructivist learning models on student attitudes is medium level. At the end of the moderator analysis based on location, it is observed that the effects of constructivist learning models on student outcomes vary. Atelier studies can be carried out in education zones to develop teaching skills about the application of constructivist learning models. On the other hand, it is seen that studies on the issue mostly focus on academic success and attitude. Following this, the effects of constructivist learning models on the other student outcomes can be analyzed.

Keywords: Academic achievement, **c**onstructivist learning model, thinking skills, second order meta-analysis.

ÖZ: Bu araştırmada yapılandırmacı öğrenme modellerinin öğrenci çıktılarına etkisi incelenmiştir. Bu doğrultuda 2015-2021 yılları arasında, yapılandırmacı öğrenme modellerinin öğrenci çıktıları üzerindeki etkisini inceleyen 19 meta analiz araştırmasından elde edilen sonuçlar second order meta analiz yöntemiyle birleştirilmiştir. Araştırma sonucunda yapılandırmacı öğrenme modellerinin öğrenci çıktılarına etkisinin orta düzeyde olduğu sonucuna varılmıştır. Ayrıca yapılandırmacı öğrenme modellerinin öğrencilerin düşünme becerilerine ve akademik başarılarına etkisinin yüksek düzeyde olduğu sonucuna erişilmiştir. Öte yandan yapılandırmacı öğrenme modellerin öğrenci tutumlarına etkisinin orta düzeyde olduğu sonucuna varılmıştır. Lokasyona göre yapılan moderatör analizi sonucunda yapılandırmacı öğrenme modellerin öğrenci çıktılarına etkisinin farklılaştığı görülmüştür. Yapılandırmacı öğrenme modellerinin öğrenci çıktılarına etkisi dolayısıyla öğretmenlerin yapılandırmacı öğrenme modellerinin uygulamasına ilişkin becerilerini geliştirmek amacıyla eğitim bölgeleri düzeyinde atölye çalışmaları yapılabilir. Ayrıca yapılan çalışmaların daha çok akademik başarı ve tutum ile ilgili olduğu görülmektedir. Bu doğrultuda yapılandırmacı öğrenme modellerinin diğer öğrenci çıktıları üzerine etkileri incelenebilir.

Anahtar kelimeler: Akademik başarı, yapılandırmacı öğrenme modeli, düşünme becerileri, second order meta-analiz.

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Curriculums are made of the purpose, content, teaching/learning methods, education environment, education instruments, and assessment and evaluation elements. The steps of designing and implementing an efficient curriculum are closely related to the development of these elements (Batdı, 2021). In countries with centralized management, decision-makers have more efficient roles in the stages of designing, implementing, and evaluating programs; teachers, on the other hand, have more authority in deciding variables such as learning approach, method, model, instruments, and putting the activities into practice. School managers have more power in organizing learning-teaching environments, planning and controlling the education process when compared to other shareholders. In other words, the authority of school managers and teachers in countries that embrace central-management understanding is limited to determining teaching methods and the process of putting them into practice. However, the roles of school managers as the leaders of the teaching process are the most significant role as they assist in developing teaching and direct education processes (Gülbahar, 2014). The value and efficiency of programs used in schools are related to student outcomes after implementing the program (Kozikoğlu, 2014). In line with this purpose, in the systems that prioritize the understanding of centralized management, the efficiency of educational programs depends on the learning approach and models chosen by teachers for planning the teaching process.

The efficiency of the teaching process is closely related to activities that support student learning by discovery and experience; additionally, learning processes should be linked with the daily life of students (Ministry of National Education [MoNE], 2009, p. 8-9). Teachers should organize classes in line with the interest and needs of students to increase learning outcomes in the teaching process (Saracaloğlu, 2019; Şimşek, 2022). The efficiency of the learning and teaching process depends on the approach, method, and technique in which students are cognitively, affectively, and socially active (Toraman & Demir, 2016). Constructivist approach is one of the approaches in which students are active in the learning process and have the responsibility of learning. (Eskicioğlu, 2021).

Individual and meta-analysis studies about the effects of learning models that centralize the constructivist learning approach on student outcomes are carefully analyzed in the scope of this study. According to the findings, at the end of the teaching and learning processes based on constructivist learning model, the effects are on student outcomes, such as students' academic success (Akuma & Callaghan, 2019; Arık & Yılmaz, 2020; Ayaz & Şekerci, 2016; Bores-Garcia et al., 2021; Erişen & Günay, 2015; Hall & Quinn, 2014; Jamal et al., 2019; Semerci & Batdı, 2015; Şad et al., 2017; Zakaria et al., 2019), attitude (Akuma & Callaghan, 2019; Ayaz & Şekerci, 2016; Azer & Azer, 2015; Hall & Quinn, 2014; Jamal et al., 2019; Semerci & Batdı, 2015; Zakaria et al., 2019) and thinking skills (Musna et al., 2021; Şaşmaz-Ören & Sarı, 2019; Suparman et al., 2021). On the other hand, when the related literature is analyzed, it is seen that meta-analysis research (Demirel & Dağyar, 2016; Musna et al., 2021; Suparman et al., 2021; Yohannes et al., 2020), in addition to the basic research about the constructivist learning model, are quite common. When the meta-analysis studies about the effects of learning models based on the constructivist learning approach are analyzed, it is determined that their impact sizes are different from one another and this difference is big (*ES*=.45 and *ES*=1.20). In line with this, it is seen that it is necessary to

make a more comprehensive and detailed study for synthesizing the findings obtained from meta-analysis studies and using the obtained knowledge more efficiently. This research is important in terms of revealing the overall effect size of learning models based on the constructivist learning approach on students' learning outcomes.

Purpose

At the end of the literature analysis, it is encountered that no study combines the results of meta-analysis studies that focus on the effect of constructivist learning models on student outcomes. It is believed that this study will contribute to the literature about the effects of these learning models on student outcomes. In line with this purpose, this study aims to analyze the effects of constructivist learning models on student outcomes. The below-mentioned questions are asked in the scope of this research study.

1. What is the impact level of constructivist learning models on student outcomes?
2. Does the effect of constructivist learning models on student outcomes vary according to moderator variables?

Literature Review and Theoretical Framework

According to the constructivist approach, teachers do not directly transfer knowledge to students who are passive throughout the process; students are active in the process of constructing knowledge (Duman, 2013; Gökalp, 2019). Students compare new information to the older ones, create schemes if necessary and internalize knowledge (Genç, 2017; Güneş & Asan, 2005). In traditional teaching approaches, learning mostly occurs in the process of transmitting knowledge to students who repeat and memorize what they learn (Demirel, 2010; Şimşek, 2022). In the constructivist learning model, learning occurs through the transfer of existing knowledge and reconstruction of it (Demirel, 2010). In this regard, practices that put the student into the center are based on the basic principles of constructivist theory (Dal & Tatar, 2017; Saracaloğlu, 2019). The process of acquiring knowledge and experiences as a result of communication with the environment and accommodation of them in a proper manner supports the creation of knowledge (Akyol, 2006). Constructivist learning approaches put students into the center, enable them to use their potential and organize knowledge, allow them to work in cooperation with their peers in the same classroom, and use their experiences while forming knowledge (Titiz, 2005). There are many learning models based on the constructivist learning approach. As a result of the literature review, when the studies on constructivist learning models are examined, it is seen that there are many meta-analysis studies on cooperative, problem-based, project-based and inquiry-based learning models (Akuma & Callaghan, 2019; Arık & Yılmaz, 2020; Ayaz & Şekerci, 2016; Azer & Azer, 2015; Bores-Garcia et al. 2021; Erişen & Günay, 2015; Hall & Quinn, 2014; Jamal et al., 2019; Musna et al., 2021; Semerci & Batdı, 2015; Suparman et al., 2021; Zakaria et al., 2019). Therefore, these models were emphasized in the study.

There is student-student interaction besides teacher-student interaction in learning environments in classrooms. The level of this interaction might have positive and negative impacts on learning levels, student attitudes towards school and teacher, their thoughts about one another, and their self-esteem (Ekinci, 2011). Cooperative learning takes learning resulting from the interaction among students into consideration.

In this learning model, students learn and support a specific topic in small groups; they help one another and work together (Gökalp, 2019). Cooperative learning includes many attractive features such as establishing new friendships, discovering one another, observing the similarities between friends in the process of learning. Teachers prefer using the cooperative learning model in learning and teaching processes for many reasons, such as increasing success, developing high-level thinking skills, improving self-esteem, supporting positive attitudes towards school and classes, and ensuring socialization (Ekinci, 2011).

Problem-based learning is used in different disciplines in the education process (Zakaria et al., 2019). This learning model presents real-life problems to students, enables them to learn in the scope of these problems, increases their active participation, enables them to make sense of information, and makes learning permanent. In this model, learning occurs as a result of the effort to understand a problem and finding a solution to it (Erdem-Gürlen, 2011). Students produce solutions by using the existing information in the frame of the problem presented by the teacher and they support each other's learning in line with a specific target (Kaptan & Korkmaz, 2001). When students can reflect on their previous knowledge and experiences in the process of problem-solving, it positively affects the problem-solving process and learning environment (Akın, 2009). In a learning process based on problem-based learning: Existing knowledge becomes observable, learning is supported by presenting problems that can occur in real-life, the acquired information is organized, and knowledge becomes permanent (Erdem-Gürlen, 2011).

The project-based learning model enables students to establish inter-disciplinary connections and accordingly create a more supportive education environment; it defends integration with the real-world while acquiring information (Genç, 2017). The purpose of this model, which is based on the creation of a product by students in a cooperative environment, is to support students have personal responsibilities, motivate them about being creative as part of a group, improve their problem-solving skills, design and create their products and think like scientists (Gökalp, 2019).

Inquiry-based learning model is an approach that enables students to actively participate in the education process, improve their ability to use scientific processes, and support their thinking skills by making discussions and activities (Duran & Dökme, 2018). In a research-based learning strategy, the student bears the role of an individual that research, question, explain and make suggestions about the information he/she should learn (Sarı & Şaşmaz-Ören, 2020). In inquiry-based learning, educators aim to enable students to analyze a topic in detail and give the effort to find a solution. Students actively participate in the process by asking questions, making research and observations, and taking responsibility (Davis, 2005).

Method

The second-order meta-analysis method is preferred in the study in line with the purpose. Second-order meta-analysis is the meta-analysis of first-order meta-analysis. Meta-analysis research is used in the second-order meta-analysis method instead of basic research (Oh, 2020). In the second-order meta-analysis method, statistical data of the meta-analysis research are synthesized, similar to the first-order meta-analysis method (Schmidt & Oh, 2013). It is possible to make more general and comprehensive

analyses in this method. The second-order meta-analysis method allows combining and evaluating more than one meta-analysis research. As the purpose of this study is to generally evaluate the effects of constructivist learning models on student outcomes, second-order meta-analysis is preferred.

Data Collection

Web of Science, Scopus, ERIC, and TR Index databases are used to collect the data for this study. TR Index is a database including Turkish scientific published articles. The option of "title" is used while doing searches in databases. Searches are carried out both in Turkish and English. Keywords presented in Table 1 are used in searching titles.

Table 1

Keyword Pool and Abbreviations

Group	Keyword pool		Abbreviations	
for learning models	for English	for Turkish	Constructivist Learning Model	CLM
	Problem-based	Probleme dayalı	Problem Based Learning	PBL
	Project-based	Proje temelli	Project Based Learning	PjBL
	Cooperative Learning, Collaborative learning, Laboratory-Based, Group learning, team learning	İşbirlikli, işbirlikçi, laboratuvar temelli, grupla öğrenme, takımla öğrenme	Cooperative Learning	CL
	Inquiry, learning cycle (3E,5E,7E)	Sorgulamaya dayalı, araştırmaya dayalı, öğrenme halkaları (3E,5E,7E)	Inquiry Based Learning	IBL
	Case-based learning	Örnek olaya dayalı	Case Based Learning	CBL
	Argumentation-Based Learning	Argumantasyona dayalı		ABL
	Constructivist	Yapılandırmacı, oluşturmacı		
for method	Meta-analysis, meta-analytic, systematic review	Meta analiz, meta analitik, sistematik inceleme		

Search results are evaluated according to the inclusion and exclusion criteria that were determined before. These criteria are taken into consideration while choosing research.

Inclusion and Exclusion Criteria

1. Meta-analysis research should focus on only one constructivist-learning model, such as PBL, CL, PjBL, or IBL. If constructivist learning models are defined and analyzed independently from one another (e.g., if moderator variable is assigned), they are included in this study. However, if the types of constructivist learning models are not clearly defined, they are excluded. Besides, meta-analysis studies that involve constructivist learning models supported with technological tools (e. g computer-based, technologies supporting, inquiry-

based mobile learning, and digital problem-based learning) are excluded. In other words, blended constructivist learning models are excluded.

2. Meta-analysis research should include basic research at the K-12 level. It is excluded if research includes basic research at the higher education level. If the analysis is carried out along with higher education level and impact size according to level (primary, middle, high, and tertiary) is reported, these meta-analysis studies are excluded.
3. Meta-analysis research should focus on student outcomes.
4. Meta-analysis research sample group should be general students. Meta-analysis research that involves gifted and high-achieving students is excluded.
5. Meta-analysis research should have been published between 2015 and 2021. Current years are preferred to decrease the problem of overlap among meta-analysis researchers.
6. The language of meta-analysis research should be either English or Turkish. As researchers of this study know English and Turkish languages, meta-analysis studies are limited to these languages.
7. Basic research that are the basis of meta-analysis research should have an experimental design. Learning models should be tools of intervention. Analyzed learning models should be well-defined. Researchers whose learning models are not certain are excluded.
8. If meta-analysis studies have more than a 25% overlapping ratio, if they are current and comprehensive, they are included in this study. Cooper and Koenka (2012) state that if overlapping ratios are below 25% these meta-analysis studies are independent of one another. Meta-analysis research that have more than a 25% overlapping ratio are presented in Table 2. On the other hand, meta-analysis research that are preferred and excluded are presented in the same table. Meta-analysis research that are current and comprehensive are preferred after determining that they are overlapping.

Table 2

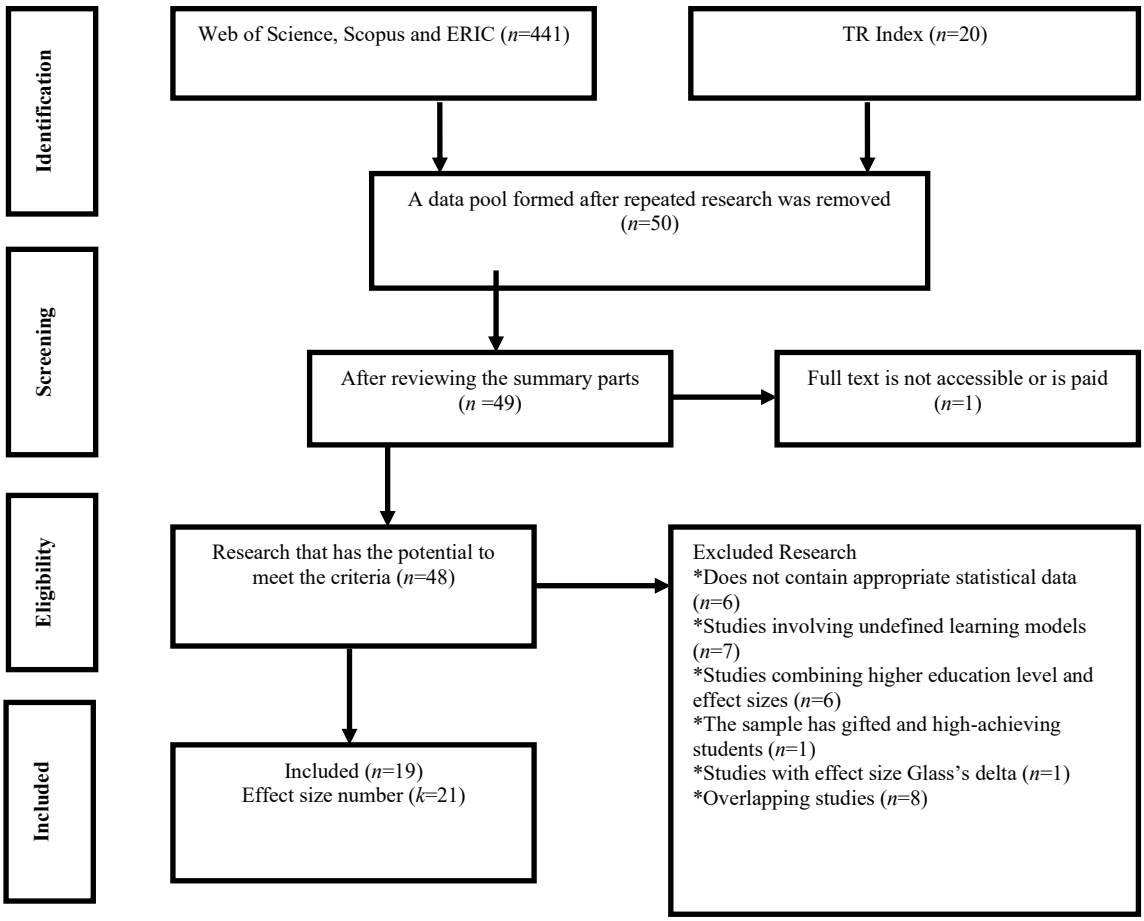
Research That Are Included and Excluded because of Overlap

Excluded	Included	Model	Outcome
Juandi & Tamur (2021)	Suparman et al. (2021)	PBL	thinking skill
	Yohannes, et al. (2020)		
	Musna et al. (2021)		
Ayaz (2015)	Demirel & Dağyar (2016)	PBL	Attitude
Capar & Tarım (2015)	Turgut & Gülşen-Turgut (2018)	CL	Achievement
Aktamış et al. (2016)	Sarı & Şaşmaz-Ören (2020)	IBL	Achievement
Aktamış et al. (2016)	Şaşmaz-Ören & Sarı (2019)	IBL	Thinking skill
Balta & Sarac (2016)	Sarac (2018)	IBL	Achievement
Yaman & Karaşah (2018)			
Balemen & Özer-Keskin (2018)	Ayaz & Söylemez (2015)	PjBL	Achievement

9. Meta-analysis research should include sufficient statistical index to calculate generic effect size (e.g., Cohen's d, Hedge's g, and lower limit based on these impact sizes (*LL*), the upper limit (*UL*), Standard error (*SE*), variance value. Glass's delta value is used when the standard deviation value between the experiment and control group is meaningfully different. The control group's standard deviation value is used to calculate Glass's delta value (Henson, 2006). This is why Glass's impact size calculation method for determining the standardized mean difference yield relatively different results from Hedge (*g*) and Cohen's (*d*) impact size calculation method. On the other hand, Hedge' *g* and Cohen's *d* yield approximately similar impact size values. This is why; meta-analysis research that involves Glass's delta impact size is excluded. Studies produced by the database according to CLM types are presented in Appendix 1. A general data flow diagram about the choice of data in the scope of this study is presented in Figure 1.

Figure 1

General Dataflow Diagram



CBL and ABL model meta-analysis research in CLM presented in Table 1 could not be accessed. This is why; the study includes 19 meta-analysis types of research of PBL, PjBL, CL, and IBL learning models. Meta-analysis research features of the dataset of this study are presented in Appendix 1. Meta-analysis research is coded after research.

Coding

CLM: PBL, PjBL, CL, and IBL are coded as constructivist learning models. If a meta-analysis study involves more than one CLM, they are coded independently (Codes: PBL, PjBL, CL, and IBL).

Student outcomes: Student outcomes are coded as academic success, thinking skills and attitude, problem-solving skills, higher-order thinking skills, and critical thinking skills.

Education level: If meta-analysis research comprises many education levels, K-12 level impact size is coded. This type of meta-analysis research is coded as mixed. If research only includes secondary or middle, it is coded as the same (Codes: mixed, middle, secondary).

Location: If meta-analysis research is made of studies originating from more than one country, it is coded as mixed. If it only represents one country, it is coded as the same (Codes: mixed, Turkey, Indonesia, China).

Primary research report type: If meta-analysis research includes at least two of the options of article, declaration, or master's thesis, it is coded as mixed; if they include one, they are coded as the same (Codes: mixed, article).

Academic field: If meta-analysis research includes at least two of the options of math, science, and other fields, they are coded as mixed; if they include only one, they are coded as the same. On the other hand, if the different field of the academic field group is k<3, it is coded as other fields (Codes: mixed, math, other).

Publication bias: If publication bias is detected, it is coded as yes. If not, it is coded as no, and if there is no information about the publication bias, it is coded as NA (Codes: yes, no, NA).

Quality level: Meta-analysis research is coded according to the scores obtained from the quality scale (Codes: Insufficient, low, medium, high).

Quality Evaluation

Revised Assessment of Multiple Systematic Reviews (R-AMSTAR), revised by Kung et al. (2010), is used to evaluate the quality of meta-analysis studies. While the R-AMSTAR scale is being evaluated: 0 to 11 = insufficient, 12 to 22 = low, 23 to 33 = medium, and 34 to 44 = high (Young, 2017). R-AMSTAR scale's 8C and 8D articles are developed for clinical practice. These articles are used in this study, and 8A and 8B articles are coded as 2 points while scoring the scale.

Data Analysis

The analysis unit of this study is at the level of research. Each meta-analysis research represents independent impact size. The use of the random effect model is suggested if research is based on different sampling and features of research vary from one another (Borenstein et al., 2011). The mean impact size, heterogeneity analysis, and moderator analysis processes of this study are carried out under a random effect model. Meta-analytic statistical analyses are carried out under CMA.2 program.

Impact Size: Cohen's impact size calculation method and (*Cohen's d*) Hedge's calculation method (*Hedge's g*) yield approximately the same results in big samplings (Marfo & Okyere, 2019; Turner & Bernard, 2006). However, Cohen's impact size

calculation method yields subjective impact size in small samplings (Turner & Bernard, 2006). Hedge, on the other hand, developed a different calculation method to correct this subjective value. Hedge's impact size calculation method is the corrected version of Cohen's d (Goulet-Pelletier, & Cousineau, 2018; Marfo & Okyere, 2019). When the above-mentioned explanations are taken into consideration, it can be said that the impact size of meta-analysis research included in the dataset of this study is coded according to how they are reported. It is accepted that the difference between *Hedge's g* and *Cohen's d* values is quite small. On the other hand, it is accepted that most of the research included in meta-analysis research has a large sample. Tamim et al. (2011) and Young (2017) used a similar coding process and acceptances in their second-order meta-analysis study in which they analyzed the technology-supported education's effects on learning outcomes. Similarly, Hew et al. (2021) used coding and acceptances in their second-order meta-analysis study focusing on analyzing flipped classroom practice's effects in different disciplines. This study uses *Hedge's g* impact size in line with this information.

Impact size calculation at K-12 level: Meta-analysis research included in this study is generally made of research that involves higher education level (n=13). In other words, meta-analysis research report impact sizes according to education levels as primary, middle, high, and tertiary. These types of research are combined under a random model for impact size at the K-12 level. There are two reasons why this combination is made. Firstly, education levels included in meta-analysis research are not coherent. For instance, primary (K1-K4) and middle (K5-K8) levels are coded independently, while some research is coded together. On the other hand, the basic number of research included in some education levels in meta-analysis research is quite low (k<5). In other words, the sampling number is quite low on some levels. Small sampling group is also a resource of bias (Lin, 2018). Impact sizes of independent education levels meta-analysis research are combined by considering this information.

Publication bias analysis: Egger's test and Duval & Tweedie's trim and fill analysis techniques are used in publication bias analyses of the dataset (Jin et al., 2015).

Heterogeneity and moderator analysis: Q statistics are used to determine the heterogeneity level of the dataset. Besides, I^2 is calculated to determine the heterogeneity level of the dataset and related value is interpreted. Reflective moderator variables that reflect the features of meta-analysis research are defined. *Q* between tests is conducted to see if the mean impact size varied according to moderator variables. On the other hand, mean impact size is calculated and interpreted according to moderator variables.

Ethical Procedures

A meta-analysis is an analysis that includes evaluations made using research results obtained in previous studies. In this regard, it does not require the approval of the ethics committee.

Results

This section of this study presents descriptive statistics of the dataset, mean impact size, publication bias analysis, heterogeneity, and moderator analyses.

Descriptive Statistics and Mean Impact Size

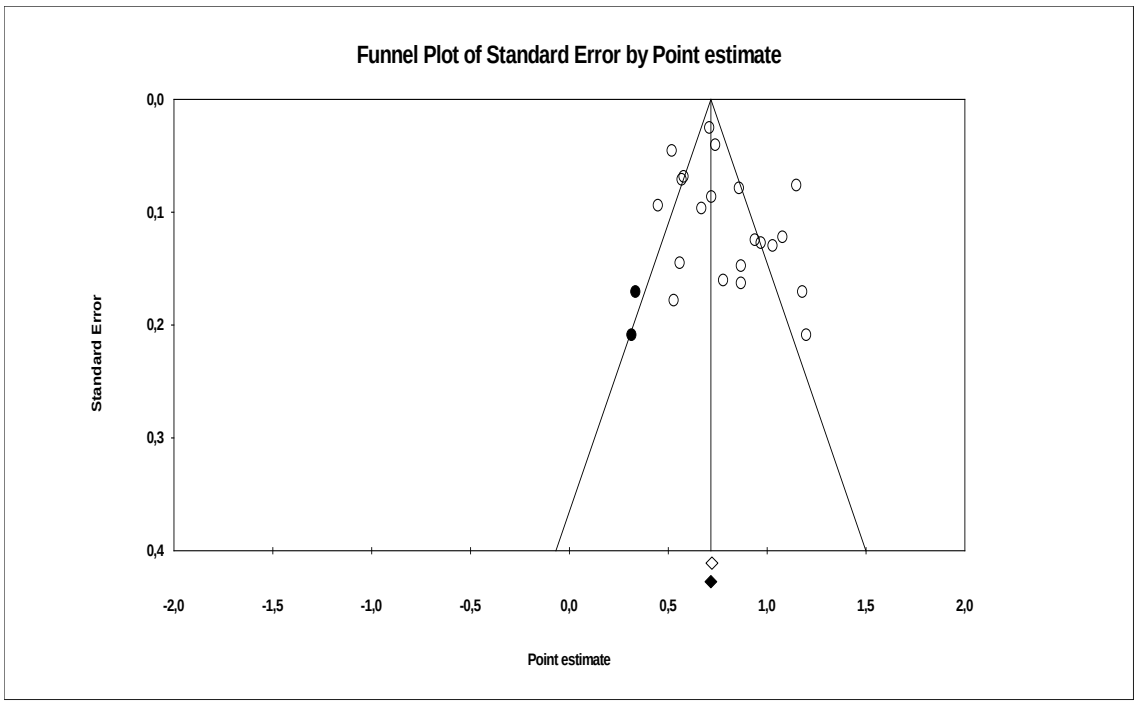
The dataset is made of n=19 independent meta-analysis research. Meta-analysis research consists of a total of 623 independent basic research. k=21 impact size is obtained from the meta-analysis research constituting the dataset. Impact sizes vary between ES=.45 and ES=1.20. The mean impact size is ES=.78 LL=.70 UL=.87. The total heterogeneity amount of the dataset is $Q(20)$ =109.18 (p<.001). The heterogeneity level of the dataset is I^2=81.68.

Publication Bias Analysis

It was determined that there is no publication bias according to Egger's regression test (t=1, 67 p=.11) result. On the other hand, it was found that there is no publication bias according to Duval & Tweedie trim and fill analysis (DTtf) result. According to the DTtf test result, two meta-analyses research should be added to the left side of the mean impact size. According to the DTtf test result, the corrected/adjusted impact size value is calculated to be ES=.76 LL=.68 UL=.84. The difference between the observed value and the corrected value is approximately .02. It can be said that this difference is not important. In addition, the graphic of the distribution of impact size according to standard errors is analyzed. The funnel plot graphic is presented in Figure 2. It can be said that the Funnel plot graphic is approximately symmetrical. When the above-mentioned publication bias analysis results are evaluated together, it can be said that there is an unimportantly low publication bias.

Figure 2

Funnel Pilot Graphic (The Number of Research on Which Dark Spots Should Be Added k=2)



Moderator and Heterogeneity Analyses

Moderator and heterogeneity analyses of the dataset are presented in Table 4. Groups with impact size numbers below k< 3 are not interpreted.

Table 4

Moderator and Heterogeneity Analyses of the Dataset

Group	*k*	*ES (g)*	*LL*	*UL*	*Q*	*df (Q)*	*p*
Outcomes					6.32	2	.04
Achievement	14	.81	.71	.91			
Attitude	3	.51	.27	.74			
Thinking skill	4	.88	.66	1.09			
CLM					1.28	3	.73
PBL	7	.86	.67	1.05			
PjBL	2	.87	.56	1.18			
CL	5	.73	.53	.94			
IBL	7	.75	.58	.92			
Domain					.17	2	.92
Math	7	.76	.60	.91			
Mixed	11	.80	.68	.91			
Other	3	.80	.57	1.03			
Location					15.55	3	<.01
Mixed	5	.67	.53	.81			
Turkey	10	.87	.76	.97			
China	3	.58	.42	.75			
Indonesia	3	1.07	.82	1.32			
Bias					4.55	2	.10
NA	1	.86	.53	1.19			
No	12	.71	.60	.81			
Yes	8	.89	.76	1.02			
Quality					.83	1	.36
High	7	.73	.59	.88			
Medium	14	.82	.71	.92			
Report Type					2.44	1	.12
Article	5	.93	.73	1.12			
Mixed	16	.75	.65	.85			
Level					3.46	2	.18
Mixed	18	.80	.71	.89			
Secondary	2	.82	.49	1.14			
Middle	1	.45	.09	.81			

Important findings in Table 4 are presented below. CLM's impact statistically varies according to student outcome types ($Q_b(2) = 6.32$, $p=.04$). While CLM has a high impact on students' thinking skills and academics (*ES*=.88, *ES*=.81 respectively), its impact on student attitudes is (*ES*=.51) medium-level. Similarly, CLM's impact on student outcomes according to the location included in the meta-analysis research statistically varies ($Q_b(3)=15.55$ $p<.01$). A mixed-type meta-analysis, including research from different countries, had a lower or medium-level effect (*ES*=.67). Similarly, meta-analysis research, including China sampling, produced medium-level impact size (*ES*=.58). On the other hand, meta-analysis research, including Turkey and Indonesia sampling, produced high-level impact (*ES*=.87; *ES*=1.07, respectively).

Discussion and Conclusion

The effects of constructivist learning models on student outcomes are analyzed in this research. For this purpose, findings of 19 different meta-analysis research results obtained from a variety of databases are synthesized with the second-order meta-analysis method. At the end of the research process, it is determined that constructivist-learning models' effects on student outcomes are medium level. When the related literature is analyzed (Akuma & Callaghan, 2019; Ayaz & Şekerci, 2016; Azer & Azer, 2015; Bores-Garcia et al., 2021; Hall & Quinn, 2014; Jamal et al., 2019; Musna et al., 2021; Şaşmaz-Ören & Sarı, 2019; Semerci & Batdı, 2015; Suparman et al., 2021; Zakaria et al., 2019), it is seen that findings are in parallel with the results of this study. Based on this information, it can be said that constructivist-learning models have a positive impact on student outcomes.

On the other hand, application of constructivist learning models is a process that requires professionalism (Kaya, 2013). Teachers and school managers need to gain knowledge and skills about constructivist learning models. In this context, in-service training programs that introduce constructivist-learning models can be organized in different education regions. Similarly, atelier studies can be organized to support teachers' knowledge and experience in practicing constructivist-learning models.

According to the results of moderator analysis, carried out according to the location of meta-analysis research, constructivist learning models' effects on student outcomes vary. If meta-analysis studies used in the research involve more than one country, they produce bigger impact sizes. On the other hand, impact size according to counties is quite different. For instance, meta-analysis research involving China produced medium-level impact size, while meta-analysis research involving Turkey and Indonesia produced high-level impact size. School systems that produce high impact size might be the countries in which traditional education methods are dominant. Turkey's education system is dominated by traditional methods (Kayabaşı, 2012; Terzi, 2011). Constructivist learning models are more flexible and put students at the center when compared to traditional learning models. This flexibility might be the reason some countries produced higher impact sizes. Location bias is a problem in meta-analysis research. According to Higgins and Green (2011), there are two forms of location bias. The first form is based on the database with research, while the second is the country from which research is collected. Vickers et al. (1998) state that impact sizes in clinical applications statistically vary; this situation about clinical applications might also be true for school applications.

To cope with location bias, meta-analysis research can be carried out in a way that includes different counties and different databases. On the other hand, country-based first-order meta-analyses can be combined with the second-order meta-analysis method. Cultural dimensions of countries can be examined as potential moderators in these combination processes. Besides, research that analyzes learning models in cultural contexts can be included.

Implications

This study is limited to the meta-analysis research carried out between 2015 and 2021 in English and Turkish languages. Suggestions for more comprehensive analyses are presented below. The effects of constructivist learning models on student outcomes in different learning models can be analyzed separately.

This study is limited to constructivist learning models: Problem-based, inquiry-based, project-based, and cooperative. Future studies can be carried out in a way that they include case-based, argumentation-based learning, and other learning models. This study excluded blended constructive learning models. Future studies can focus on the effects of constructive learning models blended with education technologies and other elements on student outcomes.

When the related literature is analyzed, it can be seen that most researchers focus on academic success. This study includes meta-analysis research about academic success in line with this finding. Future studies can focus on the effects of constructivist learning models on students' thinking skills (creative, critical, reflective, meta-cognitive, and others). When the related studies in the literature are analyzed, it is seen that meta-analysis research focuses on student attitudes more than their effective features. Meta-analysis research focusing on self-regulation, self-sufficiency, and other affective features can be carried out in the future, contributing to the literature.

Statement of Responsibility

The study was conducted and reported with equal collaboration of the researchers. The researchers had equal roles in the tasks for conceptualization, resources, data collection and analysis, reporting, drafting, reviewing and editing.

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Analysis of the Relationship between Teachers' Perceptions of Organizational Identification and Meaningful Work

Öğretmenlerin Örgütsel Özdeşleşme ile Anlamlı İş Algıları Arasındaki İlişkinin Analizi

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ABSTRACT: Teachers that identify with their organizations and find meaning at work can contribute to their students and schools from various aspects. However, there is limited evidence on teacher perceptions of organizational identification and meaningful work in the literature. The present research aims to determine the relationship between teachers' organizational identification and meaningful work perceptions. This quantitative research is in correlational design. The sample of the research consists of 330 teachers working in Kahramanmaraş. The scales of meaningful work for educational organizations and organizational identification were used as data collection tools. In the analysis of the data, Pearson correlation coefficient was calculated, and regression analyses were performed. Research findings show that there is a positive, moderately significant relationship between organizational identification and meaningful work. Organizational identification is a significant predictor of meaningful work. Organizational identification has positive and moderately significant relationships with the sub-dimensions of meaningful work (meaning at work, transcendence at work, work relationships, meaning leadership at work, humility at work), and it is a significant predictor of these dimensions. Nevertheless, it shows no significant relationship with the dimension of search for meaning at work. Implications for identifying with organizations and meaningful work are discussed.

Keywords: Organizational identification, meaningful work, school, teacher.

ÖZ: Örgütleriyle özdeşleşen ve işte anlam bulan öğretmenler, öğrencilerine ve okullarına çeşitli yönlerden katkı sağlayabilir. Ancak, literatürde öğretmenlerin örgütsel özdeşleşme ve anlamlı iş algılarına ilişkin sınırlı kanıt bulunmaktadır. Bu araştırma, öğretmenlerin örgütsel özdeşleşme ile anlamlı iş algıları arasındaki ilişkiyi belirlemeyi amaçlamaktadır. Bu nicel araştırma ilişkisel desendedir. Araştırmanın örneklemini Kahramanmaraş'ta görev yapan 330 öğretmen oluşturmaktadır. Veri toplama aracı olarak eğitim örgütleri için anlamlı iş ve örgütsel özdeşleşme ölçekleri kullanılmıştır. Verilerin analizinde Pearson korelasyon katsayısı hesaplanmış ve regresyon analizleri yapılmıştır. Araştırma bulguları, örgütsel özdeşleşme ile anlamlı iş arasında pozitif, orta düzeyde anlamlı bir ilişki olduğunu göstermektedir. Örgütsel özdeşleşme, anlamlı işin anlamlı bir yordayıcısıdır. Örgütsel özdeşleşme, anlamlı işin alt boyutları (işte anlam, işte aşkınlık, iş ilişkileri, işte liderlik, işte tevazu) ile pozitif ve orta düzeyde anlamlı ilişkilere sahip olmanın yanı sıra bu boyutların anlamlı bir yordayıcısıdır. Buna karşın işte anlam arayışı boyutu ile anlamlı bir ilişki göstermemektedir. Örgütsel özdeşleşme ve anlamlı işe yönelik çıkarımlar tartışılmıştır.

Anahtar kelimeler: Örgütsel özdeşleşme, anlamlı iş, okul, öğretmen.

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Organizational identification is among the central concepts in the field of organizational behavior and has been increasingly receiving attention in management research (Edwards, 2005). Organizational identification is positively correlated with job engagement (Ji & Cui, 2021) and improves employee job satisfaction (Van Dick et al., 2004), while a high level of job satisfaction can also contribute to employees' cognitive and emotional involvement in work. The research literature shows that organizational identification positively affects teachers' job satisfaction, professional development, and job engagement (Guglielmi et al., 2014). Some researchers have investigated the relationship between identification with school and teacher well-being and found that identification is positively related to colleague support and negatively associated with teacher burnout (Avanzi et al., 2018). However, understanding how the interconnection between teachers and school principals in educational institutions will be affected by organizational identification can give significant clues to stakeholders and schools (Dinçman, 2021). As a matter of fact, it has been shown that trust in the school principal can affect job performance, learning-oriented orientation, and organizational citizenship behavior through organizational identification and job engagement (Chughtai & Buckley, 2009).

Moreover, organizational identification is expected to contribute to the creation of meaning at work (Schnell et al., 2019). Thus, the concept of organizational identification can affect the meaning at work and have an important place in educational organizations. This study focuses on the relationship between organizational identification and meaningful work and examines whether organizational identification predicts meaningful work. As a matter of fact, while it has been determined in various studies that meaningful work predicts organizational identification (Cohen-Meitar et al., 2009; Demirtas et al., 2015; Ouwerkerk & Bartels, 2022), we assume, like Schnell et al. (2019), that organizational identification may be an antecedent of meaningful work because we expect that teachers who identify with their organizations will increase their sense of meaningful work and thus contribute more to their students and schools.

Conceptual Framework

Organizational Identification

Organizational identification has the potential to define and predict many key behaviors and attitudes in the workplace and is considered a psychological state that reflects the fundamental bond that exists between the organization and the employee (Edwards, 2005). While organizational identification is complex in nature, the key point is that it addresses relationships between organizations and individuals. This link indirectly affects the total performance and development of the organization, so it should be regarded as an essential part of organizational behavior (Fuchs, 2012). Organizations are consequential groups with which individuals can identify at various levels. Social identity theory, in which the concept of identification is addressed, is used to define and explore the psychological basis of intergroup behavior and outgroup discrimination. It specifies the elements of identification, as well as provides estimates of the conditional variability of identification. In this context, self-categorization theory, which indicates whether people describe themselves in terms of social identity, personal, and which group is related to behavior in the case of distinctive social identities, contributed to the assumptions of social identity theory by addressing the

behaviors of in-group members. The self-categorization theory asserts that individuals can consider themselves at certain levels, such as personal, middle or group, and upper (Van Dick, 2001). Hence, the concept of organizational identification has areas where the researchers may address each of these levels to reveal specifically the effects of themselves, their groups, administrations, or other factors on individuals' identification with their institutions.

Identification with the organization has been seen as a critical factor for understanding work behavior (Lee, 1971). Organizational identification is defined as a perception of sharing the experiences and characteristics of group members (Mael & Tetrick, 1992). Conversely, identification can also have negative effects on the organization. These may arise from conflicting identities between different focus and prototypical in-group norms and also may cause over-identification that can lead to the unconditional follow-up of organizational rules and the prevention of innovation initiatives (Van Dick, 2001). However, if used as an effective tool to increase organizational functioning and performance, organizational identification can help achieve the desired results. The effect of organizational identification on the success of the organization is hidden in the behaviors of the employees to contribute to the organizational goals. This is facilitated when organizational goals and individuals' goals are aligned, so there is also theoretical and empirical evidence that organizations perform better (Fuchs, 2012). In this direction, it can be assumed that teachers who identify with their schools can have a more positive effect on students' learning.

Meaningful Work

People require meaning in their lives. This meaning is a bridge from negative emotion led by negative life experiences to positive emotion through restructuring cognitively (O'Connor, 2003). In order to understand what the meaning of life means, the concepts of adaptation, purpose, and importance can be discussed: Adaptation means a sense of being understood and giving meaning to one's life. Purpose refers to key goals, purposes, and a sense of guidance in life. Importance, however, is about the intrinsic value of life and the feeling of having a valuable life (Martela & Steger, 2016). Studies on meaning in life examine a person's basic orientation to the world by addressing everything that is critical for a person's past, present, and future (Steger, 2012). In this context, the meaning people seek in their work, which is a part of their life, also has an important place in making sense of their life.

Meaningful work has been a body of growing research in recent years, with an understanding of the importance of meaningfulness for commitment, work motivation, and well-being. However, various researchers use partially overlapping, partially different conceptualizations (Martela & Pessi, 2018). The concept of 'meaningful work' refers to the positive meaning of the job that individuals experience as significant in the relevant literature. The meaning of work has two sources: the self (values, motivation, beliefs) and others (co-workers, leaders, communities and groups, family) (Rosso et al., 2010). Work meanings represent a significant part of how employees see their experience in their organization. There are two kinds of meanings related to work. These are the tasks and activities themselves (the content) and the meaning formed by assessing those tasks and activities. The meaning of work is fluid and can be configured while doing the work. Therefore, it is not constant (Wrzesniewski et al., 2003). How

people make sense of their work positively affects their individual development, the groups, and the organizations they find themselves a part of. Ultimately, individuals' deciding what role they will play in the life stage can enable them to find deeper meaning in work (Wrzesniewski, 2003). However, meaningful work has been found to be the foremost protector of well-being and burnout, but attention has also been drawn to studies showing that it can be a potential source of burnout because it causes working beyond its limits (Correia & Almeida, 2020). Therefore, within the scope of meaning at work as a motivational construct, the sense of self and the sense of balance stand out as critical dimensions besides the work itself (Chalofsky, 2003). Namely, it is important for employees to find a balance between work and life, no matter what organization they are in.

Meaningful work can be a source for a person to maintain a satisfactory work life in line with the values he/she has and to develop a transpersonal relationship at work. For teachers, practicing their profession has a special meaning in terms of the process of serving society and transferring social values, apart from the purpose of income. Due to the dignity of teaching, the meaning that society ascribes to this profession is also high. However, what makes the work meaningful is the meaning that the teacher ascribes to his/her job rather than the meaning and sanctity that society ascribes to the professional or the job. A teacher's sense of meaningful work can assume the role of either a mere educator or a savior in the eyes of students (Göçen & Terzi, 2019). That draws attention to the role of the teachers in conveying social values to students and preparing them for the future more effectively, thanks to the fact that the teachers find their jobs meaningful.

The Relation between Organizational Identification and Meaningful Work

Meaningful work is related to engagement, social support, organizational commitment, organizational identification, psychological ownership, and socio-moral climate. Research on these concepts deals with the attitudes and relationships of employees towards co-workers, supervisors, and higher-level social systems (such as work teams or the organization) (Schnell et al., 2019). In this context, a study by Ouwerkerk and Bartels (2022) on identification, meaningful work, organizational behavior, and job insecurity during the coronavirus shutdowns included employees from over 14 industries in the Netherlands. Similarly, the effects of professional identification, organizational justice, empathy, and meaningful work on burnout in doctors and nurses during the coronavirus pandemic were examined (Correia & Almeida, 2020). Akdoğan et al. (2016) investigated the strategic effect of social responsibility on organizational identification and meaningful work through ethical leadership perceptions. The data were gathered from the workers of an aviation company in Turkey. In another study on aviation workers, Demirtas et al. (2015) analyzed the effect of ethical leadership on organizational identification, follower engagement, and jealousy through meaningful work. One of these studies (Ouwerkerk & Bartels, 2022) included a small number of employees from the education sector.

Some other recent studies regarding teachers in the related literature are as follows: the relationship between teachers' reasons for whistleblowing, organizational cynicism and identification (Kaya et al., 2022), and the association between teachers' perceptions of meaningful work and their decision-making styles (Göçen et al., 2021),

the level of meaningful work among teachers and the relevant factors (Toptaş, 2018), the relationship between perceptions of total reward, work engagement, and organizational identification among Chinese kindergarten teachers (Ji & Cui, 2021), organizational change facilitated by the motivation of change agents through organizational identification and meaning (Specht et al., 2018). Furthermore, meta-analyses on organizational identification (Lee et al., 2015) and meaningful work (Allan et al., 2018) show that organizational identification is highly associated with key attitudes (work involvement, affective organizational commitment, and job satisfaction) and behaviors in organizations while meaningful work has relationships with commitment, work engagement, and job satisfaction; links with life meaning, life satisfaction, withdrawal intentions, general health; and associations with self-rated job performance, organizational citizenship behaviors, and negative affect. These results indicate that organizational identification and meaningful work have related concepts.

This research aims to determine the relationship between teachers' perceptions of organizational identification and meaningful work. It is thought that the identification of teachers with their institutions and the level of meaningfulness of their work in educational institutions and studies on these topics can contribute to students, teachers, and schools. In this context, teachers who identify with their school and find their work meaningful are more likely to take action to increase school success. Therefore, this research is expected to provide evidence to the literature in terms of revealing the relationship between meaningful work and identification perceptions of teachers in educational organizations. The relevant literature shows that the studies regarding teachers' perceptions of meaningful work and organizational identification are limited. Since little is known about the relationship between teachers' organizational identification and meaningful work perceptions, it is considered important that studies on this subject have the potential to provide evidence on identifying with organizations and experiencing meaningful work. Moreover, it is thought that the findings can bring new perspectives to organizations and administrators. From this point of view, the present research examines whether there is a relationship between teachers' organizational identification and meaningful work perceptions, and answers have been sought to the following questions:

1. What is the level of teachers' organizational identification and meaningful work perceptions?
2. Is there a significant association between teachers' organizational identification and meaningful work perceptions?
3. Do teachers' perceptions of organizational identification predict meaningful work perceptions?

Method

Research Design

This study is quantitative research in correlational design. Correlational designs are quantitative research procedures in which researchers consider the degree of relationship between two or more variables by using the correlational analysis statistically (Creswell, 2015). Since this study aims to reveal the link between teachers'

organizational identification and meaningful work perceptions, the correlational design enables the researchers to investigate this relationship.

Population and Sample

The population of this research includes 8957 teachers working in Kahramanmaraş province in the 2021-2022 academic year. The sample of the study comprises 330 participants determined with the simple random sampling technique providing equal probability of teachers' participation in the study. After the sample group was formed, the measurement tool form was reproduced as 420 pieces. The researcher collected the research data from the teachers who voluntarily wanted to participate within the scope of the research population. Before starting the analysis of the data, 23 forms that were found to be incompletely filled were excluded from the evaluation, and data analyses were conducted with 330 returned forms. The return rate of the measurement tool forms taken into the evaluation was 78.5%. Table 1 presents information about the teachers in the sample group.

Table 1

Demographic Information of Participants

Variables		*N*	Percent (%)
Gender	Female	202	61.2
	Male	128	38.8
Age	30 years and below	168	50.9
	31-40 years	120	36.4
	41-50 years	32	9.7
	51 years and over	10	3.0
Specialty	Preschool	51	15.5
	Primary school	104	31.5
	Secondary School	175	53.0
Faculty that they graduated	Faculty of Education	287	87.0
	Other	42	13.0
Professional seniority	0-5 years	135	40.9
	6-10 years	111	33.6
	11-19 years	53	16.1
	20 years and over	31	9.4
Total		330	100

It can be stated, according to Table 1, that the teachers participating in the research show sufficient diversity in terms of gender, age, specialty, faculty that they graduated from, and professional seniority. The high number of female participants means that female teachers are more involved in this task than males; On the other hand, the high number of teachers under the age of 40 and with seniority of less than 11 years can be explained by the low average age of teachers across the country.

Data Collection Tools

The research used a personal information form, the meaningful work scale for educational organizations, and the organizational identification scale as data collection tools. The researchers developed the personal information form. The form includes questions about age, gender, branch, graduation, graduated faculty, and professional seniority.

'Meaningful Work Scale for Educational Organizations' was developed by Göçen and Terzi (2019) and it has 21-item and 6-dimensions (Meaning at Work, Work Relationships, Search for Meaning at Work, Transcendence at Work, Meaning Leadership at Work, Humility at Work). To test its validity, confirmatory factor analysis (CFA) was applied in the Amos 22 program and the six-dimensional structure was examined. DFA results [$\chi 2/df$=2.01; AGFI=.88; GFI=.91; NFI=.90; CFI=.94; RMSEA=.05] showed that the scale had construct validity. The Cronbach Alpha internal consistency value for the scale's reliability was calculated as .82 in general; .84 for meaning at work, .81 for Search for Meaning at Work, .89 for Work Relationships, .73 for Transcendence at Work, .72 for Humility at Work, and .78 for Meaning Leadership at Work.

'The Organizational Identification Scale' was developed by Mael and Ashforth (1992), and the adaptation into Turkish was made by Şahin (2014). The scale has six items and one dimension. To test its validity, confirmatory factor analysis (CFA) was applied in the Amos 22 program and the one-dimensional structure was examined. DFA results [$\chi 2/df$=1.58; AGFI=.95; GFI=.98; NFI=.95; CFI=.98; RMSEA=.04] showed that the scale had construct validity. The Cronbach Alpha value for the scale's reliability was calculated as .84.

Data Analysis

The data collected through printed forms were transferred to Microsoft Excel, then SPSS before starting the data analysis. SPSS 25.0 program was used in the analysis of the data. Data distribution was tested. Since the calculated kurtosis and skewness values were between -1.5 and +1.5 (Tabachnick & Fidell, 2013), the data were considered to be normally distributed. For this reason, parametric tests were used. Analyses such as arithmetic mean, standard deviation, Pearson correlation test, and regression were used. Limits regarding the level of perceptions in the measurement tools used in the research were determined. While determining these limits, the level range was accepted as 0.80 (Score Range=Highest value-Least value/N). The values between 1.00-2.59 was interpreted as low level, 2.60-3.39 as moderate (medium), 3.40-5.00 as high. A correlation coefficient between 0.1 and 0.3 indicates a low level, values between .3 and .5 show that the relationship is moderate (medium), and values greater than .05 indicate a high level of relationship (Field, 2018). The significance level was accepted as p<.05 in the analysis of the data. Table 2 includes the measures of central tendency of variables and kurtosis-skewness coefficients.

Table 2

Measures of Central Tendency of Variables and Kurtosis-Skewness Coefficients

	Arithmetic Mean	Median	Mode	Coefficient of Skewness	Standard Error of Skewness	Coefficient of Kurtosis	Standard Error of Kurtosis
Meaningful Work (General)	3.9903	3.9524	4.00	.098	.134	.551	.268
Meaning at work	4.2986	4.4000	4.00	-.831	.134	1.225	.268
Search for Meaning at Work	2.9747	3.0000	2.00	.089	.134	-.766	.268
Work Relationships	3.9939	4.000	4.00	-.567	.134	.389	.268
Transcendence at Work	4.2040	4.0000	4.00	-.278	.134	.007	.268
Humility at Work	4.2505	4.0000	4.00	-.315	.134	-.614	.268
Meaning Leadership at Work	4.0157	4.0000	4.00	-.096	.134	-.246	.268
Organizational Identification	3.3238	3.500	3.50	-.152	.135	-.975	.270

Table 2 shows that the values of skewness and kurtosis are between -1.5 and +1.5. These values show the normal distribution. Therefore, parametric statistics were used in this study.

Ethical Procedures

This study was found ethically appropriate by the Social and Human Sciences Scientific Research Ethics Committee of Kahramanmaraş Sütçü İmam University with its decision dated 09.07.2021 and numbered E. 43426.

Results

The study examined the levels of teachers' organizational identification and meaningful work perceptions by considering the dimensions. The findings are given in Table 3.

Table 3

Findings Regarding Levels of Organizational Identification and Meaningful Work

Scale and Dimensions	*N*	$\bar{X}$	*Ss*
Meaningful Work (General)	330	3.99	.38
Meaning at work	330	4.29	.53
Search for Meaning at Work	330	2.97	1.02
Work Relationships	330	3.99	.67
Transcendence at Work	330	4.20	.55
Humility at Work	330	4.25	.59

Meaning Leadership at Work	330	4.01	.59
Organizational Identification	330	3.32	.86

Table 3 indicates that the average of teachers' perceptions of organizational identification is 3.32 (moderate) and the general average of meaningful work perceptions is 3.95 (high). It is determined that the search for meaning at work dimension of the meaningful work scale is at a medium level and the other dimensions were at a high level.

Pearson's Correlation Analysis was done to determine whether there was a relationship between teachers' organizational identification and meaningful work perceptions. The findings are given in Table 4.

Table 4

Pearson's Correlation Analysis Results Regarding the Relationships between Organizational Identification and Meaningful Work

	Meaning at work	Search for Meaning at Work	Work Relationships	Transcendence at Work	Humility at Work	Meaning Leadership at Work	Meaningful Work	Organizational Identification
Meaning at work	1							
Search for Meaning at Work	-.080	1						
Work Relationships	.414*	-.036	1					
Transcendence at Work	.603*	-.033	.375*	1				
Humility at Work	.365*	-.066	.213*	.391*	1			
Meaning Leadership at Work	.444*	.118*	.297*	.401*	.357*	1		
Meaningful Work	.740*	.346*	.644*	.691*	.546*	.671*	1	
Organizational Identification	.334*	-.028	.302*	.381*	.191*	.271*	.381*	1

*N=330; *p<.05*

The findings in Table 4 show that there is a positive and moderate relationship between organizational identification and meaningful work perceptions (r=.381; p<.05). When the dimensions of the meaningful work scale are examined in particular, it is understood that similar findings are obtained and that there is positive significant relationships between organizational identification and meaning at work, work relationships, transcendence at work, humility at work, and meaning leadership at work dimensions. However, it is seen that there is no significant correlation between organizational identification and the search for meaning at work dimension.

A simple regression test was conducted to reveal the extent to which teachers' organizational identification perceptions predicted meaningful job perceptions. The obtained findings are shown in Table 5.

Table 5

Simple Regression Analysis Results Regarding Organizational Identification Predicting Meaningful Work

Predictive Variable	*B*	*Std. E.*	*β*	*t*	*p*
Constant	3.420	.079		43.043	.000
Organizational Identification	.171	.023	.381	7.404	.000
R=.381	$F_{(1\text{-}322)}$=54.814				
R^2=.145					

Dependent Variable: Meaningful Work

As seen in Table 5, organizational identification was revealed to be a significant predictor of meaningful work perceptions (R=.381; R^2=.145; p<.05). According to the findings, teachers' perceptions of organizational identification explain 14.5% of meaningful work perceptions.

Simple regression tests were done to reveal the extent to which organizational identification predicted the sub-dimensions of meaningful work. The search for meaning dimension was not included in this analysis because it did not have a significant relationship with organizational identification. The findings are shown in Table 6 and Table 7.

Table 6

Regression Analysis Results Regarding Organizational Identification Predicting Sub-Dimensions of Meaningful Work

Dependent Variables	Meaning at work				Work Relationships				Transcendence at Work			
	B	*β*	*t*	*p*	*B*	*β*	*t*	*p*	*B*	*β*	*t*	*p*
Organizational Identification	.207	.334	6.356	.00	.236	.302	5.695	.00	.247	.381	7.403	.00
F	40.396				32.430				54.808			
R	.334				.302				.381			
R^2	.111				.091				.145			

Table 6 shows that Organizational identification is a significant predictor of meaning at work (R=.334; R^2=.111; p<.05), work relationship (R=.302; R^2=.091; p<.05), and transcendence at work (R=.381; R^2=.145; p<.05) variables. Organizational identification explains 11% of the variance for the meaning at work sub-dimension, 9% of the variance for work relationships sub-dimension, and 14% of the variance for the transcendence at work sub-dimension.

Table 7

Regression Analysis Results Regarding Organizational Identification Predicting Sub-Dimensions of Meaningful Work

Dependent Variables	Humility at Work				Meaning Leadership at Work			
	B	*β*	*t*	*p*	*B*	*β*	*t*	*p*
Organizational Identification	.132	.191	3.490	.00	.187	.271	5.047	.00
F	12.180				25.472			
R	.191				.271			
R^2	.036				.073			

Table 7 shows that Organizational identification is a significant predictor of humility at work (R=.191; R^2=.036; p<.05), and meaning leadership at work variables (R=.271; R^2=.073; p<.05). Organizational identification explains 3% of the variance for humility at work sub-dimension, and 7% of the variance for meaning leadership at work sub-dimension.

Discussion and Conclusion

This research aims to determine the relationship between teachers' perception levels of organizational identification and meaningful work. In addition to this main purpose, teachers' organizational identification and meaningful job perception levels were determined, and it was revealed whether organizational identification was a significant predictor of meaningful work perceptions. The findings show that teachers' organizational identification perceptions are moderate and meaningful work perception levels are high. In the study by Toptaş (2018), it was seen that teachers' levels of finding their jobs meaningful are high. In this context, educators who identify with their organizations show emotional and normative commitment by following the mission of their institutions and expressing their affection for their students and institutions. Yet, participants who have not been identified are likely to leave their institutions (Orphan & Broom, 2021). However, people with a high sense of meaningful work do their jobs with a sense of service and benefit to a much wider community than themselves. The sense of meaningful work in educational organizations appears as the teacher's interpretation and action in the context of a necessary compass that guides the future of society. The fact that teachers, who have the chance to touch the lives of thousands, perform their profession in the form of service to the society in a higher purpose beyond letters and supports the self-realization of teachers who feel this (Göçen & Terzi, 2019). Therefore, the fact that teachers identify with their schools and have a high meaningful work perception indicates that they can make significant contributions to the society through their students and schools.

According to another result of the research, there is a positive, moderate relationship between organizational identification and meaningful work perceptions of teachers. In addition, organizational identification is a significant predictor of meaningful work perceptions. When the dimensions of the meaningful work scale were examined specifically, it was seen that there was a significant association between

organizational identification and the dimensions of meaning at work, transcendence at work, work relationships, meaning leadership at work, humility at work, and organizational identification was a significant predictor of these dimensions. The order of importance in explaining these dimensions was as follows: Transcendence at Work, Meaning at work, Work Relationships, Meaning Leadership at Work, Humility at Work. The literature shows similar results. Some studies (Akdoğan et al., 2016; Correia & Almeida, 2020; Demirtas et al., 2015) discovered moderately positive relationships between meaningful work and organizational identification. Similarly, moderately positive significant relationships were found between positive meaning and identification with the organization and colleagues (Ouwerkerk & Bartels, 2022). While the literature showed that meaningful work predicts organizational identification, organizational identification predicts meaningful work as seen in the present research. In this context, the research findings support the researchers (Schnell et al. 2019) who assert that both causal aspects are plausible and possibly mutually influencing and reinforcing each other when considering organizational identification and meaningful work. Accordingly, it can be stated that teachers' finding their work meaningful may affect identifying with their schools or vice versa.

In this study, a different finding shows no significant association between organizational identification and the dimension of seeking meaning at work. In other words, although there is a low negative correlation between search for meaning at work dimension and organizational identification, this is not statistically significant. As a matter of fact, this finding can be interpreted that identifying with their organizations is not associated with the search of meaning at work. As meaning makers, leaders identify their followers' meanings with those of their organizations and can inspire beyond these legal ties. However, it can protect employees like teachers from emotional problems (Göçen, 2021). Thus, meaningful work can be seen as a structure that is compatible with the individuals, enabling them to realize themselves and contribute to society. In other words, meaningful work is the work in which the individuals find themselves and identify. Meaningful work can serve the individual goals and needs of employees through organizational behavior (Toptaş, 2018). In this context, Van Dick (2001) emphasizes that while it is argued that organizational identification is more important for many people than other categories such as age, gender, or ethnicity to which they belong, the organizational groups (teams, work groups etc.) how well it performs compared to other groups also depends on the individual efforts of each member. Thus, members should help their organizations become better. According to this point of view, members of the organization are expected to show participation, in-role and out-of-role behaviors, low absenteeism to build or improve their self-esteem. Therefore, teachers who identify with their organizations and develop self-esteem are expected to find meaning at work.

There is some evidence showing positive relationships between teachers' work engagement and organizational identification, job performance, learning-based orientation and organizational citizenship behavior (Chughtai & Buckley, 2009). In this context, recognizing the similarities and differences of people in work groups can improve identification, and that increases the performance. These effects can be seen directly applicable by managers when dealing with and structuring work teams, determining rewards etc. (Van Dick, 2001). Organizational identification is seen as a

significant predictor of work motivation, as identified workers can engage in behaviors that benefit their workgroup or organization (Ouwerkerk & Bartels, 2022). However, meaning at work consists of evaluations conveyed by various people experienced at work. The interpersonal dynamics that arise between people in the workplace create a strong context of work meanings. The ability to comprehend the process allows employees to reach the deeper meaning of on-the-work experience. The meaning of work can be considered as an emerging feature of the social scene at work. This subject, which is treated as individual processes, has rich relational foundations. While emphasizing the role of others in the workplace, the active role that employees play in creating work meaning through interpersonal meaning is also important. As a matter of fact, the social context draws attention to the roles of others in making sense of work (Wrzesniewski et al., 2003). Hence, it can be said that teachers' relationships with their colleagues and school administration, which are factors that affect their identification with their school, have an important role in teachers' perceptions of making sense of work. In addition, the school administrators' knowing their teachers well can contribute to this identification and meaningful work processes.

Organizations should actively support and foster managers' capacity to rethink work environments and cultures to foster greater sentiments of meaningful work. Additionally, by putting the "job crafting" idea into practice, organizations can encourage their staff to have more meaningful work experiences. Additionally, it is the responsibility of senior management to concentrate on aspects of the job that could alter employees' personal needs and make them view their work as having more meaningful (Ghadi et al., 2015). Meaningful leadership can contribute to self-realization of members in educational organizations, and provide an intrinsic motivation factor for all school members. In qualitative research with teachers, ten main themes about meaningful leadership emerged (Göçen, 2021): a high purpose in life, connecting the past- present-future, allocation of meaning, peacefulness, insight, serving others, a moral compass, fostering unity, and inner motivation. In a similar study on how leaders can build their meaningful work and their employees' meaningful work (Frémeaux & Pavageau, 2022), 42 interviews with leaders were conducted. It is discussed how leaders make sense of leadership practices, which are accepted as contributing factors to meaningful work in the relevant literature. New components of meaning associated with leadership effectiveness have been identified as moral exemplary, personal/professional support, self-awareness, community spirit, commitment to collaborative work, and a positive attitude towards situations and individuals.

With a meaningful and democratic division of work instead of a hierarchical division of work, all employees who can participate in shaping an institution's policies have the opportunity to act as autonomous individuals and encourage their autonomous development (Schwartz, 1982). However, organizational communication can play a very important role in maintaining a sense of identification. In this context, research is needed on how face-to-face and electronic communication can contribute to this. As a matter of fact, it has been determined that the lockdowns due to Covid 19, the employees find their jobs less meaningful, and they identify less with their colleagues and work (Ouwerkerk & Bartels, 2022). On the other hand, many people want meaningful work. There are also numerous books, seminars and websites to help people find meaning and purpose in their work (Steger et al., 2012). By taking these factors

into account, administrators and policymakers in schools should support teachers in terms of autonomy, participation in decisions, cooperation, feedback, and development opportunities, so that the development of a sense of meaning for teachers is possible with the preparation of an environment where teachers can experience the feeling of being a contributor (Göçen & Terzi, 2019). Thus, school administrations and senior administrations should employ practices that will increase the level of organizational identification and meaningful work perceptions of teachers.

Limitations and Recommendations

This research is limited to the participation of teachers working in a province in Türkiye. Moreover, the fact that only the teachers working in public schools constitute the sample of the research is seen as a limitation. Future research can include teachers in different provinces and private schools. Besides, researchers can examine how school administrators, colleagues, and senior management affect teachers' perceptions of organizational identification and meaningful work. The effect of these situations on student achievement can also be investigated. Mixed methods research can be conducted with teachers and school administrators to expand the literature evidence on organizational identification and meaningful work.

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Statement of Responsibility

Salih Yılmaz; Conceptualization, methodology, software, validation, formal analysis, investigation, resources, data curation, writing-original draft, writing-review & editing, visualization. Ahmet Kaya; Supervision, resources, data curation, review & editing, project administration.

Conflicts of Interest

The authors declare that there is no conflict of interest within this study.

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