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# Project-Based Learning and the Flipped Classroom Model Supported Project-Based Learning's Impact on Academic Success, Retention, and Individual Innovation Competence

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# Project-Based Learning and the Flipped Classroom Model Supported Project-Based Learning's Impact on Academic Success, Retention, and Individual Innovation Competence

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## Abstract

The aim of this study is to investigate the effects of Project-Based Learning (PBL) and Flipped Classroom Model (FCM) supported by PBL on sixth grade students' academic achievement, retention of knowledge, and individual innovation competence. A quasi-experimental design with a pre-test and post-test control group was used in the study. While the PBL method was applied to the first experimental group, FCM-supported PBL was applied to the second experimental group. In the control group, teaching was carried out according to the science curriculum. The study was conducted with 80 sixth grade students from three classes during the 2021–2022 school year at a public middle school in Muğla, a province in Turkey. The Matter and Heat Achievement Test (MHAT) and the Individual Innovation Competence Scale (IICS) were used as pre- and post-test measurements. The results revealed that the students who participated in the PBL group and FCM-supported PBL achieved significantly higher post-test scores than those in the control group, indicating increased academic achievement. However, no significant difference was found between the groups in terms of individual innovation competence. It was also observed that the PBL group had significantly higher retention scores than the control group. Investigating the long-term effects of these instructional approaches across different subjects and grade levels would be beneficial.

**Keywords:** Project based learning, Flipped classroom, Academic achievement, Innovation, Science education

## Introduction

In today's digital age, educators face increasing challenges in teaching students to learn through their own efforts. To overcome these challenges, integrating technology into the learning process and encouraging active participation can enhance students' educational experiences and outcomes by facilitating the transition from passive to active learning. Active learning refers to any instructional strategy that engages students in the learning process. By implementing active learning methods and integrating technology, educators can encourage students to actively engage with the material and collaborate with peers.

Project-Based Learning (PBL) is an active learning method where students work on real-world projects to advance their knowledge and abilities. Students in project-based learning apply what they have learned by working on real-world projects or solving problems that are relevant to them (Capraro & Slough, 2013; Larmer et al., 2015). PBL is an inquiry-based teaching method that gives students goals for their learning. In PBL, students choose research questions related to the topic, conduct investigations, evaluate the findings, and develop new questions. This method encourages ownership of learning (Wilhelm et al., 2019). PBL allows students to identify their unique learning abilities by considering their learning preferences and styles (Aksela & Haatainen, 2019). PBL engages students in authentic, real-world projects that require them to apply their knowledge and skills to solve complex problems (Chistyakov et al., 2023).

Applications such as project-based learning (PBL) can be combined with the flipped classroom model (FCM). The FCM complements PBL by shifting the acquisition of foundational knowledge to independent study outside of class time (Akçayır & Akçayır, 2018). FCM enables students to acquire basic information with the help of educational videos presented as homework before coming to the classroom. Videos assigned as pre-class homework primarily address the lower levels of Bloom's taxonomy. This allows for more interactive and engaging in-class activities focused on higher-order thinking skills (Haak & Burand, 2016; Morsch, 2016). Watching videos before class prepares students for in-class activities so that they can focus on applying the basic concepts from the videos. Students become active participants in class time, enhancing collaboration and communication skills as they work together to solve problems, discuss ideas, and present their findings (Triana

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et al., 2020). Students apply what they have learned from the videos during in-class activities, which are often interactive and collaborative. They might solve problems, analyze case studies, or conduct experiments, all aligning with Bloom's taxonomy's upper levels (Morsch, 2016). In this way, extra time can be devoted to practice, cooperation, research, and project work.

Studies have shown that active learning strategies such as project-based learning and the flipped classroom model are generally beneficial (Capraro & Slough, 2013; Çakıroğlu & Öztürk, 2016; Rau et al., 2017; Triana et al., 2020). Both PBL and the FCM promote collaboration and teamwork among students. Students collaborate in groups, share ideas, and work towards project goals. They develop communication skills as they present their projects, articulate their thoughts, and engage in meaningful discussions with peers and teachers.

Research conducted by Baepler et al. (2014) examined how the FCM affected both students' learning and perception. The results showed that in a flipped classroom, the student-faculty contact time was cut in half while student learning outcomes were at least on par with and, in one comparison, significantly superior to those of a typical classroom. Furthermore, students' overall impressions of the classroom environment saw positive shifts. According to the study by O'Flaherty and Phillips (2015), the flipped classroom can have several different models depending on the instructor. In the flipped classroom model, teachers generally give presentations in advance. Students learn through various resources, including videos, podcasts, demonstrations, and investigations. The educator is available for consultation and clarification during class time. Students can ask and discuss with their peers to understand the material (Bergmann & Sams, 2012).

Elian and Hamaidi (2018) studied the influence of the FCM on academic achievement. According to the findings, experimental groups exhibited a more positive attitude toward science than students in the control group. In a different study, similar findings were reported by González-Gómez et al. (2016), who identified that students who took part in flipped classrooms scored significantly better than students who did not. On the other hand, Ryan and Reid (2016) conducted research to assess the influence of the FCM on students' academic achievement and retention in general chemistry. They found that the outcomes of the experimental and control groups were not substantially different. Güngör (2022) stated that there was a medium-level significant relationship between high school students' individual innovation levels and their English course achievement. Individual innovation, which is related to taking risks, being open to new ideas, experiences, and different perspectives, accepting them, and being willing to learn, is an individual personality trait indicating the willingness to try new things (Goldsmith & Foxall, 2003). Deveci and Kavak (2020) stated in their study that the academic achievement variable had a significant effect on the innovative thinking tendency and that the innovative thinking tendency of students with high general academic achievement was at a higher level. Therefore, it is thought that it is important to include activities and practices that support innovation in learning environments for meaningful learning.

Today, skills such as creativity, teamwork, and innovative thinking are of great importance for a quality education. Innovation, which involves creating new products, developing new methods, or providing new services, plays a vital role in driving a country's economy (Gülhan, 2016; Keinänen et al., 2018). When examining studies on innovation, Kirton (1976) proposed a theory that classifies individuals into two profiles based on their decision-making abilities and problem-solving approaches: innovative individuals and adaptive individuals. Innovative individuals strive to make a difference in their problem-solving efforts by challenging norms and exploring new ideas, while individuals in the adaptive profile focus on improving existing methods. This classification is reinforced by Scott and Bruce (1994), who identified four sub-dimensions of innovative behaviors: creativity, self-efficacy, persistence, and openness to experience. Additionally, Kleysen and Street (2001) suggested five dimensions enabling individuals to innovate: discovering opportunities, productivity, formative review, championship, and application.

Education is a central determinant in developing innovation competencies, but one of the most challenging obstacles is that educational institutions cannot meet these competencies' needs (Keinänen et al., 2018). A research study conducted by Ovbiagbonhia et al. (2019) examined whether the way students learn in school encourages them to be innovative, if the things they learn in their classes help them develop new ideas, and if the learning environment supports their ability to be creative and innovative. The study results showed that students felt that their learning environments needed to provide more support to be innovative and develop their creative skills. Appropriate methods and techniques are needed to develop innovation competencies. Educators can use PBL and FCM to integrate knowledge and skills (Bell, 2010). According to research by Keinänen and Kairisto-Mertanen (2019), students with more exposure to innovative learning approaches demonstrated improved abilities in being innovative and creative. The study indicates that the experience of engaging with innovative learning methods positively influences students' capacity to think innovatively and generate creative ideas. Yıldırım (2022) stated that digital education and robotic coding practices positively affected the individual innovation levels of third-year pre-service science teachers. Students who initially had a low level of innovation reached a medium level of innovation after the treatment. Varas-Contreras et al. (2021) stated that employing a teaching strategy supported by innovation-oriented projects and design thinking methodology is beneficial for developing innovation skills. Barak and Usher (2021) examined the innovation levels of team

projects among engineering students in hybrid and MOOC (Massive Open Online Course) environments. Hybrid courses integrate traditional face-to-face instruction with digitally enhanced educational elements, including pre-recorded video lectures, interactive ebooks, web-based activities, interactive simulations, and online tests. MOOCs provide access to video lectures and instructional resources that can be delivered entirely online or integrated into a hybrid educational model. Projects from hybrid groups received higher evaluation scores. Hybrid group projects were considered more innovative because they demonstrated greater creativity and had the potential to make more significant contributions to the field of engineering.

The combination of project-based learning and the flipped classroom model can equip students with the 21st-century skills necessary for achievement in an increasingly complex world (Bell, 2010). By emphasizing 21st-century skills, these approaches can prepare students to succeed in academic, professional, and personal settings and to become lifelong learners capable of dealing with the challenges and opportunities of this century (Asbjornsen, 2015). Further research is necessary to explore the combined use of project-based learning (PBL) and the flipped classroom model (FCM) in middle school settings. While PBL and FCM have been studied independently, there needs to be more understanding of how they can be effectively integrated for middle school students. This study compares the experimental and control groups' learning achievement, retention levels, and innovation competences after PBL and FCM-supported PBL interventions.

## Method

### Research Design

The researchers adopted a quasi-experimental design with a pre-test and post-test in their investigation. The purpose of quasi-experimental research is to evaluate the effects of a treatment or to estimate the causal result of a specific variable, but randomization is not employed. They are often used when randomization is considered unfeasible (Creswell & Creswell, 2017).

The present study applied PBL as the primary teaching method in the first experimental group while also combining with FCM to support the application of PBL in the second experimental group. These two teaching methods were compared with instruction with activities based on the Science Curriculum in the control group. In Table 1, the study's research design is displaced.

Table 1. Research design

| Groups | O (Pre-test) | X (Treatment) | O (Post-test) | O (Retention Test) |
|---|---|---|---|---|
| PBL | $T_1$, $T_2$ | Project-Based Learning | $T_1$, $T_2$ | $T_1$ |
| TYS+PBL | $T_1$, $T_2$ | FCM-Supported Project-Based Learning | $T_1$, $T_2$ | $T_1$ |
| Control Group | $T_1$, $T_2$ | Instruction with activities based on the Science Curriculum | $T_1$, $T_2$ | $T_1$ |

T1 is the Academic Achievement and Retention Test. A multiple-choice test assesses students' academic knowledge, understanding, and ability to reason, analyze, and solve problems. The same test is used as a retention test that evaluates a student's ability to learn and retain academic knowledge, essential facts, and concepts under the same conditions. T2 is the Individual Innovation Competence Scale measure that evaluates students' capacity to create new and valuable processes and products.

### Study Group

In the 2021-2022 school year, the study included 80 sixth-grade students from three different classes at a public middle school in the Menteşe district of Muğla province in Turkey. The Matter and Heat Academic Achievement Test and Individual Innovation Competence Scale were applied to these three classes, whose achievements in the previous year's Science course were equivalent to each other, as a pre-test. The results revealed no significant differences among the scores obtained from the test. Based on their similar scores, three classes were assigned to the groups using a random lottery process.

Before the main application, a pilot application lasting two weeks (8 lesson hours) was carried out on the topic of Density in order to ensure the adaptation of the study group. The main application lasted 16 lesson hours (4 weeks) for the subjects and acquisitions in the "Matter and Heat" unit, as recommended in the Science Curriculum In the context of this study, the PBL (Project-Based Learning) group, supported by the FCM (Flipped Classroom Model), was assigned short 5-10 minute videos related to the subject of "Matter and Heat"

as part of their initial homework. These videos were specifically designed to align with students' prior knowledge and comprehension. A total of five videos were developed for the students. Over the four-week "Matter and Heat" unit, one video was assigned to students each week, covering topics related to "Matter and Heat" and "Fuels." The fifth and final video provided guidance to students on how to effectively prepare for their project presentation. For PBL, heterogeneous groups of four or five students with different achievement levels were formed, emphasizing the importance of teamwork in preparing innovative projects. The groups were guided to design, develop, and present their project work collaboratively. During the implementation, students carried out two different projects. In the first PBL activity, titled "Thermally Insulated House," during the first week of implementation, students conducted research on thermal insulation materials and the parts of the house where these materials would be applied. Group members with different skills were encouraged to collaborate on developing innovative projects or new products. Groups were also encouraged to generate original ideas and innovative project designs. Each group was tasked with creating an innovative thermal insulation material. Furthermore, the groups were encouraged to incorporate a different material into their project design, a choice they made themselves. During the implementation process, students designed various window and door shapes and created original and innovative projects by developing insulation materials suitable for these designs. In the second week of implementation, the groups finalized their innovative projects and shared them with other students and the teacher. Each group was asked to explain why their insulation was innovative. In the third week of the implementation, the groups created sub-questions related to the driving question, "How can we prevent carbon monoxide poisoning?" They were asked to conduct research and design innovative projects to address these questions. In the fourth and final week of PBL implementation, students finalized their projects in line with their group designs and made presentations. The teacher and other groups provided feedback and criticism for the projects presented. The projects were evaluated in terms of their originality, innovation, and success in thermal insulation. With the students in the control group, the "Matter and Heat" unit topics were taught with the activities in the textbook based on the 2018 Science Curriculum.

**Data Collection Tools**

The "Matter and Heat Achievement Test" (MHAT) and the "Individual Innovation Competence Scale" (IICS) were used as the pre- and post-tests for the research to collect the data.

A multiple-choice MHAT was created to examine the potential impact of various research methods on students' academic achievement and retention of knowledge. A group of experts, including three academic members with expertise in science education and two experienced science teachers, carefully analyzed the achievement test. Their primary focus was to ensure the acceptability and content validity of the test items, selecting those that accurately represented the intended subject matter. A total of 302 seventh-grade students have completed the MHAT. Utilizing the Kuder-Richardson 20 (KR-20) method, the reliability of the achievement test was assessed. KR-20 score is .88 for the MHAT. Scores above 0.70 represent a reasonable level of internal consistency and reliability. The experimental and control groups each took a pre-test and a post-test that consisted of a 25-question multiple-choice MHAT. After six weeks, the MHAT was administered once more as a retention test to measure the extent to which the learners retained the knowledge over time. By comparing the performance of the two experimental groups and the control group on the retention test, the researchers tried to determine the effectiveness of the interventions provided to the experimental groups.

The researchers developed the Individual Innovation Competence Scale (IICS) (Mutlu & Aydın, 2023) as a valid and reliable measurement tool to assess the levels of individual innovation competence among middle school students. The development process involved data collection from 933 middle school students enrolled in the science course in the Menteşe district of Muğla province. Exploratory Factor Analysis (EFA) was conducted on the collected data, revealing a three-factor structure: behavioral, social, and affective skills. The scale accounted for 55.373% of the total variance and demonstrated good internal consistency The scale was composed of 11 items: eight positively worded items and three negatively worded items. The reliability coefficients, as measured by Cronbach's alpha, were found to be 0.693, 0.651, and 0.717 for the subscales and 0.793 for the overall scale.

**Data Analysis**

A pre-test was administered to evaluate and account for any pre-existing differences between the groups. The analysis can be focused on examining the impacts or changes in the post-test scores while statistically controlling for the influence of the pre-test scores, if the pre-test scores are accounted for as a covariate. This allows the analysis to be more accurate. Considering the nature of the variables and their distributions within the groups, the study intended to ensure robust and accurate data analysis by employing the appropriate statistical tests based on the fulfillment of assumptions. The first step in quantitative data analysis is to check the data to understand how the values are distributed. Parametric statistical procedures assume that the sample distribution

is normally distributed. Nonparametric statistical methods do not use parametric assumptions about population distribution (Büyüköztürk, 2018). When the assumptions of normality were met, one-way Analysis of Variance (ANOVA) was used to compare the means of the outcome variable between the three groups (two experimental groups and one control group). Nonparametric analyses were utilized when the assumptions of ANOVA were not met. A nonparametric alternative to one-way ANOVA, the Kruskal-Wallis test, was used to compare the medians of the outcome variable across the three groups.
The Shapiro-Wilk Test was utilized to determine whether the distribution of test scores collected from groups was normally distributed after the MHAT was administered as a pre-test, post-test, and retention test; the findings are displayed in Table 2.

Table 2. Shapiro-Wilk normality test results for MHAT data

| Test | Groups | N | Shapiro-Wilk | p | Skewness | Kurtosis |
|---|---|---|---|---|---|---|
| Pre-test | Experiment 1 (PBL) | 25 | .93 | .08 | -0.47 | -0.82 |
| | Experiment 2 (FCM+PBL) | 28 | .95 | .20 | 0.45 | -0.48 |
| | Control | 27 | .96 | .33 | 0.79 | 1.01 |
| Post-test | Experiment 1 (PBL) | 25 | .73 | .00* | -1.87 | 2.80 |
| | Experiment 2 (FCM+PBL) | 28 | .86 | .00* | -0.97 | -0.22 |
| | Control | 27 | .90 | .01* | -1.06 | 0.46 |
| Retention test | Experiment 1 (PBL) | 25 | .86 | .00* | -1.23 | 0.91 |
| | Experiment 2 (FCM+PBL) | 28 | .86 | .00* | -1.20 | 0.72 |
| | Control | 27 | .84 | .00* | -1.25 | 0.62 |

*p<0.05

According to Table 2, it seems that some of the data follow a normal distribution. To determine whether the normally distributed data created a difference between the groups, ANOVA was employed. Post-test and retention test data do not show a normal distribution. Therefore, a nonparametric test, the Kruskal-Wallis, was utilized to evaluate the differences between the groups' post-test and retention test results.

To assess students' innovation competences, the researchers employed a scale referred to as the Individual Innovation Competence Scale (IICS). Table 3 displays the Shapiro-Wilk Test statistics that compare the scores of students on the IICS before and after the intervention.

Table 3. Shapiro-Wilk normality test results for ICCS data

| Test | Groups | N | Shapiro-Wilk | p | Skewness | Kurtosis |
|---|---|---|---|---|---|---|
| Pre-test | Experiment 1 (PBL) | 25 | .94 | .13 | -0.77 | 0.20 |
| | Experiment 2 (FCM+PBL) | 28 | .89 | .01* | -1.22 | 1.55 |
| | Control | 27 | .90 | .01* | -1.10 | 1.07 |
| Post-test | Experiment 1 (PBL) | 25 | .84 | .00* | -1.26 | 0.73 |
| | Experiment 2 (FCM+PBL) | 28 | .90 | .01* | -0.60 | -1.02 |
| | Control | 27 | .91 | .02* | -0.76 | -0.52 |

*p<0,05

According to Table 3, the pre- and post-test Shapiro-Wilk Test results show that the assumptions of a parametric test are not fulfilled. Therefore, the data were evaluated using nonparametric tests such as the Kruskal-Wallis test to compare the individual innovation test scores for groups.

## Results

The following section presents the study's results, which aimed to assess the impact of PBL and FCM-supported PBL on students' academic achievement, retention, and individual innovation competence in science courses.
A one-way ANOVA was used to compare the pre-test outcomes of all three groups (PBL, FCM-supported PBL, and control group). The ANOVA test assumes that the variances across the groups are equal. However, to confirm this assumption, Levene's test was employed. Levene's test is designed to assess the equality of variances. If the test yields a significant result, it suggests that the assumption of equal variances is violated,

indicating that the groups have unequal variances (Field, 2018). A p-value of 0.321, which was higher than the typical significance level of 0.05 in hypothesis testing, showed that the results of Levene's test, in this case, demonstrated that the variances between the groups were indeed equal. Table 4 provides more details about the results of the ANOVA conducted in this study.

Table 4. ANOVA results regarding academic achievement pre-test scores

| | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| Between Groups | 94.529 | 2 | 47.265 | 2.709 | .073 |
| Within Groups | 1343.471 | 77 | 17.448 | | |
| Total | 1438 | 79 | | | |

According to the results of the ANOVA, which are summarized in Table 4, there is not a statistically significant difference between the groups in terms of their academic achievement pre-test scores. [F (2, 77) = 2.709, p>0,05]. In other words, the groups were similar in terms of their academic achievement levels prior to any intervention.

To examine the relationships between the means of post-test results and academic achievement across the three groups, the researchers employed the Kruskal-Wallis test. This nonparametric statistical test is used to compare the mean ranks among multiple groups when the data does not meet the assumptions of normality or homogeneity of variances (Field, 2018). Table 5 summarizes the relationship between the groups regarding the post-test results.

Table 5. Comparison of post-test scores by using the Kruskal-Wallis test for academic achievement

| Group | N | Mean of Ranks | sd | $x^2$ | p |
|---|---|---|---|---|---|
| Experiment 1 (PBL) | 25 | 48.68 | 2 | 10.661 | .005* |
| Experiment 2 (FCM+PBL) | 28 | 44.34 | | | |
| Control | 27 | 28.94 | | | |

*p ≤ .05

Table 5 shows the Kruskal-Wallis H test results, which were used to determine if different teaching methods affect post-test academic achievement. The PBL group's mean rank score was 48.68, the FCM+PBL was 44.34, and the control group's was 28.94. The Kruskal-Wallis H test revealed a statistically significant difference between the three groups ($x^2(2) = 10.661$, $p = .005$). This result suggests that the methods used in this study impact academic achievement. However, it is essential to note that this test does not indicate where the differences between the groups lie. Further post-hoc analysis was used to make specific comparisons between the groups. To identify which groups are truly different, the Mann-Whitney U test was performed to compare the mean rank for each group as a follow-up analysis. Table 6 shows the results of the Mann-Whitney U test.

Table 6. Comparisons of post-test academic achievement mean ranks

| Group | N | Mean of Ranks | Sum of Mean Ranks | U | Z | p |
|---|---|---|---|---|---|---|
| Experiment 1 (PBL) | 25 | 28.22 | 705.50 | | | |
| Experiment 2 (FCM+PBL) | 28 | 25.91 | 725.50 | 319,5 | -0,548 | .58 |
| Experiment 1 (PBL) | 25 | 33.46 | 836.50 | | | |
| Control | 27 | 20.06 | 541.50 | 163.5 | -3,207 | .001* |
| Experiment 2 (FCM+PBL) | 28 | 32.93 | 922.00 | | | |
| Control | 27 | 22.89 | 618.00 | 240 | -2,333 | .020* |

*p < 0.05

When examining the findings in Table 6, it can be observed that students who participated in both Experiment 1 (PBL) and Experiment 2 (FCM+PBL) did perform better in the post-test for academic achievement compared to those in the control group. The p-values, which indicate statistical significance, are below the conventional 0.05 threshold for both Experiment 1 group (PBL) versus Control group (p=.001) and Experiment 2 group (FCM+PBL) versus Control group (p=.020). This indicates that the improved academic achievement for students in the PBL and FCM+PBL groups is statistically significant.

Six weeks after the post-test, the experimental and control group students were subjected to another round of academic achievement tests. This second testing phase allows us to assess the durability of students' learning over time. The Kruskal-Wallis was conducted to analyze the data obtained from the retention test. The results of the Kruskal-Wallis test, including the test statistic and other relevant data, are presented in Table 7.

Table 7. Kruskal-Wallis test statistics for the retention test

| Group | N | Mean of Ranks | sd | $x^2$ | p |
|---|---|---|---|---|---|
| Experiment 1 (PBL) | 25 | 47.64 | 2 | 5.975 | .050* |
| Experiment 2 (FCM+PBL) | 28 | 42.07 | | | |
| Control | 27 | 32.26 | | | |

*p ≤ .05

Table 7 shows that the p-value (.05) is at the commonly accepted threshold for significance. This suggests that there is a statistically significant difference in the medians of at least two of the groups. However, it is essential to remember that the Kruskal-Wallis test only tells us if there is a difference somewhere among the groups, but it does not tell us where the difference lies. Post-hoc tests were conducted to determine which groups differed from each other.

Pairwise comparisons were performed between the experimental and control groups based on their mean rankings from the Kruskal-Wallis test. These comparisons can be seen in Table 8.

Table 8. Mann-Whitney U test statistics for the retention test

| Group | N | Mean of Ranks | Sum of Mean Ranks | U | Z | p |
|---|---|---|---|---|---|---|
| Experiment 1 (PBL) | 25 | 29.04 | 726.00 | 299 | -0,916 | .36 |
| Experiment 2 (FCM+PBL) | 28 | 25.18 | 705.00 | | | |
| Experiment 1 (PBL) | 25 | 31.60 | 799.00 | 210 | -2.3351 | .019* |
| Control | 27 | 21.78 | 588.00 | | | |
| Experiment 2 (FCM+PBL) | 28 | 31.39 | 879.00 | 283 | -1.616 | .106 |
| Control | 27 | 24.48 | 661.00 | | | |

*p < 0.05

Table 8 shows that implementing the project-based learning (PBL) method had a statistically significant effect on retention test scores compared to the control group. This means that the students who received PBL instruction could remember and retain more information than the students in the control group who had instruction with activities based on the Science Curriculum.

The pre-test data obtained from the Individual Innovation Competence Scale (IICS) did not exhibit a normal distribution. The Kruskal-Wallis, a nonparametric statistical test, was utilized to compare the medians of the three groups. This test is a nonparametric version of the regular one-way analysis of variance (ANOVA). Table 9 shows pre-test scores.

Table 9. Kruskal-Wallis results of IICS pre-test scores

| Group | N | Mean of Ranks | sd | $x^2$ | p |
|---|---|---|---|---|---|
| Experiment 1 (PBL) | 25 | 41.02 | 2 | 0.019 | 0.991 |
| Experiment 2 (FCM+PBL) | 28 | 40.21 | | | |
| Control | 27 | 40.31 | | | |

When examining the results in Table 9, it can be observed that the PBL group has a slightly higher mean score than the other two groups. However, the lack of statistical significance in the pre-test results ($p > 0.05$) indicates that there were no significant differences between the groups in terms of innovation before the interventions were introduced ($x^2(2) = 0.019$; $p>.05$). This shows that the groups had similar innovation levels at the beginning of the study.

Since the post-test data acquired after the intervention from the Individual Innovation Competence Scale (IICS) did not exhibit a normal distribution, the assumptions necessary for carrying out parametric tests were not met. As a result, a nonparametric statistical test called Kruskal-Wallis was employed to compare the medians of the different groups. Table 10 presents the three groups' Kruskal-Wallis results of the IICS post-test scores.

The results in Table 10 allow us to assess the effectiveness of the interventions on individual innovation competence by examining the differences in post-test scores among the groups.

Table 10. Kruskal-Wallis results of IICS post-test scores

| Group | N | Mean of Ranks | sd | $x^2$ | p |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Experiment 1 (PBL) | 25 | 44.64 | 2 | 1.239 | 0.538 |
| Experiment 2 (FCM+PBL) | 28 | 37.77 | | | |
| Control | 27 | 39.50 | | | |

The results presented in Table 10 indicate that there aren't any statistically significant differences in the post-test scores observed among the groups ($x^2(2) = 1.239$, $p > .05$). The post-test innovation competence score of the PBL group showed growth. However, the post-test scores of the FCM-supported project-based learning group and the control group did not show growth.

According to what is presented in Table 10, the mean ranks on the IICS post-test showed a difference in the results that is likely not due to chance between the groups. The results of the PBL group's post-test were compared to the group's scores from the pre-test. The PBL group's post-test score exceeded their pre-test scores and therefore displayed growth in their innovation competence scores. FCM-supported PBL and the control group had similar post-test results.

## Conclusion

This study primarily dealt with the impacts of Project-Based Learning (PBL) and the combination of Flipped Classroom Model and Project-Based Learning (FCM+PBL) on students' academic achievement and retention scores. In this study, the findings suggest that both PBL and PBL, which is supported by the FC model, were effective for improving students' academic achievement compared to those who participated in 2018 Science Curriculum-based textbook activities. Bekereci (2022) found that the integrated application of PBL positively impacted students' academic achievements and facilitated the retention of knowledge, mirroring the results of this study. However, other studies, such as Topçu (2019), and Dilşeker and Serin (2018), did not find a statistically significant difference in academic achievement with PBL, suggesting the outcomes might depend on the specific implementation or the context of the PBL. These results from this study also align with many previous studies examining the effects of the FC model. For instance, Keskin et al. (2021), Çakır and Yaman (2018), and Aydin and Demirer (2022) all found positive effects of the FC model on academic achievement. Yıldırım-Yakar's (2021) meta-analysis and the study by Güler et al. (2023) also identified the FC model as beneficial for academic achievement in mathematics. However, Cabi (2018) found that the FC model did not significantly impact students' academic achievements, showing that the model's effectiveness might vary across different settings.

As indicated in the findings, in the retention test that was carried out six weeks after the post-tests, it was discovered that the retention levels in the PBL group were significantly higher than the levels of the students who had participated in the control group. Most FC model retention studies have been conducted at the university and high school levels (Alsancak-Sirakaya & Ozdemir, 2018). It is asserted that the influence of the FC model on retention in learning is debatable and that further quantitative research is required on this topic (Ryan & Reid, 2016). The fact that the retention level was only positive for the PBL group in this study raises the question of whether learning that takes place outside of the classroom setting has a negative impact on the amount of information that can be recalled.

In theory, combining the FCM and PBL strategies might seem like a promising approach: students get an initial exposure to the material at home (FCM) and then do project work in class (PBL), potentially getting the best. However, the results of this study suggest that adding an FC component to the PBL approach did not further improve retention scores. The reasons for this could be diverse; it might be that the FC component was not implemented effectively, or it could be that the added complexity of the FC component did not provide additional benefits over the PBL approach alone. Further research would be needed to understand this better. Therefore, the key result from this study is that while the PBL approach appears to be effective in improving retention of knowledge, adding a Flipped Classroom component does not necessarily enhance this effect.

Regarding innovation, this study indicated that neither PBL nor FCM+PBL significantly affected the post-test scores related to individual innovation competence. This might be seen as contrasting with studies like Akdeniz (2020) and Perçin (2019), which found positive impacts on individual innovative behavior with specific interventions. This discrepancy might be attributed to the specific methods used in each study or how "innovation" is defined and measured. Moreover, this study extends the understanding of how these educational strategies impact innovation competence, an area that needs to be explored in previous studies. Although no significant effect was found in this study, this adds valuable information to the ongoing discussion about the role of pedagogical strategies in fostering innovation.

One of the critical contributions of this study lies in exploring the integrated use of Project-Based Learning (PBL) and the Flipped Classroom Model (FCM). This study has demonstrated that PBL and FCM+PBL

positively impact post-test academic achievement scores. This study also showed that combining FCM and PBL was beneficial.

## Recommendations

Despite the potential benefits of the PBL-FCM integration, it is essential to acknowledge its limitations and the need for further research. One of the critical challenges is the requirement for significant changes in teaching practices and infrastructure. Teachers must be trained to implement and manage this integrated approach effectively, and sufficient technological resources must be available to support PBL with FCM. Furthermore, ensuring that all students can equitably access these resources is another area that needs attention.
Research on the impacts of the PBL-FCM integration is still relatively developing, and more studies are needed to strengthen understanding of its impacts on various learner populations. Longitudinal studies would be valuable to assess the long-term impacts on academic achievement, retention, and the development of innovation competencies. Future research should also consider the role of assessment in a FCM-PBL environment.

## Author (s) Contribution Rate

The outhors contributed equally to this research.

## Conflicts of Interest

The authors declare that they have no personal and financial conflict of interest associated with this publication to disclose.
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## Ethical Approval

Ethical permission (05.11.2019-192) was obtained from Muğla Sıtkı Koçman University Human Research Ethics Committee for this research.

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# The Mediating Roles of Smartphone Addiction and Resilience in the Relationship Between Triangling and Differentiation of Self

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# The Mediating Roles of Smartphone Addiction and Resilience in the Relationship between Triangling and Differentiation of Self

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## Abstract

Triangling is one of the factors in a better understanding of self-differentiation. University students may develop behavioral addictions to cope with higher exposure to triangling and have lower resilience, resulting in poor self-differentiation. The current study aimed to investigate the mediating role of smartphone addiction and resilience in the relationship between triangling and differentiation of self. The sample consisted of a total of 536 university students, and data were gathered using the Triangular Relationship Inventory (TRI), Differentiation of Self Inventory Short Form (DSI-SF), Smartphone Addiction Scale-Short Version (SAS-SV), Brief Resilience Scale (BRS), and Demographic Information Form. Findings indicated that the path from triangling to smartphone addiction to resilience explained 45% of the variance in differentiation of self. Smartphone addiction has mediated the relationship between triangling and differentiation of self. However, resilience was not a significant mediator in the relationship between triangling and differentiation of self. Strategies (i.e., de-triangling) may help university students overcome SPA. The current study underlies the potential threats associated with triangling on behavioral addictions (i.e., smartphones), in which the risks may increase as resilience levels of university students decrease, resulting in lower self-differentiation.

**Keywords:** Triangling, Differentiation of self, Resilience, Smartphone addiction

## Introduction

Family relationships may become paradoxical due to the inherent contradiction between the needs of togetherness and separateness (Kerr & Bowen, 1998; Williamson, 1991). Murray Bowen's Therapy of Family Systems (BFST; Bowen, 1978) is one of the leading approaches that concentrates on this underlying dilemma by defining several concepts of the family of origin, such as triangling and differentiation of self (DoS). These two concepts are inversely related (Bresin et al., 2017) to each other and play a crucial role in family members' optimal functioning (Kerr & Bowen, 1988); symptoms (e.g., addictions) may emerge in the family system otherwise. Recent research has supported this argument, indicating that family-of-origin triangulation is associated with symptoms such as marital instability (Song et al., 2022) and depression (Wang & Crane, 2001). Similarly, DoS has been associated with online game addiction among university students (Jiaojiao et al., 2023). Children's behavioral disorders may be signs of a more serious issue in their family of origin (Young, 1998). Thus, the current study focused on Bowen's (1978) constructs of triangling and DoS, which were specific family dynamics in understanding behavioral symptoms (i.e., addiction) among university students.

### Triangling and Differentiation of Self (DoS)

DoS is the core construct of BFST, requiring two crucial skills (Bowen, 1978; Kerr & Bowen, 1988): (1) One should distinguish cognitive functions from emotional reactions to stressful events for greater DoS. In this way, individuals can respond more rationally to adversities, especially in stressful and anxiety-fueled situations, instead of giving more emotionally reactive and automatic responses. Otherwise, individuals have more difficulties with this ability to regulate their emotions and thoughts in the face of challenging situations (intrapsychic dimension). (2) One's ability to maintain authentic, intimate relationships with significant others while achieving individuation. In the absence of greater DoS, several emotional symptoms within the family system emerge, and triangling is one of them (Kerr & Bowen, 1988).

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A triangle is an emotional unit with a trio of family members, including the mother, father, and child. Triangles arise as symptoms when there is an absence of a greater DoS in the family system (Kerr & Bowen, 1988). Triangles develop as family boundaries become rigid, and a dyadic relationship produces chronic anxiety over time, particularly in stressful situations (e.g., crises). A third person (e.g., kin or friend) is involved in a dyadic relationship to mitigate stress and anxiety on both sides. Triangling typically emerges between two parents and a child and is more likely to occur in families with higher levels of chronic anxiety (Kerr & Bowen, 1988). Triangles that parents initiate have been classified into four distinct categories (Bell et al., 2001): (1) In the *balanced* type, a dyad can resolve disagreements effectively where family members are equally distant from one another's boundaries. (2) The *mediator* is in a pull-in position in which children serve as a bridge between parents, calming both sides and developing closer bonds with either parent than the parents do with each other. (3) When one parent and one child align with one parent against the other, also known as side-taking, a *cross-generational coalition* forms. (4) To maintain the dyadic relationship, *scapegoating* illustrates the child's position being pushed out in a triangle. The dyad becomes more preoccupied with the child's issues than their marriage. Whether the child is impacted by the conflict depends on the couple's ability to handle psychological distress. Children are less likely to be included in the triangle, depending on how healthy the dyadic relationship is with stress. BFST establishes a link between the family of origin dynamics and addictions of alcoholism (Bowen, 1978), substance abuse (Pinheiro et al., 2006), and recent research has also focused more on technology-based addictions such as game addiction (Yu & Park, 2016) and social media addiction (Sotero et al., 2019). However, no study has investigated behavioral addictions such as smartphone addiction (SPA) in the context of triangling and DoS, to the author's knowledge.

**Smartphone Addiction**

Smartphones are mobile phones that provide internet use and access to mobile apps and have become high-priority tools for most individuals. Mobile phones reached almost 6.4 billion users worldwide in 2022 and are expected to be 7.7 billion by 2028 (Taylor, 2023). With the increasing use of smartphones, millions of students had a chance to have remote education via their smartphones during the COVID-19 pandemic days. Türkiye (where the present study was conducted) has a similar trend, in which smartphone use rates were 75% among adolescents between 11 and 15 years old (Turkish Statistic Institute [TÜİK], 2021). Alongside the benefits, there has been increasing concern over the potential for excessive smartphone use, mostly indicating functional impairment among university students (Lin et al., 2016). Such digital devices' uncontrolled use negatively affects some individuals' functioning and may lead to addiction for a small percentage of users (Griffiths, 2000). Addiction is a persistent and relapsing disorder manifesting itself through compulsive drug-seeking behaviors in which individuals lose their self-control over consumption, despite adverse effects (Berridge & Robinson, 2016). Digital addiction, meanwhile, reflects non-chemical addictive behaviors indicating human-machine interaction (Griffiths, 1999).

Whether behavioral addictions (e.g., social media) may be referred to as addictions is an ongoing debate. Some researchers use terms such as 'problematic social media use' (Zendle & Bowden-Jones, 2019) instead of 'addiction'. On the other hand, Griffiths (2005) claims that any addiction has six key characteristics and that no matter the type of behavior, any person engaging in a behavior that meets these six criteria should be operationally defined as addicted. The six-component model (Griffiths, 2005) of SPA illustrates these criteria: (1) *Mood modification* refers to one's internal relieving results in immediate mood changes via SPA. Smartphone use becomes a tool to overcome stress and provide addicts with an alternate reality through psychological reinforcement. (2) *Tolerance* refers to one's excessive smartphone use at an increasing rate, maintaining the former mood-modifying effect (i.e., relieving). Individuals need increasing amounts of smartphone use to have former relieving effects. (3) *Withdrawal* indicates symptoms of uncomfortableness with a reduction in smartphone use. For example, addicts may feel nervous and irritable or have physiological reactions when prohibited from using their smartphones. (4) *Conflict* reflects the interpersonal difficulties of smartphone addicts, which indicates an impairment in functioning in particular activities (e.g., academic achievement) and their relationships, especially with their significant others. (5) *Salience* indicates that smartphone use becomes the dominant activity in addicts' daily lives that influences functioning levels in managing their emotions, thoughts, and behaviors constructively. (6) *Relapse* describes smartphone addictive behaviors that may relapse after abstinence, though addicts give up or control their excessive use, albeit for a while.

Moreover, research (Park & Choi, 2017) suggests that resilience is one of the dynamics in understanding SPA. Especially stressful life events (e.g., COVID-19) are risk factors for SPA that reduce adolescents' resilience (Yıldırım & Çiçek, 2022). Adolescents seem more vulnerable to emotional dysregulation, such as depression or impulsivity, when they have poor resilience (Kim et al., 2014). The current study assumes that family dysfunction may also be a source of stress. University students may chronically respond to their aversive

internal stimulus with excessive smartphone use once dysfunctional family patterns (i.e., triangling) emerge, negatively affecting their psychological functioning. More specifically, the addictive behaviors in smartphone use might be a reaction to their triangling experiences that climax in university students' efforts to balance their parents' unhealthy or conflictual relationship system, in which their resilience level is affected.

**Resilience**

There is uncertainty about the meaning and content of resilience. Thus, the word contains many ambiguities and blurred meanings; definitions frequently emphasize the construct as a trait, coping strategy, or outcome (Luthar et al., 2000). Even the scales on the construct focused on the factors that improve resilience rather than the recovery from adversity or one's return process to a former functional state (Smith et al., 2008). Still, common critical points in definitions exist, such as "homeostatic return to a prior condition" (Carver, 1998, p. 247) and an ability to adapt to adversity or stressful life events (Liu et al., 2017). Nevertheless, resilience is a more comprehensive process than recovery, reflecting an ability to preserve equilibrium as an extension of coping (Bonanno, 2004) and the bounce-back from stressful situations (Smith et al., 2008). Resilience is more likely to be achieved when individuals overcome the effects of a prolonged adverse experience (e.g., trauma) or when detrimental effects are absorbed by supportive intimate relationships (Herrman et al., 2011).

Contemporary approaches focus on more integrative and multi-faced models of resilience, including intra-individual, interpersonal, and socio-ecological dimensions (Liu et al., 2017). For instance, *internal resilience,* or interpersonal dimension, consists of skills and experiences in relationships with significant others and social groups. *Core resilience* reflects intra-individual factors, including health-related behaviors, stress-reacted systems to adversities, gender/sex, physiology, and biological elements. *External resilience* indicates socio-ecological factors, including individuals' socioeconomic status and access to formal or informal institutions in society. Resilience-related research on youth mainly concentrated on particular dimensions reflecting the associations between resilience, stress, and social support (Bacchi & Licinio, 2017; Hamdan-Mansour et al., 2014; Kokou-Kpolou et al., 2021; McGillivray & Pidgeon, 2015). However, the interpersonal dimension demonstrates that significant others (i.e., family) contributions rarely concern researchers. The conjunction of SPA, stress, and resilience in the sample of university students is also considered (Kim & Sim, 2018), especially in the Far East countries. In smartphone use, risky groups of university students reported lower resilience levels (Kim et al., 2014). Resilience is a protective factor against excessive smartphone use (Shen, 2020), and improvements in the ego-resilience levels of university students decreased their SPA levels (Jun & Jo, 2016).

Resilience and DoS have theoretical similarities; both are developmental processes shaped throughout life experiences beginning in childhood (Greene et al., 2003; Kerr & Bowen, 1988). Moreover, the intrapsychic dimension of DoS reflects a similar mechanism to resilience: "someone who is resilient and capable of deciding how much to control emotion would likely be able to distinguish between cognition and emotion" (Prince-Embury, 2013, p. 327). Resilience and DoS support individuals' adaptive coping strategies against adversities. For instance, Sutherland et al. (2009) indicated that women with lower DoS and resilience levels were less able to recover from substance abuse. Other researchers have revealed that higher DoS levels predicted lower stress and higher resilience in an adult Turkish sample (Süloğlu & Güler, 2021). Alongside, we propose two factors that are interrelated with university students' resilience levels in the current study, reflecting their psychological functioning levels: triangling in their family-of-origin that resulted in excessive use of smartphones and a weakened state of resilience.

**Rationale for the Current Study**

SPA may be considered a symptom from the BFST perspective. The function behind this symptom might be to indicate that a small number of adolescents unconsciously attempt to regulate parental tension (i.e., triangling), especially during conflicts, by drawing attention from the dyadic relationship to the risky behavior of SPA. Triangling may also reflect the university students' poor emotion-regulation strategies and abilities to adapt dysfunctional family relationship patterns, which reveal chronic anxiety with lower DoS in their lives. In this formulation, resilience and DoS may be the weakening abilities due to university students' dysfunctional coping mechanisms for excessive smartphone use. The SPA among Turkish university students is substantial (Noyan et al., 2015). The relationship between DoS and SPA is well-defined, indicating that individuals with higher DoS can manage their emotions more healthily and report lower SPA. The fusion or enmeshed (reflecting lower DoS) patterns of family relationships emerged as distinct dimensions regarding DoS (Ercengiz et al., 2020; Jimeno et al., 2021; Park & Park, 2017). We chose SPA as a mediator variable because smartphones bring many conveniences to our daily lives besides their adverse effects on interpersonal relationships, physical and mental health, well-being, and functionality (Park & Lee, 2012). A small percentage of university students are inclined to use smartphones excessively, which may be related to the problems they experience in their close

relationships. Turkish university students reported that smartphones provide them with an escape from their problems. They no longer need others, do not feel alone, and handle the difficulties of expressing themselves in face-to-face relationships (Özdemir et al., 2019).

Characteristics of SPA in university students' daily lives may provide a symptomatic context for better understanding the effects of dysfunctional relationship mechanisms in their family of origin, such as triangling. Still, no studies have investigated the mediating role of SPA in the relationship between triangling, resilience, and DoS from an integrative perspective. In other words, we assume university students react to triangling with SPA as a coping mechanism. Furthermore, we presume that this link between triangling, SPA, and resilience can be better understood when DoS is included in the model as an exogenous variable. The direct and indirect effects of triangling on DoS were examined previously (Ross et al., 2016). The triangling may form the individuals' DoS levels throughout their childhood and adolescence experiences within an intergenerational relationship system (Ross et al., 2016). Thus, we suggest that the association between resilience and the DoS levels of our participants will be negatively affected by the association between triangling and resilience. Investigating triangling and DoS with another theoretical construct of resilience and SPA from an integrationist perspective can significantly contribute to the literature, for which no studies have recently been available to figure out which has the following hypotheses:

Hypothesis 1: SPA mediates the relationship between triangling and DoS.
Hypothesis 2: Resilience mediates the relationship between triangling and DoS.
Hypothesis 3: The association between triangling and DoS was serially mediated by both SPA and resilience.

## Method

### Participants and Procedure

Using convenience sampling, 536 undergraduate students (331 females, 61.8%; 205 males, 38.2%) participated in the study from universities in the north region of Türkiye. Participants were aged between 18-23 years old (94%). They reported an average GPA of 2.99 (*SD*= 0.39) in the 4.00 grading system. The participants' parents were mainly married and living together (479, 89.4%). 333 participants lived with their friends (in a dormitory or flat, 62.1%). Of 161 of them, 30 were living with their parents (30%), 28 were alone (5.2%), 8 were with a partner or spouse (1.5%), and 6 were with their relatives (1.2%). No incentives were provided to students to participate in the study. Researchers were granted ethical permission from the institutional review board of the Ordu University Social and Human Sciences Ethics Committee (approval number: 2021-199). The study was conducted in accordance with the Declaration of Helsinki and the ethical guidelines of this institutional review board. Due to COVID-19 conditions, the data were uniquely collected by the online survey method between November 2021 and December 2021. Participants were informed of the purpose of the study in WhatsApp student groups, and they declared their voluntariness via a consent form on the first page of the Google form. University students started these groups to sustain communication and remote learning between students and academics during COVID-19.

### Instruments

*Triangular Relationship Inventory*
The TRI (Bresin et al., 2017) assesses the triangling levels of young adults with 24 items (e.g., "My parents handle tension between one another without including me") using a 5-point Likert type (total scores range between 24 and 120). Higher scores indicate higher triangling levels. Cronbach's alpha coefficient of total TRI produced .93. Total TRI's test-retest reliability was .76 in the original study (Bresin et al., 2017). Turkish TRI (Kurşuncu & Baştemur, 2020) produced a similar Cronbach's alpha coefficient of .88 to the original scale. Turkish TRI's test-retest reliability for university students was .80. The total TRI produced .87 for McDonald's Omega and .88 for Cronbach's Alpha coefficient in the current study.

*Differentiation of Self Inventory Short Form*
The DSI-SF (Drake et al., 2015) assesses the DoS levels of young adults and adults with 20 items (e.g., "I am extremely sensitive to criticism") using a 6-point Likert type (total scores range between 20 to 120, and 5 to 30 on mean values). Higher scores indicate higher DoS levels. Cronbach's Alpha coefficient of total DSI-SF produced .88. Total DSI-SF's test-retest reliability was .85 in the original study (Drake et al., 2015). Turkish DSI-SF (Sarıkaya et al., 2018) produced a similar Cronbach's Alpha coefficient of .82 to the original scale. Turkish DSI-SF's test-retest reliability was .86. The total DSI-SF has .84 for McDonald's Omega and Cronbach's Alpha coefficients in the current study.

*Smartphone Addiction Scale—Short Version*
The SAS-SV (Kwon et al., 2013) assesses the smartphone addiction of university students with ten items (e.g., "Even if I don't use it, my smartphone is on my mind") using a 6-point Likert type (total scores range between 10 and 60). Higher scores indicate a higher smartphone addiction risk. Cronbach's alpha coefficient of SAS-SV produced .91 (Kwon et al., 2013). Turkish SAS-SV (Noyan et al., 2015) has a Cronbach's alpha coefficient of .87. Turkish SAS-SV's test-retest reliability was .93. The total SAS-SV had .91 for McDonald's Omega and Cronbach's Alpha coefficients in the current study.

*Brief Resilience Scale*
The BRS (Smith et al., 2008) assesses individuals' resilience levels with six items (e.g., "I have difficulty coping with stressful events") using a 5-point Likert type (scores range between 6 and 30). Higher scores indicate higher resilience levels. Cronbach's alpha coefficients of BRS were .80 to .91 in different sample groups. Test-retest reliabilities were also .62 to .69 in the same sample groups (Smith et al., 2008). Turkish BRS (Doğan et al., 2015) had a Cronbach's alpha coefficient of .83. The total BRS had .87 for both McDonald's Omega and Cronbach's Alpha coefficients in the current study.

*Demographic Information Form*
Researchers developed a study-oriented form (e.g., gender, age, GPA, parents' marital status, whether or not participants live separately from their parents, with whom participants lived) describing the demographic characteristics of the participants briefly.

**Data Analysis**
Preliminary analyses, including bivariate correlations among the study variables, were first examined using SPSS 22 (IBM, 2013). The inflated chi-square statistic (Nevitt & Hancock, 1998) was adjusted using the Maximum Likelihood Estimation (MLE in AMOS 24; Arbuckle, 2016). For SEM results, the fit indices and cutoff values were considered as $\chi 2$/df-ratio < 3 (Kline, 1998); CFI ≥ .95, NNFI≥ .95, RMSEA < .06, and SRMR < .08 (Hu & Bentler, 1999). As some scales consisted of many items attributed to a single latent variable (e.g., 24 items for triangling, 20 items for DoS), item parcels were employed to adjust inflated measurement errors and the bias in structural parameters (Bandalos, 2002). The model generated four parcels for triangling and DoS and three parcels for SPA as measurement indicators. Using a random assignment technique based on the mean values of the items from highest to lowest, the individual items of triangling, DoS, and SPA were assigned to these parcels (Little et al., 2002).

## Results

**Preliminary Analysis**
We had no missing data, as responding to all items in the Google form was mandatory. The skewness (highest, 1.25) and kurtosis (highest, -1.44) values were within suggested limits (Kline, 2011). The highest bivariate Pearson correlation ($r$ = .53 max.) among study variables was also within the required limit of .90 (Kline 2011), and the tolerance values were above .20 for the variables (minimum tolerance = .71). No violation of homoscedasticity or linearity was noticed in the scatterplot and partial regression plots. The sample exhibited a higher level of DoS ($M$ = 18.10, $SD$ = 3.51), moderate level of resilience ($M$ = 18.27, $SD$ = 5.07), lower level of triangling ($M$ = 62.44, $SD$ = 16.24), and SPA ($M$ = 31.60, $SD$ = 11.12) when possible range scores were examined (Table 1). The strongest bivariate Pearson correlation among study variables was between DoS and resilience ($r$ = .53, $p$<.001). The correlation between triangling and resilience was not significant.

*Table 1. Descriptive, Bivariate Pearson Correlations, and Reliabilities of the Study Variables (N=536)*

| | 1. Triangling | 2. Smartphone addiction | 3. Resilience | 4. Differentiation of self |
|---|---|---|---|---|
| 1. | - | | | |
| 2. | .18** | - | | |
| 3. | -.06 | -.19** | - | |
| 4. | -.15* | -.36** | .53** | - |
| M | 62.44 | 31.60 | 18.27 | 18.10 |
| SD | 16.24 | 11.12 | 5.07 | 3.51 |
| Range | 24-116 | 10-60 | 6-30 | 5.25-27.25 |

Note: ** $p$<0.001; * $p$<0.002 level (two-tailed).

**Mediation Model**

The model (in Figure 1) examined the indirect relationships between triangling, SPA, and resilience in predicting the scores for DoS. Findings indicated a good model fit of $\chi 2$ (113)/224.18=1.98, $p$<.001; CFI = .98; NNFI = .98; SRMR = .03; RMSEA = .043 (90% CI=.035-.051). Factor loadings were between .66 and .95 in the model. Triangling accounted for 3% of the variance in SPA. Together, triangling and SPA accounted for 5% of the variance in resilience. Triangling, SPA, and resilience together explained 45% of the variance in DoS. The direct effect of triangling on DoS ($\beta$ =-.07) was not significant.

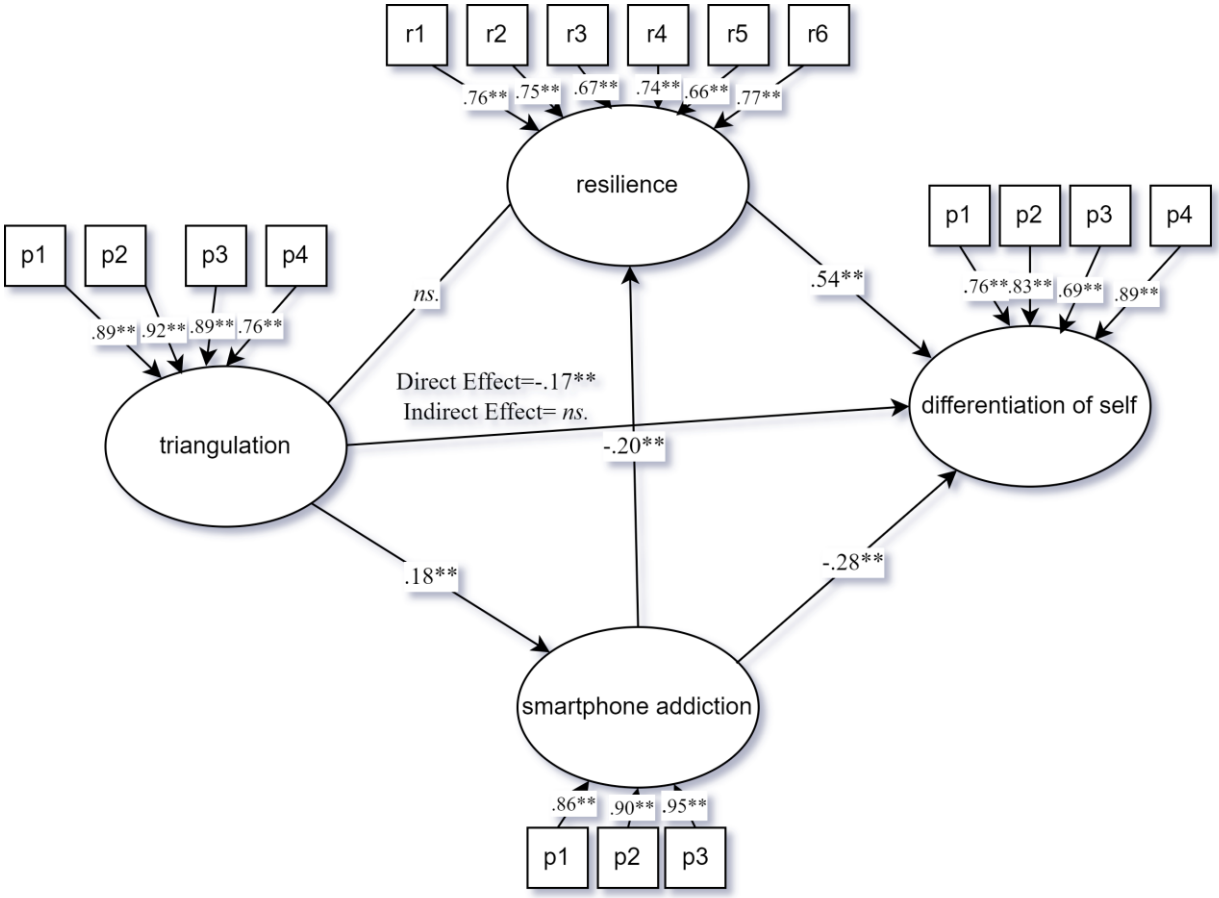


*Figure 1.* Standardized coefficients and paths of the mediation model (** $p$<.001)

*$H_1$ (triangling to SPA to DoS)*

The path from triangling ($\beta$ = -.04, $p$<.010, [CI= -.02, -.06]) to DoS (via SPA) was significant, and SPA fully explained the association as a mediator. When university students had higher exposure to triangling, they reported more SPA and a lower DoS.

*$H_2$ (triangling to resilience to DoS)*

The path from triangling ($\beta$ = -.02, *ns.*) to DoS (via resilience) was not significant.

*$H_3$ (triangling to SPA to resilience to DoS)*

The path of triangling ($\beta$ = -.01, $p$<.003, [CI= -.01, -.03]) on DoS (via SPA to resilience) was significant. When university students had higher exposure to triangling, they reported more SPA, lower resilience, and lower DoS.

## Discussion

**Triangling to SPA to DoS ($H_1$)**

The first hypothesis investigated was whether triangling predicted DoS through SPA. The analysis revealed the full mediating role of SPA. More accurately, triangling did not directly contribute to DoS unless university students reported SPA. This first hypothesis contributes to research (Willis et al., 2021) that has examined the relationship between triangling and DoS. BFST (Bowen, 1978; Kerr & Bowen, 1988) presumes that parents with higher DoS are less likely to include their children in a triangle. Moreover, cross-generational and mediator types of triangling have been correlated to higher degrees of psychological symptoms among university students (Murdock et al., 2022). The symptom in the current model is considered SPA. The function of SPA might be to help university students escape the detrimental emotional effects of triangling through excessive smartphone use.

**Triangling to resilience to DoS ($H_2$)**

We found no significant indirect effect of triangling to resilience to DoS. This finding may be related to the characteristics of the current sample, as participants reported lower triangling and SPA but higher resilience and DoS when possible range scores on mean values were examined. Moreover, the bivariate Pearson correlation between resilience and DoS was the strongest. On the other hand, the bivariate relationship between triangling and DoS was weak, and no relationship between triangling and resilience was found. The symptom-producing manner of triangling seemed to work only when triangling was correlated with SPA. When participants reported higher resilience and DoS, the adverse effect of triangling may have weakened.

**Triangling to SPA to resilience to DoS ($H_3$)**

When SPA and resilience were included in the model, the direction of the indirect effect in the first hypothesis remained significant and constant. The $H_3$ theoretically consolidated the association between triangling and DoS through SPA and resilience. When university students reported higher triangling, a small number of students reported higher SPA, predicting a lower resilience and DoS. The current study (with $H_3$) may have completed the missing piece of the picture that the researchers indicated separately for the study variables. For instance, Kim et al. (2014) reported an inverse relationship between SPA and resilience. Süloğlu & Güler (2021) represented a positive relationship between resilience and DoS. Bresin et al. (2017) defined an inverse association between triangling and DoS. Moreover, Ercengiz et al. (2020) demonstrated that intolerance of uncertainty mediated the relationship between DoS and nomophobia among university students. One can suppose that intolerance of uncertainty has great concordance with resilience, as research also suggests an association (Lee, 2019). Nomophobia was also classified as Smart-Phone Addiction Disorder (Tran, 2016). The path from DoS to intolerance of uncertainty to nomophobia is supported by the authors (Ercengiz et al., 2020), indicating the predictor role of DoS in nomophobia. Furthermore, $H_3$ presents a similar structure and suggests triangling (reflecting poor DoS) as one of the predictors to associate with SPA in expanding the previous research. Findings of $H_3$ may explain the links among these variables with BFST's emphasis on triangling, which is one of the boundary-violating patterns reflecting the 'closed' family systems (Kerr & Bowen, 1988). In the configuration of BFST, triangling is a symptom when family members have poor DoS levels. However, triangling may also have a symptom-producing characteristic or aggravate these symptoms (Mayseless & Scharf, 2009), on which the current findings have a similar emphasis. On the other hand, based on the mean values of the participants in the current study indicating moderate resilience and greater DoS levels, and on $H_3$ findings, one can conclude that higher resilience and DoS might play protective roles against behavioral addictions and triangling. Van Dijk et al. (2021) indicated that unless they have greater self-esteem, adolescents from dysfunctional families might get involved in more triangling and problematic internet use. Similarly, greater resilience and DoS may weaken the adverse effects of triangling and SPA. University students in the current sample may have been better able to cope with the consequences of triangling and SPA when they exhibited stronger resilience and DoS.

**Implications for Theory and Practice**

The results supported the underlying theoretical framework of triangling, which explains how a behavioral addiction (i.e., SPA) within a family system might develop. These findings can help researchers expand their theoretical approach or methodology and aid them in creating their interventions. By developing psychosocial intervention programs on SPA using integrative theoretical models similar to the current model, academics in mental health may support universities' psychological counseling centers. Moreover, the present study theoretically contributed to research (Hanson, 1997; Ross et al., 2016; Willis et al., 2021), indicating a weak inverse or no relationship between triangling and DoS on BFST's assumption. Although triangling correlated with DoS in the current preliminary analysis, triangling had no slightly direct effect on DoS in the mediation analysis.

**Implications for Practice**

Mental health specialists may consider the possible negative impacts of triangling and poor DoS on behavioral addictions and target creating de-triangulation strategies with their clients suffering from SPA. According to Titelman's (2008) suggestions, therapists may assist clients in several ways. For instance, specialists may help clients develop their abilities to sustain "neutral, person-to-person contact" (Titelman, 2008, p. 48) in a dysfunctional family. Such an ability allows one to have an objective perspective on the emotional functioning mechanisms of a family of origin. However, gaining this perspective is the first step, and the clients should progress toward getting rid of emotional symptoms. For instance, emotional reactivity is one of these symptoms in BFST (Kerr & Bowen, 1988), indicating poor DoS and self-regulation practices on cognitions and feelings may help clients. Moreover, clients become more conscious of their own contribution to the dysfunctional dynamics in their families.

**Limitations**

The current study has several limitations: (1) The participants were mainly female (61.8%), and a suggestion may be for future studies to have demographically more gender-balanced samples. (2) The participants were not mainly living with their families during the data gathering (62.1%), and a suggestion may be for future studies to have samples who live with their parents to understand the adverse triangling effects more specifically. Because living apart from the parents may weaken the adverse effects of some typical characteristics of triangling, such as scapegoating (Wang et al., 2017), (3) The current results depend on the self-reports of university students. A suggestion may be for future studies to conduct intergenerational interviews for a more accurate assessment of triangling in addition to the self-reports of participants. (4) The current study was cross-sectional and longitudinal studies may be more applicable to more specific empirical evidence on triangling and DoS and how participants manage the dysfunctional family environment in the long run.

## Conclusion

Triangling may produce behavioral addictions (i.e., SPA) and weaken the psychological functioning of university students, and in the current study, resilience and DoS were considered. On the other hand, detriangling strategies with an effort to increase DoS may protect university students from the negative impacts of SPA, resulting in higher resilience and DoS.

## Recommendations

One remedy may be to learn how university students manage their unpleasant emotions related to triangling experiences. To prevent behavioral addictions (i.e., SPA) and improve psychological well-being among university students, the potential risks of triangling should be addressed in universities' mental health centers.

## Author(s) Contribution Rate

The author contributed at all stages, including planning, conducting and writing.

## Conflicts of Interest

There is no conflict of interest in this study.

## Ethical Approval

Ethical permission (2021-199) was obtained from Ordu University Social and Human Sciences Ethics Committee for this research.

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# Examination of the Effectiveness of EMDR Intervention in Children with Animal Phobias: Case Study

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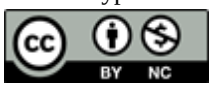

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# Examination of the Effectiveness of EMDR Intervention in Children with Animal Phobias: A Case Study

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## Abstract

Children's experiences of animal fears can be caused by direct conditioning, experiencing negative events, or modeling others' fears or situations. The fear of an animal that develops in a child as a result of various experiences may turn into an animal phobia over time. This study aims to examine the effectiveness of EMDR interventions for two different children with animal phobias through case studies. In the interventions conducted with the children in this study, facilitative techniques such as allowing the children to express themselves through drawings were utilized in addition to EMDR procedures. The study utilized a multiple-case study design, which is among qualitative research methods. One of the cases is a 9-year-old boy who developed a phobic condition related to dogs after being attacked by a dog and experiencing psychological distress associated with his dog phobia in daily life (such as running towards home, increased heart rate, and screaming when seeing a dog on his way home from school). The second case is a 10-year-old boy who developed a phobic condition related to insects after being stung by a bug while sleeping, experiencing fear of bugs in nature, such as during a picnic, and having difficulties sleeping alone. In this study, narrative analysis was utilized in the data analysis to describe the experiences of Client-1 and Client-2 regarding their phobic conditions and to present their narratives related to EMDR intervention in a chronological and holistic manner. According to the research findings, EMDR interventions conducted with two children (C1 and C2) who had animal phobias were found to have a positive impact on their phobic conditions. The current study revealed findings related to negative cognition as "*I am afraid*" and positive cognitions as "*I am brave*" and "*I can overcome it*" regarding children's phobic conditions, along with the expressions provided by the children during the interventions. In future studies, presenting the outcomes of EMDR interventions for children's phobic conditions in a qualitative design would allow for a more in-depth analysis of the prominent cognitions and expressions of the children.

**Keywords:** Animal phobia in children, EMDR intervention, Case study

## Introduction

When examining phobias in the DSM-5, five main types of specific phobias stand out: 1. animal-related phobias (such as dogs, cats, and spiders); 2. natural environment-related phobias (such as heights and water phobia); 3. situational phobias (such as enclosed spaces, driving, flying, and elevators); 4. blood-injection-injury phobias (such as fear of seeing blood); and 5. other phobias (such as fear of illness) (American Psychiatric Association-DSM-5, 2014). Phobias can be observed in many children at an early age, just as they may occur in adults. Common phobias in children include fears of being in the dark, nightmares, falling into empty spaces, heights, and animal fears. These fears can be associated with anxiety-related distress and may involve fear and avoidance of an object, regardless of age (Farrell et al., 2021; Ferrari, 1986; King, Muris, & Ollendick, 2005; Ollendick, King, & Muris, 2002; Weems et al., 1999).

Traumatic experiences related to a specific fear object during childhood can lead to various fears in the form of phobic conditions later in life (van Dijke, Hopman, & Ford, 2018). For example, being chased by a dog can be a reason for a child to develop a fear of dogs for an extended period of time (Bal, 2010). Children's experiences of animal fears, as in the given example, can be caused by direct conditioning, experiencing negative events, or modeling others' fears or situations (King, Clowes-Hollins, & Ollendick, 1997).

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Studies examining interventions for children's phobic experiences in psychological counseling sessions show various interventions being implemented. In one study, single-session therapy, which is a type of cognitive-behavioral therapy (CBT), was suggested for children and adolescents with various phobic conditions. This therapy was reported to include psychoeducation, CBT techniques, exposure, cognitive challenges, skills training, and reinforcement. The single-session therapy intervention may last up to three hours, and it was emphasized by researchers that it was effective for phobias in children and adolescents (Davis, Ollendick, & Öst, 2009). In another study, it was predicted that enhanced evidence-based exposure therapy, rather than traditional cognitive-behavioral therapy, would be more appropriate in working with dog phobias in young children. 10–13-session exposure therapy significantly reduced the children's phobias in two cases (May et al., 2013).

Apart from studies on CBT approaches to phobic conditions, there have also been studies comparing CBT with EMDR interventions, which have shown no difference in their effectiveness. In both cases, it was found that individuals started to function better in their daily lives, and their distress was reduced (de Jongh et al., 2011). In this context, it can be said that both CBT, or exposure therapy, and EMDR interventions facilitate the reprocessing of cognition and emotions related to phobic conditions. It has been noted in the literature that EMDR is an effective intervention for specific phobic conditions in children, such as animal fears, and it can be applied practically (Tinker & Wilson, 1999). De Roos and de Jongh (2008) stated in their study that children with drowning phobia experienced distressing situations related to drowning and that these situations were associated with traumatic experiences. They further mentioned that EMDR was used to reprocess the memories, cognitions, emotions, and bodily sensations associated with these experiences, and that EMDR proved to be an effective intervention for such phobic conditions. Similarly, Vuþina (2021) reported that a 12-year-old child who developed a phobic condition related to sleep due to nightmares experienced positive outcomes in overcoming this phobic condition with EMDR intervention.

When examining phobic cases, it is observed that individuals can avoid the feared situation and its associated triggers. According to explanations regarding the emergence and maintenance of fear, fear initially arises through dependent learning and is sustained through fear conditioning. Essentially, threat evaluation requires an accurate prediction of a deterrent consequence from the current environmental signals. Therefore, fear conditioning is considered a powerful tool to investigate emotional learning and the neurobiology supporting fear expression in both human and non-human subjects. Fear conditioning studies have identified the critical roles of the amygdala, hippocampus, and cerebral cortex in regulating fear memory and behavioral expression (Gilmartin, Balderston, & Helmstetter, 2014). Particularly, the amygdala is generally accepted to be involved in various forms of emotional learning and memory, such as Pavlovian fear conditioning (Helmstetter, 1992; Maren, 2003). Any behavior that assists the individual in avoiding situations that elicit conditioned responses will be reinforced over time. In this context, when looking at the prominent aspects of EMDR when working with phobic conditions, the technique can focus on desensitizing the individual's negative experiences through bilateral stimulation and replacing them with pleasant memories (Sheikhi et al., 2020). EMDR therapy is also found to contribute to restoring disruptions occurring in the amygdala-temporal network and facilitating the process of fear extinction, leading to the placement of positive emotions instead of negative emotions (Rousseau et al., 2019).

EMDR intervention consists of a series of steps, including history taking, client preparation, assessment, desensitization, installation, body scan, closure, and reevaluation (Greenwald, 2004; Shapiro, 2012). EMDR intervention can enhance accessing the details of disturbing memories and accelerate their reprocessing by focusing on the sensory components (affective, cognitive, and somatic) in the experience (Shapiro, 2002), and it continues until the traumatic memory no longer brings emotional distress and a positive and adaptive perspective towards the traumatic memory is established (Ten Hoor, 2013). In conclusion, with EMDR, it is possible for individuals to strengthen their positive cognitions instead of negative cognitions, replace negative emotions with positive emotions, and reprocess a memory related to a phobic condition by emphasizing a clear beginning. The aim of this study is to demonstrate the applicability of the EMDR technique to children with animal phobia.

**EMDR Intervention Protocol**

EMDR consists of eight phases: history-taking, preparation, assessment, desensitization, installation, body scan, closure, and re-evaluation. The "history-taking phase" involves obtaining information about the client's distressing situations, bodily sensations, onset, how they have intensified, coping resources, and previous psychological history. The "preparation phase" focuses on preparing the client for what to expect during the EMDR session, and it may involve conducting a "safe place" exercise. During the preparation phase, the

procedure for performing eye movements with bilateral stimulation is explained, highlighting their significance in reducing negative emotions and facilitating the reprocessing of positive emotions.

In the "assessment phase," the client's negative cognition, positive cognition, degree of belief in positive cognition (VOC), emotions related to the issue, level of belief in negative cognition (SUD), and bodily sensations are identified. During the "desensitization phase," sets of eye movement stimulation are performed based on the assessment of the distressing image. The therapist takes a less active role in this phase. The desensitization process continues until the distress level decreases to 0 or 1 on a scale of 10.

Next, the "installation phase" is conducted. The client is asked about the credibility of the positive belief identified during the assessment phase, such as "How do you feel about yourself (stating the positive belief)? Is it appropriate?" Eye movement sets are continued until the credibility level of the positive belief reaches 7 on a scale of 1-7. In the "body scan phase," the client is instructed to focus on any bodily sensations and continue with eye movement sets until the discomfort level reaches 0 or 1. During the “closure phase,” the effects of the previous session on the client over the week are explored, including any experienced discomfort.

The "re-evaluation" phase involves reviewing the goals addressed in the previous session, reassessing the distress level associated with the most vivid image, and checking if current triggers or reminders of the trauma are distressing the client. If any discomfort is present with current triggers, it is addressed in this phase. Additionally, a future template is worked on to prepare the client for future scenarios (Jarero, Artigas, & Hartung, 2006, pp. 122-123; Kavakçı, 2012, pp. 27-69).

Children often find it easier to express their thoughts and feelings through drawings rather than verbal expressions (Burris, 2005; Steele & Kuban, 2013). Therefore, in addition to all the above-mentioned EMDR intervention stages conducted with children, additional activities involving drawings are utilized. During the "preparation phase," children may create drawings of safe places. During the "desensitization" phase, they can draw or paint the images that come to their minds or any new images that arise between sets. In the "installation" phase, they may engage in drawing or painting activities related to positive images. Drawings may also be used during the body scan phase (Bayhan et al., 2022, p. 4). When working with children, bilateral stimulation does not necessarily have to involve eye movements. Alternative methods, such as following a "rhythmic machine" (Adler-Tapia & Settle, 2008, p. 24) or the child engaging in "rhythmic tapping on their own knees" or rhythmic stimuli like a "butterfly hug" (Bayhan et al., 2022, p. 4), can be chosen. In this case, the child can be given the following instruction: "During EMDR, we can use these tools. We can try various methods and find the one that suits you best. By doing this, we can minimize what bothers us and increase positive feelings while decreasing the negative ones" (Adler-Tapia & Settle, 2008, p. 24).

## Method

The study utilized the multiple-case study design, which is one of the qualitative research methods. One of the cases involved a 9-year-old male child who developed a phobic condition towards dogs after being attacked by a dog and experiencing fear of dogs that led to psychological distress in his daily life (e.g., running towards home when seeing a dog on the way from school, increased heart rate, screaming). The second case involved a 10-year-old male child who developed a phobic condition towards insects after being bitten by a bug while sleeping, experienced fear of insects in outdoor settings, such as picnics, and had difficulty sleeping alone. In case studies, which are among qualitative research methods, elements related to a case, such as individuals, places, events, and temporal processes, are examined holistically (Yıldırım & Şimşek, 2013, p.83). The aim is to reveal what children experience regarding their animal fears through EMDR intervention. Additionally, similarities and differences in the experiences children report during the EMDR intervention for animal fears are thoroughly examined and described. Therefore, the multiple-case approach, which highlights the similarities and differences in the descriptions of cases, is considered suitable for this research (Creswell, 2018).

### Ethical Aspects of the Research

To conduct this study, ethical approval was obtained from the Van Yüzüncü Yıl University Social and Humanities Ethics Board Presidency, dated April 25, 2018 and numbered 2018/05. Additionally, written consent forms were obtained from the mothers, ensuring that no identifying information would be used in presenting the research. At the conclusion of the interviews with the children, it was discussed that the study could be presented in a manner that would be beneficial for other children and psychological counselors without utilizing any identifying information.

**The Data Collection Tool**

The data collection tool for this study consisted of interviews. The interviews were conducted with two different children at different times, with each session lasting between 45 and 50 minutes. When there was a psychological demand from mothers regarding their children's phobic conditions, psychological counseling interviews were conducted with the children. The children willingly agreed to participate in the sessions. The mothers were not involved in the interventions. A total of seven interview sessions were conducted with Client-1, and eight sessions were conducted with Client-2. Additionally, "The Child Posttraumatic Stress Disorder Reaction Index (CPTS-RI)" was used to examine the effectiveness of EMDR intervention on the phobic symptoms of the clients (it was observed that their phobic symptoms were associated with traumatically experienced situations). The questionnaire information is provided below.

*The Child Posttraumatic Stress Disorder Reaction Index (CPTS-RI)*

The Child Posttraumatic Stress Disorder Reaction Index (CPTS-RI) is a scale developed by Pynoos et al. (1987) and adapted to Turkish culture by Erden et al. (1999). The researchers established criteria for scale scores based on studies conducted with children who have experienced different traumas. They categorized the scores as follows: scores between 12 and 24 indicate mild symptoms; scores between 25 and 39 indicate moderate symptoms; scores between 40 and 59 indicate severe symptoms; and scores of 60 and above indicate very severe symptoms, indicating the presence of posttraumatic stress disorder. The researchers obtained a test-retest reliability of .86 and a Cronbach's alpha coefficient of .75 for the scale. The scale consists of 20 items, rated on a 0-4 scale, ranging from "never" to "very often," using a 5-point Likert-type scale (Erden et al., 1999, pp. 144–149).

**Data Analysis**

In this study, narrative analysis was utilized for the data analysis, as the objective was to describe and present the EMDR intervention on the phobic experiences of Client-1 (C1) and Client-2 (C2) in a chronological and comprehensive narrative format. Narrative analysis involves examining the data in terms of actions, factual situations, and the resulting descriptions, and it generates stories as a method of analysis. For instance, these stories can be derived from the cases studied in the research (Uğuz Arsu & Tekindal, 2021).

**Case-1**

In Case-1, it was reported that a dog ran towards a 10-year-old boy (C1) while he was alone, barking and showing its open mouth with visible saliva. With the help of neighbors, C1 managed to move away from the dog and ran back home. After this incident, C1 expressed fear and anxiety whenever he saw a dog, with an increased heart rate. He also developed a fear of going to school alone and hesitated to go outside by himself. C1 mentioned that this event had occurred a few months before the interview. C1 expressed the desire to overcome his general fear of dogs and even mentioned that seeing a dog with his friends after school made him feel better. Even when observing that dog from a distance without approaching it, he felt partially hopeful and believed that he could overcome his fear of dogs in this way, stating, *"Not only fear, but I also know that I can love them. I can show mercy. With my two friends, I can get a little closer to a dog named Alaca (a cute dog that doesn't bark). My self-confidence increases; I can do it."*

C1 indicated that he did not want to feel a sense of difficulty when encountering animals, desired to go outside comfortably on his own, and wanted to overcome his phobic condition. C1 mentioned that situations involving encountering dogs could happen in various places; for example, when a relative's hunting dog tried to jump on him to play, C1 would cry and quickly give up, believing that he couldn't succeed in such situations. The possibility of implementing an EMDR intervention for C1's developed fear was explained to him through metaphors. A total of seven sessions were conducted with C1.

**Case-2**

In Case-2, a 10-year-old boy (C2) reported that while sleeping in his bed, a bug stung him, and he developed a general fear of bugs. C2 also experienced a jumping sensation in his bed when sleeping alone in his room. Similar to C1, C2 mentioned that this incident had occurred a few months before the interview. C2 expressed that he had repetitive thoughts about seeing bugs again while spending time alone in his room. Additionally, C2 stated that he could only spend 10 minutes alone in his room and couldn't push himself further.

Following this event, C2 exhibited attitudes indicating avoidance of nature, such as avoiding picnics, and when lying in bed at night to sleep, repetitive thoughts came to the fore about the bug that stung him. It was reported by him that one night, C2 was suddenly stung by a bug and woke up by jumping. C2 expressed hesitation due to the fear developed towards bugs (phobic condition), which caused fear of staying alone in the room and sleeping alone. C2 stated, "*I think about the bug while lying down. I want my father to stay with me when I go to bed."* The possibility of implementing an EMDR intervention for C2's developed fear was explained to him through metaphors. A total of eight sessions were conducted with C2.

## Results and Discussion

The findings obtained are presented below according to the sequence of EMDR intervention stages.

### Findings Related to the EMDR History-Taking Phase

A total of three sessions were held with C1 for the history-taking phase. C1 mentioned that his school was close to his home, and one day he felt anxious when dogs started barking while he was sitting on a bench after school. According to C1, a dog growled and ran towards him, causing him to start running towards home. C1 stated that a neighbor noticed him and chased the dog away. C1 said, *"The neighbor came and left me at home. The dog was still following us."* C1 mentioned that he continued to tremble when he arrived home. Several months later, C1 gave examples of instances such as when he wanted to go out for a bike ride but ended up returning home without riding because he saw a dog. He also mentioned being affected by rumors of dogs attacking others. C1 further stated that even seeing pet animals outside made him uncomfortable.

C1 exceptionally expressed that seeing a black-and-white-spotted dog with his friends after school made him feel good. Even from a distance without approaching the dog, he felt partially hopeful and believed that he could overcome his fear of dogs in this way. He emphasized feeling good when he saw that dog with his friends while going to school. This situation gave C1 hope, and he stated, *"I can overcome 50% of my fear."* In the third session, it was observed that C1 drew a picture of the spotted dog and his friends. The drawing can be seen in Figure 1 below.

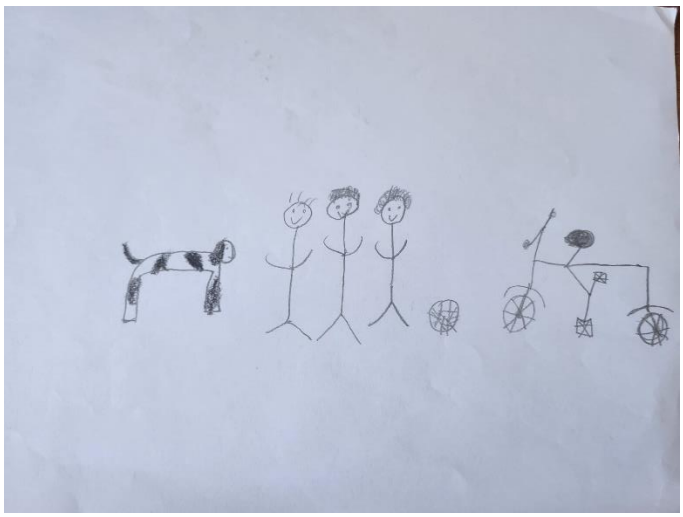

Figure 1. Drawing made by C1 in the third session

It was observed that C1 expressed his belief in overcoming the fear he experienced. C1 exceptionally didn't run away when he saw the black-and-white spotted dog (which he found cute) outdoors, but rather had an affection for it from a distance. Among C1's sources of strength, it was mentioned by him as follows: playing basketball, riding a bike, playing outside with friends, reading books, going for walks with his parents, playing board games like Monopoly with his family, and being engaged in technology lessons such as robotic coding and projects such as building a sensor-controlled car.

A total of three sessions were completed with C2 during the history-taking phase. When discussing with C2, it was expressed that C2 was stung by a bug while sleeping in his bed and developed a general fear of bugs. For

instance, C2 started to experience a jumping sensation in his bed when sleeping alone in his room. Especially when getting ready to sleep in the evening, he talked to himself with the thought of *"bugs coming to mind; bugs might appear again."* C2 mentioned that he had never seen such a bug before; the sting caused a lot of pain, and he (with his father) even went to the hospital, where he felt better. C2 stated that when the bug bit him, he screamed and jumped out of bed, and at that moment, his father came into the room, took the bug away, and immediately took C2 to the emergency room. C2 mentioned that going to the hospital made him feel better and that his father comforted him while they were there. C2 added that he received a serum at the hospital. C2 expressed that the image of the bug occasionally comes to his mind, saying, *"The image of the bug is big; it bothers me." Among C2's sources of strength, he mentioned that he enjoys drawing, school projects, taking care of plants at home, and playing basketball with his friends. Similar to C1, C2's views on feeling hope, peace, and feeling good were obtained, and it was seen that he wrote a note as follows: "When we talk about feeling good, the first things that come to mind are happiness, joy, and peace. Could we live without peace and feeling good? Of course not, because if life was all about boredom, we couldn't live. Peace is actually the reflection of life in the mirror. We should start our lives with this word, always. We should feel good about ourselves."*

It is observed that both C1 and C2 share similarities in their sources of strength, including playing basketball, playing with friends, and developing projects at school.

**Findings Related to the EMDR Preparation Phase**

In the fourth session, during the preparation phase, both C1 and C2 were explained how EMDR intervention is applied and what it serves through metaphors. The practitioner (who is also the researcher) provided the following instruction: *"Moments related to the event you experienced can flow in front of your eyes like a movie reel. It might be uncomfortable at times, like a train entering a tunnel, but I am here with you. There is light at the end of the tunnel, and when you tap your knees rhythmically like this, the uncomfortable feelings will decrease and the relaxing, positive feelings will increase. We will reorganize the disturbing memories, just like rearranging books in a library on a train, and our state of well-being will improve."*

Both C1 and C2 found *"knee tapping"* appropriate as bilateral stimulation. A safe-place exercise was conducted with both C1 and C2. During the safe place exercise, the practitioner gave the following instruction to both C1 and C2: *"I want you to imagine yourself in a safe and peaceful place. It can be a real or imaginary place. What images do you see? What sounds do you hear? What tastes do you experience? If you want to give a clue name to this place, what name would you choose?"* Regarding the safe place, C1 described the following place: *"It's a square place. There are pictures of things I love, like a sailboat and the sea. I can hear my mother's voice. I can also hear the voices of my friends. My aunt's voice is audible too. It's a place of fun moments; everyone is happy, and I am the one with play dough. Clue name: Memory Room."* C1's depiction of the safe place is shown below in Figure 2.

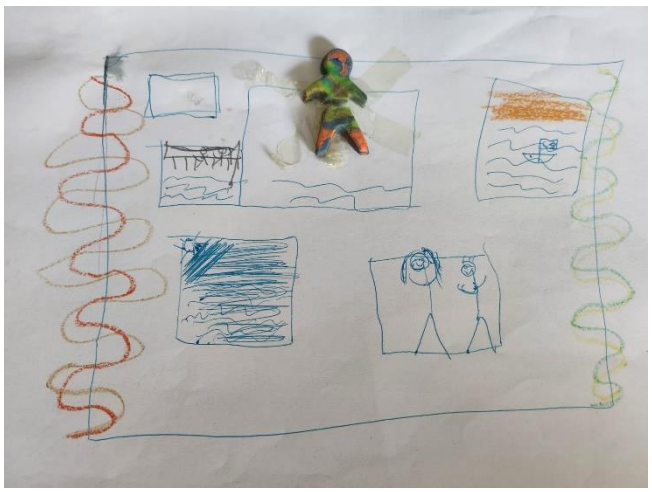

Figure 2. The safe place picture that C1 drew during the EMDR preparation phase, the "memory box"

C2, on the other hand, shared the following about the safe place during the fourth session: *"A place by the seaside. Only me; I'm the only one on the island. The sound of my footsteps Blue everywhere is deep blue. Birds*

*are flying around. Very beautiful and relaxing. I have a lively, joyful feeling in my hands. Clue name: Magical Island. Very happy and soothing. Full of liveliness and joy."*

Both C1 and C2 depicted sea-related imagery in their descriptions of the safe place, but with some differences. C1 referred to the clue name as a memory box, while C2 used the depiction of a magical island. C1 emphasized other important people in their safe place, whereas C2 emphasized being the only person in the safe place and the presence of birds. C1 utilized drawings to depict the safe place, while C2 did not make any specific drawings. C1 mentioned the voices of their friends in relation to the safe place, while C2 focused on the sound of his own footsteps. C1 did not provide any expression related to bodily sensations in the safe place, whereas C2 mentioned experiencing a pleasant sensation in his hands.

**Findings Related to the EMDR Assessment Phase**

The information obtained regarding the assessment phase (fifth session) with C1 and C2 is presented in Table 1 below.

Table 1. Information regarding C1 and C2's EMDR assessment phase

| | **The clearest image related to the memory.** | **NC (Negative Cognition)** | **PC (Positive Cognition)** | **Degree of belief in positive cognition (VOC) ( 1-7 rating scale)** | **Emotions related to the memory** | **Sud (Belief level regarding negative cognition and emotion)** | **Somatic Sensation** |
|---|---|---|---|---|---|---|---|
| C1 | The moment when the dog first opened its mouth and started running | I am scared | I can be brave | 1 | Feeling teary-eyed | 10 | A tingling sensation in my head |
| C2 | The moment when the bug stung | I am scared | I can be brave | 3 | Fear | 5 | Tingling sensation in my finger |

As seen in Table 1, both C1 and C2 emphasized images related to the attack of the animal they experienced in their most vivid image regarding the traumatic event. Both C1 and C2 included the negative cognition *"I am scared"* and the positive cognition *"I can be brave"* in relation to the memory. C1 had a higher belief level in negative cognition (SUD) compared to C2 (C1 gave the highest belief level score to negative cognition), while C1 had a lower belief level in positive cognition (VOC) compared to C2. C1's emotional response to the memory was feeling teary, while C2's emotional response was fear. Both C1 and C2 experienced tingling sensations in their bodies, with C1 emphasizing tingling in the head and C2 in the finger.

**Findings Related to the EMDR Desensitization Phase**

Immediately following the assessment phase in the fifth session, both C1 and C2 underwent the EMDR desensitization phase. During this phase, bilateral stimulations were applied, and the initial and final SUD values for both C1 and C2 were graphically presented in Figure 3. The relevant explanations for both C1 and C2 are provided below.

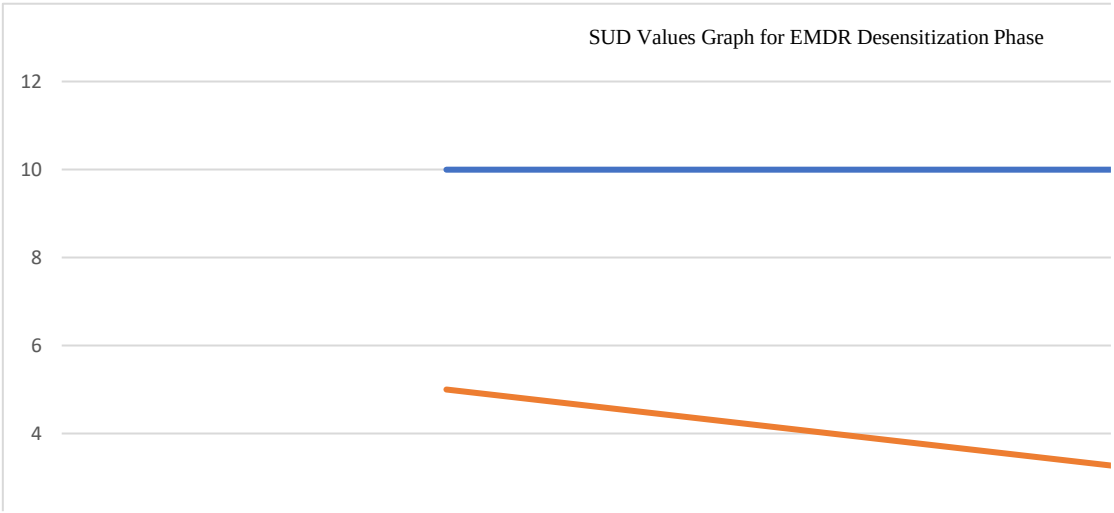


Figure 3. SUD values of C1 and C2 during EMDR desensitization phases

During the desensitization phase of EMDR conducted with bilateral stimulation sets related to the moment when the dog first opened its mouth and ran, C1's level of distress (SUD) was 10 at the beginning and remained at 10 at the end. However, during the 6th session, when discussed with C1, he mentioned that the moment of the dog opening its mouth and running no longer bothered him (SUD level was reported as 0). Therefore, a desensitization phase was completed with C1. In the desensitization phase of the 5th session, C1 provided the following statements within the sets:

*"The dog opened its mouth and barked loudly."*
*"It started running."*
*"Another dog came from behind..."*
*"In fact, that other dog was trying to save me; it barked at him.""*
*"Our neighbor came."*
*"I went home."*
*"SUD 10."*

After the EMDR assessment statements, during the 5th session, C2 underwent the first desensitization phase with bilateral stimulation sets related to the moment when the bug stung. The level of distress (SUD) associated with that moment was initially 5 and decreased to 3 at the end (Figure 4 shows the drawing made by C2 during the first desensitization phase).

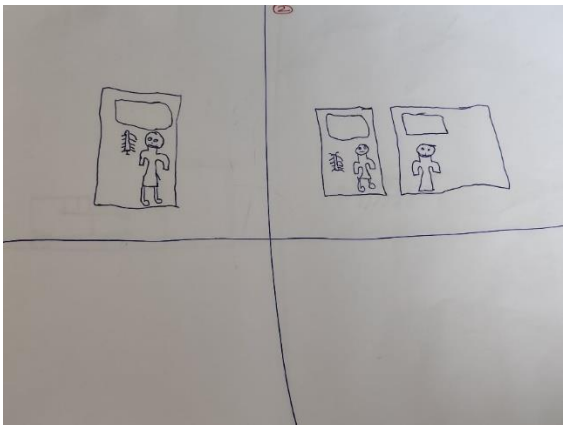

Figure 4. Drawing made by C2 during the first desensitization phase in the 5th session

C2 engaged in drawing activities during the first desensitization phase. The drawings made by C2 during the first desensitization phase are as follows:

*"I cried because I was anxious."*
*"My father said there was nothing to fear."*
*"I was scared because of what I saw."*
*"I was so frightened."*
*"My father killed it."*
*"I felt relieved when my father killed it."*
*"My father got rid of it."*
*"SUD 3."*

During the second desensitization phase conducted with bilateral stimulation sets related to the moment when the bug stung, C2's level of distress (SUD) was 2 at the beginning and reached 0 at the end (Figure 5 shows the drawing made by C2 during the second desensitization phase).

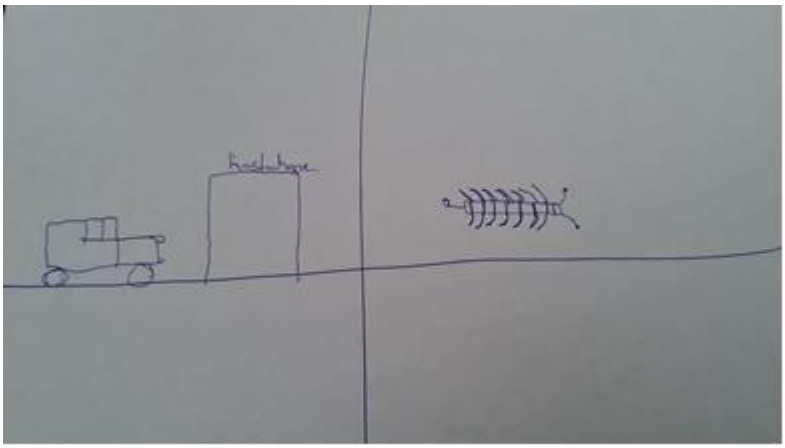

Figure 5. The picture drawn by C2 during the second desensitization phase in the 6th session

The statements provided by C2 within the sets during the second desensitization phase in the 6th session were as follows:

*"I feel a bit of fear. I can feel it in my finger."*
*"That bug shouldn't have scared me; it's just an ordinary bug."*
*"Going to the hospital helped."*
*"I was with my father. It also made me happy that my father killed the bug."*
*"I felt good at the hospital."*
*"My father comforts me."*
*"The sight of the bug scared me a lot."*
*"I screamed when the bug bit me."*
*"Now there's nothing."*
*"SUD 0."*

During the desensitization phase, C1 had one session of desensitization sets, while C2 had two separate sessions. In the sixth session, C1 expressed that the visual image no longer bothered him (SUD=0 Both C1 and C2 mentioned visual images of the supportive resources and people during the desensitization phase. For example, C1 described that, besides the chasing dog, another dog tried to protect him and emphasized the presence of their neighbor. C2, on the other hand, highlighted being with his father and feeling relieved when his father killed the bug during both desensitization sets. C1 did not express any specific emotions (such as fear) during the desensitization sets, while C2 displayed expressions of fear during both the first and second desensitization sets.

**Findings Related to the EMDR Installation Phase**

During the installation phase, in the sixth session, C1 expressed a positive cognition of *"I am courageous"* regarding the moment when the dog first opened its mouth and ran. C1 rated his belief in the cognition (VOC) on a scale of 1-7) as 6 and mentioned that with the installation sets, his belief increased to 7. C1's statements during the installation phase were as follows:

*"I could have been braver."*
*"Instead of running away, I could have chased."*
*"There's not much to it."*
*"Can you chase? Be brave."*

In the seventh session, during the installation phase, C2 expressed a positive cognition of *"I can overcome it"* regarding the moment when the bug bit him. C2 rated his belief in cognition (VOC) on a scale of 1-7) as 3 and mentioned that with the installation sets, his belief increased to 7. C2's statements during the installation phase were as follows:

*"I would tell them to handle it like an ordinary ant."*
*"I can remove the bug without causing harm."*
*"It's not frightening."*

During the installation phase, C1 expressed the positive cognition of "I am courageous," while C2 expressed the cognition of "I can overcome it." Both C1 and C2 mentioned that they could actively engage in effective actions during the most vivid image. For example, C1 stated that instead of running away, he could chase the dog, while C2 expressed the belief that he could remove the bug without causing harm.

**Findings Related to the EMDR Body Scan and Closure Phase**

During the body scan phase in the sixth session, C1 reported a discomfort level (SUD) of 1 related to a sensation of numbness in the head. Through the sets (bilateral stimulation sets), C1 stated that the discomfort related to body sensations had reduced to 0. In the seventh session, during the closure phase, C1 was asked about the impact of the previous session's work throughout the week (such as any remaining discomfort). C1 mentioned that there was no discomfort. The practitioner or researcher acknowledged C1's excellent progress during the closure phase.

In the seventh session, C2 reported no discomfort during the body scan phase. In the eighth session, during the closure phase, C2 was asked about the impact of the previous session's work throughout the week, such as any remaining discomfort. C2 mentioned that there is no discomfort experienced. The practitioner or researcher acknowledged C2's excellent progress during the closure phase. In contrast to C1, who had discomfort related to body sensations during the body scan phase, C2 expressed that there was no discomfort during the body scan phase.

**Findings Related to the EMDR Re-evaluation Phase**

During the re-evaluation phase, both C1 and C2 were asked if there were any daily triggers that currently bothered them. Both C1 and C2 reported that they did not have any distressing triggers. In the re-evaluation phase, positive cognition related to a hypothetical future template can be targeted using desensitization sets. Both C1 and C2 underwent desensitization sets for positive cognition related to the future template. During the seventh session, the results of the re-evaluation phase for C1 are as follows:

In the future, template exercises will be conducted with C1:
The envisioned image related to the future was reported as *"being attacked by a dog"* by C1. He expressed the positive cognition of *"I am brave"* regarding this image. C1 rated his belief in this positive cognition on a scale of 1-7, giving it a level of 6, and with the desensitization sets, his belief was reaffirmed at level 7. Some statements made by C1 during the "re-evaluation phase" of the "future template exercise" are as follows:

*"I have my guitar; I can use it to keep the dog away."*
*"I would ask for help."*
*"There's a guy waiting at the service station; he gets out of the car and helps."*
*"If there's a stray dog, it will come to attack."*
*"My father's car has a remote lock/unlock button."*
*"I also have a dog repellent that I can activate."*

C2 underwent the re-evaluation phase in the eighth session, and the results of the re-evaluation phase regarding the future template are presented below.

During the future template exercise with C2, the mental image of the future scenario was described as *"a spider appearing on the bed."* C2 expressed a positive cognition related to this scenario as *"I am brave."* He rated his belief in this positive cognition on a scale of 1-7 and gave it a score of 7, indicating a high level of belief. With the implementation of the installation sets, his belief level of 7 was reaffirmed. C2 provided the following statements during the re-evaluation phase of the future template exercise:

*"I will quietly tell my father."*
*"My father will remove the spider and take it outside."*
*"I will go back to bed peacefully."*

C1 and C2 both showed similarities in selecting the positive belief of being *"brave"* during the future template work. Both C1 and C2 expressed the view that they received support from another source in relation to the future template work. For instance, C1 mentioned the support he could receive from his father's car or the bus driver, while C2 mentioned the possibility of his father taking action. However, C1 differed from C2 in that C1 expressed the belief that he could take active actions in relation to the hypothetical scene in the future template. C1 mentioned using his own guitar to ward off the dog or activating his dog repellent, indicating a sense of agency and self-efficacy in dealing with the situation.

**Findings Regarding Pre-Test and Post-Test Results of CPTS-RI**

The findings regarding the pre-test and post-test results of C1 and C2 on CPTS-RI scores are shown in Figure 6 below.

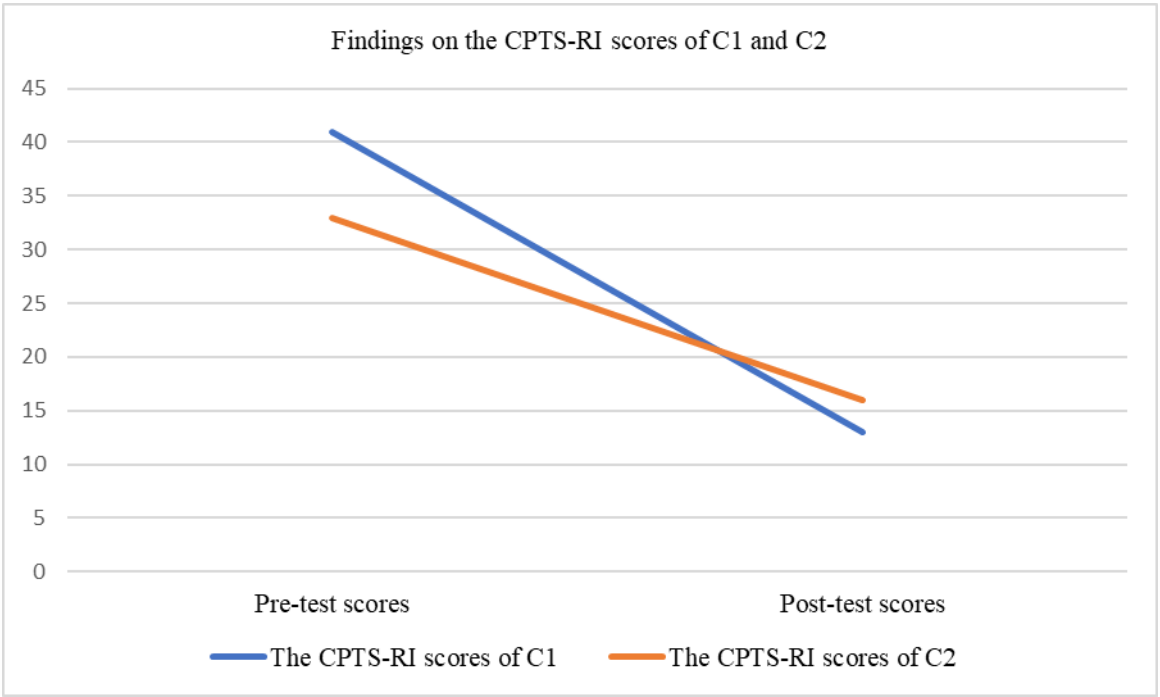


Figure 6. Findings on the CPTS-RI scores of C1 and C2

As seen in Figure 6, C1's CPTS-RI score decreased from 41 to 13. On the other hand, C2's pre-test CPTS-RI score was 33, while his post-test score was 16.

## Conclusion

In this study, it was found that EMDR interventions conducted with two children (C1 and C2) who had animal phobias had a positive effect on their phobic conditions. This conclusion can be drawn from both the children's narratives and the findings of the pre-test and post-test scores of the CPTS-RI. When the literature is examined, supporting studies for this result can be found. In a study investigating the short-term effect of EMDR intervention for hospital-related needle and blood phobia in children aged 4-15 receiving treatment in the hospital, it was found that collective EMDR intervention along with group therapy significantly differentiated or

reduced the children's hospital-related phobias (Meentken et al., 2020). There are also studies indicating that EMDR is an effective intervention for different phobic conditions in various age groups (Faretta & Dal Farra, 2019; Qorbanpoor Lafmejani, Samadi Biniaz, & Rezaei, 2020).

It was noticed from the narratives of both C1 and C2 that they had beliefs and hopes about overcoming their phobic conditions during the history-taking and preparation phases. C1, during the history-taking phase, mentioned that unlike the fear of a specific dog that created a phobic condition, he was not afraid of a spotted dog and felt good when he saw that dog from a distance with his friends. In this context, he expressed his belief in overcoming the fear of dogs. C2, on the other hand, made statements during the history-taking phase emphasizing the importance of being hopeful. During the EMDR preparation phase, in the “safe place” exercise, C1 described and drew a box that represented positive memories (good memories with his mother, aunt, and friends) and included seaside locations, while C2 depicted a magical island with birds and a sea. When looking at the literature, it is stated that children often include meaningful experiences with important individuals in their lives, such as their mothers, or depict memorable experiences in their safe place exercises during the EMDR protocol (Wizansky, 2007).

In this study, during the EMDR assessment phase, both C1 and C2 emphasized the moments when animals initially frightened them as their "most vivid image memory" and the negative cognition “I am scared” stood out. There are studies indicating the presence of negative cognitions such as I am scared regarding disturbing images during the assessment phase of EMDR interventions with children with various phobic conditions (Klaff, 2016; Schmidt, 1999). This study also highlighted the emotional experiences of fear and tearfulness among children during the assessment phase of their phobic conditions. In a study conducted with an individual suffering from childhood phobia and fear of losing loved ones, it was noted that the assessment phase of the EMDR intervention revealed prominent feelings of fear and the negative cognition that I am weak (Imširović, Omeragić, & Hasanović, 2021).

During the desensitization phase of the EMDR interventions with the children in this study, C2 utilized drawings while reprocessing the images that came to their mind. C2 occasionally expressed the images that came to their mind through drawings and sometimes verbally, which shows similarity to systematic desensitization interventions presented in cognitive-behavioral therapy. When looking at the literature, studies can be found that utilize systematic desensitization interventions (interventions involving thinking about disturbing memories) for children's phobias and the use of children's drawings. In a study involving a 6-year-old child with swallowing and choking phobia (chewing food but not swallowing) who developed PTSD due to medical examinations and treatment related to their stomach in the hospital and attempted to avoid hospitals and doctors, it was mentioned that systematic desensitization interventions (interventions involving thinking about negative images in the hospital) and adapted diagrams and drawings were used for the child's phobic condition, and the child overcame their phobic condition as a result of the interventions (Rachidi et al., 2022).

In this study, C2 utilized drawings to express his experiences during the desensitization phases (Desensitization 1 and Desensitization 2), while C1 did not make use of drawings during the desensitization phase. C2's initial drawing depicted the disturbing insect and their worst memory of being stung by the insect. In a study by Kokanović and Barron (2021), they conducted EMDR interventions with a 4-year-old child who developed a solid food phobia due to a fishbone getting stuck in his or her throat. During the EMDR assessment phase, the child reported the moment when the food got stuck as the most distressing image and shared the imagery of scribbling the food in his or her throat. The researchers noted that during the installation phase, the child exhibited positive cognitions of “I am brave” and “I am strong.” They mentioned that the child created a clay container during the installation phase where they could discard their fears and used a key to lock away all their fears, indicating that she or he was now strong and safe and capable of coping with fear (Kokanović & Barron, 2021, pp. 36-38). This finding is similar to the EMDR installation phases related to animal fears in this study, in which both children (C1 and C2) exhibited positive cognitions such as “I am brave” (C1) and “I can overcome” (C2) cognitions, as well as coping statements like “I have a dog repellent, I can activate it" (C1) and "I can remove the insect without harming it” (C2).

In the re-assessment phase of this study, both C1 and C2 emphasized their positive cognition of “I am brave” regarding a hypothetical future situation, such as encountering the animal that previously bothered them, and both had a high level of belief in this cognition. C1 reported current and future coping resources, such as “the guy is waiting in the school bus, getting off the bus, and helping,” “if there's a spotted dog, it will come to attack,” and “my father's car has a button to open and close the car.” C2 also expressed the resources in their surroundings for present and future coping situations, such as “I will quietly tell my dad,” “my dad will remove the insect and throw it outside,” and “I will turn my bed to a better position.” While C2's environmental coping

resources partially resemble those of C1, C1 also emphasized the resources where he himself would take active action (e.g., chasing the dog with his guitar). Similar to this study, Klaff (2016) stated that a child with chronic heart-related health problems emphasized effective coping resources in the re-assessment phase of EMDR intervention, such as I will do and continue to do the healthiest things for my life in the future.

## Recommendations

The findings of this study provide some recommendations for practical application when conducting EMDR interventions with children. The researcher suggests that children can be offered the option to draw pictures during EMDR phases, but it should not be insisted upon. In fact, in this study, one child expressed the desire to draw during the safe place and history-taking phase but did not want to draw during the desensitization phase or other stages. During the desensitization phase, children can be supported by incorporating safe-place exercises when they become tired. In this study, during the EMDR installation and re-evaluation phases, it was observed that children exhibited creative, active, and social coping resources. In this regard, EMDR interventions with children can be further supported by incorporating creative supplementary activities that relate to the coping resources identified during the strengthening-oriented installation and re-evaluation phases. Encouraging children to create hypothetical stories about their coping strategies and how they can apply them to their daily lives may be highlighted as a valuable approach.

For future research, EMDR interventions for children with phobic conditions can be conducted in a group setting, and the research findings can be presented in an experimental design for scientific purposes. The current study revealed findings related to negative cognition as “I am afraid” and positive cognitions as “I am brave” and “I can overcome it” regarding children's phobic conditions, along with the expressions provided by the children during the interventions. In future studies, presenting the outcomes of EMDR interventions for children's phobic conditions in a qualitative design would allow for a more in-depth analysis of the prominent cognitions and expressions of the children. Additionally, the relationship between these cognitions and phobic conditions can be re-evaluated in the context of existing literature. During the EMDR installation and reprocessing phases, children's coping statements regarding their phobic conditions highlighted both problem-focused coping strategies and environmental coping resources. In future research, comparative qualitative and quantitative studies can be conducted on EMDR interventions for children with phobic or distressing conditions, focusing on coping strategies during these phases. These studies can be linked to existing literature in the field.

## Conflicts of Interest

The author declares that she has no personal or financial conflict of interest associated with this publication to disclose.

## Ethical Approval

Ethical permission (2018/05) was obtained from Van Yüzüncü Yıl University Social and Humanities Ethics Board Presidency for this research.

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# The Relationship between Teachers' Mobbing Experiences, Organizational Silence, and Organizational Cynicism

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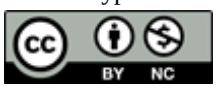

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# The Relationship between Teachers' Mobbing Experiences, Organizational Silence, and Organizational Cynicism*

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## Abstract

This research aimed to determine the relationship between teachers' mobbing experiences, organizational cynicism, and organizational silence. The research population consisted of 33,286 teachers working in public primary education institutions in the central districts of Ankara. The sample was determined using a multistage sampling method. A total of 403 teachers in 40 schools were selected using a stratified sampling method in the first stage and a simple random sampling method in the second stage. The Negative Acts Questionnaire (NAQ), Organizational Silence Scale (OSS), and Organizational Cynicism Scale (OCS) were used as data collection tools in the research. The results revealed that teachers were more exposed to negative treatment such as withholding information that affects performance, mocking, and teasing. Teachers exhibited silence behaviors mostly in the "administrative" dimension and, at least, in the "organizational culture" dimension. Teachers displayed fewer organizational silence behaviors. Teachers experienced mostly "behavioral" cynicism and the least "affective" cynicism. Teachers also displayed a low level of organizational cynicism. It was concluded that as teachers' mobbing levels rose, their level of organizational silence and cynicism increased.

**Keywords:** Mobbing, Organizational silence, Organizational cynicism

## Introduction

According to research conducted in educational institutions with intense social relations, organizational cynicism, silence, and mobbing are frequently experienced (Cemaloğlu, 2011). Most employee problems originate from the organization itself. Mobbing is considered a natural result of organizational competition and has become a prevalent research topic in recent years. The term mobbing has drawn attention because most victims have begun to resign due to mobbing (Tınaz, 2006). Due to intensifying globalization and international competition, employees struggle to cope with both mobbing from top to bottom and horizontal mobbing, characterized by mutual competition and psychological pressure among employees to secure their jobs (İlhan, 2010).

Organizational silence stems from mobs, unfavorable working conditions, human relations, and wrong managerial decisions and practices. Organizational silence, mobbing, stress, conflict, and various concerns cause teachers to become introverted and display silence behaviors (Çakıcı, 2008). According to the studies, mobbing is prevalent in educational institutions; teachers do not struggle with negative behaviors, stress, fear, or anxiety but prefer to remain silent and withdraw from social interaction (Bayram, 2010; Kahveci, 2010; Yanık, 2012).

Unfavorable working conditions, unfair opportunities and treatments, managerial inadequacies of administrators (Bayram, 2010; Çakıcı, 2008), interpersonal problems, poor performance, and administrative problems (Bayram, 2010; Bildik, 2009; Yanık, 2012) are among the causes of organizational silence in educational institutions. Additionally, administrators' prejudices about teachers' being selfish and arrogant (Morrison & Milliken, 2000), communication barriers, oppressive management style, centralization, performance priority over human relations, individualism, ineffective conflict management, continuous supervision (Pinder & Harlos, 2001), demographic characteristics such as age, education status, gender, professional experience (Özgen & Sürgevil 2009), and organizational and managerial differences play a role in education employees' displaying organizational silence (Çakıcı, 2008).

As a result of organizational silence in educational institutions, teachers' organizational commitment declines (Oruç, 2013; Sağlam & Yüksel, 2015). Organizational silence affects education employees negatively and leads

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to low productivity and performance. The organizational commitment and sense of responsibility of teachers who experience organizational silence decline over time, their demand for early retirement increases, they come to work late, they have less self-confidence and job dissatisfaction and more professional incompetence, organizational cynicism, and fear of making mistakes (Cemaloğlu, 2011). There is a positive linear relationship between organizational silence and organizational cynicism, which emerges as a result of organizational silence, suggesting an interrelated change in both concepts (Nartgün & Kartal, 2013).

Organizational cynicism, which has a positive relationship with organizational silence, is a field of study with philosophical roots and a long history and has been a research topic in several fields, including religion, sociology, management, and psychology (Kalağan & Güzeller, 2010). It is among the topics that have been addressed due to its harmful effects on organizational dimensions in recent years (James, 2005; Kutanış & Dikili, 2010). Organizational cynicism is generally defined as employees' negative attitudes toward an organization characterized by cognitive, affective, and behavioral dimensions (Dean et al., 1998). It refers to negative feelings and thoughts toward an organization due to perceived unfair treatment (Pelit & Ayduğan, 2011; Tokgöz and Yılmaz, 2008). Many factors can cause organizational cynicism, one of which is individual. Although certain variables such as gender, age, marital status, education status, and income were not found to be very influential on employees' organizational cynicism (Andersson & Bateman, 1997; Bommer et al., 2005; James, 2005), it was observed that male employees experienced more organizational cynicism than female employees (Kanter & Mirvis, 1989). Similarly, young employees experienced more cynicism than older adults (Delken, 2004; Pelit & Ayduğan, 2011), the single experienced more than the married (Çakır, 2007), and those with high income experienced more than those with low income (Kanter & Mirvis, 1989). The reasons for organizational cynicism can be listed as follows: psychological contract violations, conflict of purpose, insufficient social support, mobbing, long working hours, the sense of failure to meet personal expectations, organizational downsizing and restructuring, and cancellation of employment contracts (Eaton, 2000; Cartwright & Holmes, 2006; Pelit & Ayduğan, 2011).

The literature findings indicate that organizational cynicism leads to decreases in personal and organizational commitment, productivity, efficiency, job satisfaction, and education quality and triggers burnout, alienation, negative attitudes and behaviors, disappointment, and competitive and mocking behaviors among teachers (Abraham, 2000; Brandes et al., 1999; Eaton, 2000; Johnson & O'Leary-Keely, 2003; Kalağan, 2009; Wanous et al., 1994; Wanous et al., 2000).

Organizational cynicism is a result of mobbing (Cartwright & Holmes, 2006; Özler et al., 2010). Teachers who are mobbing victims believe there is no way out for them, and there is no honesty, justice, sincerity, or fairness in the organization where they are exposed to mobbing. Such a belief or perception gives rise to organizational cynicism in mobbing victims (Guastello et al., 1992; Davis & Gardner, 2004).

Mobbing is one of the potent factors that reduce teachers' organizational commitment and motivation, and teachers exposed to mobbing have negative attitudes toward school and experience psychological problems (Bowling & Beehr, 2006; Koç & Bulut, 2009; Toker Gökçe, 2012). The number of studies on organizational silence and cynicism (Schumann, Craig, & Rosu, 2014) or the relationship between teachers' mobbing, organizational silence, and organizational cynicism levels is minimal (Yıldız, 2013). Therefore, we aimed to determine the relationship between teachers' mobbing, organizational silence, and organizational cynicism and sought answers to the following questions:

1. What level of mobbing do teachers experience?
2. What level of organizational silence do teachers experience?
3. What level of organizational cynicism do teachers experience?
4. How do teachers' mobbing experiences affect their organizational silence and cynicism?

## Method

### *Sampling*

The research universe consisted of teachers working in public primary schools in Ankara. According to the data provided by the Ministry of National Education (MoNE), there were a total of 33286 teachers in the 25 districts covered. To recruit participants, single-stage or multistage sampling methods can be used in sample calculation (Cohen & Manion, 1989). In this study, the multistage sampling method was preferred. stratified and simple random sampling methods were employed in selecting the sample. A total of 403 teachers in 40 schools were selected using a stratified sampling method in the first stage and a simple random sampling method in the second stage.

### *Measures*

*Negative Acts Questionnaire (NAQ):* Developed by Einarsen and Raknes (1997) to measure teachers' mobbing levels, NAQ was adapted into Turkish by Cemaloğlu (2007a). The scale had one factor and 22 items. Unlike the other scale items, the 22$^{nd}$ item was a two-point Likert type with "Yes" and "No" options ("Have you been exposed to physical abuse?"). Therefore, the 22$^{nd}$ item was not included in the factor analysis. The 21-item scale was in a five-point Likert-type format with (1) Never, (2) Sometimes, (3) Once a month, (4) Once a Week, and

(5) Everyday options. The Cronbach Alpha reliability coefficient was 0.94, and factor loads were between 0.59 and 0.87 in the Turkish version (Cemaloğlu, 2007a). It was a reliable instrument, as the reliability coefficient was recommended to be 0.70 and above for psychological tests (Büyüköztürk, 2012). According to Büyüköztürk (2012), items with a value of 0.30 and above have good distinctiveness power. In this study, the item-test correlation was between 0.52 and 0.73. Confirmatory factor analysis (CFA) was performed to test the scale's construct validity, and no missing values were found in the data set. In data sets with no missing data and good regression coefficients, a sample group of 150 people is sufficient to perform CFA (Muthen & Muthen, 2002). Accordingly, our sample group of 403 people was sufficient for CFA. The Mardia normality test results revealed that the data set did not have a normal distribution ($p<0.05$), so covariance matrices were preferred (Şimşek, 2007). The Robust Maximum Probability Method (Kline, 2011) and CFA were applied to estimate the asymptotic covariance matrix for the construct validity of the data set.

Parameter estimates are significant at 0.01 when the t values are above 2.56 (Çokluk et al., 2012). However, t values less than 1.96 are statistically insignificant considering a margin of error of 0.05 (Jöreskog & Sörbom, 1993). Based on the CFA results, the t values of the latent variables explaining the observed variable were significant ($t> 2.56$, $p< 0.01$). Besides, in terms of standardized loads, there was a statistically significant relationship between each observed variable (item) and latent variable (dimension) ($r>0.52$; $p<0.01$). The biggest distinctiveness was measured in I17: 'Allegations and accusations against you' (58%) and at least in I1: 'Someone withholding information that affects your performance' (27%). The critical N value, suggesting the adequacy of the research sample, was 156.32. Accordingly, the number of participants in this study was sufficient. Table 1 shows the fit indices obtained from CFA.

Table 1. *Confirmatory Factor Analysis Fit Indices of the Negative Acts Questionnaire*

| *Model* | $\chi^2$ | $(\chi^2/sd)$ * | *RMSEA* | *SRMR* | *NNFI* | *CFI* | *GFI* | *AGFI* |
|---|---|---|---|---|---|---|---|---|
| NAQ | 613,77 | 3,25 | 0,08 | 0,07 | 0,97 | 0,98 | 0,77 | 0,72 |

*sd = 189, p < 0,01

As seen in Table 1, the single factor structure of the 21-item NAQ was validated, and it showed fit indices in the range of medium and good.

*Organizational Silence Scale (OSS).* OSS was developed by Daşcı and Cemaloğlu (2016) to measure organizational silence. It had 36 items and five dimensions: “individual” (8 items), “administrative” (6 items), “organizational culture” (8 items), “colleagues” (8 items), and “pressure groups” (6 items). Since the Ankara Provincial Directorate of National Education did not allow us to collect data from “pressure groups," this factor was removed from the scale, and the data were collected and analyzed accordingly. It was a 5-point Likert-type scale with (1) I totally disagree, (2) I disagree, (3) I partially agree, (4) I agree, and (5) I totally agree options. The Cronbach Alpha values of the original scale were 0.95, and it was measured at 0.98 for “individual” and "administrative," 0.97 for “organizational culture," 0.99 for "colleagues,” and 0.98 for “pressure groups” dimensions. In this research, Cronbach's alpha coefficient was calculated at 0.93 for the total scale, and it was 0.81 for the "individual," 0.73 for the "administrative," 0.93 for the “organizational culture," and 0.82 for the "colleagues” dimensions. Item-test correlations ranged from 0.21 to 0.73. The preliminary CFA was applied to confirm the validity, and the results revealed no missing data in the data set. In data sets with no missing data, a sample group of 150 people is sufficient to perform CFA (Muthen & Muthen, 2002). Since there were 403 people in our sample, it was sufficient to perform CFA. The Mardia Normality Test results showed that the data set did not have a normal distribution ($p<0.05$). If the normality assumption is not met, it is recommended to use covariance matrices (Şimşek, 2007). Therefore, the Robust Maximum Probability Method (Kline, 2011) was applied, and CFA was performed to estimate the asymptotic covariance matrix for the construct validity of the data set. Based on the preliminary CFA results, the t values of the latent variables explaining the observed variable were statistically significant ($t>2.56$; $p<0.01$). In terms of standardized loads, there was a significant relationship between each observed variable (item) and latent variable (dimension) ($r>0.22$; $p<0.01$). The critical N value, suggesting the adequacy of the research sample, was 156.32. Accordingly, the number of participants in this study was sufficient. Table 2 shows the fit indices obtained from CFA.

Table 2. *Confirmatory Factor Analysis Fit Indices of the Organizational Silence Scale*

| *Model* | $\chi^2$ | $(\chi^2/sd)$* | *RMSEA* | *SRMR* | *NNFI* | *CFI* | *GFI* | *AGFI* |
|---|---|---|---|---|---|---|---|---|
| OSS: Preliminary CFA | 1800.18 | 4.51 | 0.09 | 0.08 | 0.93 | 0.93 | 0.72 | 0.67 |

*sd = 399, p < 0,01

According to the data in Table 2, the 4-dimension structure of the OSS, including 30 items, showed fit indices in the range of medium to poor, and it was a valid tool. Then, secondary factor analysis was applied. Since the data set did not meet the normality assumptions, the Robust Maximum Probability method was preferred (Kline, 2011; Şimşek, 2007) to estimate the asymptotic covariance matrix. Based on the secondary CFA results, the t values of the latent variables explaining the observed variable were statistically significant ($t>2.56$; $p<0.01$). The first item in each dimension was the observed variable set at 1. In terms of standardized loads, there was a

significant relationship between each observed variable (item) and latent variable (dimension) (r>0.21; p<0.01). Accordingly, the most significant distinctiveness was measured in item OSS25: "If I share any problem at school with my colleagues, I could be ostracized" (71%) and the least in item OSS6: "I can easily communicate with others about school problems" (5%). The critical N value, suggesting the adequacy of the research sample, was 105.69. Accordingly, the number of participants in this study was sufficient. Table 3 shows the fit indices obtained from the secondary CFA.

Table 3. *Secondary Confirmatory Factor Analysis Indices of Organizational Silence Scale*

| *Model* | $\chi^2$ | $(\chi^2/sd)$* | *RMSEA* | *SRMR* | *NNFI* | *CFI* | *GFI* | *AGFI* |
|---|---|---|---|---|---|---|---|---|
| OSS: Secondary CFA | 1804.01 | 4.49 | 0.09 | 0.08 | 0.93 | 0.93 | 0.72 | 0.68 |

*sd = 401, p < 0,01

As seen in Table 3, the 4-factor structure of the OSS had fit indices in the range of medium to poor, suggesting the scale's validity.

*Organizational Cynicism Scale (OCS).* Developed by Brandes, Dharwadkar, and Dean (1999), OCS was adapted into Turkish by Kalağan (2009). It had three dimensions and 13 items: “cognitive” (5 items), “affective” (4 items), and “behavioral” (4 items). It was a 5-point Likert scale with (1) I totally disagree, (2) I disagree, (3) I partially agree, (4) I agree, and (5) I totally agree options. The Cronbach Alpha reliability coefficient was 0.93 for the original scale, 0.91 for the “cognitive," 0.95 for the "affective," and 0.87 for the “behavioral” dimension. In this study, it was measured at 0.94 for the total scale, 0.93 for the “cognitive," 0.97 for the “affective," and 0.91 for the “behavioral” dimension. The item-test correlations ranged from 0.50 to 0.80. The preliminary CFA was applied to confirm the scale's validity, and the results revealed no missing data in the data set. In data sets with no missing data, a sample group of 150 people is sufficient to perform CFA (Muthen & Muthen, 2002). Since there were 403 people in our sample, it was sufficient to perform CFA. The Mardia Normality Test results showed that the data set did not have a normal distribution (p<0.05). If the normality assumption is not met, it is recommended to use covariance matrices (Şimşek, 2007). Therefore, the Robust Maximum Probability Method (Kline, 2011) was applied, and CFA was performed to estimate the asymptotic covariance matrix for the construct validity of the data set. Based on the preliminary CFA results, the t values of the latent variables were statistically significant (t>2.56; p<0.01), and there was a significant relationship between each observed variable (item) and latent variable (dimension) (r>0.70, p<0.01). The critical N value, suggesting the adequacy of the research sample, was 105.96. Accordingly, the number of participants was sufficient. Table 4 shows the fit indices obtained from the preliminary CFA.

Table 4. *Preliminary CFA Indices of the Organizational Cynicism Scale*

| *Model* | $\chi^2$ | $(\chi^2/sd)$* | *RMSEA* | *SRMR* | *NNFI* | *CFI* | *GFI* | *AGFI* |
|---|---|---|---|---|---|---|---|---|
| OCS: Preliminary CFA | 243.42 | 3.93 | 0.09 | 0.06 | 0.98 | 0.98 | 0.88 | 0.82 |

*sd = 62. p < 0.01

According to the data in Table 4, the 3-dimensional structure of the 13-item OCS had good fit indices, proving the scale's validity. Therefore, secondary factor analysis was applied, and an asymptotic covariance matrix was used. Based on the secondary CFA results, the t values of the latent variables explaining the observed variable were statistically significant (t>2.56; p<0.01). The first item in each dimension was the observed variable set at 1. In terms of standardized loads, there was a significant relationship between each observed variable (item) and latent variable (dimension) (r>0.70, p<0.01). The most exceptional items related to organizational cynicism were I6: 'I get angry when I think about my workplace,' I7: 'I get furious when I think about my workplace' and I8: 'I get nervous when I think about my workplace (92%); the least distinctive item was I11: 'When the conversation comes to my workplace, my colleagues and I wink at each other implicitly' (49%). The critical N value was calculated at 150.96, suggesting a sufficient number of participants in the sample. Table 5 shows the fit indices obtained from the secondary CFA.

Table 5. *Secondary CFA Indices of the Organizational Cynicism Scale*

| *Model* | $\chi^2$ | $(\chi^2/sd)$* | *RMSEA* | *SRMR* | *NNFI* | *CFI* | *GFI* | *AGFI* |
|---|---|---|---|---|---|---|---|---|
| OCS: Secondary CFA | 243.42 | 3.93 | 0.09 | 0.06 | 0.98 | 0.98 | 0.88 | 0.82 |

*sd = 62. p < 0.01

According to Table 5, the 3-dimensional structure of the 13-item OCS had good fit indices, suggesting the scale's validity.

**Data Analysis**

The researcher administered data collection tools, and the data were analyzed using the SPSS and LISREL 8.80 programs. Descriptive statistics were preferred for the first, second, and third sub-problems, and fit indices in the structural equation model were examined for the fourth sub-problem. Structural equation models (SEM) are a statistical approach to testing the models with causal relations between observed and latent variables

(Kline, 2011). Latent variables are assumed to exist in theory and can be measured through observed variables, which are the items used in the measurement tool (Şimşek, 2007).

One-way arrows in SEM indicate a one-way linear relationship; each arrow points out a hypothesis. Each is considered a path (X→Y) (Kline, 2011), and whether each path coefficient is significant, in other words, whether each latent variable statistically predicts an observed variable, is checked (Şimşek, 2007). The LISREL program allows calculating the path coefficients and fitting statistics to test a model. The goodness of fit statistics show the consistency between a theoretical model and data. They point out the coherence between the two matrices (observed and latent variables) (Çokluk et al., 2012).

The fit indices include $\chi 2$ (Chi-Square), RMSEA, SRMR, NNFI, CFI, GFI, and AGFI. The $\chi 2$ value is the criterion of the goodness of fit (Çelik & Yılmaz, 2013) and denotes whether the original matrix is different from the default matrix. It shows the significance level of regression coefficients and gives information about a model. It also predicts the accuracy of an entire model (Kline, 2011). Since the value of $\chi 2$ is sensitive to sample size, it is recommended to use other indicators. A relatively high *χ2/sd* value indicates a poor fit (Tabachnick & Fidell, 2007). In large samples, *χ2/sd* is acknowledged as a criterion for significance (Çokluk et al., 2012). It is suggested to consider other fit indices in addition to the $\chi 2$ value, which is challenging to measure. Before statistical analyses, we checked whether there were missing values and found no missing values in the data sets. If there is a non-parametric distribution, the outlier automatically disappears. Therefore, the univariate and multivariate normality of the data were evaluated in order to test the normality assumption:

Table 6. *Univariate Normality Test Results Regarding Continuous Variables*

| | Skewness | | Kurtosis | | Skewness and Kurtosis | |
|---|---|---|---|---|---|---|
| Variable | *Z* | *p* | *Z* | *p* | *Chi-Square* | *p* |
| NAQ | 99.099 | 0.00 | 31.485 | 0.00 | 10811.861 | 0.00 |
| OSS | 77.952 | 0.00 | 23.787 | 0.00 | 6642.286 | 0.00 |
| OCS | 41.809 | 0.00 | 20.515 | 0.00 | 2168.888 | 0.00 |

As seen in Table 6, the univariate normality assumption was not met ($p<0.05$), so a multivariate normality test was performed.

Table 7. *Mardia's Multivariate Normality Test Results Regarding Continuous Variables*

| Skewness | | | Kurtosis | | | Skewness and Kurtosis | |
|---|---|---|---|---|---|---|---|
| *Value* | *Z* | *p* | *Value* | *Z* | *p* | *Chi-Square* | *p* |
| 1893.79 | 178.64 | 0.00 | 5286.30 | 32.04 | 0.00 | 32937.06 | 0.00 |

Table 7 showed that the multivariate normality assumption was not met ($p<0.05$). Therefore, the Weighted Least Squares estimation method, recommended for nonparametrically distributed data, was used (Kline, 2011). Accordingly, 403 questionnaires were evaluated regarding the missing value, outlier, and normality, and the necessary conditions for data analysis were met.

## Findings

Table 8. *Teachers' Mobbing Levels*

| Factor / Item | $\bar{\chi}$ | *S* |
|---|---|---|
| I1 | 1.74 | 0.92 |
| I2 | 1.36 | 0.71 |
| I3 | 1.62 | 0.89 |
| I4 | 1.54 | 0.76 |
| I5 | 1.63 | 0.83 |
| I6 | 1.55 | 0.75 |
| I7 | 1.23 | 0.51 |
| I8 | 1.49 | 0.66 |
| I9 | 1.24 | 0.58 |
| I10 | 1.25 | 0.60 |
| I11 | 1.36 | 0.62 |
| I12 | 1.45 | 0.61 |
| I13 | 1.52 | 0.71 |
| I14 | 1.64 | 0.73 |
| I15 | 1.36 | 0.67 |
| I16 | 1.51 | 0.76 |
| I17 | 1.33 | 0.65 |
| I18 | 1.50 | 0.78 |

| | | |
|---|---|---|
| I19 | 1.41 | 0.75 |
| I20 | 1.21 | 0.55 |
| I21 | 1.45 | 0.70 |
| Total | 1.45 | 0.48 |

I22. Have you been exposed to physical abuse? Yes: 61 (15.1%) No: 342 (84.9%)

As seen in Table 8, the teachers were most exposed to'someone withholding information that affects your performance' ( $\bar{X}$=1.74) and least exposed to 'being exposed to excessive teasing and sarcasm' ($\bar{X}$=1.21). According to the standard deviation values, the most homogeneous distribution was found in'making insulting and humiliating remarks about your personality (e.g., habits and manners), attitude, or privacy' (S=0.51), and the most heterogeneous distribution was measured in'someone withholding information that affects your performance' (S=0.92). In other words, teachers were more exposed to negative treatment that would affect their performance, such as hiding information, than to teasing and sarcasm.

Table 9. *Teachers' Organizational Silence Levels*

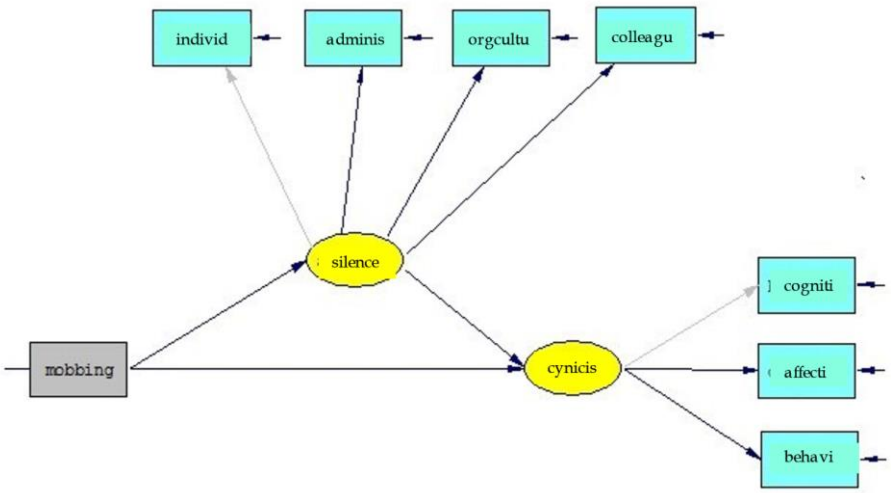
| Factor / Item | $\bar{X}$ | *S* |
|---|---|---|
| Individual | 2.16 | 0.64 |
| Administrative | 2.34 | 0.69 |
| Organizational Culture | 1.95 | 0.76 |
| Colleagues | 2.20 | 0.68 |
| General | 2.17 | 0.60 |

As seen in Table 9, the “administrative” organizational silence behaviors of the teachers ($\bar{X}$=2.34) were more prevalent than those categorized under the "colleagues" ($\bar{X}$=2.20), “individual” ($\bar{X}$=2.16), and “organizational culture” dimensions ($\bar{X}$=1.95). Besides, the most homogeneous distribution was found in the “individual” dimension (S=0.64), and the most heterogeneous distribution was in the “organizational culture” dimension (S=0.76). Accordingly, teachers exhibited mainly "administrative" organizational silence behavior and at least “organizational culture. "It can be inferred that teachers' organizational silence behaviors were 'low.'

Table 10. *Teachers' Organizational Cynicism Levels*

| Factor / Item | $\bar{X}$ | *S* | Factor / Item | $\bar{X}$ | *S* | Factor / Item | $\bar{X}$ | *S* |
|---|---|---|---|---|---|---|---|---|
| Cognitive | 2.16 | 0.89 | Affective | 1.72 | 0.91 | Behavioral | 2.27 | 0.92 |
| I1 | 2.18 | 1.11 | I6 | 1.73 | 0.96 | I10 | 2.02 | 1.00 |
| I2 | 2.11 | 1.03 | I7 | 1.70 | 0.91 | I11 | 2.05 | 1.03 |

According to the data in Table 10, teachers' “behavioral” cynicism behaviors ($\bar{X}$=2.27) were more common than “cognitive” ($\bar{X}$=2.16) and “affective” cynicism behaviors ($\bar{X}$=1.72). The most heterogeneous distribution was observed in the behavioral cynicism dimension (S=0.92). It can be suggested that teachers exhibited behavioral cynicism most frequently and affective cynicism the least. It was also determined that teachers' organizational cynicism behaviors were 'low.' Path analysis was conducted to determine the effects of teachers' mobbing experiences on organizational silence and cynicism behaviors. Path analysis reveals predictor variables' direct and indirect effects on predicted variables. The conceptual model is shown in Figure 1:



As understood from the conceptual model in Figure 1, teachers' perceptions of mobbing affected their organizational silence, and organizational cynicism levels and organizational silence predicted the cynicism level. Teachers' mobbing experiences also, directly and indirectly, affected their organizational cynicism. In the model, one latent variable (mobbing) was exogenous, and two latent variables (organizational silence and cynicism) were endogenous. The independent latent variable "mobbing" was explained by itself (one dimension). The "individual," "administrative," "organizational culture," and "colleagues" indicators explained the latent dependent variable "organizational silence," while "cognitive," "affective," and "behavioral" indicators explained the dependent latent variable "organizational cynicism." As a result of the analysis, it was concluded that the data set did not meet the multivariate normality assumption ($p<0.05$). Detailed information is given in Table 11 below. The Weighted Least Squares estimation method was used for non-normally distributed data (Kline, 2011). The structural model is presented in Figure 7, and the representation of SEM is shown in Figure 8. First, the findings regarding the suitability of SEM were evaluated. Kline (2011) recommends using the $\chi^2$/sd ratio as a criterion for model fit. The $\chi^2$/sd value was measured at 4.37, indicating good fit indices (Sümer, 2000). Then, alternative fit indices in the model were examined.

Table 11. *Fit Indices of the Model*

| $\chi^2$ | ($\chi^2$/sd)* | *RMSEA* | *SRMR* | *NNFI* | *CFI* | *GFI* | *AGFI* |
|---|---|---|---|---|---|---|---|
| 78..71 | 4.37 | 0.09 | 0.24 | 0.73 | 0.83 | 0.95 | 0.90 |

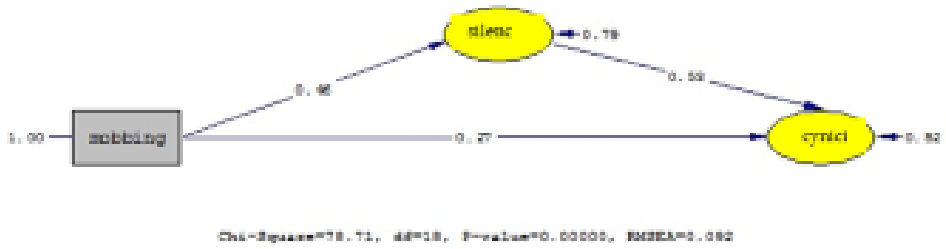
*sd = 18. $p < 0.01$

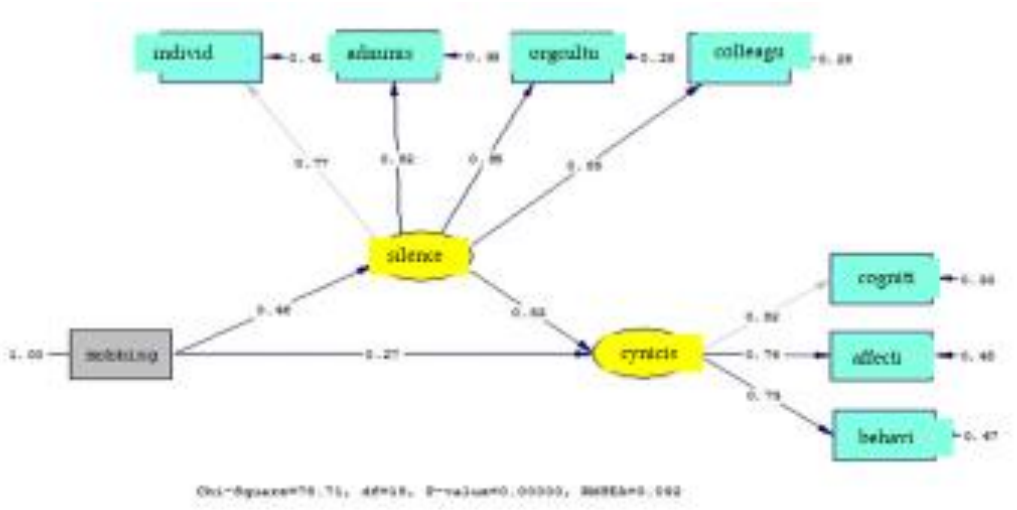
According to Table 11, the model generally had good fit indices, suggesting an acceptable and valid model. The critical N value, proving the adequacy of the research sample, was 178.77. Accordingly, the number of participants in this study was sufficient. Table 12 shows the SEM results.

Table 12. *SEM Results of the Model*

| Latent / Observed Variables | t-value * | Standardized Loads | $R^2$ |
|---|---|---|---|
| *Mobbing* | | | |
| *Organizational Silence* | | | |
| Individual | | 0.77 | 0.59 |
| Administrative | 16.98 | 0.82 | 0.67 |
| Organizational Culture | 18.30 | 0.85 | 0.72 |
| Colleagues | 16.53 | 0.85 | 0.72 |
| *Organizational Cynicism* | | | |
| Individual | | 0.82 | 0.67 |
| Affective | 11.81 | 0.74 | 0.55 |
| Behavioral | 10.76 | 0.73 | 0.53 |
| **Structural Relations** | **t-value*** | **Standardized Loads** | |
| mobbing → organizational silence | 8.69* | 0.46 | |
| mobbing → organizational cynicism | 3.62* | 0.27 | |
| organizational silence → organizational cynicism | 7.79* | 0.53 | |
| **Structural Equations** | | **$R^2$** | |
| organizational silence = 1.14 *x* mobbing | | 0.21 | |
| organizational cynicism = 1.28 *x* mobbing | | 0.26 | |
| organizational cynicism = 0.54 *x* organizational silence + 0.67 *x* mobbing | | 0.48 | |

*p< 0.01






In an analysis of the LISREL program, beta (β) is the regression coefficient of a dependent (internal) latent variable on another latent dependent variable. Gamma (γ) is the regression coefficient of an independent (external) latent variable on a latent dependent variable. (R2), defined as the explained variance, shows the extent of changes observed in the variables in the structural equation model. The factor loads between a latent variable and an observed variable are shown by lambda (λ) (Çelik & Yılmaz, 2013). In light of our findings, the best indicators of organizational silence were the "organizational culture" "(λ=0.85; t=18.30) and "colleagues" dimensions (λ=0.85; t=16.53). The best indicator of organizational cynicism was the "cognitive" dimension (λ=0.82). Accordingly, a moderate, positive, and statistically significant correlation existed between mobbing and organizational silence (γ=0.46; t=8.69). It suggests that a 1-point increase in mobbing results in a 0.46-point increase in organizational silence, or vice versa. Thus, it can be inferred that as teachers' mobbing level increases, their organizational silence levels increase. A low, positive, statistically significant correlation was found between mobbing and organizational cynicism (γ=0.27; t=3.62). A 1-point increase in mobbing causes a 0.27-point increase in organizational cynicism, or vice versa. Accordingly, as teachers' mobbing levels increase, so do their organizational cynicism levels. A moderate, positive, and statistically significant correlation was measured between organizational silence and organizational cynicism (β=0.53; t=7.79), which signals that a 1-point increase in organizational silence causes a 0.53-point increase in organizational cynicism or vice versa. As teachers' organizational silence levels increase, their organizational cynicism levels also increase.

Teachers' mobbing levels (γ=0.46) explained 21% of their organizational silence acts. Additionally, teachers' mobbing levels (γ=0.27) explained 26% of their organizational cynicism acts. It was determined that mobbing (γ= 0.27) and organizational silence (β=0.53) explained 48% of organizational cynicism. It can be interpreted that 48% of the total change in organizational cynicism is explained by the direct effect of mobbing and organizational silence latent variables and also by the indirect effect of mobbing on silence. It can be suggested that organizational silence alone has a significant and predictive effect on organizational cynicism, and as teachers' mobbing levels increase, so do their organizational silence and cynicism levels.

**Discussion**

This research explored the relationship between teachers' mobbing levels and organizational cynicism and silence behaviors. According to the findings of the first sub-problem, the negative treatment that teachers were most exposed to was I1, I14, I5, and I2. "They were least exposed to I20, I7, and I9 and "I10. The analysis results revealed that teachers were exposed to a "low" level of mobbing, which overlaps with the findings reported by several studies in the literature (Alkan et al., 2011; Beşoğul, 2014; Boydak Ozan & Nanto, 2017; Cemaloğlu, 2011; Cemaloğlu & Kılınç, 2012; Cerit, 2013; Ehi, 2011; Einarsen &Rakness, 1997; Ergener, 2008; Gündüz &Yılmaz, 2008; Karyağdı, 2007; Kılınç, 2009; Kul, 2010; Okçu & Çetin, 2017; Onbaş, 2007; Şener, 2013; Yıldırım & Eken, 2014). Teachers' exposure to mobbing is unethical and worrisome. Studies show most teachers have been exposed to at least one mobbing behavior throughout their careers (Aksu & Balcı, 2009; Blase & Blase, 2002; Cemaloğlu, 2007a; Hubert & Van Veldhoven, 2001), which points out the presence of a problem in a school environment. Mobbing is directly related to the school environment (Toker Gökçe, 2008). For instance, Cemaloğlu and Kılınç (2012) revealed mobbing was less common in schools where safety and ethics were prevalent. Ergener (2008) similarly found "none" or "very low" levels of mobbing in safe schools. Although the mobbing levels were different in our and Ergener's study (2008), the common findings of both studies in schools suggested that teachers were mostly ignored or ostracized. Toker Gökçe (2008) argued that the reason for mobbing is often jealousy. In such situations of jealousy, a mobbing victim has characteristics that the aggressor does not have, which is unacceptable for the aggressor. Additionally, the teaching profession

requires expertise, which leads to a competitive environment in educational institutions. It can be indicated that in organizations where school administrators trust the expertise of teachers and build a tolerant school climate, mobbing rarely occurs.

The findings of the second sub-problem imply that the teachers' organizational silence behaviors in the "administrative" dimension were higher than those in the "colleagues," "individual," and "organizational culture" dimensions. It was concluded that the teachers exhibited mostly silence behaviors in the "administrative" dimension and at least those in the "organizational culture" dimension. It was found that teachers exhibited a "low" level of organizational silence behaviors. Research shows that organizations generally have a low tolerance for criticism and dissenting opinions. The reasons for employee silence involve negative past experiences, lack of trust in managers, fear of ostracism, and the risk and fear of disturbing personal relationships (Alioğulları, 2012). Our findings showed that the risk of talking frankly in schools, authoritarian administrators, low administrative performance, and fear of ostracism are among the main reasons for organizational silence. In this sense, the attitudes of school administrators play a critical role in teachers' organizational silence. Taşkıran (2010) found that employees generally exhibited indecisive attitudes towards organizational silence. Similarly, Yüksel (2014) examined teachers' organizational silence in terms of administrative and organizational factors and the dimensions of lack of experience, fear of ostracism, and deterioration of relations, and concluded that teachers exhibited low levels of silence behaviors in all dimensions. Nartgün and İşleyici (2013) determined that the teachers had a "moderate" level of organizational silence behaviors. Similarly, in some studies, teachers exhibited low organizational silence behaviors (Bildik, 2009; Oruç, 2013). Accordingly, it can be argued that teachers tend to remain silent due to concerns such as unreliable administrators, fear of ostracism, and an insecure school environment. Morrison and Milliken (2000) emphasize that some prefer not to express their opinions for fear that they will get them into trouble.

According to the findings regarding the third sub-problem, teachers' cynicism behaviors categorized in the "behavioral" dimension were higher than those in the "cognitive" and "affective" dimensions. Accordingly, teachers exhibited behavioral cynicism at most and affective cynicism at least. It was measured that teachers' organizational cynicism behaviors were at a "low" level', which is in parallel with the findings in the literature (Kalağan, 2009; Kalay et al., 2012; Karyağdı, 2007; Kaygısız & Doğan, 2012; Kul, 2010). In some studies, it was moderate (Daşçı, 2014; Kılınç, 2009; Gündüz & Yılmaz, 2008; Onbaş, 2007; Okçu, 2011). Despite the differences in statistical rates, our findings were familiar with other findings. For example, some studies (Cemaloğlu, 2007b; Toker Gökçe, 2006) revealed a moderate level of mobbing among teachers. Teachers are expected to have less organizational cynicism for an effective teaching process. In other words, a high perception of organizational cynicism may lead to negative attitudes, low teaching motivation, avoidant behaviors, low organizational justice perception, and prejudices regarding the fact that there would not be a fair distribution of tasks. It may cause teachers to feel estranged from school and have low motivation and productivity.

The findings regarding the fourth sub-problem indicate that teachers' perceptions of mobbing affected organizational silence and cynicism. A moderate, positive, and statistically significant relationship was found between mobbing and organizational silence. In this sense, it is assumed that organizational silence predicted cynicism and that the mobbing experiences of teachers directly or indirectly affected organizational cynicism. Accordingly, a 1-point increase in mobbing may cause a 0.46-point increase in organizational silence. As teachers' mobbing levels increase, so do their organizational silence levels.

Additionally, a low, positive, statistically significant relationship existed between mobbing and organizational cynicism. It can be inferred that as teachers' mobbing increases, their organizational cynicism also increases. We found a moderate, positive, and statistically significant relationship between organizational silence and organizational cynicism, and a 1-point increase in organizational silence may lead to a 0.53-point increase in organizational cynicism.

## Conclusion

We concluded that teachers were mainly exposed to information-hiding behaviors, underestimation of their ideas and opinions, and gossip and rumors about them. They were rarely exposed to intimidating behaviors such as teasing and mockery, finger-pointing, invasion of personal space, pushing, blocking the way, and insults and humiliation about their personalities or private lives. The reasons behind organizational silence involve that they do not want to be the ones who give the bad news, believe that nothing will change, and are worried that social media shares might be used against them. The reasons behind organizational cynicism include that what is said and what is done are different, teachers feel anxious when they think about their workplace, and they talk about how things are run. Mobbing victims in schools choose organizational silence and cynicism as a way out. Teachers experiencing organizational cynicism have poor motivation and performance and spread that school's negative reputation and image to others.

**Implications**

In light of the research results and findings, awareness-raising training on mobbing can be organized for school administrators and teachers. Similarly, meetings, conferences, and events can be planned to increase teachers', administrators', students', and parents' awareness of the effects of mobbing. Professional help can be offered to mobbing victims. Public information events can be organized with the MoNE to prevent school mobbing and create a healthy school climate. Besides, school psychological counselors can intervene in cases of mobbing within the scope of their duties and responsibilities. Sanctions against mobbing can be imposed as well.

In line with the findings of organizational silence, awareness-raising conferences and panels can be arranged for school administrators and teachers. Teachers' knowledge and skills can be enhanced thanks to anger control, stress management, and effective communication training. A small community can be established to help potentially silent individuals get legal support. It is also essential to gain awareness that teachers guide future generations so that they should not remain silent. However, the research results show that teachers do not remain silent in the face of unfavorable school events, so they should be supported to improve their self-confidence and self-efficacy.

Following the findings of organizational cynicism, cynical behaviors can be minimized in a democratic school climate where teachers express themselves and feel valued. Additionally, the inclusion of teachers in the decision-making process helps them see their functioning and possible outcomes.

The active participation of teachers in decision-making in schools and a democratic school climate where others' ideas and opinions are welcome are essential. School administrators should plan educational activities inclusively, positively impacting teacher and student performances. An open and frank communication culture is critical for schools, where everyone can express their opinions. Administrators and teachers should be open to criticism and create a reassuring atmosphere in schools. Since school administrators' leadership styles, attitudes, and behaviors influence teachers' organizational silence and cynicism, in-service training can be planned for school administrators. The professional development of teachers and school administrators can be supported by postgraduate education programs to gain a scientific understanding of organizational culture.

## Author(s) Contribution Rate

This article is a part of the master's thesis of the first author Songül Akkoç, which was accepted at Gazi University, Institute of Educational Sciences. Prof. Dr. Necati Cemaloğlu is the advisor of the thesis.

## Conflicts of Interest

There is no conflict of interest in this study.

## Ethical Approval

During the preparation of the thesis, necessary permissions were obtained from the Ethics Committee of Gazi University.

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Appendix I. *Teachers' Mobbing Levels*

| Factor / Item | n | $\bar{\chi}$ | *S* |
|---|---|---|---|
| 1. Someone withholding information that affects your performance | 403 | 1.74 | 0.92 |
| 2. Being recruited in tasks below your qualification | 403 | 1.36 | 0.71 |
| 3. Being forced to work below your competence | 403 | 1.62 | 0.89 |
| 4. Replacing your important responsibilities with less important and unpleasant tasks | 403 | 1.54 | 0.76 |

| | | | |
|---|---|---|---|
| 5. Gossiping and spreading rumors about you | 403 | 1.63 | 0.83 |
| 6. Being ignored and ostracized | 403 | 1.55 | 0.75 |
| 7. Making insulting and humiliating remarks about your personality (e.g., habits and manners), attitude, or privacy | 403 | 1.23 | 0.51 |
| 8. Being yelled at or exposed to anger (or greed) | 403 | 1.49 | 0.66 |
| 9. Intimidating behaviors such as finger-pointing, invasion of personal space, pushing, blocking your way | 403 | 1.24 | 0.58 |
| 10. Others' hinting or signaling you to quit your job | 403 | 1.25 | 0.60 |
| 11. Being exposed to constant reminding you of your mistakes | 403 | 1.36 | 0.62 |
| 12. Underestimation or disregard of your suggestions and facing hostile reactions | 403 | 1.45 | 0.61 |
| 13. Endless criticism of your work or effort | 403 | 1.52 | 0.71 |
| 14. Underestimation of your ideas and opinions | 403 | 1.64 | 0.73 |
| 15. Being exposed to jokes (pranks) by people you do not get along with | 403 | 1.36 | 0.67 |
| 16. Being given inappropriate tasks or excessive workload | 403 | 1.51 | 0.76 |
| 17. Allegations and accusations against you | 403 | 1.33 | 0.65 |
| 18. Excessive monitoring of your work | 403 | 1.50 | 0.78 |
| 19. Being exposed to pressures not to claim your rights (e.g., sick leave, vacation entitlement, travel allowance) | 403 | 1.41 | 0.75 |
| 20. Being exposed to excessive teasing and sarcasm | 403 | 1.21 | 0.55 |
| 21. Being exposed to an unmanageable workload | 403 | 1.45 | 0.70 |
| Total | | 1.45 | 0.48 |
| 22. Have you been exposed to physical abuse? Yes: 61 (15.1%) No: 342 (84.9%) | | | |

Appendix II. *Teachers' Organizational Silence Levels*

| Factor / Item | n | $\bar{\chi}$ | *S* |
|---|---|---|---|
| Individual | | 2.16 | 0.64 |
| 1. I hesitate to express school problems. | 403 | 1.99 | 0.97 |
| 2. I ignore some problems at school to protect myself. | 403 | 2.06 | 0.96 |
| 3. Even if I have different solutions to problems, I follow the majority. | 403 | 2.67 | 1.09 |
| 4. I do not want to be the one who gives the bad news. | 403 | 2.92 | 1.25 |
| 5. I am introverted, which prevents me from interfering with problems. | 403 | 1.88 | 1.05 |
| 6. I can easily communicate with others about school problems. | 403 | 2.22 | 1.26 |
| 7. Although I have reasonable opinions about improving our school, I do not share them with others. | 403 | 1.92 | 1.00 |
| 8. I isolate myself from the school environment. | 403 | 1.66 | 0.86 |
| Administrative | | 2.34 | 0.69 |
| 9. I hesitate to talk to school principals about unfavorable situations. | 403 | 1.87 | 0.95 |
| 10. I do not talk to school principals about the issues that would ruin our relationship. | 403 | 2.14 | 1.08 |
| 11. I do not hesitate to warn our principals if they make mistakes. | 403 | 3.11 | 1.28 |
| 12. I find it disrespectful to appeal a decision taken by our school principal. | 403 | 2.21 | 1.10 |
| 13. I can easily communicate with our principal. | 403 | 2.23 | 1.31 |
| 14. I do not want to show my weaknesses to the school principal. | 403 | 2.51 | 1.24 |
| Organizational Culture | | 1.95 | 0.76 |
| 15. It is not worthwhile to talk about school problems. | 403 | 1.87 | 1.01 |
| 16. No one asks for my opinion about solutions to school problems. | 403 | 2.03 | 1.04 |
| 17. No one asks for my opinion in making decisions. | 403 | 2.00 | 0.97 |
| 18. Even if I share my ideas, nothing changes. | 403 | 2.28 | 1.05 |
| 19. I lose others' trust and respect if I express school problems. | 403 | 1.84 | 0.96 |
| 20. If I talk about problems at school, I get ostracized. | 403 | 1.75 | 0.85 |
| 21. If I talk about problems at school, my workload increases. | 403 | 1.94 | 0.91 |
| 22. I do not find the school environment reassuring. | 403 | 1.90 | 0.98 |
| Colleagues | | 2.20 | 0.68 |
| 23. Even if I have a different opinion from my colleagues, I do not share mine. | 403 | 1.83 | 0.88 |
| 24. I do not talk to my colleagues about disruptive issues. | 403 | 2.26 | 1.12 |
| 25. If I share any problem at school with my colleagues, I could be ostracized. | 403 | 1.85 | 0.87 |
| 26. My colleagues do not like to talk about the problems at school. | 403 | 2.00 | 0.98 |
| 27. My colleagues and I do not strive to find solutions to problems at school. | 403 | 2.19 | 1.23 |
| 28. When we encounter a problem at school, we exchange ideas to solve it. | 403 | 2.33 | 1.23 |
| 29. I cannot comment on my colleagues' behaviors that I disapprove of. | 403 | 2.53 | 1.18 |

| | | | |
|---|---|---|---|
| 30. I cannot express my opinions on social media (e.g., Facebook and Twitter) as they might be used against me. | 403 | 2.66 | 1.29 |
| General | | 2.17 | 0.60 |

## Appendix III. *Teachers' Organizational Cynicism Levels*

| Factor / Item | n | $\bar{\chi}$ | *S* |
|---|---|---|---|
| Cognitive | | 2.16 | 0.89 |
| 1. What is said and done is different in my workplace. | 403 | 2.18 | 1.11 |
| 2. There is little in common between the policies, goals, and practices of my workplace. | 403 | 2.11 | 1.03 |
| 3. If I am told that my workplace will do something, I doubt it will happen. | 403 | 2.09 | 0.97 |
| 4. What is expected from employees and the rewarded behavior is different in my workplace. | 403 | 2.25 | 1.11 |
| 5. I see little consistency between what is said to be done and what actually happens. | 403 | 2.17 | 1.04 |
| Affective | | 1.72 | 0.91 |
| 6. I get angry if I think about my workplace. | 403 | 1.73 | 0.96 |
| 7. I get furious if I think about my workplace. | 403 | 1.70 | 0.91 |
| 8. I feel nervous if I think about my workplace. | 403 | 1.70 | 0.93 |
| 9. I feel anxious if I think about my workplace. | 403 | 1.74 | 0.97 |
| Behavioral | | 2.27 | 0.92 |
| 10. I complain to my friends about what happens at work. | 403 | 2.02 | 1.00 |
| 11. When the conversation comes to my workplace, my colleagues and I wink at each other implicitly. | 403 | 2.05 | 1.03 |
| 12. I talk to others about how things are run in my workplace. | 403 | 2.67 | 1.21 |
| 13. I criticize my workplace's policies and practices with others. | 403 | 2.34 | 1.17 |
| General | | 2.05 | 0.78 |


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# Action Research on Improving Students' Conceptual Understanding in the "Force and Energy" Unit through Semantic Mapping

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## Abstract

This study was aimed at eliminating the difficulties in teaching the concepts and the students' conceptual understanding in the "Force and Energy" unit through semantic mapping. The study was conducted using the action research method. This study was conducted in the control group using the existing learning method in the science curriculum, while in the experimental group, homework practices with semantic maps were added. The study sample comprised 49 students studying in the seventh grade of a public middle school affiliated with the Republic of Turkey Ministry of National Education [MoNE] in the 2021–2022 academic year. Data collection tools in this study were administered: the "New Force and Energy Unit Conceptual Understanding Test," the "Semantic Mapping Evaluation Rubric," and the "Implementation Interview Form." The study findings determined that the semantic mapping practice, applied to improve the conceptual understanding of the seventh grade middle school students focused on the concepts within the scope of the "Force and Energy" unit, had positive effects on the students. The results of the structured interview form to obtain the views of the seventh grade students participating in this study on the semantic mapping practice indicate that the students reinforced the subject, demonstrating more effective learning. Another result revealed that students had more fun and were more enthusiastic as they actively participated in the process. Our study results reveal that semantic mapping positively affects student performance and attitudes. From this perspective, the use of semantic mapping in the science education process can be expanded.

**Keywords:** Conceptual understanding, Homework, science education, Semantic mapping

## Introduction

Today, considering the contemporary understanding of education, students' active participation in the education process, the mental structuring of knowledge, and its transfer to daily life are emphasized (Ülküdür, 2016). These high-level actions come to the fore owing to the multidirectional communication that occurs between teachers and students (Erciyeş, 2010). In this context, teachers should come to class prepared (Bilen, 1999), support students' active participation in the process, encourage students individually or in groups according to the content of the activity (Erciyeş, 2010), provide timely feedback in the process (Uysal, 2016), and strengthen the learning environment by treating students with unconditional love. This way, students can achieve more meaningful learning (Büyükbıçakcı, 2018).

In meaningful learning, new concepts are associated with the concepts that exist in the learner's mind (Meydan, 2018), and thus, the process results in more permanent learning (Zorlu & Sezek, 2016, 2020). Accordingly, combining different learning methods and techniques in concept learning with semantic mapping activities in modern education can enable students to concretize concepts and realize meaningful learning (Yavuz, 2006). According to Jillfitzgerald, Elmore, Kung, and Jackson (2017), semantic maps allow students to establish relationships between concepts and accomplish more meaningful learning. Semantic maps—two-dimensional visual tools that show students the names, properties, and meanings of concepts—are important tools in making learning easier and more meaningful for students (Ekici, 2014). Semantic mapping helps students concretize concepts, interpret experiences, and actively engage in the educational process, enhancing student enjoyment and participation (Aktepe, Cepheci, Irmak, & Palaz, 2017; Gürlek & Demirkuş, 2020). For this reason,

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researchers have recommended using semantic mapping as a learning tool for students of all ages in science lessons and have noted its positive effect on the structuring of the mind (Aktepe, Cepheci, Irmak, & Palaz, 2017; Badr & Abu-Ayyash, 2019; Demir & Sezek, 2009).

According to Üstünel (2016), the results obtained from studies conducted in the education and training process show that homework is one of the practices that positively affects academic achievement. The results of the process of consciously fulfilling homework requests reveal that homework requests contribute positively to academic achievement (Küçükahmet, 2001). However, for homework to have a positive impact on academic achievement, it should be relevant, and teachers should provide timely feedback and corrections for homework requests (MacBeath & Turner, 1990). In this respect, homework activities not only contribute positively to academic achievement but also affect the acquisition of individual study, self-management, and self-regulation skills (Epstein, 1988). As a matter of fact, studies examining the effects of homework activities in middle school science education lessons found that homework practice positively affects students' academic performance (Aksu & Karaçöp, 2015; Aladağ & Doğu, 2009; Arslan, 2021; Büyükkaynak, Ok & Aslan, 2016; Ersoy & Anagün, 2009; Kaya & Kaya, 2018). Moreover, the process of providing feedback on assignments increases the interaction between teachers and students (Aladağ & Doğu, 2009).

In the related literature, while research based on semantic mapping practices is scant, prior studies have mostly focused on revealing students' academic achievement to which the practice is administered (Evrekli & Balım, 2010; Tuna, 2013). Nonetheless, researchers believe implementing semantic mapping activities in terms of time and cost is possible and that these activities can be used at different levels for different purposes (Gobert & Clement, 1999; Berionni & Oliva Baldon, 2006; Demir & Sezek, 2009; Evrekli & Balım, 2010; Dilek & Yürük, 2012; Tuna, 2013; Fitzgerald, Elmore, Kung & Stenner, 2017; Aktepe, Cepheci, Irmak; Palaz, 2017; Koponen & Nousiainen, 2019; Barut, 2020; Zorlu & Zorlu, 2020; Demirkuş & Gürlek, 2020; Yolcu, Karamustafaoğlu & Karamustafaoğlu, 2021; Södervik, Nousiainen & Koponen, 2021). Additionally, Gürlek and Demirkuş (2020) have emphasized that the methods applied to concepts provide the most efficient use of existing knowledge; therefore, semantic mapping activities are valuable. From this perspective, the semantic mapping method and homework activities were integrated into the research, considering the positive effect of homework practices in the research process, and the study evaluated that realizing semantic mapping activities with homework activities that provide positive advantages in terms of learning effectiveness is important.

Before starting the research, determining the needs in the education process in a realistic way was important, and in this regard, the interview form prepared by the researchers was administered to 36 science teachers working in middle schools affiliated with the Ministry of National Education (MoNE). In the interview form, science teachers stated that they had difficulties teaching concepts and homework practices in the "Force and Energy" unit. Thus, this study included the "Force and Energy" unit. In this context, based on the information obtained as a result of the literature review, the study aimed to eliminate the difficulties in teaching the concepts in the "Force and Energy" unit by using semantic maps, and the research aimed to support the conceptual understanding of students in the "Force and Energy" unit through semantic mapping. Considering the positive effect of the semantic mapping method and homework practices in the research process, these were integrated into the research to improve the conceptual understanding of middle school students within the scope of the "Force and Energy" unit through semantic maps and to answer the following question: Do semantic mapping activities affect the conceptual understanding of middle school students in the "Force and Energy" unit?

## Method

The study was conducted using the action research method. The action research method can be defined as the process of studying the actual classroom or school situation to understand and improve the quality of actions and teaching (Hensen, 1996; McTaggart, 1997; Schmuck, 1997, as cited in Johnson, 2015). Within the scope of this study, first, a needs analysis was conducted by administering an interview form to 36 science teachers working in middle schools affiliated with the MoNE in the 2021–2022 academic year. The needs analysis determined that there were difficulties in teaching the concepts in the "Force and Energy" unit and evaluated that integrating semantic mapping practices into the teaching process would provide more effective teaching for the concepts within the scope of the "Force and Energy" unit. Within the scope of the action research conducted in this regard, this study followed a mixed-method research model, using quantitative and qualitative research methods together. This study used a quasi-experimental design with a pretest-posttest control group as a quantitative research method. As a qualitative research method, this study used a case research method and emphasized the participants' views with open-ended questions. By combining quantitative and qualitative methods in the implementation process, this study aimed to increase the validity and reliability of the research and produce more qualified results in understanding and improving the current situation.

**The Study Group**

The study group was determined through a simple random sampling method. The study sample comprised 49 students studying in the seventh grade of a public middle school affiliated with the Republic of Turkey Ministry of National Education [MoNE] in the 2021–2022 academic year. Two classes were selected from the seventh grade level. One of these two classes was randomly selected as the experimental group and one as the control group using a simple random sampling method. There were 27 students (17 girls and 10 boys) in the experimental group and 22 students (13 girls and 9 boys) in the control group.

**Research Design**

This study was conducted in the control group using the existing learning method in the science curriculum, while in the experimental group, homework practices with semantic maps were added. Before the implementation, the "New Force and Energy Unit Conceptual Understanding Test" (NFEUCUT) was used as a data collection tool in the experimental and control groups. Additionally, the "Semantic Mapping Evaluation Rubric" (SMER) was used on the experimental group during the implementation. At the end of the implementation, the NFEUCUT was administered to the experimental and control groups, and the "Implementation Interview Form" [IIF] was administered to the experimental groups (Figure 1).

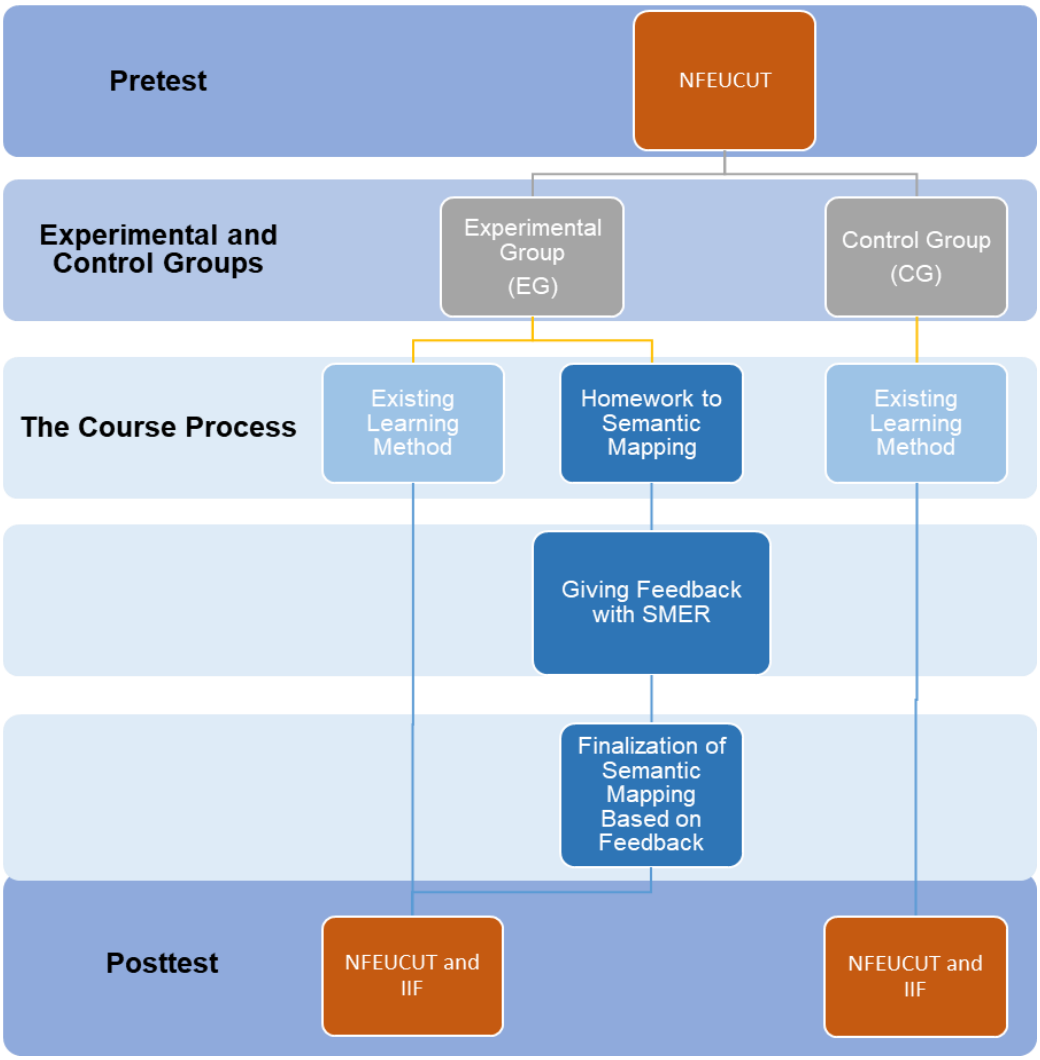



Figure 1. Research design

**Data Collection Tools**

Before and after the implementation, the students in the experimental and control groups were administered the NFEUCUT, developed by Özden (2019) within the scope of the science curriculum; the SMER, developed by

Zorlu and Zorlu (2020); and the IIF, prepared by using the researchers' observations during the research process.

*New Force and Energy Unit Conceptual Understanding Test (NFEUCUT)*

Özden's (2019) NFEUCUT comprises 17 multiple-choice questions. The Kuder-Richardson 20 (KR-20) reliability coefficient was determined to be 0.81. The questions constitute three stages to identify the existing misconceptions. The first phase evaluates the student's competence based on their answers (P1 score type: This involves evaluating the answer to the first stage of the question by giving 1 and 0 points). The second phase measures the reason for the answers given to the first question (P2 score type: If both questions are answered correctly, 1 point is awarded, while other answers receive 0 points). The third stage measures whether students are confident in their answers (P3 score type: when the correct answer and the certain option are marked in both stages, it is evaluated as 1 point, while other answers are evaluated as 0 points). Within the scope of this study, the KR-20 reliability coefficient of the NFEUCUT was 0.83.

*Semantic Mapping Evaluation Rubric (SMER)*

Zorlu and Zorlu's (2020) SMER within the scope of their study was organized and developed as five items: "Key Concepts," "Key Groups," "Eligibility of Groups by Key Concepts," "Concepts Other Than Key Concepts," and "Highlighting What is Important From Groups in Creating a Concept Network." Each item was allocated 5 points. On the scale, one item was scored according to the number of concepts, while the other items were scored according to the percentage of concepts (Table 1).

Table 1. Semantic mapping evaluation rubric (SMER)

| Items | 5 points | 4 points | 3 points | 2 points | 1 points |
|---|---|---|---|---|---|
| Key Concepts | %100-81 | %80-61 | %60-41 | %40-21 | %20-1 |
| Key Groups | %100-81 | %80-61 | %60-41 | %40-21 | %20-1 |
| Eligibility of Groups by Key Concepts | %100-81 | %80-61 | %60-41 | %40-21 | %20-1 |
| Concepts Other Than Key Concepts | …-21 Concept | 20-16 Concept | 15-11 Concept | 10-6 Concept | 5-1 Concept |
| Highlighting What is Important From Groups to Creating a Concept Network | %100-81 | %80-61 | %60-41 | %40-21 | %20-1 |

*Implementation Interview Form (IIF)*

The researchers used the IIF, comprising three open-ended questions, to obtain the opinions of the students participating in the study. The researchers created and used the questions to determine the students' perceptions about the positive and negative aspects, as well as suggestions concerning the semantic mapping activities applied in the teaching of the "Force and Energy" unit.

**Implementation Process**

*Implementation Process in the Experimental Group*

The research process started with the application of the form indicating that the students participated in the study voluntarily. At the beginning of the research process, randomly selected experimental group students were administered the NFEUCUT as a pretest before any research-based study occurred to reveal their existing knowledge about the "Force and Energy" unit. The data obtained as a result of the pretest was kept on record. Then, the experimental group students received information about the implementation process and semantic mapping, and sample semantic maps were introduced. After the experimental group students received sufficient knowledge about semantic mapping, the study implementation started. The "Force and Energy" unit comprises three subtopics, and the same study steps were carried out for each subtopic. The first subtopic, "Mass and Weight Relationship," was completed in accordance with the course process. The relationship between mass and weight was examined using a dynamometer and an equal-arm scale. Elaborations were made on the subject by giving examples from daily life, and finally, the process was completed using measurement and evaluation tools. At the end of the topic, teachers asked students to prepare a semantic map within the scope of this subtopic. Students were given sufficient time to prepare their semantic maps and were asked to submit their maps by the deadline. The submitted semantic maps were analyzed and scored with the help of SMER, and then students received feedback. The students finalized their semantic maps by making corrections within the specified time period in line with the feedback given, and the semantic maps were evaluated again using SMER

and their final scores were determined. The data obtained was recorded. The other two subtopics of the "Force and Energy" unit were covered similarly. At the end of the implementation process, the NFEUCUT was administered to the experimental group students as a posttest, and the results were recorded. To reveal the thoughts of the participant experimental group students about the implementation process, the IIF was administered. The results of the IIF were evaluated, and the data were recorded.

*Implementation Process in the Control Group*

The research process started with the application of the form indicating that the students participated in the study voluntarily. At the beginning of the research process, randomly selected control group students were administered the NFEUCUT as a pretest before any research-based study to reveal their existing knowledge about the "Force and Energy" unit. The data obtained as a result of the pretest was kept on record. The other two subtopics of the "Force and Energy" unit were covered similarly. The "Force and Energy" unit comprises three subtopics, and the lesson processes were conducted in each subtopic in accordance with the science curriculum and achievements. The first subtopic, "Mass and Weight Relationship," was completed in accordance with the course process. The relationship between mass and weight was examined using a dynamometer and an equal-arm scale. The teacher elaborated on the subject by giving examples from daily life, and finally, the process was completed using measurement and evaluation tools. The other two subtopics of the "Force and Energy" unit were covered similarly. At the end of the unit, the NFEUCUT was administered as a posttest. After the posttest, students were given information about semantic mapping, and sample concept networks were introduced. After the students learned about semantic mapping, they were asked to create a semantic map related to the "Force and Energy" unit. After collecting the semantic maps, the maps prepared by the students in the control group were evaluated and scored, and the students received feedback accordingly.

**Data Analysis**

The researchers analyzed the quantitative data obtained in the study with the SPSS program's descriptive and predictive statistical methods. They analyzed the qualitative data obtained through the content analysis method. The research products are the concept networks prepared by 27 students in the experimental group for three subtopics within the "Force and Energy" unit. Each semantic map received feedback, and the semantic maps were re-evaluated based on the feedback given. The evaluation was made using SMER, prepared by paying attention to the general features of the semantic mapping implementation. The quantitative data obtained from the P1 and P3 score types of the NFEUCUT were analyzed using normality tests and descriptive and predictive statistical analyses. The data obtained from the IIF were analyzed using the content analysis method within the scope of qualitative data analysis. The process continued by determining themes and codes. The themes and codes obtained were evaluated in terms of percentage and frequency.

## Results

The students in the experimental and control groups were administered the NFEUCUT as a pretest and posttest. As the NFEUCUT comprises a three-stage question type, P1 and P3 scores were used in the study.

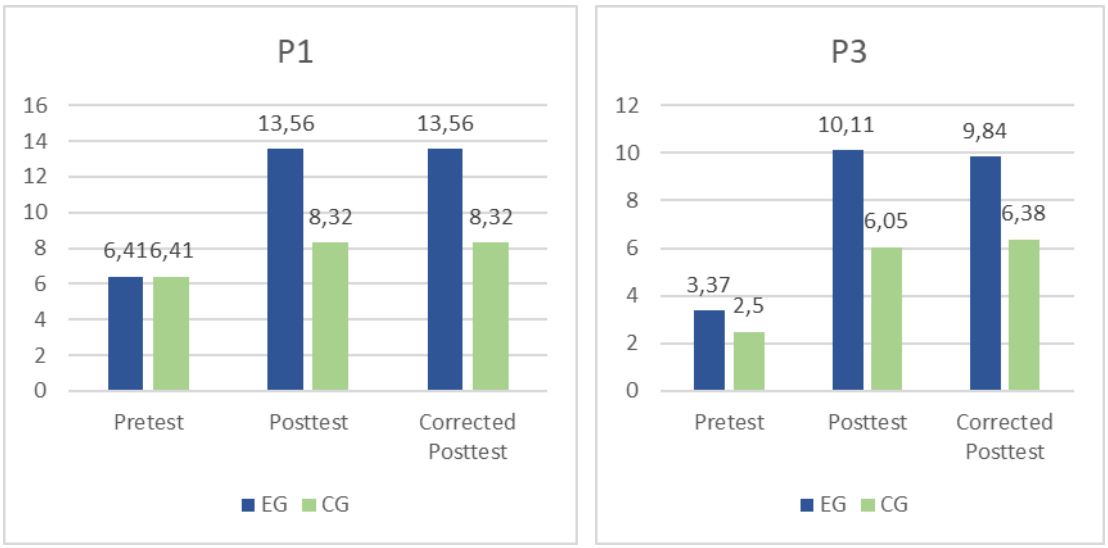
Table 2. Descriptive values and normality table according to NFEUCUT P1 and P3 score types

| Score Types | | Groups | X | Median | Mode | Ranj | Skewness | Skewness Standard Error | Kurtosis | Kurtosis Standard Error |
|---|---|---|---|---|---|---|---|---|---|---|
| P1 | Pretest | EG | 6.41 | 6.00 | 4.00 | 8.00 | 0.358 | 0.448 | -0.997 | 0.872 |
| | | CG | 6.41 | 6.50 | 7.00 | 6.00 | 0.176 | 0.491 | -0.298 | 0.953 |
| | Posttest | EG | 13.56 | 13.00 | 12.00 | 7.00 | 0.348 | 0.448 | -0.235 | 0.872 |
| | | CG | 8.32 | 8.50 | 10.00 | 10.00 | -0.179 | 0.491 | -0.995 | 0.953 |
| P3 | Pretest | EG | 3.37 | 3.00 | 2.00 | 7.00 | 0.476 | 0.448 | -0.933 | 0.872 |
| | | CG | 2.50 | 2.50 | 3.00 | 6.00 | 0.626 | 0.491 | 0.060 | 0.953 |
| | Posttest | EG | 10.11 | 11.00 | 11.00 | 15.00 | -0.210 | 0.448 | 0.492 | 0.872 |
| | | CG | 6.05 | 5.50 | 5.00 | 9.00 | 0.379 | 0.491 | -0.886 | 0.953 |

The skewness and kurtosis values of the pretest and posttest data of the NFEUCUT P1 and P3 score types were between −1 and +1, and the ratio of skewness value/skewness standard error and kurtosis value/kurtosis standard error was between −1.96 and +1.96 (Table 2). Skewness and kurtosis values between −1 and +1

(Morgan, Leech, Gloeciner & Barret, 2004) and skewness value/skewness standard error and kurtosis value/kurtosis standard error ratios between −1.96 and +1.96 (Can, 2014) indicate that the data distribution is normal. Additionally, researchers conducted a Shapiro-Wilk analysis of normality tests. In line with the Shapiro-Wilk analysis, the distribution was normal ($p > 0.05$).

The scores obtained from the posttests of the NFEUCUT P1 and P3 score types applied to the students in the experimental and control groups were correlated, and analysis of covariance (ANCOVA) was performed to determine whether the differences were statistically significant. Graph 1 and Table 3 present the data obtained as a result of the analysis.




Graph 1. Pretest, posttest, and corrected posttest scores of the experimental and control groups

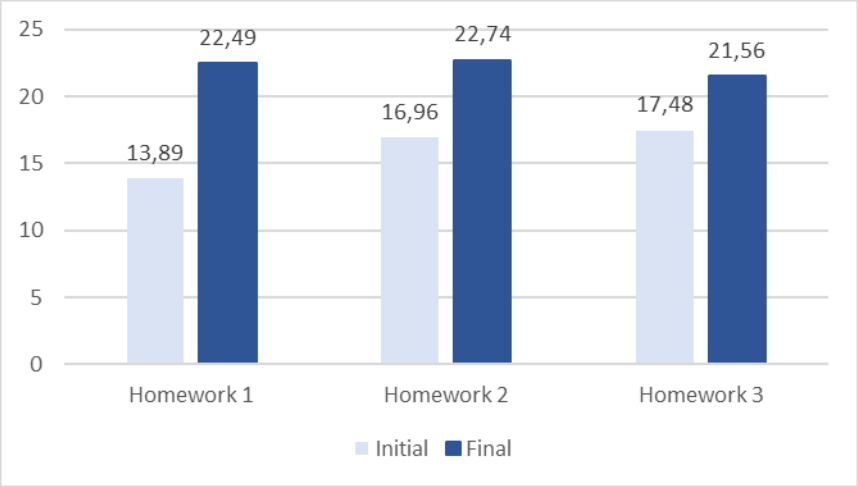
An analysis of Graph 1 suggests that the average posttest scores of the experimental group students are higher than those of the control group students. To understand whether the difference is statistically significant, an ANCOVA analysis was performed on the pretest and posttest results of the NFEUCUT P1 and P3 score types. Table 3 presents the results of the analysis.

Tablo 3. ANCOVA analysis results of NFEUCUT P1 and P3 score types

| Source | Sum of Squares | df | Mean of Squares | F | p | η2 | Source |
|---|---|---|---|---|---|---|---|
| P1 | NFEUCUT (Pretest) | 22.947 | 1 | 22.947 | 3.536 | 0.066 | 0.071 |
| | Method | 332.589 | 1 | 332.589 | 51.255 | **0.000** | 0.527 |
| | Error | 298.492 | 46 | 6.489 | | | |
| | Total | 6805.000 | 49 | | | | |
| P3 | NFEUCUT (Pretest) | 92.768 | 1 | 92.768 | 12.520 | 0.001 | 0.214 |
| | Method | 138.521 | 1 | 138.521 | 18.694 | **0.000** | 0.289 |
| | Error | 340.853 | 46 | 7.410 | | | |
| | Total | 3998.000 | 49 | | | | |

According to the ANCOVA analysis results in Table 3, there were statistically significant differences between the scores of the students in the experimental and control groups in the NFEUCUT P1 and P3 score types in favor of the experimental group [P1: $F_{(1–49)} = 51.255$, $p < .05$; P3: $F_{(1–49)} = 18.694$, $p < .05$]. In line with the applied experimental variable, η2 (eta squared) was found to be 0.527 for the P1 score type and 0.289 for the P3 score type. Approximately 53% of the variance in the posttest scores of the NFEUCUT, which is the dependent variable in the study for the P1 score type, and 29% for the P3 score type, is explained by the implementation process in the experimental and control groups, which are the independent variables.

The three semantic maps prepared by the students in the experimental group were analyzed according to the SMER, and Graph 2 presents the averages of their initial and final scores.




Graph 2. Averages of initial and final scores of semantic mapping homework according to SMER

An examination of Graph 2 reveals that the experimental group students had lower mean scores in the first form of the first semantic map. In the first state of the second and third semantic maps, the mean scores were close to each other and higher than the first semantic map's mean score. The mean scores of the final version of the three semantic maps are close to each other. Table 4 presents the frequency distribution of the initial and final forms of all three semantic maps.

Table 4. Frequency distribution of the initial and final forms of all three semantic maps

| | Homework 1 | | | | Homework 2 | | | | Homework 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Initial | | Final | | Initial | | Final | | Initial | | Final | |
| Score Range | f | % | f | % | f | % | f | % | f | % | f | % |
| 0-5 | 3 | 11.1 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| 6-10 | 6 | 22.2 | 0 | 0.0 | 3 | 11.1 | 0 | 0.0 | 1 | 3.7 | 0 | 0.0 |
| 11-15 | 6 | 22.2 | 0 | 0.0 | 6 | 22.2 | 1 | 3.7 | 2 | 7.4 | 0 | 0.0 |
| 16-20 | 7 | 25.9 | 5 | 18.5 | 7 | 25.9 | 2 | 7.4 | 17 | 63.0 | 7 | 25.9 |
| 21-25 | 5 | 18.6 | 22 | 81.5 | 11 | 40.8 | 24 | 88.9 | 7 | 25.9 | 20 | 74.1 |
| Total | 27 | 100.0 | 27 | 100.0 | 27 | 100.0 | 27 | 100.0 | 27 | 100.0 | 27 | 100.0 |

Table 4 indicates that the experimental group students only had assignments that scored between 0–5 points in the first state of the first semantic map assignment. In the first cases of the semantic mapping assignments, the third assignment (f = 24, 88.9%) was the most common assignment between 16 and 25 points, while the first assignment (f = 12, 44.5%) was the least common assignment. In the final versions of the semantic mapping assignments, there was only one assignment (3.7%) between 0–15 points in the second semantic mapping assignment, while there was no assignment between this score in the other two semantic mapping assignments. According to the observations, 74.1%–88.9% of the final versions of the semantic mapping assignments were between 21–25 points. Sample semantic maps prepared by the students are given in the appendix.

Table 5. Positive aspects of the semantic mapping practice

| Positive Aspects | f | % |
|---|---|---|
| Reinforcement of the learned subject | 14 | 29.2 |
| Ensuring better learning of the subject | 13 | 27.1 |
| Providing ease of understanding | 10 | 20.8 |
| Making the learning process enjoyable | 6 | 12.5 |
| Ensuring the development of classification skills | 4 | 8.3 |
| Developing a sense of responsibility | 1 | 2.1 |
| Total | 48 | 100.0 |

According to Table 5, semantic mapping helps teach the subject to be learned more easily and effectively. Permanence increases as the information learned is reinforced. As learners actively participate in the process, a more enthusiastic learning environment is created. The following are some sample student statements.

- *I learned the concepts more easily. I learned how to group things, and the concepts I learned became more permanent in my mind.* (Student EG-10)
- *Creating a semantic map was nice and fun. I can keep concepts in mind more easily.* (Student EG-12)

- *Thanks to semantic mapping, I reinforced the information I learned better.* (Student EG-5)
- *It helps me learn easily. It reveals our sense of responsibility.* (Student EG-22)
- *I learned the concepts faster and did not forget them.* (Student EG-2)
- *It made the lesson review fun for us.* (Student EG-1)

Table 6. Negative aspects of the semantic mapping practice

| Negative Aspects | f | % |
|---|---|---|
| No negative aspects | 18 | 47.4 |
| Exhausting preparation process | 8 | 21.1 |
| Time-consuming | 7 | 18.4 |
| Concepts are hard to find | 2 | 5.3 |
| Difficult to establish an order of importance | 1 | 2.6 |
| Responsibility needs to be taken | 1 | 2.6 |
| Does not provide detailed information | 1 | 2.6 |
| Total | 38 | 100.0 |

According to Table 6, most students who participated in the implementation process had positive opinions about the practice. Negative perceptions about the implementation were that the process was tiring and time-consuming owing to the need to take responsibility. There were comments that semantic mapping did not provide detailed information and that there should be some changes during the implementation. The following are some sample student statements.

- *In my opinion, there is no negative aspect of semantic mapping because it helps us learn.* (Student EG-26)
- *It takes me a lot of time to create a semantic map.* (Student EG-8)
- *Creating a semantic map is very laborious, and I get tired.* (Student EG-22)
- *It is very difficult to find the concepts.* (Student EG-3)
- *Making groups in order of importance is a negative aspect.* (Student EG-9)
- *It is necessary to take responsibility.* (Student EG-5)
- *Semantic mapping does not give us much information.* (Student EG-6)

Table 7. Recommendations for the semantic mapping implementation

| Recommendations | f | % |
|---|---|---|
| No suggestion. | 17 | 43.6 |
| There should be no list of key concepts. | 6 | 15.4 |
| The teacher can provide key concepts. | 4 | 10.3 |
| Explanations for concepts can be added. | 4 | 10.3 |
| Areas of use can be expanded. | 3 | 7.7 |
| Evaluation questions can be asked after the implementation. | 2 | 5.1 |
| The order of importance may not be specified. | 1 | 2.6 |
| The list of key concepts can change places with the semantic map. | 1 | 2.6 |
| Key concepts can be written directly without grouping. | 1 | 2.6 |
| Total | 39 | 100.0 |

According to Table 7, 44% of the students who participated in the implementation found it to be sufficient and did not feel the need for improvement. Suggestions for improvement from other students were that there should not be a step to list concepts at the beginning of the semantic mapping process or that concepts should be given when the teacher finds them. Suggestions such as including the definitions of these concepts instead of using only concepts in semantic maps, not ranking or grouping concepts, and asking end-of-term assessment questions also appeared in the results. The following are some sample student statements.

- *After our semantic mapping practice, we should ask each other questions to understand what we have learned.* (Student EG-1)
- *The step of listing key concepts can be removed from the practice.* (Student EG-22)
- *We can give the definitions of the concepts we specified in the semantic map.* (Student EG-14)
- *Our teacher could have prepared the concepts themselves and given them to us.* (Student EG-4)
- *Everyone should apply it, and its use should be widespread.* (Student EG-1)
- *It was not important to list the concepts found in the semantic map; instead, we could have written the definitions of the concepts by grouping them without considering their degree of importance.* (Student EG-15)

– *It would be better if we prepared the semantic map concepts, wrote them at the top, and then did the next step of creating groups underneath that.* (Student EG-10)

## Conclusion and Discussion

A modern educational approach is necessary for science education to progress dynamically on the path of science (Öztürk, 2019). In contrast to current teaching, the contemporary teaching approach, which includes various learning models, methods, and techniques in the process, forms the basis of the general objectives of the science curriculum updated in 2018 (MoNE, 2018). Based on the results obtained in the literature on semantic maps, the aim was to develop a conceptual understanding of the seventh grade "Force and Energy" unit through semantic mapping within the study framework. In line with this purpose, the findings section demonstrates the results of the information obtained in this study and their association with the literature.

*Research on Semantic Maps for Conceptual Understanding in the Seventh Grade "Force and Energy" Unit*

The study findings determined that the semantic mapping practice, applied to improve the conceptual understanding of the seventh grade middle school students focused on the concepts within the scope of the "Force and Energy" unit, had positive effects on the students. The study results are consistent with the results of prior studies in that the experimental groups wherein semantic mapping was applied during the teaching process were academically ahead of the control groups that continued with the current teaching method (Aktepe, Cepheci, Irmak & Palaz, 2017; Badr & Abu-Ayyash, 2019; Barut, 2020; Büyüktokatlı, 2009; Dilek & Yürük, 2013; Engür, 2006; Epstein, 1988; Günhan, 2009; Gürlek & Demirkuş, 2020; Jillfitzgerald, Elmore, Kung & Jacson, 2017; MacBeath & Turner, 1990; Reza & Azizah, 2019; Sinan, 2007; Tuna, 2013). Literature reviews indicate that semantic mapping supports current and alternative learning and facilitates effective learning by establishing a relationship between them (Badr & Abu-Ayyash, 2019; Engür, 2006; Heimlich & Pittelman, 1986; Turgut, 1990); moreover, it was observed that the retention of information learned increases in individuals who learn effectively (Zorlu & Sezek, 2016). Students who experience a sense of effective learning have positive attitudes (Erdem, 2019). Active student participation, expressing the desire to learn, fosters increased interaction between teachers and students (Erciyeş, 2010), ensuring that the entire subject is covered (Gürlek & Demirkuş, 2020).

The difficulties of concept teaching in science are noteworthy. In this regard, using semantic mapping for effective concept teaching is recommended (Barut, 2020; Engür, 2006; Gürlek & Demirkuş, 2020; Heimlich & Pittelman, 1986; McIntosh, 1995; Patrizi, Ice, & Burgess, 2013). The fact that one can use it at different stages of the teaching process is seen as an advantage of semantic mapping. Using semantic mapping as homework in these various teaching processes draws attention (Engür, 2006). Studies in the literature show that desired behaviors are formed as a result of using semantic mapping as a homework activity (Engür, 2006; Erdem, 2019; Gürlek & Demirkuş, 2020; Turgut, 1990). For example, students gain self-regulation skills through feedback and correction (Erdem, 2019) and expand and develop concepts in their minds as a result of associating existing knowledge with alternative knowledge (Gürlek & Demirkuş, 2020); furthermore, they develop a sense of responsibility, a thorough, effective, and planned use of time, and individual study skills (Engür, 2006; Erdem, 2019; Turgut, 1990). Owing to the semantic mapping practice, students actively participate in the process and develop positive attitudes toward learning with an increase in the quality of teaching (Dilek &Yürük, 2013; Erciyeş, 2010). The preparation of semantic maps is a student-specific, subjective process; therefore, researchers recommend preparing a separate evaluation rubric for each student (Gürlek & Demirkuş, 2020). With timely feedback, students will not acquire information incorrectly and will correct their existing mislearning (Uysal, 2016). Our conclusion that the concepts in the "Force and Energy" unit provide meaningful learning by effectively implementing semantic mapping as homework without causing problems in terms of time and cost if the process is planned and maintained from the beginning and by giving individual feedback with the correct evaluation scale is in line with the results of the literature (Bilen, 1999).

*Seventh Grade Students' Views on the Semantic Mapping Practice*

The results of the structured interview form to obtain the views of the seventh grade students participating in this study on the semantic mapping practice indicate that the students reinforced the subject, demonstrating more effective learning. Another result revealed that students had more fun and were more enthusiastic as they actively participated in the process. The effectiveness of teaching increases with active participation in the learning process, and therefore, the importance of using semantic mapping emerges. Most students who participated in the application stated that they did not have negative perceptions about semantic mapping.

According to the students' opinions, the negative aspect of the semantic mapping practice was that it was time-consuming and labor-intensive. For this reason, they generally found the implementation adequate and did not make suggestions for improvement. The existing negative thoughts reveal the need for students to develop a sense of responsibility. Suggestions for improving the semantic mapping practice were that teachers should provide and list the concepts to be used, that explanations of the concepts should be added, and that there should not be an indication of importance. These suggestions are desirable because they reduce students' responsibility and are indirectly linked to their negative opinions about semantic mapping. Based on an analysis of the related studies in the literature, previous studies have similar research results, indicating that the subject is learned and reinforced more effectively (Dilek & Yürük, 2013; Ekici, 2014; Günhan, 2009; Jillfitzgerald, Elmore, Kung & Jacson, 2017; Zorlu ve Zorlu, 2020, 2021). The results that semantic maps involve students more actively in the process with the implementation of semantic maps as homework in the experimental group are in parallel with the results in the literature (Aktepe, Cepheci, Irmak, & Palaz, 2017; Badr & Abu-Ayyash, 2019; Demir & Sezek, 2009; Gürlek & Demirkuş, 2020). In this regard, the use of semantic mapping is recommended to achieve effective teaching process outcomes. Additionally, suggestions for improving the implementation process, making the method more widespread, and measuring the information learned with evaluation questions at the end of the implementation are similar to the results of this study (Badr & Abu-Ayyash, 2019; Dilek & Yürük, 2013; Ekici, 2014; Günhan, 2009; Gürlek & Demirkuş, 2020). Based on the results, the process should be supported with evaluation questions at the end of the semantic mapping implementation, and its use should be expanded to different levels and courses.

## Recommendations

- Semantic mapping implementation can be planned and executed at different grade levels to explore the impact of different variables.
- In this study, researchers selected the experimental group using simple sampling methods and reached the results on a limited scale. Future research can be conducted by expanding the sample area or in schools with different characteristics.
- Our study results reveal that semantic mapping positively affects student performance and attitudes. From this perspective, the use of semantic mapping in the science education process can be expanded.
- Our study results show that semantic mapping influences meaningful conceptual learning and, thus, academic achievement. To popularize its use, informative seminars can be given to educators about semantic mapping.

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## Author (s) Contribution Rate

First Author's Contribution Rate: 40%, Second Author's Contribution Rate: 30%, and Third Author's Contribution Rate: 30%.

## Conflicts of Interest

There aren't any potential conflicts of interest.

## Ethical Approval (only for necessary papers)

Ethical permission (Meeting Date: 30.12.2021; Number: 2021/10) was obtained from Dumlupınar University institution for this research.

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Appendix: Samples of the experimental group students' semantic mappings are given below.

| Initial | Final |
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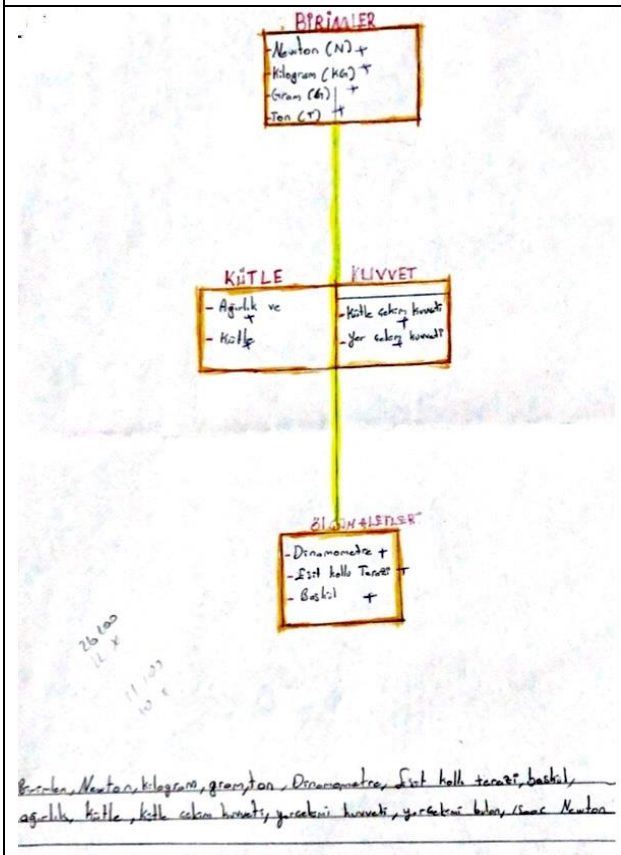
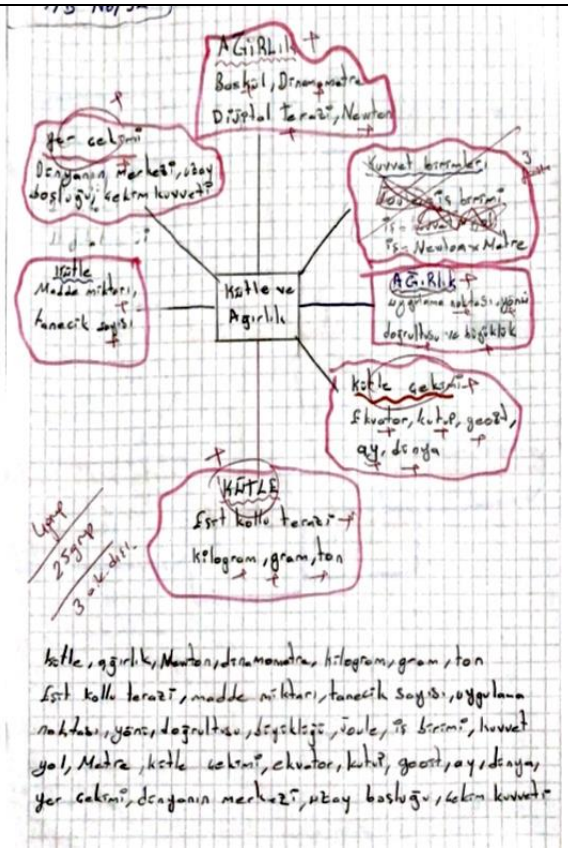
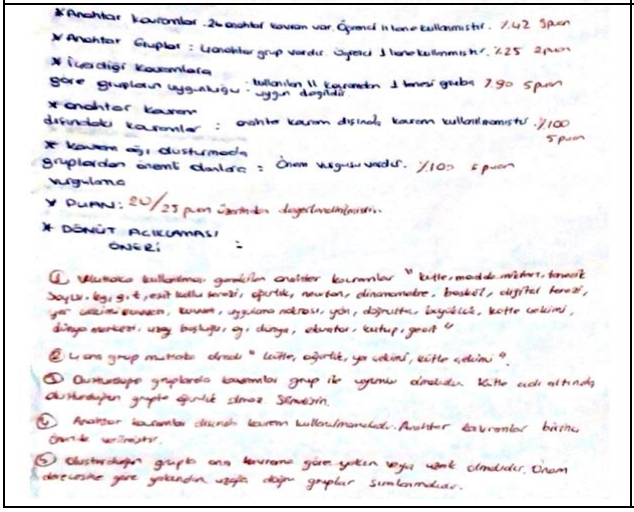
|  |  |
|  | **Anahtar Kavramlar:** 26 kavram kullanılmalıdır. Öğrenci 25 tane kullanmıştır. 5 puan.<br>**Anahtar Gruplar:** 4 grup oluşturulmalıdır. Öğrenci hepsini oluşturmuştur. 5 puan.<br>**İçerdiği Kavramlara Göre Grupların Uygunluğu:** Kullanılan kavramlar gruplara uygundur. 5 puan.<br>**Anahtar Kavram Dışındaki Kavramlar:** Anahtar kavram dışında 3 kavram vardır. 5 puan.<br>**Kavram Ağı Oluşturmada Gruplardan Önemli Olanlara Vurgu:** Önem vurgusu vardır. 5 puan.<br><br>**Puan:** 25 puan.<br><br>**Dönüt Açıklaması:**<br>1. Mutlaka kullanılması gerekilen kavramlar 'Kütle, Madde Miktarı, Tanecik Sayısı, Kg, g, t, Eşit Kollu Terazi, Ağırlık, Dinamometre, Baskül, Dijital Terazi, Yer Çekimi, Kuvvet, Uygulama Noktası, Yön, Doğrultu, Büyüklük, Kütle Çekimi, Dünya Merkezi, Uzay Boşluğu, Ay, Dünya, Ekvator, Kutup, Geoit '.<br>2. Mutlaka kullanılması gereken 4 grup olmalıdır. Bunlar 'Kütle, Ağırlık, Yer Çekimi, Kütle Çekimi'.<br>3. Kullanılan kavramlar gruplara uygun olmalıdır.<br>4. Birinci öneride verilen kavramlar haricinde kavram kullanılmamalıdır.<br>5. Oluşturulan gruplar ana kavrama yakınlık uzaklık bakımından önem derecesine göre oluşturulmalıdır. |

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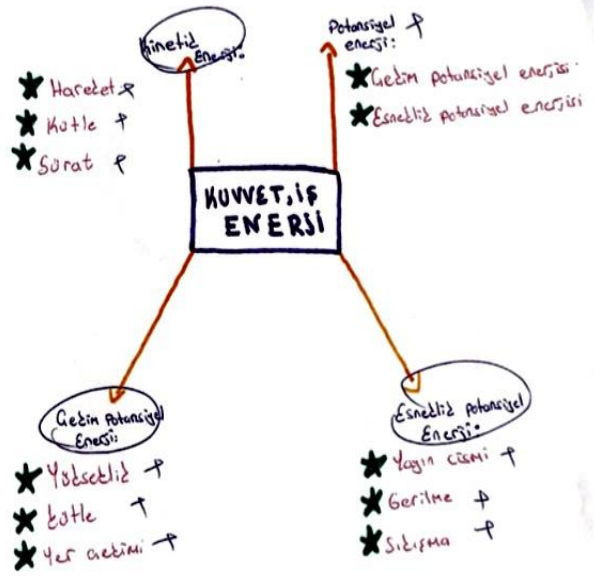
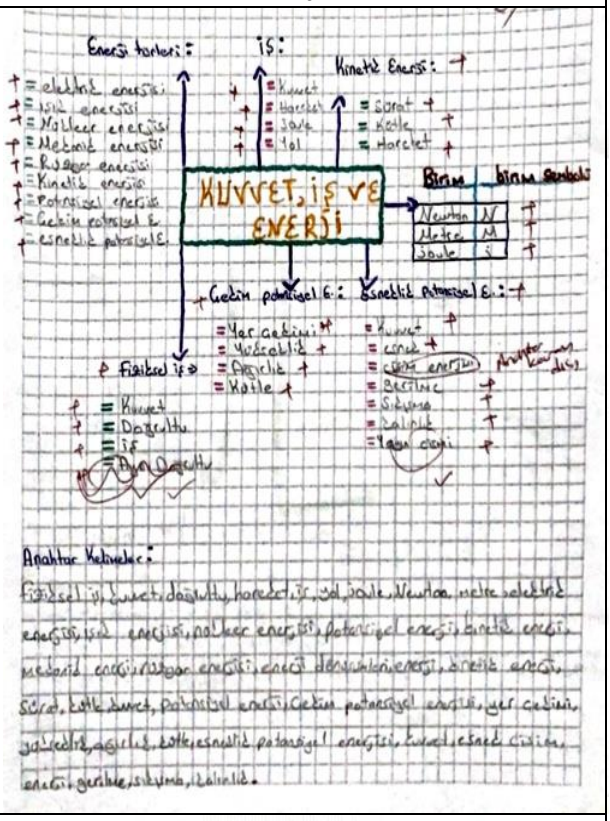
|  |  |
| **Anahtar Kavramlar:** 35 kavram kullanılmalıdır. Öğrenci 13 tane kullanmıştır. 2 puan.<br>**Anahtar Gruplar:** 4 grup oluşturulmalıdır. Öğrenci 3 tane oluşturmuştur. 4 puan.<br>**İçerdiği Kavramlara Göre Grupların Uygunluğu:** Kullanılan kavramlar gruplara uygundur. 5 puan.<br>**Anahtar Kavram Dışındaki Kavramlar:** Anahtar kavram dışında kavram yoktur. 5 puan.<br>**Kavram Ağı Oluşturmada Gruplardan Önemli Olanlara Vurgu:** Önem vurgusu yoktur. 0 puan.<br><br>**Puan:** 16 puan.<br><br>**Dönüt Açıklaması:**<br>1. Mutlaka kullanılması gerekilen kavramlar 'Fiziksel iş, kuvvet, doğrultu, hareket, iş, yol, joule, Newton, metre, elektrik enerjisi, ışık enerjisi, nükleer enerji, potansiyel enerji, kinetik enerji, mekanik enerji, rüzgâr enerjisi, enerji dönüşümleri, enerji, kinetik enerji, sürat, kütle, kuvvet, potansiyel enerji, çekim potansiyel enerjisi, yer çekimi, yükseklik, ağırlık, kütle, esneklik potansiyel enerjisi, kuvvet, esnek cisim, enerji, gerilme, sıkışma, kalınlık'.<br>2. Mutlaka kullanılması gereken 4 grup olmalıdır. Bunlar ' Fiziksel iş, Kinetik Enerji, Çekim Potansiyel Enerjisi, Esneklik Potansiyel Enerjisi'.<br>3. Kullanılan kavramlar gruplara uygun olmalıdır.<br>4. Birinci öneride verilen kavramlar haricinde kavram kullanılmamalıdır.<br>5. Oluşturulan gruplar ana kavrama yakınlık uzaklık bakımından önem derecesine göre oluşturulmalıdır. | **Anahtar Kavramlar:** 35 kavram kullanılmalıdır. Öğrenci 35 tane kullanmıştır. 5 Puan<br>**Anahtar Gruplar:** 4 grup oluşturulmalıdır. Öğrenci 4 tane oluşturmuştur. 5 puan.<br>**İçerdiği Kavramlara Göre Grupların Uygunluğu:** Kullanılan kavramlar gruba uygundur. 5 puan.<br>**Anahtar Kavram Dışındaki Kavramlar:** Anahtar kavram dışında 1 tane kavram vardır. 5 puan.<br>**Kavram Ağı Oluşturmada Gruplardan Önemli Olanlara Vurgu:** Önem vurgusu vardır. 5 puan.<br><br>**Puan:** 25 puan.<br><br>**Dönüt Açıklaması:**<br>1. Mutlaka kullanılması gerekilen kavramlar 'Fiziksel iş, kuvvet, doğrultu, hareket, iş, yol, joule, Newton, metre, elektrik enerjisi, ışık enerjisi, nükleer enerji, potansiyel enerji, kinetik enerji, mekanik enerji, rüzgâr enerjisi, enerji dönüşümleri, enerji, kinetik enerji, sürat, kütle, kuvvet, potansiyel enerji, çekim potansiyel enerjisi, yer çekimi, yükseklik, ağırlık, kütle, esneklik potansiyel enerjisi, kuvvet, esnek cisim, enerji, gerilme, sıkışma, kalınlık'.<br>2. Mutlaka kullanılması gereken 4 grup olmalıdır. Bunlar ' Fiziksel iş, Kinetik Enerji, Çekim Potansiyel Enerjisi, Esneklik Potansiyel Enerjisi'.<br>3. Kullanılan kavramlar gruplara uygun olmalıdır.<br>4. Birinci öneride verilen kavramlar haricinde kavram kullanılmamalıdır. Cisim enerjisi anahtar kavram değildir.<br>5. Oluşturulan gruplar ana kavrama yakınlık uzaklık bakımından önem derecesine göre oluşturulmalıdır. |

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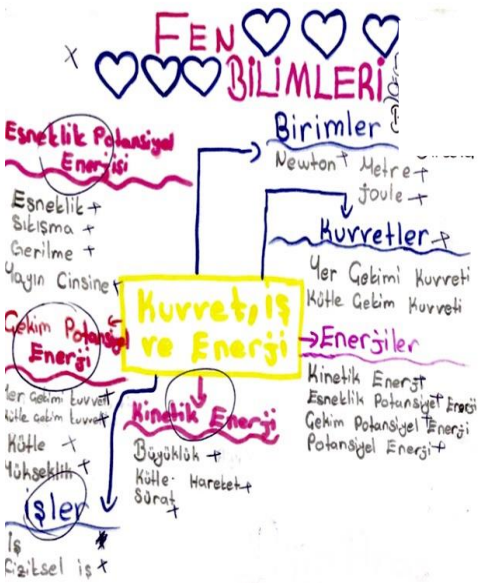
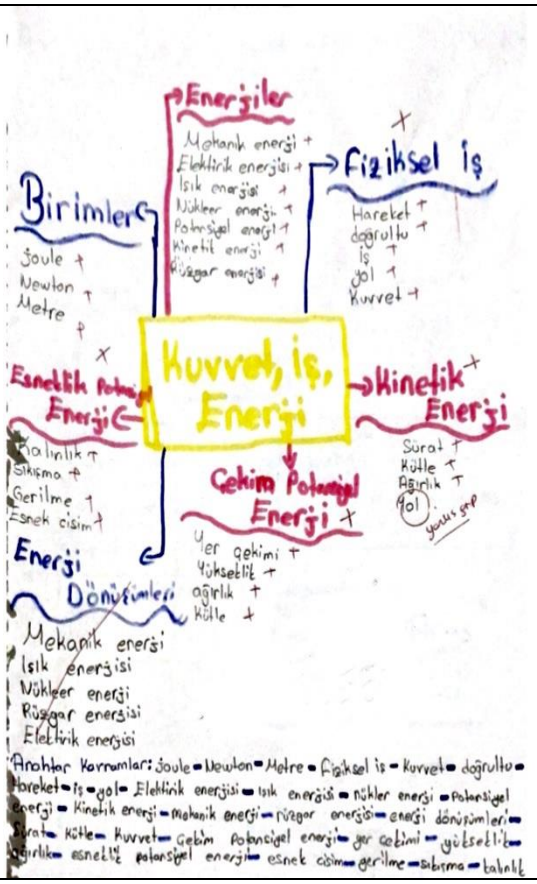
|  |  |
| **Anahtar Kavramlar:** 35 kavram kullanılmalıdır. Öğrenci 20 tane kullanmıştır. 3 Puan<br>**Anahtar Gruplar:** 4 grup oluşturulmalıdır. Öğrenci hepsini oluşturmuştur. 5 puan.<br>**İçerdiği Kavramlara Göre Grupların Uygunluğu:** Kullanılan kavramlar gruplara uygundur. 5 puan.<br>**Anahtar Kavram Dışındaki Kavramlar:** Anahtar kavram dışında kavram yoktur. 5 puan.<br>**Kavram Ağı Oluşturmada Gruplardan Önemli Olanlara Vurgu:** Önem vurgusu vardır. 5 puan.<br><br>**Puan:** 23 puan.<br><br>**Dönüt Açıklaması:**<br>1. Mutlaka kullanılması gerekilen kavramlar 'Fiziksel iş, kuvvet, doğrultu, hareket, iş, yol, joule, Newton, metre, elektrik enerjisi, ışık enerjisi, nükleer enerji, potansiyel enerji, kinetik enerji, mekanik enerji, rüzgâr enerjisi, enerji dönüşümleri, enerji, kinetik enerji, sürat, kütle, kuvvet, potansiyel enerji, çekim potansiyel enerjisi, yer çekimi, yükseklik, ağırlık, kütle, esneklik potansiyel enerjisi, kuvvet, esnek cisim, enerji, gerilme, sıkışma, kalınlık'.<br>2. Mutlaka kullanılması gereken 4 grup olmalıdır. Bunlar ' Fiziksel iş, Kinetik Enerji, Çekim Potansiyel Enerjisi, Esneklik Potansiyel Enerjisi'.<br>3. Kullanılan kavramlar gruplara uygun olmalıdır.<br>4. Birinci öneride verilen kavramlar haricinde kavram kullanılmamalıdır.<br>5. Oluşturulan gruplar ana kavrama yakınlık uzaklık bakımından önem derecesine göre oluşturulmalıdır. | **Anahtar Kavramlar:** 35 kavram kullanılmalıdır. Öğrenci 30 tane kullanmıştır. 5 Puan<br>**Anahtar Gruplar:** 4 grup oluşturulmalıdır. Öğrenci hepsini oluşturmuştur. 5 puan.<br>**İçerdiği Kavramlara Göre Grupların Uygunluğu:** Kullanılan kavramlardan 1 tanesi gruba uygun değildir. 5 puan.<br>**Anahtar Kavram Dışındaki Kavramlar:** Anahtar kavram dışında kavram yoktur. 5 puan.<br>**Kavram Ağı Oluşturmada Gruplardan Önemli Olanlara Vurgu:** Önem vurgusu vardır. 5 puan.<br><br>**Puan:** 25 puan.<br><br>**Dönüt Açıklaması:**<br>1. Mutlaka kullanılması gerekilen kavramlar 'Fiziksel iş, kuvvet, doğrultu, hareket, iş, yol, joule, Newton, metre, elektrik enerjisi, ışık enerjisi, nükleer enerji, potansiyel enerji, kinetik enerji, mekanik enerji, rüzgâr enerjisi, enerji dönüşümleri, enerji, kinetik enerji, sürat, kütle, kuvvet, potansiyel enerji, çekim potansiyel enerjisi, yer çekimi, yükseklik, ağırlık, kütle, esneklik potansiyel enerjisi, kuvvet, esnek cisim, enerji, gerilme, sıkışma, kalınlık'.<br>2. Mutlaka kullanılması gereken 4 grup olmalıdır. Bunlar ' Fiziksel iş, Kinetik Enerji, Çekim Potansiyel Enerjisi, Esneklik Potansiyel Enerjisi'.<br>3. Kullanılan kavramlar gruplara uygun olmalıdır. Yol kavramı gruba uygun değildir.<br>4. Birinci öneride verilen kavramlar haricinde kavram kullanılmamalıdır.<br>5. Oluşturulan gruplar ana kavrama yakınlık uzaklık bakımından önem derecesine göre oluşturulmalıdır. |

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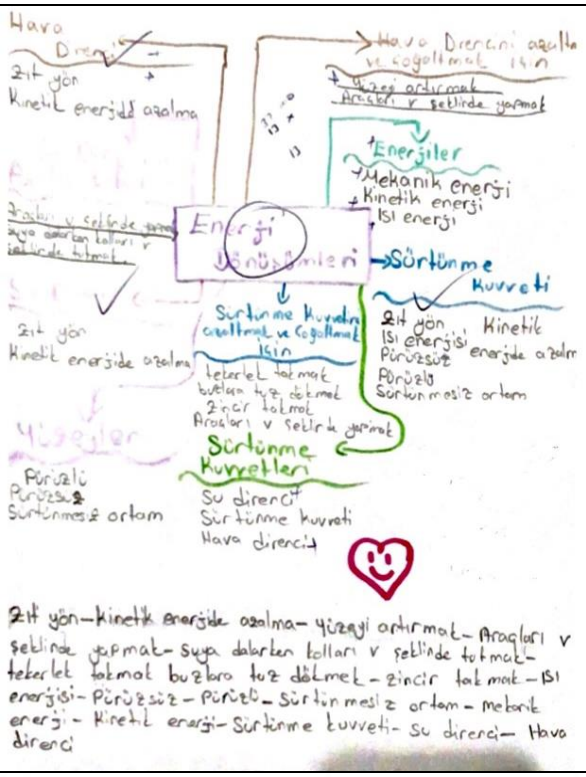
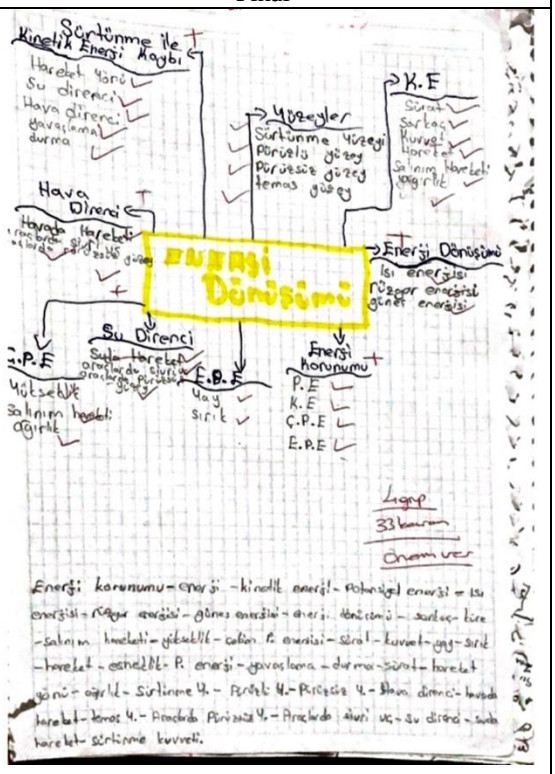
|  |  |
| **Anahtar Kavramlar:** 37 kavram kullanılmalıdır. Öğrenci 13 tane kullanmıştır. 2 puan.<br>**Anahtar Gruplar:** 4 grup oluşturulmalıdır. Öğrenci 3 tane oluşturmuştur. 4 puan.<br>**İçerdiği Kavramlara Göre Grupların Uygunluğu:** Kullanılan kavramlar gruplara uygundur. 5 puan.<br>**Anahtar Kavram Dışındaki Kavramlar:** Anahtar kavram dışında kavram yoktur. 5 puan.<br>**Kavram Ağı Oluşturmada Gruplardan Önemli Olanlara Vurgu:** Önem vurgusu vardır. 5 puan.<br><br>**Puan:** 21 puan.<br><br>**Dönüt Açıklaması:**<br>1.Mutlaka kullanılması gerekilen kavramlar 'Enerji korunumu, enerji, kinetik enerji, potansiyel enerji, ısı enerjisi, rüzgâr enerjisi, güneş enerjisi, enerji dönüşümü, sarkaç, küre, salınım hareketi, yükseklik, çekim potansiyel enerjisi, sürat, kuvvet, yükseklik, yay, sırık, hareket, esneklik potansiyel enerji, yavaşlama, durma, sürat, hareket yönü, ağırlık, sürtünme yüzeyi, pürüzlü yüzey, pürüzsüz yüzey, hava direnci, havada hareketi, temas yüzeyi, hareket yönü, araçlarda pürüzsüz yüzey, araçlarda sivri uç, su direnci, suda hareket, sürtünme kuvveti'.<br>2. Mutlaka kullanılması gereken 4 grup olmalıdır. Bunlar 'Enerji Korunumu, Enerji Dönüşümü, Sürtünme ile Kinetik Enerji Kaybı, Hava ve Su Direnci'.<br>3. Kullanılan kavramlar gruplara uygun olmalıdır.<br>4. Birinci öneride verilen kavramlar haricinde kavram kullanılmamalıdır.<br>5. Oluşturulan gruplar ana kavrama yakınlık uzaklık bakımından önem derecesine göre oluşturulmalıdır. | **Anahtar Kavramlar:** 37 kavram kullanılmalıdır. Öğrenci 33 tane kullanmıştır. 5 puan.<br>**Anahtar Gruplar:** 4 grup oluşturulmalıdır. Öğrenci 4 tane oluşturmuştur. 5 puan.<br>**İçerdiği Kavramlara Göre Grupların Uygunluğu:** Kullanılan kavramlar gruba uygundur. 5 puan.<br>**Anahtar Kavram Dışındaki Kavramlar:** Anahtar kavram dışında kavram yoktur. 5 puan.<br>**Kavram Ağı Oluşturmada Gruplardan Önemli Olanlara Vurgu:** Önem vurgusu vardır. 5 puan.<br><br>**Puan:** 25 puan.<br><br>**Dönüt Açıklaması:**<br>1.Mutlaka kullanılması gerekilen kavramlar 'Enerji korunumu, enerji, kinetik enerji, potansiyel enerji, ısı enerjisi, rüzgâr enerjisi, güneş enerjisi, enerji dönüşümü, sarkaç, küre, salınım hareketi, yükseklik, çekim potansiyel enerjisi, sürat, kuvvet, yükseklik, yay, sırık, hareket, esneklik potansiyel enerji, yavaşlama, durma, sürat, hareket yönü, ağırlık, sürtünme yüzeyi, pürüzlü yüzey, pürüzsüz yüzey, hava direnci, havada hareketi, temas yüzeyi, hareket yönü, araçlarda pürüzsüz yüzey, araçlarda sivri uç, su direnci, suda hareket, sürtünme kuvveti'.<br>2. Mutlaka kullanılması gereken 4 grup olmalıdır. Bunlar 'Enerji Korunumu, Enerji Dönüşümü, Sürtünme ile Kinetik Enerji Kaybı, Hava ve Su Direnci'.<br>3. Kullanılan kavramlar gruplara uygun olmalıdır.<br>4. Birinci öneride verilen kavramlar haricinde kavram kullanılmamalıdır.<br>5. Oluşturulan gruplar ana kavrama yakınlık uzaklık bakımından önem derecesine göre oluşturulmalıdır. |

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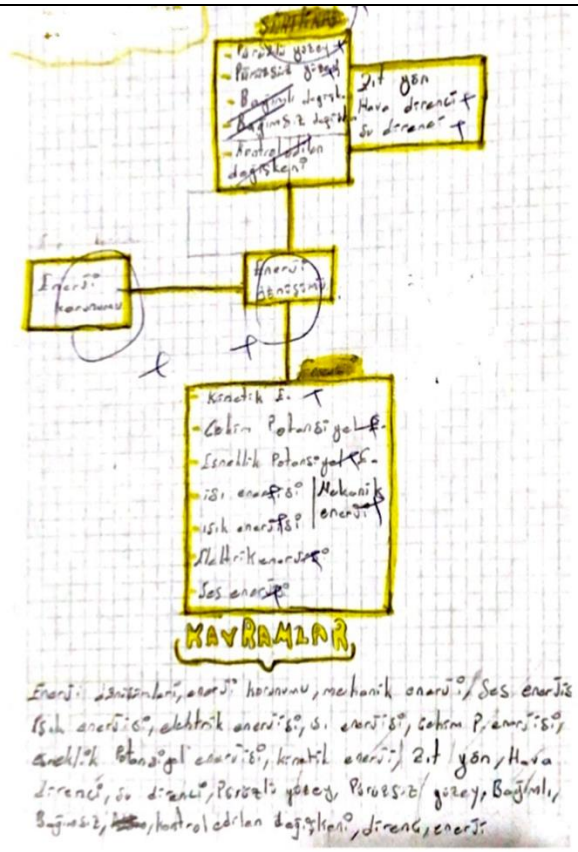
|  |  |
| **Anahtar Kavramlar:** 37 kavram kullanılmalıdır. Öğrenci 15 tane kullanmıştır. 2 puan.<br>**Anahtar Gruplar:** 4 grup oluşturulmalıdır. Öğrenci 3 tane oluşturmuştur. 4 puan.<br>**İçerdiği Kavramlara Göre Grupların Uygunluğu:** Kullanılan kavramlardan 3 tanesi gruba uygun değildir. 2 puan.<br>**Anahtar Kavram Dışındaki Kavramlar:** Anahtar kavram dışında 3 tane kavram vardır. 2 puan.<br>**Kavram Ağı Oluşturmada Gruplardan Önemli Olanlara Vurgu:** Önem vurgusu yetersizdir ama vardır. 3 puan.<br><br>**Puan:** 13 puan.<br><br>**Dönüt Açıklaması:**<br>1.Mutlaka kullanılması gerekilen kavramlar 'Enerji korunumu, enerji, kinetik enerji, potansiyel enerji, ısı enerjisi, rüzgâr enerjisi, güneş enerjisi, enerji dönüşümü, sarkaç, küre, salınım hareketi, yükseklik, çekim potansiyel enerjisi, sürat, kuvvet, yükseklik, yay, sırık, hareket, esneklik potansiyel enerji, yavaşlama, durma, sürat, hareket yönü, ağırlık, sürtünme yüzeyi, pürüzlü yüzey, pürüzsüz yüzey, hava direnci, havada hareketi, temas yüzeyi, hareket yönü, araçlarda pürüzsüz yüzey, araçlarda sivri uç, su direnci, suda hareket, sürtünme kuvveti'.<br>2. Mutlaka kullanılması gereken 4 grup olmalıdır. Bunlar 'Enerji Korunumu, Enerji Dönüşümü, Sürtünme ile Kinetik Enerji Kaybı, Hava ve Su Direnci'.<br>3. Kullanılan kavramlar gruplara uygun olmalıdır. Bağımlı, bağımsız, kontrol edilen değişken kavramları gruba uyun değildir.<br>4. Birinci öneride verilen kavramlar haricinde kavram kullanılmamalıdır. Bağımlı, bağımsız, kontrol edilen değişken kavramları anahtar kavram dışındadır.<br>5. Oluşturulan gruplar ana kavrama yakınlık uzaklık bakımından önem derecesine göre oluşturulmalıdır. | **Anahtar Kavramlar:** 37 kavram kullanılmalıdır. Öğrenci 31 tane kullanmıştır. 5 puan.<br>**Anahtar Gruplar:** 4 grup oluşturulmalıdır. Öğrenci 4 tane oluşturmuştur. 5 puan.<br>**İçerdiği Kavramlara Göre Grupların Uygunluğu:** Kullanılan kavramlardan 4 tanesi gruba uygun değildir. 5 puan.<br>**Anahtar Kavram Dışındaki Kavramlar:** Anahtar kavram dışında kavram yoktur. 5 puan.<br>**Kavram Ağı Oluşturmada Gruplardan Önemli Olanlara Vurgu:** Önem vurgusu vardır. 5 puan.<br><br>**Puan:** 25 puan.<br><br>**Dönüt Açıklaması:**<br>1.Mutlaka kullanılması gerekilen kavramlar 'Enerji korunumu, enerji, kinetik enerji, potansiyel enerji, ısı enerjisi, rüzgâr enerjisi, güneş enerjisi, enerji dönüşümü, sarkaç, küre, salınım hareketi, yükseklik, çekim potansiyel enerjisi, sürat, kuvvet, yükseklik, yay, sırık, hareket, esneklik potansiyel enerji, yavaşlama, durma, sürat, hareket yönü, ağırlık, sürtünme yüzeyi, pürüzlü yüzey, pürüzsüz yüzey, hava direnci, havada hareketi, temas yüzeyi, hareket yönü, araçlarda pürüzsüz yüzey, araçlarda sivri uç, su direnci, suda hareket, sürtünme kuvveti'.<br>2. Mutlaka kullanılması gereken 4 grup olmalıdır. Bunlar 'Enerji Korunumu, Enerji Dönüşümü, Sürtünme ile Kinetik Enerji Kaybı, Hava ve Su Direnci'.<br>3. Kullanılan kavramlar gruplara uygun olmalıdır. Sarkaç, küre, yay, sırık kavramları gruba uygun değildir.<br>4. Birinci öneride verilen kavramlar haricinde kavram kullanılmamalıdır.<br>5. Oluşturulan gruplar ana kavrama yakınlık uzaklık bakımından önem derecesine göre oluşturulmalıdır. |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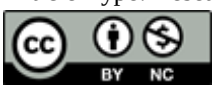

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# Development of an Achievement Test for the "Seasons and Climate" Unit of the Eighth Grade Science Course in Secondary School

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## Abstract

This study aims to develop a valid and reliable achievement test to measure the achievement of eighth-grade students in the "Seasons and Climate" unit of the science course. The research was carried out using a survey model. The study group consists of 298 eighth-grade students studying in various cities in Turkey in the 2020–2021 academic year. The content validity of the prepared questions was examined with a table of specifications. An achievement test of 25 questions was obtained by making item analyses with the data obtained from the pre-pilot study. After the pilot study of this test, the reliability analysis of the test was made, and the KR-20 internal consistency coefficient was 0.88; the KR-21 internal consistency coefficient was determined to be 0.86. In addition, while the mean item difficulty index of the test was 0.61, the mean discrimination index was calculated as 0.50. As a result, a valid and reliable achievement test was obtained for the metacognitive learning outcomes of the "Seasons and Climate" unit in the eighth grade 2018 science curriculum. In addition, since the science curriculum of the Ministry of National Education is updated from time to time according to international developments, it is possible to say that the achievement test developed is for international readers. In the way followed in this study, researchers can develop multiple-choice achievement tests that measure metacognitive learning outcomes for different subjects.
**Keywords:** Achievement test; Science education; Seasons and climate; Test development

## Introduction

In education, the measurement process is carried out through exams to evaluate the knowledge of students in various courses and subjects. For this purpose, many alternative or traditional assessment and evaluation tools can be used. While alternative assessment and evaluation tools are applied to students during the teaching process, traditional assessment and evaluation tools are applied at the end of the teaching process and are mostly preferred for measuring cognitive domain learning. In this study, it was aimed at developing a measurement tool for cognitive domain learning outcomes. For this reason, it is thought that the measurement tool to be developed is more suitable for the measurement tools in the traditional approach.

Traditional cognitive domain assessment and evaluation tools can be handled under three headings: written, oral, and objective exams (Başol, 2019). Each of these exam types has strengths and weaknesses. Particularly, the subjectivity in the scoring of the written and oral exams is an important negative feature in terms of scoring reliability. For this reason, written and oral exams are not preferred in exams where large groups of students will be placed in a higher education institution to measure their cognitive domain success. On the other hand, since objective exams are read with an optical reader or perforated answer key, they are highly reliable (Başol, 2019). Therefore, it is thought that it would be more appropriate to design the measurement tool, which is aimed at being developed within the scope of this study, as an objective test. Questions used in objective exams are true-false, fill-in-the-blank (complementary), matched, and multiple-choice test items. The most commonly used of these questions are multiple-choice tests (Demir et al., 2016; Ogan Bekiroğlu, 2004).The fact that the chance factor is high in finding answers to true-false, matched questions, and the fact that questions with fill-in-the-blank measure only knowledge-level behaviors affect the validity negatively. For this reason, multiple-choice test questions are used in many national and international objective exams in which students' cognitive achievement is measured (Akbulut & Çepni, 2013; Pressley et al., 1997). Considering all these features related to the questions used in objective exams, it is thought that it would be appropriate to use multiple-choice

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questions in the measurement tool that will be developed to measure the cognitive achievement status of students within the scope of this study.

Studies in the related literature show that multiple-choice tests are one of the most frequently used measurement tools after interviews in revealing thoughts about understanding a certain subject or concept (Kempa, 1986; Ogan Bekiroğlu, 2004). In this respect, according to Özçelik (1998), the measurement tool with the most superior measurement features is the multiple-choice test. On the other hand, in some studies in the literature, it is stated that while multiple-choice tests are more suitable for measuring the learning outcomes of the lower stages of the cognitive domain, such as remembering, understanding, and application, they are insufficient for measuring life skills such as creativity and self-expression (Başol, 2019; Küçükahmet, 2002). Considering that the majority of the competencies and learning outcomes in the science course secondary school curriculum of the Ministry of National Education [MoNE] (2018) are high-level, measuring these learning outcomes with multiple-choice tests may constitute an important limitation in terms of validity. Therefore, while designing an objective exam in which high-level learning outcomes consisting of multiple-choice questions will be measured, preparing the questions according to Bloom's metacognitive steps (analysis, synthesis, and evaluation) may be effective in minimizing this limitation (Küçükahmet, 2002). In addition, the questions in the multiple-choice tests are suitable for the purpose, scope, and learning outcomes of the course, and classifying them according to the Bloom taxonomy also increases the quality of the measurement tool in terms of reliability and validity (Kızkapan ve Bektaş, 2018). Therefore, in this study aiming to design a measurement tool with high validity and reliability by using multiple-choice questions, questions were classified according to Bloom's Taxonomy, and mostly questions measuring metacognitive skills were included in the test.

In the related literature, there are many achievement tests prepared for the Science course (Boz et. al., 2022; Çirkinoğlu Şekercioğlu & Yılmaz Akkuş, 2019; Dağ & Karamustafaoğlu, 2023; Doğru & Çepni, 2023; Karamustafaoğlu & Tutar, 2016; Sontay & Karamustafaoğlu, 2020; Türk, 2015; Varzikioğlu, 2023). Achievement tests in some of these studies are about astronomy (Çirkinoğlu Şekercioğlu & Yılmaz Akkuş, 2019; Karamustafaoğlu & Tutar, 2016; Sontay & Karamustafaoğlu, 2020; Türk, 2015; Varzikioğlu, 2023). Astronomy subjects are included in the "Earth and Universe" learning area at all grade levels in the MoNE 2018 secondary school science curriculum. When the studies in the related literature are examined, most of the achievement tests developed for astronomy topics in the "Earth and Universe" learning area are at the fifth, sixth, and seventh grade levels (Çirkinoğlu Şekercioğlu & Yılmaz Akkuş, 2019; Karamustafaoğlu & Tutar, 2016; Sontay & Karamustafaoğlu, 2020; Türk, 2015; Varzikioglu, 2023). When the MoNE (2018) science curriculum is examined, the "Seasons and Climate" unit is included within the scope of the "Earth and Universe" learning area at the eighth grade level. This unit is focused on the topics "Formation of Seasons" and "Climate and Air Movements." Within the scope of "The Formation of the Seasons," it is intended that the students discover the causes of the seasons by estimating. The main factors in the formation of seasons are the annual motion of the Earth and its axis tilt. As a result of the tilt of the Earth's axis, the change in the angle of incidence of the Sun's rays on the Earth throughout the year causes seasons to occur. However, the change in the angle of incidence of the Sun's rays on the Earth throughout the year basically causes the formation of seasons and also causes many other situations, such as day and night periods, changes in the length of the shadow, periastron, apastron, and equinox. Therefore, all these situations mentioned within the scope of the "Formation of Seasons" topic are touched upon. Another topic included in the "Seasons and Climate" unit is "Climate and Air Movements." Climate and weather movements (events) are two related concepts. Due to the similarities between the two concepts, they are often confused by students or considered synonymous. For this reason, the similarities and differences between these two concepts are emphasized in the subject of "Climate and Air Movements." Climate can be defined as the average air movement over large areas over many years. Weather events occur as a result of changes in factors such as temperature, humidity, and pressure. Wind, rain, snow, etc. are weather events. The meanings of the sciences of climatology and meteorology are given by making comparisons in terms of similarities and differences in the subject of "climate and weather movements." In this way, branches of science that deal with two different concepts, such as climate and weather movements, can be learned. In addition, environmental events such as climate change, global warming, and the greenhouse effect are also addressed within the scope of this subject. When the relevant literature is examined, it is seen that measurement tools for different grade levels are mostly developed by considering these subjects separately (Akşit & Şahin, 2011; Bolat & Altınbaş, 2018; Uzunöz & Buldan, 2012). When the studies on the formation of the seasons are examined, it is seen that mostly open-ended or closed-ended questions are asked in the developed tests (Bolat & Altınbaş, 2018; Gülen, 2019; Türk & Kalkan, 2015; Türk et al., 2016). In some of these studies and some studies on general astronomy, multiple-choice questions about the formation of the seasons were also used by turning them into open-ended questions (Gülen, 2019; Schoon, 1992). In the study conducted by Bolat and Altınbaş (2018), using the parallel mixed method, it was tried to determine the understanding of the prospective teachers studying in different departments about the subject of seasons. In the

study conducted by Gülen (2019), the achievements of the eighth grade students in the "Seasons and Climate" unit were determined with six open-ended questions, and the student learning outcomes were interpreted. In these studies, it has been observed that there are many misconceptions among the students about the formation of the seasons. In this respect, it can be said that most of the studies on the formation of seasons using open-ended questions are aimed at identifying misconceptions (Bolat & Altınbaş, 2018; Gülen, 2019; Öksüz & Güven Demir, 2019; Schoon, 1992; Sneider et al., 2011; Yilmaz & Bulunuz, 2019). Therefore, in the related literature, there are a limited number of studies in which achievement tests consisting of multiple-choice questions on the subjects of "Seasons Formation" and "Climate and Weather Movements" within the scope of the eighth grade "Seasons and Climate" unit in the science curriculum of MoNE (2018) are available (Birgin & Özcan, 2022; Geren, 2022; Yanardağ, 2021). In the study conducted by Birgin and Özcan (2022), a multiple-choice achievement test was tried to be developed to measure the knowledge of eighth grade students about the formation of the seasons. However, in the achievement test developed by Birgin and Özcan (2022), there are no questions on the subject of "Climate and Weather Movements" within the scope of the "Seasons and Climate" unit. On the other hand, in the studies conducted by Geren (2022) and Yanardağ (2021), two different multiple-choice achievement tests were developed, including all the topics of the "Seasons and Climate" unit. However, in the achievement tests of Geren (2022) and Yanardağ (2021), there are sample questions of the High School Entrance Examination [HSEE] and learning outcome comprehension test questions, which are considered to be highly valid and reliable in various sources of MoNE. It is stated that due to the COVID-19 pandemic, while the achievement tests were developed in the studies of Geren (2022) and Yanardağ (2021), a pilot study could not be conducted and only expert opinion was taken. In addition, questions in the achievement tests developed by Geren (2022) and Yanardağ (2021) were selected without any cognitive classification. Considering all these features, it can be said that the achievement tests developed for the "Seasons and Climate" unit in the literature have limitations in terms of validity and reliability. Therefore, it is thought that the "Seasons and Climate" achievement test developed within the scope of this study will contribute to the relevant literature by eliminating these deficiencies.

### Problem Statement

The problem statement of this research, "Is the achievement test developed for the "Seasons and Climate" unit of the eighth grade science lesson valid and reliable?" has been determined.Depending on the determined problem statement, the sub-problems of the research are presented below.

*Sub-Problems of the Research*

1. Is the achievement test developed for the "Seasons and Climate" unit of the middle school eighth grade science lesson valid?
2. Is the achievement test developed for the "Seasons and Climate" unit of the middle school eighth grade science lesson reliable?

### Purpose of the Research

The purpose of this study is to develop a valid and reliable achievement test for the eighth grade "Seasons and Climate" unit within the scope of the MoNE (2018) science curriculum.

## Method

In this section, information about the research model, sample, the development process of the data collection tool, and the analysis of the data are included.

### Model of the Research

This study was carried out in accordance with the survey model since it was aimed at developing a valid and reliable achievement test for the eighth grade "Seasons and Climate" unit of secondary school. Survey studies are studies carried out by the researcher to determine the current situation without any intervention (Creswell, 2012). This method allows making predictions about the universe as a result of the analysis of the data obtained from the sample (Özmen & Karamustafaoğlu, 2019). In this study, the pilot achievement test developed by the researchers in accordance with the learning outcomes comprehension test of the "Seasons and Climate" unit was applied to a sample of eighth grade secondary school students. In this way, the validity and reliability were calculated by analyzing the data obtained for each item. As a result, the study was carried out in accordance with

the survey model, since it was aimed at obtaining a valid and reliable achievement test to measure the academic achievement of the eighth grade "Seasons and Climate" unit.

**Sample**

While developing the achievement test for the research, two pilot studies were made. The sample of the study consists of 298 secondary school eighth grade students: 223 in the pre-pilot study and 75 in the pilot study. While determining the sample, the "maximum diversity sampling" method, one of the purposive sampling methods, was used. Purposeful sampling allows for an in-depth investigation of information-rich situations in line with the purpose of the study (Büyüköztürk et al., 2015). As a result of this study, it is aimed at developing a valid and reliable "Seasons and Climate" achievement test applicable to secondary school eighth grade students. In order for the achievement test to be obtained at the end of the research to be generalizable to all eighth grade students, it is necessary to apply this test to groups that are similar but different from each other during the test development process. As a matter of fact, in maximum diversity sampling, it is essential to work by determining different situations similar to the problems examined in the universe (Büyüköztürk et al., 2015). As a result, the purpose of choosing the sample in this way is to reflect the sample diversity at the highest level for the achievement test to be applied (Yıldırım & Şimşek, 2016). For this reason, it was thought that it would be appropriate to determine the study group with maximum variation sampling, one of the purposive sampling methods. The distribution of the students in the sample according to the provinces of education is presented in Table 1.

Table 1. Distribution of the students in the sample according to the provinces of education

| Province | Number of Students (N) | Percentage (%) |
|---|---|---|
| Kocaeli | 179 | 60.07 |
| Balıkesir | 21 | 7.05 |
| Bursa | 13 | 4.36 |
| İstanbul | 12 | 4.03 |
| Hatay | 6 | 2.01 |
| Muğla | 6 | 2.01 |
| Denizli | 5 | 1.68 |
| Kahramanmaraş | 4 | 1.34 |
| Mersin | 4 | 1.34 |
| Ankara | 4 | 1.34 |
| Yalova | 3 | 1.01 |
| Gaziantep | 3 | 1.01 |
| Tokat | 3 | 1.01 |
| Bartın | 3 | 1.01 |
| Antalya | 3 | 1.01 |
| Aksaray | 2 | 0.67 |
| Niğde | 2 | 0.67 |
| Zonguldak | 2 | 0.67 |
| Siirt | 2 | 0.67 |
| Konya | 2 | 0.67 |
| İzmir | 2 | 0.67 |
| Samsun | 2 | 0.67 |
| Nevşehir | 2 | 0.67 |
| Şanlıurfa | 1 | 0.34 |
| Adana | 1 | 0.34 |
| Çorum | 1 | 0.34 |
| Düzce | 1 | 0.34 |
| Sakarya | 1 | 0.34 |
| Afyon | 1 | 0.34 |
| Kırşehir | 1 | 0.34 |
| Kırıkkale | 1 | 0.34 |
| Sivas | 1 | 0.34 |
| Bitlis | 1 | 0.34 |
| Rize | 1 | 0.34 |
| Ordu | 1 | 0.34 |
| Kayseri | 1 | 0.34 |
| Total | 298 | 100 |

**Developing the Seasons and Climate Achievement Test**

The "Seasons and Climate" academic achievement test was developed by considering Güler's (2021) test development steps. Therefore, the development stages of the "Seasons and Climate" academic achievement test are summarized as follows:

*Determining the Purpose of the Test*

While preparing the test, it was aimed to take into account the learning outcomes of the "Seasons and Climate" unit in the eighth grade "Earth and Universe" subject area in the MoNE (2018) Science Curriculum, to take into account the level of the students, and to benefit the teachers.

*Determining the Scope of the Test*

The scope of the test was determined according to the information on the eighth grade "Seasons and Climate" unit in the Science Curriculum of the MoNE (2018). General information on the "Seasons and Climate" unit is given in Table 2.

Table 2. General information on seasons and climate units

| Unit Name | Subject Area Name | Numbers of Learning Outcomes | Course Hours | Percentage of Learning Outcomes (%) |
|---|---|---|---|---|
| Seasons and Climate | Earth and the Universe | 3 | 14 | 9.7 |

When the information in Table 2 is examined, there are three learning outcomes belonging to the Seasons and Climate unit within the scope of the Earth and Universe subject area. The recommended time for teaching these learning outcomes is 14 course hours.
The subjects, concepts, suggested duration, learning outcomes, and warnings of the Seasons and Climate Unit are given in Table 3.

Table 3. Subjects, concepts, suggested duration, learning outcomes, and warnings of the seasons and climate unit

| Subjects | Concepts | Suggested Duration | Learning Outcomes | Warnings |
|---|---|---|---|---|
| F.8.1.1. Formation of the Seasons | -Earth's axis of rotation<br>-Orbital plane<br>-Heat Energy<br>-Seasons | Eight lesson hours | F.8.1.1.1. It makes predictions about the formation of the seasons. | a. It is mentioned that the Earth is the axis of rotation.<br>b. The relationship between the Earth's axis of rotation and the plane of its orbit around the Sun is mentioned.<br>c. The effect of the amount of energy falling on a unit surface of light on the seasons is mentioned. |
| F.8.1.2. Climate and Weather Movements | -Climate<br>-Climatology<br>-Climatologist<br>-Global climate change | Six lesson hours | F.8.1.2.1. Explain the difference between climate and weather events.<br>F.8.1.2.2. It says that climate science (climatology) is a branch of science, and experts working in this field are called climate scientists (climatologists). | |

At this stage, where the scope of the test is determined, the type, number, and application time of the questions are decided. The questions in the test were prepared with four options in accordance with the multiple-choice

question type. While preparing the questions, the learning outcomes in the 2018 Science Curriculum (MoNE, 2018) and the warnings about the learning outcomes in Table 3 were taken into account. In addition, the contents of the eighth grade textbook (Yancı; 2019), Education and Informatics Network [EIN], were examined. By examining the national and international studies (Bolat & Altınbaş, 2018; Sneider et al., 2011) in the related literature, it was tried to determine the concepts and learning outcomes that students had difficulty learning within the scope of the Seasons and Climate unit. In the study conducted by Sneider et al. (2011), they draw attention to the importance of asking questions about the results along with the reasons for the formation of the seasons in determining the knowledge level of the students about the seasons. Therefore, in this study, which aims to develop a valid and reliable achievement test for the "Seasons and Climate" unit, care was taken to include questions about the causes and consequences of the formation of the seasons. An item pool consisting of 75 questions with four options for these learning outcomes and concepts was created by making use of various national exam preparation books in EIN. However, this study was carried out in the 2020–2021 academic year, when distance education was available due to the COVID-19 pandemic. Therefore, the pre-pilot study of the achievement test was decided to be carried out by the researchers online via the Google Form. Considering situations such as the pre-pilot study being conducted online and the questions being aimed at metacognitive learning outcomes, it was seen that 75 questions were not appropriate according to the grade level and attention span of the students. For this reason, 49 questions were determined from the 75-item pool by the researchers before the pilot study.

*Validity of the Test*

A table of specifications has been prepared for the content validity of the achievement test (see Table 11). The learning outcomes in the MoNE (2018) curriculum for the eighth grade "Seasons and Climate" unit are metacognitive domain learning outcomes. In addition, these learning outcomes have general expressions. Therefore, in order to make the learning outcomes of the questions more specific, the sub-learning outcomes for the questions were written by the researchers while preparing the specification table and classified according to Bloom's Taxonomy.

Then, 49 questions were determined by the researchers in accordance with the learning outcomes from the item pool consisting of 75 questions from all levels, but mostly by considering metacognitive domain skills. In order to ensure content validity, expert opinion was obtained in two stages for the classification made according to Bloom's taxonomy and face validity. In both stages, opinions were received from a total of four experts, two science teachers, and two faculty members in the science education department. The first expert opinion is for 49 questions determined by the researchers out of 75 questions. As a result of the suggestions and corrections from the expert opinions, a preliminary achievement test of 49 questions was created for the pre-pilot study. After the pre-pilot study, item analyses were carried out. As a result of the analysis, it was seen that some items should be removed from the test or improved. In addition, the number of items was reduced to 25 as a result of the item analysis carried out by the researchers, since 49 questions were too many to apply in a class hour. While reducing the number of items in the test, the researchers paid special attention not to affect the distribution of the items according to Bloom's taxonomy in terms of content validity. Therefore, a second expert opinion was needed. The second expert opinion was taken for the final version of the academic achievement test, consisting of 25 questions. Some formal and verbal corrections were made in the 11th, 15th, 18th, 26th, 45th, and 46th items in order to better understand the questions with the suggestions from these expert opinions. Thus, the academic achievement test for the eighth grade "Seasons and Climate" unit, consisting of 25 questions in total, was made ready.

*Pre-Pilot Study*

This academic achievement test development study was carried out in the 2020–2021 academic year, when distance education was held due to the COVID-19 pandemic. For this reason, a pre-pilot was conducted online with 223 eighth grade students to determine whether the questions in the achievement test were understandable by the students before the pilot study and whether the time to answer the questions was sufficient during the application of the test. Students have the right to take this online exam, which consists of 49 questions, and the exam duration is determined to be 120 minutes. As a result of the pre-pilot study, item analyses were made, and 1st, 2nd, 3rd, 4th, 7th, 9th, 13th, 14th, 17th, 19th, 20th, 21th, 23th, 24th, 30th, 32th, 33th, 35th, 37th, 38th, 40th, 41th, 47th, and 49th items were excluded from the test. After these test items were removed from the test, the second expert opinion was taken. According to expert opinions, the "Seasons and Climate" achievement test with 25 questions was made ready for pilot study by making formal and verbal adjustments in the 11th, 15th, 18th, 26th, 45th, and 46th items.

*Pilot Study*

The "Seasons and Climate" achievement test, consisting of 25 multiple-choice questions, was applied to 78 eighth grade students in the 2022–2023 academic year. The duration of the exam is determined as one lesson hour. As a result of the analysis, the tests of three students were not analyzed due to incorrect or incomplete marking. As a result, the test answers of 75 students were included in the analysis.

*Reliability and Item Analysis*

The "Seasons and Climate" achievement test consists of multiple-choice test questions. While analyzing the data obtained from the developed achievement test, one point was given for correct answers and zero points for wrong answers or blanks. While the "Seasons and Climate" achievement test was being developed, two applications were made as a preliminary pilot study and a pilot study, so item and reliability analysis were performed twice in order to compare the first and final versions of the test. KR-20 and KR-21 internal consistency coefficients were calculated in the reliability analysis of the questions in the developed achievement test. In this study, "item discrimination index" and "item difficulty index" were calculated for each item in the test by using two different methods in Classical Test Theory for item analysis. It is a measure of being able to distinguish those who know the feature that is wanted to be measured with a test item from those who do not (Güler, 2021). The rate of correct answers to each item in a test is defined as the "item difficulty index" (Hasançebi et al., 2020). While the simple method (lower-upper group method) was used in the first item analysis, the method described as the "second method" by Güler (2021) was applied in the other. While the simple method (lower-upper group method) is preferred when the number of students is 300–400 or more, the second method can be preferred when 60–70 or less (Güler, 2021). In the simple method (lower-upper group method), the scores of the students in the achievement test are ordered from the highest score to the lowest score. 27% of the people with the highest scores are defined as the "upper group," while 27% of the people with the lowest scores are determined as the "lower group" (Beuchert & Mendoza, 1979). Item analyses are made by considering these groups. The item difficulty index is indicated by $Pj$ and when the simple method is used, the item difficulty index is calculated with the formula in the Table 4.

Table 4. Item difficulty index formula

| Formula | Variables in the formula |
|---|---|
| $Pj = \left(\frac{n(cu) + n(cl)}{N}\right)$ | $Pj$: Difficulty index of the item<br>$n(cu)$: The number of those who answered the item correctly in the upper group<br>$n(cl)$: The number of those who answered the item correctly in the lower group<br>$N$: Total number of students in the upper group and lower group |

The item discrimination index is shown, and in the simple method, the item discrimination index is calculated with the formula given in Table 5.

Table 5. Item discrimination index formula

| Formula | Variables in the formula |
|---|---|
| $r_{jx} = \left(\frac{n(cu) - n(cl)}{N}\right)$ | $r_{jx}$: Item discrimination index<br>$n(cu)$: The number of those who answered the item correctly in the upper group<br>$n(cl)$: The number of those who answered the item correctly in the lower group<br>$N$: Number of students in any of the groups |

In the second method, the scores of all students to whom the achievement test was applied are included in the calculation. When this method is used, the formula in Table 6 is applied to calculate item difficulty.

Table 6. Item difficulty index formula

| Formula | Variables in the formula |
|---|---|
| $Pj = \left(\frac{n(c)}{N}\right)$ | $Pj$: Difficulty index of the item<br>$n(c)$: Number of people who answered the item correctly<br>$N$: Total number of students |

When the second method is used, the item discrimination index should be calculated using the formula presented in Table 7.

Table 7. Item discrimination index formula

| Formula | Variables in the formula |
|---|---|
| $r_{jx} = \frac{(\underline{X}(d) - \underline{X})}{S_x} \times \sqrt{\frac{pj}{qj}}$ | $r_{jx}$: Item discrimination index<br>$n(cu)$: The number of those who answered the item correctly in the upper group<br>$n(cl)$: The number of those who answered the item correctly in the lower group<br>$N$: Number of students in any of the groups |

Since item discrimination is related to the reliability of the item, it is the most important statistic of an item, and whether the item will be included in the test is decided by looking at the item discrimination index (Güler, 2021). The item discrimination index of the items in the test developed in this study was evaluated according to Table 8 (Akbulut & Çepni, 2013).

Table 8. Item Discrimination Index and Evaluation

| Item Discrimination Index | Evaluation |
|---|---|
| 0.40 and higher | Very good item |
| 0,30-0,39 | Pretty good item |
| 0,20-0,29 | It must be corrected. |
| 0.19 and less | Very weak item. It should be removed from the test. |

When the relevant literature is examined, it is desired that the average discrimination index of an ideal test should be as close to +1.00 as possible (Güler, 2021).

The difficulty of the items in the "Seasons and Climate" achievement test was evaluated according to Table 9 (Akbulut & Çepni, 2013).

Table 9. Item Difficulty Index and Evaluation

| Item Difficulty Index | Evaluation |
|---|---|
| 0.29 and higher | Difficult |
| 0.30- 0.49 | Medium difficulty |
| 0.50- 0.69 | Easy |
| 0.70- 1.00 | Very easy |

In many sources in the related literature, it is stated that the average difficulty of a test is around 0.50 and that there should be questions from all levels in the test (Güler, 2021; Karamustafaoğlu & Tutar, 2016).

After calculating the item discrimination and difficulty indexes in the study, reliability was calculated. There are many formulas for calculating the reliability of a measurement tool. If the items in the measurement tool have only one correct answer, the KR-20 or KR-21 internal consistency coefficient should be preferred to calculate the reliability of the test. Therefore, KR-20 or KR-21 internal consistency coefficients are calculated in studies to develop multiple choice achievement tests (Boz et al., 2022; Yazıcı et al., 2022). For this reason, in this study in which the "Seasons and Climate" achievement test was developed, the reliability of the test was calculated by using both the KR-20 and KR-21 internal consistency coefficients, the formulas of which are given in Table 10.

Table 10. Formulas of internal consistency coefficients KR-20 and KR-21

| Formula | Variables in the formula |
|---|---|
| $KR-20 = \frac{k}{k-1}\left(1 - \frac{\sum {s_j}^2}{{S_x}^2}\right)$ | $k$: Number of items in the test<br>$\sum {s_j}^2$: Sum of item variances<br>${s_j}^2 = p_j.q_j$: Variance of an item<br>$p_j$: Item difficulty index<br>$q_j = (1 - p_j)$: Percentage of those who answered the item incorrectly<br>${S_x}^2$ : Variance of the test |
| $KR-21 = \frac{k}{k-1}\left(1 - \frac{k.\underline{X} - \underline{X}^2}{k.{S_x}^2}\right)$ | $k$: Number of items in the test<br>$\underline{X}$ : Arithmetic mean<br>${S_x}^2$ : Variance of the test |

## Results

In this section, the findings obtained through the validity and reliability study after the application of the multiple-choice achievement test prepared for the "Seasons and Climate" unit in the Earth and Universe learning area of the eighth grade Science course are included.

In order to ensure the content validity of multiple-choice achievement tests, a table of specifications should be prepared. In this study, the cognitive domain learning outcomes of the related unit in the MoNE (2018) secondary school science curriculum were examined and classified according to Bloom's taxonomy. However, since these learning outcomes are metacognitive learning outcomes and contain very general skill expressions, sub-learning outcomes were written by the researchers according to Bloom's taxonomy and associated with the questions. The table of specifications prepared in this way is presented in Table 11.

Table 11. Specification table

| Learning Outcomes | Knowledge | Understanding | Application | Analysis | Synthesis | Evaluation |
|---|---|---|---|---|---|---|
| F.8.1.1.1. It makes predictions about the formation of the seasons. | | | | | | |
| It expresses that the seasons are formed as a result of the earth's axial tilt. (Knowledge)* | 1 | - | - | - | - | - |
| It compares the days and nights to be experienced on certain dates by looking at the positions of the countries according to the tropics on the world model. (Application)* | - | - | 2,3 | - | - | - |
| It shows the position of the country on the world model based on the events and information experienced on a certain date. (Application)* | - | - | 4,5 | - | - | - |
| Explains the events that occur in different hemispheres from the equinox date to the solstice date, depending on the Earth's axial tilt.(Understanding)* | - | 6 | - | - | - | - |
| Explains the locations and dates when the sun's rays reach the earth at an oblique angle. (Understanding)* | - | 7, 40 | - | - | - | - |
| It compares the events that can be experienced in different hemispheres by looking at the angle of incidence of sunlight in the tropics on the model. (Analysis)* | - | - | - | 8, 36 | - | - |
| Establishes a relationship between the average precipitation graph and the model showing the Earth's movement around the Sun. (Analysis)* | - | - | - | 9 | - | - |
| Designs an experiment to show the effect of the change in the angles of the sun's rays falling on the earth on the formation of the seasons. (Synthesis)* | - | - | - | - | 10 | - |
| It questions the effect of the distance between them on the formation of the seasons during the movement of the Earth around the Sun. (Evaluation)* | - | - | - | - | - | 11 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Evaluates the events that may occur in the absence of the Earth's axial tilt. (Evaluation)* | - | - | - | - | - | 15 |
| Draws a graph of daylight hours in a year using tabular data on a country's solstice and equinox dates. (Synthesis)* | - | - | - | - | 34 | - |
| Interprets and compares two graphs showing the variation of the angle of incidence of sunlight according to hours. (Analysis)* | - | - | - | 35 | - | - |
| It creates a model that shows the location of the cities by using the data in the graphs showing the day and nighttime on different dates. (Synthesis)* | - | - | - | - | 37 | - |
| It establishes a relationship between the data in the shadow length change graph of an object during the day and the date and location. (Analysis)* | - | - | - | 38 | - | - |
| Evaluates the results of the experiment designed for the effect of the angle of incidence of sunlight on temperature. (Evaluation)* | - | - | - | - | - | 39 |
| It refers to the solstice and equinox dates in different hemispheres. (Knowledge)* | 41, 42 | | | | | |
| Expresses the gases that make up the structure of the atmosphere and the greenhouse effect. (Knowledge)* | 43 | | | | | |
| Question the reasons for the formation of the seasons with an experiment. (Evaluation)* | | | | | | 45 |
| It creates a model that shows the location of the regions by using the data in the graph showing the amount of energy per unit surface on the date of the solstice. (Synthesis)* | | | | | 46 | |
| Explains the effect of the change in the angle of incidence of the sun's rays on the temperature depending on the axial tilt of the earth. (Understanding)* | | 47 | | | | |
| Relates the seasonal temperature values of countries located in different hemispheres to the world model and the angles of incidence of the sun's rays. (Analysis)* | | | | 48 | | |
| F.8.1.2.1. Explain the difference between climate and weather events. | | | | | | |
| It shows how factors affecting wind formation are used in the design of some technological tools. (Application)* | - | - | 12 | - | - | - |
| Designs experiments or models to show wind formation and direction. (Synthesis)* | - | - | - | - | 13 ,1 4 | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| Interprets by comparing the data given in the precipitation-temperature graph or in the form of a table. (Analysis)* | - | - | - | 17, 18, 19, 20 | - | - |
| Evaluates the results of the experiment designed for the formation of the greenhouse effect. (Evaluation)* | - | - | - | - | - | 21 |
| Evaluates the results of the experiment designed for the formation of weather events. (Evaluation)* | - | - | - | - | - | 22 |
| Shows the factors affecting precipitation patterns, wind formation, direction, and intensity on a map, model, table, or figure. (Application)* | - | - | 23, 24, 25 | | | |
| It creates a meteorological warning map in line with the data.(Synthesis)* | - | - | - | - | 26 | - |
| Establishes example sentences describing the characteristics of climate and weather. (Understanding)* | - | 27, 32, 33 | - | - | - | - |
| Evaluates the results of the experiment designed for the factors affecting the wind intensity. (Evaluation)* | - | - | - | - | - | 28, 29 |
| Explain the effect of temperature, humidity, and pressure on the formation of weather events. (Understanding)* | - | 30 | - | - | - | - |
| Explain the difference between dew and frost formation. (Understanding)* | - | 31 | - | - | - | - |
| Explain the consequences of global climate change.(Understanding)* | - | 44,49 | - | - | - | - |
| F.8.1.2.2. It says that climate science (climatology) is a branch of science, and experts working in this field are called climate scientists (climatologists). | | | | | | |
| It refers to the experts working in the field of climate science as "climatologists." (Knowledge) | 16 | - | - | - | - | - |

* Added learning outcomes later

When Table 11 is examined, it is seen that some of the learning outcomes are found in the eighth grade "Seasons and Climate" unit in the Science course curriculum of the MoNE (2018). Other learning outcomes are the sub-learning outcomes developed by the researchers for the subjects and concepts of the "Seasons and Climate" unit, depending on these learning outcomes. Only one of these sub-learning outcomes was written by dividing the behaviors indicated by the learning outcomes in the MoNE (2018) Science Curriculum, and the others were written by the researchers by associating the unit content with the learning outcomes in the curriculum." F.8.1.2.2. It says that climate science (climatology) is a branch of science, and experts working in this field are called climate scientists." The learning outcome in the MoNE (2018) curriculum has been shortened and arranged as a sub-acquirement. This sub-learning outcome has been written as "It refers to the experts working in the field of climate science as "climatologists"." On the other hand, the sub-learning

outcomes written by the researchers considering the unit content and the learning outcomes in the curriculum are as follows:

- It expresses that the seasons are formed as a result of the earth's axial tilt.
- It compares the days and nights to be experienced on certain dates by looking at the positions of the countries according to the tropics on the world model.
- It shows the position of the country on the world model based on the events and information experienced on a certain date.
- Explains the events that occur in different hemispheres from the equinox date to the solstice date, depending on the Earth's axial tilt.
- Explains the locations and dates when the sun's rays reach the earth at an oblique angle.
- It compares the events that can be experienced in different hemispheres by looking at the angle of incidence of sunlight in the tropics on the model.
- Establishes a relationship between the average precipitation graph and the model showing the Earth's movement around the Sun.
- Designs an experiment to show the effect of the change in the angles of the sun's rays falling on the earth on the formation of the seasons.
- It questions the effect of the distance between them on the formation of the seasons during the movement of the Earth around the Sun.
- Evaluates the events that may occur in the absence of the Earth's axial tilt.
- Draws a graph of daylight hours in a year using tabular data on a country's solstice and equinox dates.
- Interprets and compares two graphs showing the variation of the angle of incidence of sunlight according to hours.
- It creates a model that shows the location of the cities by using the data in the graphs showing the day and nighttime on different dates.
- It establishes a relationship between the data in the shadow length change graph of an object during the day and the date and location.
- Evaluates the results of the experiment designed for the effect of the angle of incidence of sunlight on temperature.
- It refers to the solstice and equinox dates in different hemispheres.
- Expresses the gases that make up the structure of the atmosphere and the greenhouse.
- Questions the reasons for the formation of the seasons with an experiment.
- It creates a model that shows the location of the regions by using the data in the graph showing the amount of energy per unit surface on the date of the solstice.
- Explains the effect of the change in the angle of incidence of the sun's rays on the temperature depending on the axial tilt of the earth.
- Relates the seasonal temperature values of countries located in different hemispheres to the world model and the angles of incidence of the sun's rays.
- It shows how factors affecting wind formation are used in the design of some technological tools.
- Designs experiments or models to show wind formation and direction.
- Interprets by comparing the data given in the precipitation-temperature graph or in the form of a table.
- Evaluates the results of the experiment designed for the formation of the greenhouse effect.
- Evaluates the results of the experiment designed for the formation of weather events.
- Shows the factors affecting precipitation patterns, wind formation, direction, and intensity on a map, model, table, or figure.
- It creates a meteorological warning map in line with the data.
- Establishes example sentences describing the characteristics of climate and weather.
- Evaluates the results of the experiment designed for the factors affecting the wind intensity.
- Explain the effect of temperature, humidity, and pressure on the formation of weather events.
- Explain the difference between dew and frost formation.
- Explain the consequences of global climate change.

Considering that these sub-learning outcomes are necessary for the content validity of the subject, they were written in line with expert opinions and added to the specification table. Then, item analysis of the achievement test was made, and item difficulty and item discrimination were calculated and presented in Table 12.

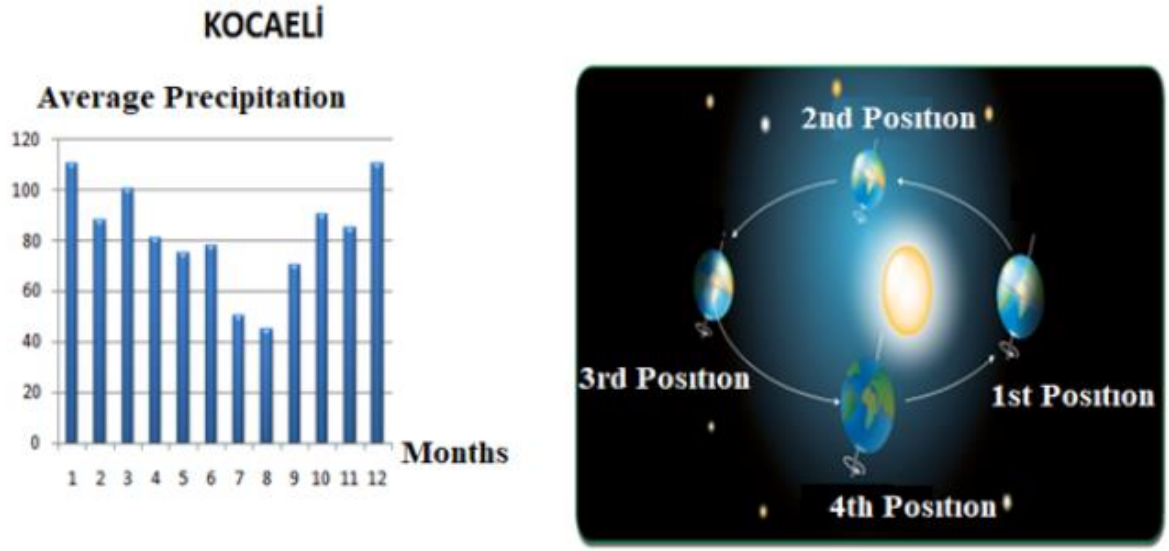
Table 12. Item Difficulty (p) and Discrimination Indexes (r) in the Result of Achievement Test Item Analysis

| Item | Upper group | Lower group | Item difficulty index (p) | Evaluation | Item discrimination index (r) | Evaluation |
|---|---|---|---|---|---|---|
| 1 | 55 | 17 | 0.6 | Easy | 0.63 | Very good item |
| 2 | 56 | 15 | 0.59 | Easy | 0.68 | Very good item |
| 3 | 58 | 26 | 0.7 | Very easy | 0.53 | Very good item |
| 4 | 42 | 13 | 0.46 | Medium difficulty | 0.48 | Very good item |
| 5 | 57 | 12 | 0.58 | Easy | 0.75 | Very good item |
| 6 | 46 | 7 | 0.44 | Medium difficulty | 0.65 | Very good item |
| 7 | 43 | 13 | 0.47 | Medium difficulty | 0.5 | Very good item |
| 8 | 58 | 11 | 0.58 | Easy | 0.78 | Very good item |
| 9 | 21 | 12 | 0.28 | Difficult | 0.15 | Very weak item |
| 10 | 43 | 17 | 0.5 | Easy | 0.43 | Very good item |
| 11 | 43 | 9 | 0.43 | Medium difficulty | 0.57 | Very good item |
| 12 | 56 | 10 | 0.55 | Easy | 0.77 | Very good item |
| 13 | 8 | 20 | 0.23 | Difficult | -0.2 | Very weak item |
| 14 | 39 | 13 | 0.43 | Medium difficulty | 0.43 | Very good item |
| 15 | 57 | 8 | 0.54 | Easy | 0.82 | Very good item |
| 16 | 58 | 10 | 0.57 | Easy | 0.8 | Very good item |
| 17 | 41 | 11 | 0.43 | Medium difficulty | 0.5 | Very good item |
| 18 | 45 | 9 | 0.45 | Medium difficulty | 0.6 | Very good item |
| 19 | 52 | 8 | 0.5 | Easy | 0.73 | Very good item |
| 20 | 60 | 9 | 0.58 | Easy | 0.85 | Very good item |
| 21 | 47 | 20 | 0.56 | Easy | 0.45 | Very good item |
| 22 | 44 | 13 | 0.48 | Medium difficulty | 0.52 | Very good item |
| 23 | 48 | 12 | 0.5 | Easy | 0.6 | Very good item |
| 24 | 54 | 8 | 0.52 | Easy | 0.77 | Very good item |
| 25 | 54 | 16 | 0.58 | Easy | 0.63 | Very good item |
| 26 | 51 | 18 | 0.58 | Easy | 0.55 | Very good item |
| 27 | 57 | 13 | 0.58 | Easy | 0.73 | Very good item |
| 28 | 36 | 9 | 0.38 | Medium difficulty | 0.45 | Very good item |
| 29 | 59 | 12 | 0.59 | Easy | 0.78 | Very good item |
| 30 | 51 | 10 | 0.51 | Easy | 0.68 | Very good item |
| 31 | 38 | 9 | 0.39 | Medium difficulty | 0.48 | Very good item |
| 32 | 56 | 12 | 0.57 | Easy | 0.73 | Very good item |
| 33 | 32 | 10 | 0.35 | Medium difficulty | 0.37 | Pretty good item |
| 34 | 55 | 13 | 0.57 | Easy | 0.7 | Very good item |
| 35 | 15 | 20 | 0.29 | Difficult | -0.08 | Very weak item |
| 36 | 49 | 15 | 0.53 | Easy | 0.57 | Very good item |
| 37 | 27 | 10 | 0.31 | Medium difficulty | 0.28 | It must be corrected. |

| | | | | | | |
|---|---|---|---|---|---|---|
| 38 | 56 | 12 | 0.57 | Easy | 0.73 | Very good item |
| 39 | 55 | 14 | 0.58 | Easy | 0.68 | Very good item |
| 40 | 50 | 17 | 0.56 | Easy | 0.55 | Very good item |
| 41 | 54 | 13 | 0.56 | Easy | 0.68 | Very good item |
| 42 | 59 | 10 | 0.58 | Easy | 0.82 | Very good item |
| 43 | 47 | 15 | 0.52 | Easy | 0.53 | Very good item |
| 44 | 53 | 16 | 0.58 | Easy | 0.62 | Very good item |
| 45 | 60 | 12 | 0.6 | Easy | 0.8 | Very good item |
| 46 | 44 | 13 | 0.48 | Medium difficulty | 0.52 | Very good item |
| 47 | 47 | 14 | 0.51 | Easy | 0.55 | Very good item |
| 48 | 54 | 12 | 0.55 | Easy | 0.7 | Very good item |
| 49 | 35 | 15 | 0.42 | Medium difficulty | 0.33 | Pretty good item |

Table 12 shows item numbers, the number of correct answers in the upper and lower groups, item difficulty indexes, and item discrimination indexes. According to the difficulty indexes of the items in the test, one is very easy, thirty-one is easy, fourteen is middle difficulty, and three is difficult. In addition, it is seen that forty-three of the items have very good item discrimination, two are pretty good, one needs to be corrected, and three are very weak. It was determined that the difficulties of the 9th, 13th, and 35th items in the test were difficult. These items, which are described as difficult in terms of item difficulties, also have low discrimination. As a result of the item analysis, the 9th, 13th, and 35th items were excluded from the test because their discrimination indexes were below 0.19. Item 37th, whose discrimination index is between 0.20 and 0.29, needs to be corrected. In order to correct this item, the distractors need to be rewritten. However, after these corrections, it is usually necessary to perform item analysis by re-application for the final test. It may not always be possible to make such an application. In such cases, if the relevant items do not affect the distribution of learning outcomes according to Bloom's taxonomy, they can be removed from the test. Item 37th, which needs to be corrected in this study, was excluded from the test because it did not change the distribution of learning outcomes according to Bloom's taxonomy. Some detailed explanations about these items that were excluded from the test are given below. The 9th item, which was asked to determine how accurately the relationship between the average precipitation graph and the model showing the movement of the Earth around the Sun can be established, is given in Figure 1.

The distribution chart of the last 35 years of average precipitation in Kocaeli province by months and the various positions of the Earth while orbiting the Sun are given below.




**Which locations on Earth are located in the month with the highest average precipitation in Kocaeli?**

**A)** 1st and 2nd **B)** 2nd and 3rd **C)** 3rd and 4th **D)** 4th and 1st

Figure 1. Item 9 that should be removed from the test

The answers given by the students in the upper and lower groups to item 9 given in Figure 1 are presented in Table 13.

Table 13. The answers given to item 9th

| Groups | Options | | | |
|---|---|---|---|---|
| | A | B | C | D* |
| Upper group (60) | 37 | 2 | 0 | 21 |
| Lower group (60) | 15 | 17 | 16 | 12 |

**Correct answer*

According to Table 13, it is seen that most of the students in the upper and lower groups of the 9th item were mistaken by choosing option A. Therefore, most of the students could not distinguish between the 4th and 1st positions of the World at the beginning of December, when the most precipitation was seen, according to the graph. The fact that most of the students in the lower and upper groups marked the distractor in option A, and especially the students in the upper group marked this option more, indicates that the 9th item is not distinctive.

Item 13th, which is a question of designing an experiment for the demonstration of wind formation and direction of movement, is presented in Figure 2.

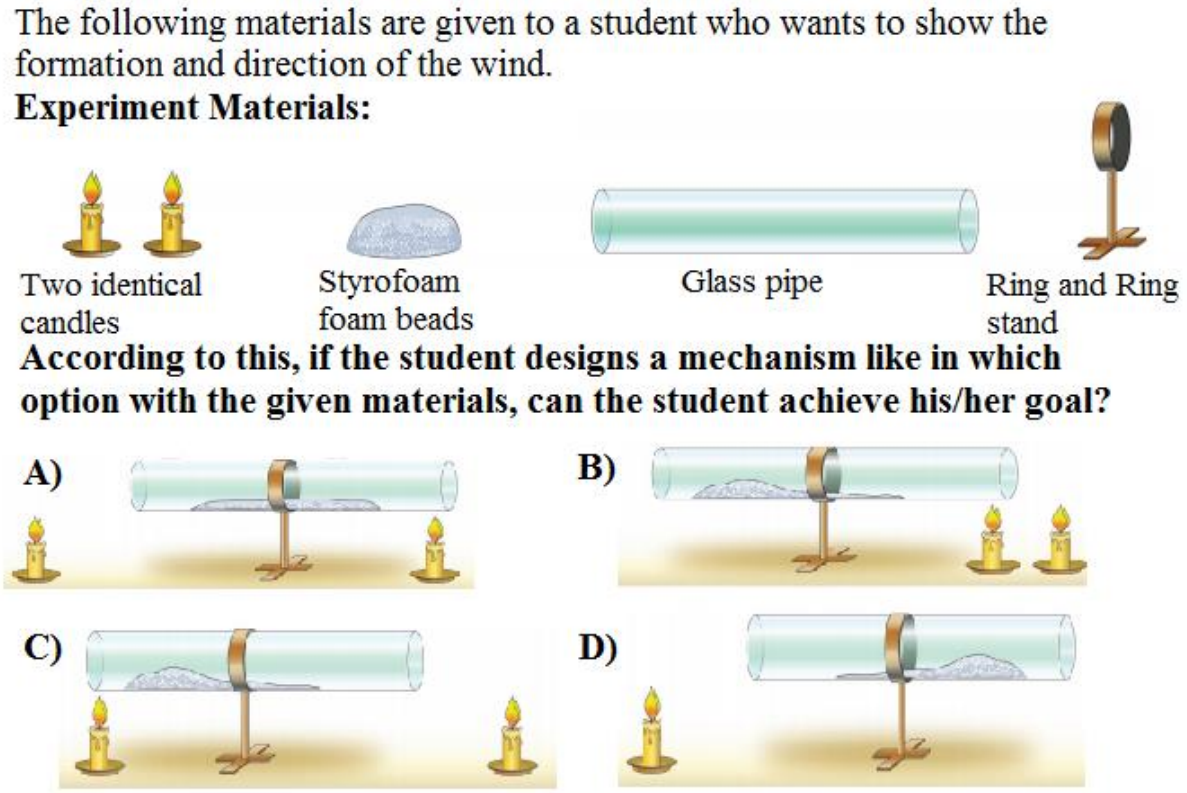



Figure 2. Item 13 should be removed from the test

The answers given by the students in the upper and lower groups to item 13th in Figure 2 are presented in Table 14.

Table 14. The answers given to item 13th

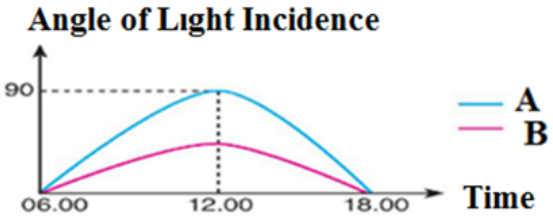
| Groups | Options | | | |
|---|---|---|---|---|
| | A* | B | C | D |
| Upper group (60) | 8 | 13 | 38 | 1 |
| Lower group (60) | 20 | 15 | 15 | 10 |

**Correct answer*

When Table 14 is examined, it is seen that most of the students in the upper and lower groups made mistakes by marking the B and C options for the 13th item. When the experimental setups in these marked options are examined, the candles for wind formation are correctly positioned to create a temperature difference at both ends of the pipes. However, in the B and C options, the styrofoam foams are not evenly distributed inside the pipe. This is experimentally wrong. Because in order for an experiment to yield clear results, effectiveness must be investigated by manipulating one variable, while other variables must be controlled by keeping them constant. This variable that is manipulated in the experiment is called the independent variable, and the other variables that are kept constant are called the control variable. The independent variable whose effectiveness was investigated and manipulated in the question is temperature. Since the distribution of the styrofoam foam inside the pipe, which will show the wind direction, is a control variable, it should be equally distributed to both ends of the pipe, as in option A. Therefore, according to Table 14, it can be said that most of the students in the lower and upper groups correctly know the information that the wind occurs from cold to hot. However, these students could not distinguish that there should be only one independent variable while conducting an experiment. In addition, the fact that the number of students in the upper group who marked the distractor in option C is higher than the number of students in the lower group, and the number of students in the upper group who marked the correct answer to question A is less than the number of students in the lower group, are the findings supporting that item 33 is not distinctive and should be removed from the test.

The 35th item, which is asked to determine how accurately it is possible to interpret two graphs showing the change of the angle of incidence of sunlight according to hours and compare them with each other, is presented in Figure 3.

**35)** The time-dependent graph of the angles of sunlight reaching cities A and B on the same day is given below.




**Accordingly, regarding cities A and B,**

**I.** On this date, the air temperature in city A is higher than the air temperature in city L.

**II.** City A is in the Southern Hemisphere, city B is in the Northern Hemisphere.

**III.** On this date, the day time in city A is longer than the night time.

**which of these judgments is definitely true?**

**A)** Only I **B)** I and II **C)** I and III **D)** I, II and III

Figure 3. Item 35 that should be removed from the test

The answers given by the students in the upper and lower groups to item 35 in Figure 3 are presented in Table 15.

Table 15. The answers given to item 35th

| Groups | Options | | | |
|---|---|---|---|---|
| | A* | B | C | D |
| Upper group (60) | 15 | 1 | 42 | 2 |
| Lower group (60) | 20 | 14 | 14 | 12 |

**Correct answer*

When Table 15 is examined, it is seen that most of the students in the lower and upper groups made a mistake by choosing option C. Therefore, most of the students could not distinguish that it is not possible to make any judgments about the duration of the day and night by only looking at the angles of incidence of the sun's rays in the same day without knowing the location of the cities. In particular, the fact that the number of students in the upper group who marked the distractor in option C is higher than the number of students in the lower group and that the number of students in the upper group who marked the correct answer to question A is less than the number of students in the lower group are the findings showing that item 35 should be excluded from the test as it is not distinctive.

Figure 4 presents the 37th item asked to determine how accurately a model showing the location of the cities is constructed by using the data in the graphs showing the day and night durations on different dates.

**37)** The night times in city A are shown in Graph-I, and the daytimes in city B are shown in Graph-II at the beginning of the season.

**According to this, which of the models showing the position of cities A and B on the face of the Earth to the Sun on December 21 is given correctly?**

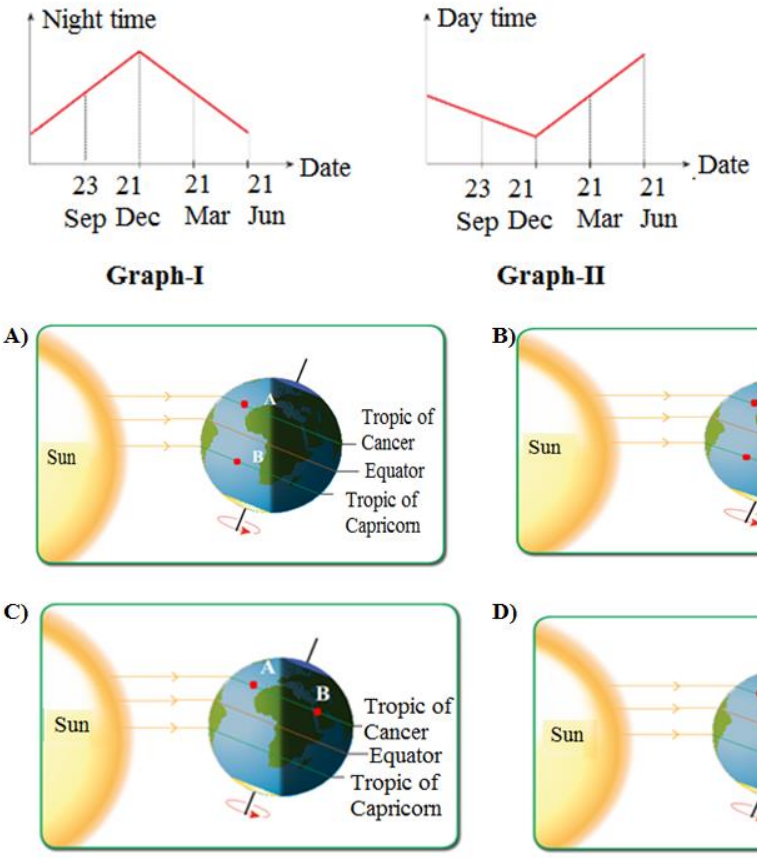



Figure 4. Item 37 that needs to be corrected

The answers given by the students in the upper and lower groups to item 37 in Figure 4 are presented in Table 16.

Table 16. The answers given to item 37

| Groups | Options | | | |
|---|---|---|---|---|
| | A | B | C | D* |
| Upper group (60) | 13 | 6 | 14 | 27 |
| Lower group (60) | 13 | 18 | 19 | 10 |

**Correct answer*

When Table 16 is examined, it is seen that the 37th item is not distinctive, and most of the students in the upper and lower groups made a mistake by choosing option C. In particular, most of the students in the upper group, which we can define as successful, could not distinguish that it is not possible to make any judgments about the duration of the day and night by only looking at the angles of incidence of the sun's rays on the same day without knowing the location of the cities. In addition, the fact that the number of students in the upper and lower groups who marked the distractor in option A was equal is another remarkable finding. This shows that the distractors in options A and C should be rewritten, and item 37 should be corrected.

As a result of the item analysis, the 9th, 13th, 35th, and 37th items were excluded from the test. However, considering the fact that the exam duration is one class hour and the attention span of the students is taken into consideration, it has been observed that the number of questions is high despite the removal of the specified items from the test. For this reason, in addition to the four items removed from the test, twenty more items that did not affect the distribution of learning outcomes according to Bloom's taxonomy were determined and excluded from the test. As a result, a total of twenty-four items were removed from the test. Items removed from

the test: 1st, 2nd, 3rd, 4th, 7th, 9th, 13th, 14th, 17th, 19th, 20th, 21st, 23rd, 24th, 30th, 32nd, 33rd, 35th, 37th, 38th, 40th, 41st, 47th, and 49th items. There are 25 questions in total in the achievement test. A second expert opinion was needed by the researchers in order to examine the questions in this achievement test, which consists of 25 questions, in order to affect the distribution of the learning outcomes of the items according to Bloom's taxonomy and to examine the questions figuratively and linguistically. In line with the suggestions received from these expert opinions, the 8th grade "Seasons and Climate" achievement test, consisting of a total of 25 questions, was made ready for pilot study by making some formal and verbal corrections in the 11th, 15th, 18th, 26th, 45th, and 46th items. The KR-20 and KR-21 reliability coefficients were calculated as a result of the pilot study made with 75 eighth grade students and presented in Table 17.

Table 17. Statistical results of the seasons and climate unit achievement test

| | Initial state of the test | Final version of the test |
|---|---|---|
| Seasons and climate achievement test number of questions | 49 | 25 |
| Number of applied persons (N) | 223 | 75 |
| KR-20 | 0.93 | 0.88 |
| KR-21 | 0.93 | 0.86 |
| Average item difficulty ($P_{jx}$) | 0.50 | 0.61 |
| Average item discrimination ($r_{jx}$) | 0.58 | 0.50 |

## Discussion and Conclusion

This study was carried out to develop a valid and reliable achievement test for the eighth grade "Seasons and Climate" unit within the scope of the science curriculum (MoNE, 2018).

The most important feature of a measurement tool is its validity. There are many types of validity, such as content validity, construct validity, predictive validity, and face validity. However, content validity is a more important type of validity than the others (Demircioğlu, 2007). For this reason, one of the most important conditions for ensuring the validity of a measurement tool is to ensure the content validity of the developed measurement tool (Yiğittir & Çalışkan 2013). Content validity expresses to what extent the questions in the measurement tool can measure the targeted acquirement universe (Büyüköztürk et al., 2015; Fraenkel & Wallen, 2006; cited in Yiğittir & Çalışkan, 2013). In order to ensure the content validity of a measurement tool, the questions must be in accordance with the specification table in terms of the learning outcomes it measures (Baykul, 2000). For this reason, a table of specifications was prepared for the validity of the Seasons and Climate Achievement Test, and scope validity was tried to be ensured. The table of specifications prepared in this study was prepared by taking into account the learning outcomes in the 2018 Science Curriculum (MoNE, 2018) and classified according to Bloom's Taxonomy. In the relevant literature, it is stated that expert opinion is a necessary prerequisite for ensuring content validity (Karslı & Ayas, 2013). For this reason, in order to ensure content validity in the study, the opinions of three science education specialist lecturers, two science teachers, and a Turkish teacher were taken. The scope validity of the "Seasons and Climate" achievement test, which was prepared as a result of these studies, was ensured.

When the studies on the subjects of "Formation of Seasons" and "Climate and Air Movements" in the eighth grade seasons and climate unit in the MoNE (2018) science curriculum are examined, it is seen that there are some limitations in terms of validity and reliability (Birgin & Özcan, 2022; Geren, 2022; Yanardağ, 2021). The achievement test in the study of Birgin and Özcan (2022) was developed to determine the level of knowledge of eighth grade students about "the formation of the seasons." In the study conducted by Birgin and Özcan (2022), questions for validity were classified using the one-dimensional cognitive domain taxonomy developed by Bloom (1956) and updated by Haladyna (1997) in the context of higher-order thinking skills. In addition, in the study of Birgin and Özcan (2022), item analysis and internal consistency coefficients were calculated by making a pilot study for the reliability study. Although a valid and reliable achievement test has been obtained as a result of all the studies, the test developed by Birgin and Özcan (2022) is not suitable for measuring success for all the subjects in the "Seasons and Climate" unit in terms of content validity since it only covers the subject of "The Formation of the Seasons." In the study conducted by Geren (2022), it was aimed to determine the perception, perception skills, cause-effect relationship, cause-effect relationship skills, and exam successes of eighth grade students regarding the concepts in the "Seasons and Climate" unit and to investigate the relationship between these variables. Additionally, determining whether these variables differ according to gender was also investigated. Therefore, many scales (perception, perception skill, cause-and-effect relationship,

etc.) were developed by Geren (2022) for the concepts in the "Seasons and Climate" unit within the scope of the research. One of these is the Seasons and Climate exam. On the other hand, in the study conducted by Yanardağ (2021), it was aimed at investigating the effect of the flipped classroom application on the academic success and learning retention of eighth grade students for the "Seasons and Climate" unit. For this reason, the "Seasons and Climate" academic achievement test was developed and used by Yanardağ (2021). When the academic achievement tests developed by Geren (2022) and Yanardağ (2021) were examined, it was seen that they covered all subjects of the "Seasons and Climate" unit. However, only expert opinion was taken for content validity in both achievement tests developed by Geren (2022) and Yanardağ (2021).In addition, while Geren (2022) and Yanardağ (2021) were developing the achievement tests, the HSEE sample questions in various sources of the MoNE and the questions in the learning outcomes comprehension tests were used without changing them. In order to ensure the reliability of the achievement tests in the study of Geren (2022) and Yanardağ (2021), a pilot study and item analysis could not be performed. For this reason, although the achievement tests developed by Geren (2022) and Yanardağ (2021) were developed for all subjects in the "Seasons and Climate" unit, it can be said that they are limited in terms of validity and reliability.

It is an important feature of a measurement tool to be reliable as well as valid. Şencan (2005) states that scientists refer to reliability as a lower limit value of validity. Therefore, it is possible to say that reliability is a prerequisite for validity. Reliability can be defined as a measurement tool accurately measuring the feature to be measured and giving similar results in different samples selected from the same population at different places and times (Şencan, 2005). Therefore, reliability may change as the sample changes (Capraro & Capraro, 2002; Henson et al., 2001). Therefore, while developing a measurement tool, the reliability of the measurements should be calculated (Capraro et al., 2001; Thompson, 1994). In this study, which was carried out to develop an achievement test for the Seasons and Climate unit, in order to ensure reliability, the pre-pilot study was carried out online for the eighth grade students in secondary school, and the pilot study was carried out in writing in the classroom environment. Item analysis and KR-20 and KR-21 internal consistency coefficients were calculated with the data obtained from both pilot studies.

As a result of the pre-pilot study, both the KR-20 and KR-21 reliability coefficients of the 49-question "Seasons and Climate" achievement test were calculated at 0.93. According to Büyüköztürk (2013), a reliability coefficient of 0.70 and above is sufficient for the reliability of the measurement results. In this respect, it is possible to say that the reliability of the first version of the achievement test is sufficient. In addition, in the first version of the Seasons and Climate Achievement Test, the average item difficulty was calculated as 0.50, and the average discrimination index was calculated as 0.58. In a test, the average item difficulty should be around 0.50 and the average discrimination index should be above 0.30 (Çepni, et al., 2008; Tekin, 2010). In this respect, the first version of the Seasons and Climate Achievement Test is at the desired level in terms of average difficulty and average discrimination index. However, according to the item analyses made through the data obtained from the pre-pilot study, the 9th, 13th, and 35th items should be removed from the test because the discrimination index is below 0.30, and the 37th item should be corrected because the discrimination index is 0.28. However, since there were other items in the test that could measure the learning outcomes measured by these items, all of the 9th, 13th, 35th, and 37th items were excluded from the test. Considering that the duration of the exam is one lesson and the attention span of the students is very high, the number of questions is very high in terms of the applicability of the exam. For this reason, twenty more items that did not affect the distribution of learning outcomes according to Bloom's taxonomy were determined and removed from the test. As a result, a total of twenty-four items were removed from the test. Items removed from the test: 1st, 2nd, 3rd, 4th, 7th, 9th, 13th, 14th, 17th, 19th, 20th, 21st, 23rd, 24th, 30th, 32nd, 33rd, 35th, 37th, 38th, 40th, 41st, 47th, and 49th items. By removing the specified items from the test, an achievement test of 25 questions was obtained. Expert opinion was needed to remove the items specified by the researchers, to affect the distribution of the learning outcomes according to Bloom's taxonomy, and to control the questions figuratively and linguistically. In line with the suggestions received from these expert opinions, the 8th grade "Seasons and Climate" achievement test, consisting of a total of 25 questions, was made ready for pilot study by making some formal and verbal corrections in the 11th, 15th, 18th, 26th, 45th, and 46th items. As a result of the pilot study, the KR-20 reliability coefficient was calculated at 0.88 and the KR-21 reliability coefficient at 0.86. The reliability coefficient values in the final version of the seasons and climate achievement test decreased compared to the first version. This may be due to the decrease in the number of test items. As a matter of fact, the number of items in a measurement tool is a factor affecting its reliability (Şencan, 2005). Although the reliability coefficient values of the test decrease due to the decrease in the number of items in the test, the KR-20 and KR-21 values in the final version of the test are above 0.70. KR-20 and KR-21 values above 0.70 indicate that the measurement results are statistically reliable. Therefore, it is possible to say that the Seasons and Climate Achievement Test with 25 questions developed within the scope of this study is a reliable test. In addition, in the final version of the Seasons and Climate Achievement Test, the average item difficulty was calculated at 0.61

and the average discrimination index was calculated at 0.50. The fact that the average item difficulty is around 0.50 and the average discrimination index is above 0.30 in the developed test (Çepni et al., 2008; Tekin, 2010) shows that the discrimination and difficulty levels of the test are sufficient.

As a result of the analyses made in this study, an achievement test was developed for the whole eighth grade "Seasons and Climate" unit, consisting of 25 items with questions about different levels of Bloom's Taxonomy and statistically sufficient validity and reliability.

## Suggestions

In the context of the findings obtained from the studies carried out to ensure the validity and reliability of the "Seasons and Climate" achievement test, some suggestions are presented below.

- Since this achievement test for the Seasons and Climate unit was developed with a survey model, it can be applied to 8th grade students in secondary school in terms of generalizability to the universe. In this respect, it can be used for measurement and evaluation purposes.
- The learning outcomes in the 2018 secondary school science curriculum are metacognitive learning outcomes. Therefore, with the "Seasons and Climate" achievement test developed, it was aimed at measuring more metacognitive achievements. For this reason, the questions and the determined outcomes were classified according to Bloom's Taxonomy, and mostly questions in the application, analysis, synthesis, and evaluation steps were used in the test. In addition, multiple-choice questions, which are easy to apply to large masses but not suitable for measuring metacognitive skills, have been made suitable for measuring high-level skills in this way. In this way, researchers can develop multiple-choice achievement tests for different subjects and achievement tests that measure metacognitive achievements.
- While developing the achievement test for the "Seasons and Climate" unit, the achievements in the MoNE science curriculum were taken as a basis. Since MoNE's science curriculum is updated from time to time according to international developments, it is possible to say that the achievement test developed is aimed at international readers. In this sense, the developed achievement test can be translated into different languages and adapted.
- After the adaptation work is done, the academic achievements of the students in different countries for "Seasons and Climate" can be determined and compared with those of the students in Turkey.

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This study was carried out within the scope of the doctoral thesis of Emine YURTYAPAN, who is the corresponding author of the article.

## Author (s) Contribution Rate

Emine Yurtyapan: Literature review, Achievement test development, Data collection, Data Analysis, Application, Writing and Editing
Ayşe Gül Çirkinoğlu Şekercioğlu: Methodology, Consulting, Audit, Review and Editing

## Conflicts of Interest

There is no conflict of interest.

## Ethical Approval (only for necessary papers)

Ethical permission (15.09.2023-E.293638 and 14.09.2023-E.293277) was obtained as a result of the decision of the Scientific and Engineering Sciences Ethics Commission of Balıkesir University Institute of Science and Technology at its meeting dated 12.09.2023 and numbered 2023/5.

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# The Effect of the Montessori Method Integrated with Collaborative Learning on Early Mathematical Reasoning Skills

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# The Effect of the Montessori Method Integrated with Collaborative Learning on Early Mathematical Reasoning Skills*

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## Abstract

The purpose of the study was to explore the effect of the Montessori Method integrated with cooperative learning on mathematical reasoning skills in the preschool period. In this study, an experimental design with a pretest-posttest control group was used. The study group included a total of 30 children, 15 of whom were in the experimental group and 15 in the control group. The study was conducted with mathematics teaching supported by the Montessori Method integrated with cooperative learning activities in the experimental group and mathematics teaching supported by the Turkish Ministry of National Education (MoNE) Preschool Curriculum (2013) in the control group. The "Evaluation Instrument for the Early Mathematical Reasoning Skills" was used as the data collection tool, and the data were analyzed with the Mann-Whitney U Test in line with the gender and reasoning variables. When the performances of the experimental group students who were taught mathematics supported by the Montessori Method integrated with cooperative learning and the control group students who were taught mathematics supported by the Turkish MoNE Preschool Curriculum (2013) were compared, a significant difference in favor of the experimental group was determined. However, no significant difference was determined in experimental and control group students' reasoning skills according to gender. By integrating the Montessori Method with different methods, materials, and techniques, its effects on developmental areas can be investigated.

**Keywords:** preschool education, reasoning, mathematics, Montessori method, collaborative learning

## Introduction

In the literature, there are various studies conducted in order to reveal the individual changes and developments that Montessori Method applications provide for children (Cossentino, 2006; Duckworth, 2006; Deluca & Hughes, 2014; Macià-Gual & Domingo-Peñafiel, 2021). However, there are also criticisms of the method in the literature, arguing that structured materials and the cerated environment lead children to intense individual thinking and restrict social communication and cooperation (Kilpatrick, 1914; DeVries & Goncu, 1987; Rathunde & Csikszentmihalyi, 2005; Beatty, 2011; Kayılı & Arı, 2016). The criticisms stated that social development is as important as individual development in preschool children and drew attention to the fact that it is very important to support adaptation and group cooperation. In line with these views, it would not be wrong to say that children's communication with their peers in the learning process is of great importance for the effectiveness of learning. Active communication with their peers in the learning process can also support the development of children's mathematical thinking skills, such as reasoning and problem solving. The frequent use of the cooperative learning method in the process of attainment of mathematical skills in the literature supports these ideas (Leikin & Zaslavsky, 1997; Lavasani & Khandan, 2011; Siew, Chin & Sombuling, 2017; Rambe, Syahputra, & Elvis, 2020).

The relevant literature argues that different methods and techniques used to support the acquisition of mathematical thinking and reasoning skills in the preschool period play an effective role in the learning process of the children. It can be stated that examining the different methods and techniques used in preschool education

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and integrating and reflecting their effective aspects into the teaching process will also appeal to the individual differences of children. Studies have revealed the positive effects of implementing robotics applications (Elkin, Sullivan & Bers, 2014), STEM activities (Çakır & Altun Yalçın, 2022), music activities (Rajan, 2017; Dansereau & Wyman, 2020), and movement activities (Laure & Habe, 2023) with the Montessori Method. However, Montessori Method applications integrated with cooperative learning were not found in the literature. In this context, it is predicted that the study will bring a new perspective to the literature, and this aspect reveals the importance of the study. It can be foreseeable that the use of collaborative learning activities with intense group communication in addition to the Montessori Method's mathematical materials and individual tasks as an answer to the criticisms directed at the Montessori Method about intensive individual tasks limiting social interaction will be effective on the related skills. In line with this prediction, the purpose of this study was to examine the effects of the Montessori Method integrated with cooperative learning on preschool children's attainment of mathematical reasoning skills. Within the scope of this study, the problem statement was determined as 'Does the Montessori Method integrated with cooperative learning have an effect on early mathematical reasoning skills?' The determined problem statement was tested within the scope of the hypotheses and sub-dimensions presented below:

- The performance of the mathematical reasoning skills of preschool children who were taught with the Montessori Method integrated with cooperative learning is higher than that of the children who were taught with the MoNE (2013) Preschool Curriculum.
- Mathematical reasoning skills performance of preschool children who were taught with the Montessori Method integrated with cooperative learning shows a significant difference according to gender.
- Mathematical reasoning skills and performance of preschool children who were taught with the MoNE (2013) Preschool Curriculum shows a significant difference according to gender.

**Mathematical Reasoning Skills in the Preschool Period**

There are many studies revealing that preschool education aims to support children in all developmental areas, adapts to their developmental characteristics and individual differences, and helps them discover their existing potentials (Dearing, McCartney, & Taylor, 2009; Burchinal, Vandergrift, Pianta, & Mashburn, 2010; Gomes & Pereira, 2014; Manigo & Alison, 2017). Since 80% of human development occurs in this period, this period has a very important role in human life (Duffy, 1998). Children who receive preschool education continuously improve themselves in areas such as cognitive, social-emotional, psychomotor, and language development (Reynolds, 2004). Qualified and adequate educational support will be beneficial in raising children with high cognitive levels in the preschool period, especially when cognitive development is quite rapid (Whitebread & Coltman, 2015).

The most important task in the cognitive development of children is physical awareness, in line with coordinated studies (Lillard, 1996). In the preschool period, children focus directly on what they see, and this helps them gain physical knowledge. As children gain physical awareness, they are highly motivated and go into the effort of exploration. The physical knowledge they gain forms the basis for logical reasoning (Ayvacı, 2010). This whole process is a sign that children are getting ready for the acquisition of mathematical thinking skills. The mathematical reasoning process begins in early childhood with an awareness of quantity and size. This is followed by the skills of counting in sequence, understanding the connection between numbers and the amount they represent, comprehending the last digit indicating the number of objects in a row, producing solutions to simple arithmetic problems, and trying different estimation strategies using effective techniques (Sarnecka & Gelman, 2004; Geary, 2006).

The mathematical experiences children gain enable them to understand their own world, and in line with these experiences, children lay the mathematical foundations necessary for their success in their educational lives (Charlesworth & Lind, 2010). In the literature, there are many different studies investigating the effects of learning methods and techniques on mathematical thinking skills used in the education process (Rauscher et al., 1997; Clements & Sarama, 2008; Sumpter & Hedefalk, 2015; Ahmed, Mengistie, & Wondimu, 2020; Murtazaevich, 2020). The Montessori Method, which gives importance to the training of the senses based on physical learning, is among these methods.

**Montessori Method and Mathematics Materials**

Maria Montessori focused on the education of the senses and accordingly developed sensory materials that create an environment for children to learn through exploration (Lillard, 2007). The relevant materials used as a learning method in the Montessori Method aim to facilitate children's learning by concretizing mathematical concepts. Montessori creates an exploration area for children with the materials she uses in the method she developed and observes them in their own exploration area. Children experience their own experiences with the help of sensory materials in the exploration environment offered to them, and the foundations of logical thinking begin to be laid during this period. (Lillard, 2013). In addition, the individual use of materials encourages

children to stay connected to their own learning speed and control their mistakes, encouraging them to work independently without a need for others (Denervaud, Knebel, Immordino-Yang, & Hagmann, 2020).
Muchyidin and Priatna (2022) found that students who used Montessori mathematics materials were able to convey their mathematical ideas orally or in writing and use mathematical concepts more qualitatively. According to the results of Faryadi's (2017) study, Montessori mathematics materials increased children's learning success by improving their problem-solving skills and positive classroom behaviors. However, some research (Basargekar & Lillard, 2021; Brown & Lewis, 2017; Mallett & Schroeder, 2015) investigating the math achievement and learning of Montessori students and alumni has not consistently found the instruction that is based on Montessori to be more effective than other instructional approaches. The results of research in the literature regarding whether Montessori materials and teaching have effects on mathematics are inconsistent. This situation requires further study on the subject.

## Method

### Study Design

Since the effect of the Montessori Method integrated with cooperative learning on early mathematical reasoning skills was explored in the study, an experimental design with a pretest-posttest control group was employed. Experimental design is a research design that aims to determine cause-and-effect relationships between variables by examining any situation and comparing the results (Hinkelmann & Kempthorne, 2005).

### Study Group

The experimental group, who were taught with the Montessori Method integrated with cooperative learning, included eight girls and seven boys (n=15), and the control group, who were taught with the MoNE Preschool Curriculum (2013), included seven girls and eight boys (n=15). While forming the study group, a classroom from the Y preschool, which had Montessori mathematics materials required by the study and used the Montessori Method, and a classroom from the X preschool, which was in a close neighborhood to the Y preschool in the same district and used only the MoNE Preschool Curriculum (2013) and was closest to the experimental group in terms of age, were selected as the experimental group and the control group, respectively, using the purposive sampling method. The purposeful association of systematic and randomly selected case samples for the study purpose is defined as purposive sampling (Marshall & Rossman, 2014). The study group was formed by simple random sampling from the classrooms, determined by purposive sampling. Simple random sampling refers to each member of a group having the same chance of being included in the sample (West, 2016). Information on the selected study group is presented in Table 1.

Table 1. Study Group

| School/Center | Classroom | Number of Children |
|---|---|---|
| Y Preschool | Morning Group | 15 |
| X Preschool | Morning Group | 15 |
| Total | | 30 |

As seen in Table 1, in this study, 15 subjects for the experimental group and 15 subjects for the control group were selected impartially. The gender distribution of the subjects participating in the study is presented in Table 2.

Table 2. Gender Distribution

| Gender | Experimental Group | Control Group | Total |
|---|---|---|---|
| Girl | 8 | 7 | 15 |
| Boy | 7 | 8 | 15 |
| Total | 15 | 15 | 30 |

As seen in Table 2, the experimental group of the present study consisted of eight girls and seven boys, and the control group consisted of seven girls and eight boys. There were 15 children in both groups, and the study group consisted of a total of 30 children.

### Equivalency Process

In order to examine the equivalence between the experimental and control groups, the mathematical reasoning skills pretest scores of the experimental and control groups were compared. The results obtained are presented in Table 3.
Table 3. Mann-Whitney U Test Results Regarding Pretest Scores of the Experimental and Control Groups

| | Groups | N | Mean Rank | Sum of Ranks | U | p |
|---|---|---|---|---|---|---|
| Mathematical Reasoning | Experimental | 15 | 18,47 | 277,00 | 68,0 | 0,067 |
| | Control | 15 | 12,53 | 188,00 | | |

According to Table 3, when Mann-Whitney U Test values comparing the pre-test scores of preschool children who will be applied collaborative mathematics activities supported by Montessori materials and preschool children who will be applied mathematics activities supported by MoNE (2013) Preschool Curriculum are examined, there is no statistically significant difference (U= 68,0, p>.05) between the groups. In this case, the experimental and control groups were considered equal for their mathematical reasoning skills.

In order to examine the equivalence of the mathematical reasoning skills of the experimental group according to gender, the pretest scores of the boys and girls were compared. The results obtained are presented in Table 4.

Table 4. Mann-Whitney U Test Results Regarding Pretest Scores of the Experimental Group According to Gender

| | Groups | N | Mean Rank | Sum of Ranks | U | p |
|---|---|---|---|---|---|---|
| Mathematical Reasoning | Girl | 8 | 1,11 | 7,75 | 26,0 | 0,82 |
| | Boy | 7 | 1,24 | 8,29 | | |

According to Table 4, when the pre-test scores of preschool girls and boys who participated in collaborative mathematics activities supported by Montessori materials in the experimental group are compared, there is no statistically significant difference (U=26.0, p>.05) according to gender. In this case, the experimental group was considered equal in terms of the mathematical reasoning skills of the boys and girls.

In order to examine the equivalence of mathematical reasoning skills in the control group according to gender, the pretest scores of the boys and girls were compared. The results obtained are presented in Table 5.

Table 5. Mann-Whitney U Test Results Regarding Pretest Scores of the Control Group According to Gender

| | Groups | N | Mean Rank | Sum of Ranks | U | p |
|---|---|---|---|---|---|---|
| Mathematical Reasoning | Girl | 7 | 1,13 | 7,79 | 26,5 | 0,86 |
| | Boy | 8 | 1,10 | 8,19 | | |

According to Table 5, when the pre-test scores of preschool girls and boys who participated in the activities of MoNE (2013) Preschool Curriculum in the control group are compared, there is no statistically significant difference (U=26.5, p>.05) according to gender. In this case, the control group was considered equal in terms of the mathematical reasoning skills of the boys and girls.

**Data Collection Tools**

The study data were collected using the "Evaluation Instrument for the Early Mathematical Reasoning Skills" developed by Ergül (2014). Of the 40 questions in the measurement tool, 21 are about measurement, and 19 are about data analysis and probability. There are 21 questions on inductive reasoning and 19 questions on deductive reasoning. The general skills in the questions about measurement include comparing objects and events, measuring non-standard units, comparing measurement results, sequencing time, estimating, and examining the situation in which the result is given. The general skills in the questions about data analysis and probability include sorting and classifying objects, making graphics using real materials, making graphics using the pictures of objects, making graphics using symbols, reading one-dimensional graphics, reading two-dimensional graphics, assessing a situation or data in an event, questioning the probability status according to the data obtained because of the assessment, and making situational or numerical estimations. Twenty-eight of the questions in the scale are communicated to the children verbally through the prepared pictures, nine of them using various materials, and the remaining three questions are communicated to the children verbally without using any material. In the study, a rubric was preferred for reasons such as the importance of the process in mathematical reasoning studies and the small age group. A rubric was created for the assessment tool, and each question was scored on a scale of 0-5 according to the children's answers. For the reliability studies of the assessment tool, a test-retest application was conducted with 40 children. The test-retest reliability for all domains in the assessment tool was found to be above .98.

**Implementation Process**

Before proceeding to the implementation process related to the study, a general meeting was held with the teachers of the classes constituting the experimental and control groups regarding the purpose and subject of the study and the data collection tools to be used in it. In the first stage of the process, the "Evaluation Instrument for the Early Mathematical Reasoning Skills" was administered to all groups simultaneously by the classroom teachers in order to determine the mathematical reasoning skills of the children in the experimental and control groups before they started their preschool education.

In the second stage of the process, the children in the experimental group were taught mathematics using the Montessori method. In the experimental group, mathematics activities planned with the Think Pair Share technique based on cooperative learning were carried out. On the other hand, the control group was only taught mathematics with the MoNE (Ministry of National Education) (2013) Preschool Curriculum by the classroom teacher.

When the process was completed, the "Evaluation Instrument for the Early Mathematical Reasoning Skills" was administered to the children in the experimental and control groups as a posttest by the groups' classroom teachers.

**Data Analysis**

Since the number of participants in the groups was below 30, a non-parametric test was preferred (Çokluk, Şekercioğlu & Büyüköztürk, 2021). Therefore, since the number of participants in each group is 15, the data were analyzed with the Mann-Whitney U test in line with the hypotheses. Mann-Whitney U tests are used to compare two independent groups and test whether the findings differ significantly from each other (Nachar, 2008).

## Results and Discussion

The first hypothesis of the study was that "the performance of the mathematical reasoning skills of preschool children who were taught with the Montessori Method integrated with cooperative learning is higher than the children who were taught with the MoNE Preschool Curriculum (2013)." The data from the Mann-Whitney U test performed for the related hypothesis are presented in Table 6.

Table 6. Mann-Whitney U Test Results Regarding Posttest Scores of Experimental and Control Group Children

| | | Groups | N | Mean Rank | Sum of Ranks | U | p |
|---|---|---|---|---|---|---|---|
| MESUREMENT | | Experimental | 15 | 3,58 | 23,0 | 9,2 | 0,00* |
| | | Control | 15 | 2,35 | 8,0 | | |
| Induction | | Experimental | 15 | 3,77 | 22,40 | 9,0 | 0,00* |
| | | Control | 15 | 2,47 | 8,60 | | |
| | Length and Weight | Experimental | 15 | 4,37 | 21,53 | 22,0 | 0,00* |
| | | Control | 15 | 3,19 | 9,47 | | |
| | Area and Volume | Experimental | 15 | 3,63 | 23,0 | 23,7 | 0,00* |
| | | Control | 15 | 2,13 | 8,0 | | |
| | Sequencing Time | Experimental | 15 | 3,10 | 21,07 | 29,0 | 0,00* |
| | | Control | 15 | 2,09 | 9,93 | | |
| Deduction | | Experimental | 15 | 3,39 | 21,97 | 15,5 | 0,00* |
| | | Control | 15 | 2,23 | 9,03 | | |
| | Testing | Experimental | 15 | 3,84 | 21,37 | 24,5 | 0,00* |
| | | Control | 15 | 2,51 | 9,63 | | |
| | Comparing Word Problems | Experimental | 15 | 2,93 | 21,03 | 29,5 | 0,00* |
| | | Control | 15 | 1,96 | 9,97 | | |
| DATA ANALYSIS and PROBABILITY | | Experimental | 15 | 3,38 | 22,93 | 1,0 | 0,00* |
| | | Control | 15 | 2,18 | 8,07 | | |
| Induction | | Experimental | 15 | 3,78 | 22,33 | 10,0 | 0,00* |
| | | Control | 15 | 2,89 | 8,67 | | |
| | Knowing the Properties of Shapes | Experimental | 15 | 4,51 | 21,30 | 25,5 | 0,00* |
| | | Control | 15 | 3,40 | 9,70 | | |
| | Making Graphs | Experimental | 15 | 3,04 | 19,53 | 52,0 | 0,01* |
| | | Control | 15 | 2,38 | 11,47 | | |
| Deduction | | Experimental | 15 | 2,99 | 22,87 | 2,0 | 0,00* |
| | | Control | 15 | 1,47 | 8,13 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Examining the Picture and Guessing the Situation in the Picture | Experimental | 15 | 3,23 | 20,57 | 36,5 | 0,00* |
| | Control | 15 | 2,12 | 10,43 | | |
| Reading Graphs and Telling the Results | Experimental | 15 | 3,20 | 21,67 | 20,0 | 0,00* |
| | Control | 15 | 1,76 | 9,33 | | |
| Specifying Probability | Experimental | 15 | 2,53 | 22,80 | 3,0 | 0,00* |
| | Control | 15 | 0,54 | 8,20 | | |
| Mathematical Reasoning | Experimental | 15 | 3,48 | 23,0 | 2,4 | 0,00* |
| | Control | 15 | 2,27 | 8,0 | | |

As seen in Table 6, the values (U=2,4 p<.05) of the Mann-Whitney U test comparing the mathematical reasoning skill performances of preschool children who were taught with the Montessori Method integrated with cooperative learning and preschool children who were taught with the MoNE Preschool Curriculum (2013) showed that there was a significant difference in favor of the experimental group.

There was a significant difference in the posttest scores in the measurement (U=9,2, p<.05) and data analysis-probability (U=1,0, p<.05) list and in the posttest scores of induction (U=9,0, p<.05) and deduction (U=15,5, p<.05) dimensions in the measurement list in favor of the experimental group. A significant difference was also found in favor of the experimental group in the posttest scores of the deduction dimension's length and weight (U=22,0, p<.05), area and volume (U=23,7, p<.05), sequencing time (U=29,0, p<.05) and induction dimension's testing (U=24,5, p<.05) and comparing word problems (U=29,5, p<.05) skills.

In addition, there was a significant difference in the posttest scores of the induction (U=10,0, p<.05) and deduction (U=2,0, p<.05) dimensions in the data analysis-probability list in favor of the experimental group. A significant difference was also found in favor of the experimental group in the posttest scores of the induction dimension's knowing the properties of shapes (U=25,5, p<.05), and making graphs (U=52,0, p<.05) skills and posttest scores of the induction dimension's examining pictures and guessing the situation in the picture (U=36,5, p<.05), reading graphs and telling the results (U=20,0, p<.05) and specifying probability (U=3,0 p<.05) skills.

The second hypothesis of the study was that "the mathematical reasoning skills performance of preschool children who were taught with the Montessori Method integrated with cooperative learning shows a significant difference according to gender." The data from the Mann-Whitney U test performed for the related hypothesis are presented in Table 7.

Table 7. Mann-Whitney U Test Results Regarding the Posttest Scores of the Experimental Group Children According to Gender

| | | Groups | N | Mean Rank | Sum of Ranks | U | P |
|---|---|---|---|---|---|---|---|
| MEASUREMENT | | Female | 8 | 3,50 | 7,06 | 20,5 | 0,38 |
| | | Male | 7 | 3,67 | 9,07 | | |
| Induction | | Female | 8 | 3,74 | 7,19 | 21,5 | 0,45 |
| | | Male | 7 | 3,81 | 8,93 | | |
| | Length and Weight | Female | 8 | 4,40 | 8,13 | 27,0 | 0,91 |
| | | Male | 7 | 4,33 | 7,86 | | |
| | Area and Volume | Female | 8 | 3,65 | 8,19 | 26,5 | 0,86 |
| | | Male | 7 | 3,62 | 7,79 | | |
| | Sequencing Time | Female | 8 | 3,17 | 7,31 | 22,5 | 0,52 |
| | | Male | 7 | 3,47 | 8,79 | | |
| Deduction | | Female | 8 | 3,27 | 7,31 | 22,5 | 0,52 |
| | | Male | 7 | 3,52 | 8,79 | | |
| | Testing | Female | 8 | 3,63 | 6,75 | 18,0 | 0,24 |
| | | Male | 7 | 4,10 | 9,43 | | |
| | Comparing Word Problems | Female | 8 | 2,92 | 8,06 | 27,5 | 0,95 |
| | | Male | 7 | 2,95 | 7,93 | | |
| DATA ANALYSIS and PROBABILITY | | Female | 8 | 3,29 | 6,69 | 17,5 | 0,22 |
| | | Male | 7 | 3,49 | 9,50 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Female | 8 | 3,75 | 7,63 | 25,0 | 0,72 |
| Induction | | Male | 7 | 3,81 | 8,43 | | |
| | Knowing the Properties of Shapes | Female | 8 | 4,58 | 8,75 | 22,0 | 0,46 |
| | | Male | 7 | 4,43 | 7,14 | | |
| | Making Graphs | Female | 8 | 2,92 | 7,69 | 25,5 | 0,77 |
| | | Male | 7 | 3,19 | 8,36 | | |
| | | Female | 8 | 2,84 | 6,81 | 18,5 | 0,27 |
| Deduction | | Male | 7 | 3,16 | 9,36 | | |
| | Examining the Picture and Guessing the Situation in the Picture | Female | 8 | 3,03 | 7,06 | 20,5 | 0,37 |
| | | Male | 7 | 3,46 | 9,07 | | |
| | Reading Graphs and Telling the Results | Female | 8 | 3,08 | 7,25 | 22,0 | 0,48 |
| | | Male | 7 | 3,33 | 8,86 | | |
| | Specifying Probability | Female | 8 | 2,40 | 6,50 | 16,0 | 0,16 |
| | | Male | 7 | 2,69 | 9,71 | | |
| Mathematical Reasoning | | Female | 8 | 3,40 | 6,75 | 18,0 | 0,25 |
| | | Male | 7 | 3,58 | 9,43 | | |

As seen in Table 7, the values (U=18,0, p<.05) of the Mann-Whitney U test comparing the mathematical reasoning skill performances of preschool children who were taught with the Montessori Method integrated with cooperative learning showed that there was no significant difference according to gender. No significant difference was found in the posttest scores in the measurement (U=20,5, p<.05) and data analysis-probability (U=17,5, p<.05) list and in the posttest scores of induction (U=21,5, p<.05) and deduction (U=22,5, p<.05) dimensions in the measurement list according to gender. A significant difference was also not found in the posttest scores of the deduction dimension's length and weight (U=27,0, p<.05), area and volume (U=26,5, p<.05), sequencing time (U=22,5, p<.05), and induction dimension's testing (U=18,0, p<.05) and comparing word problems (U=27,5, p<.05) skills according to gender.

Furthermore, there was no significant difference in the posttest scores of induction (U=25,0, p<.05) and deduction (U=18,5, p<.05) dimensions in the data analysis-probability list, the posttest scores of induction dimension's knowing the properties of shapes (U=22,0, p<.05), and making graph (U=25,5, p<.05) skills, and posttest scores of induction dimension's examining pictures and guessing the situation in the picture (U=20,5, p<.05), reading graphs and telling the results (U=22,0, p<.05) and specifying probability (U=16,0, p<.05) skills according to gender.

The third hypothesis of the study was that "the mathematical reasoning skills performance of preschool children who were taught with the MoNE Preschool Curriculum (2013) shows a significant difference according to gender." The data from the Mann-Whitney U test performed for the related hypothesis are presented in Table 8.

Table 8. Mann-Whitney U Test Results Regarding the Posttest Scores of the Control Group Children According to Gender

| | | | Groups | N | Mean Rank | Sum of Ranks | U | p |
|---|---|---|---|---|---|---|---|---|
| MEASUREMENT | | | Female | 7 | 2,32 | 7,57 | 25,0 | 0,73 |
| | | | Male | 8 | 2,38 | 8,38 | | |
| | | | Female | 7 | 2,49 | 8,36 | 25,5 | 0,77 |
| | Induction | | Male | 8 | 2,45 | 7,69 | | |
| | | Length and Weight | Female | 7 | 3,26 | 8,21 | 26,5 | 0,86 |
| | | | Male | 8 | 3,13 | 7,81 | | |
| | | Area and Volume | Female | 7 | 2,21 | 9,00 | 21,0 | 0,41 |
| | | | Male | 8 | 2,06 | 7,13 | | |
| | | Sequencing Time | Female | 7 | 2,00 | 7,21 | 22,5 | 0,52 |
| | | | Male | 8 | 2,17 | 8,69 | | |
| | | | Female | 7 | 2,14 | 7,07 | 21,5 | 0,45 |
| | Deduction | | Male | 8 | 2,31 | 8,81 | | |
| | | Testing | Female | 7 | 2,38 | 7,00 | 21,0 | 0,41 |
| | | | Male | 8 | 2,62 | 8,88 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Comparing Word Problems | Female | 7 | 1,90 | 7,36 | 23,5 | 0,59 |
| | | Male | 8 | 2,00 | 8,56 | | |
| DATA ANALYSIS and PROBABILITY | | Female | 7 | 2,33 | 10,00 | 14,0 | 0,11 |
| | | Male | 8 | 2,05 | 6,25 | | |
| Induction | | Female | 7 | 3,07 | 10,07 | 13,5 | 0,08 |
| | | Male | 8 | 2,73 | 6,19 | | |
| | Knowing the Properties of Shapes | Female | 7 | 3,48 | 8,36 | 25,5 | 0,77 |
| | | Male | 8 | 3,33 | 7,69 | | |
| | Making Graphs | Female | 7 | 2,67 | 9,86 | 15,0 | 0,13 |
| | | Male | 8 | 2,13 | 6,38 | | |
| Deduction | | Female | 7 | 1,59 | 9,00 | 21,0 | 0,42 |
| | | Male | 8 | 1,37 | 7,13 | | |
| | Examining the Picture and Guessing the Situation in the Picture | Female | 7 | 2,18 | 8,21 | 26,5 | 0,86 |
| | | Male | 8 | 2,06 | 7,81 | | |
| | Reading Graphs and Telling the Results | Female | 7 | 1,95 | 9,07 | 20,5 | 0,38 |
| | | Male | 8 | 1,58 | 7,06 | | |
| | Specifying Probability | Female | 7 | 0,64 | 9,57 | 17,0 | 0,19 |
| | | Male | 8 | 0,46 | 6,63 | | |
| Mathematical Reasoning | | Female | 7 | 2,32 | 9,00 | 21,0 | 0,42 |
| | | Male | 8 | 2,22 | 7,13 | | |

As seen in Table 8, the values (U=18,0, p<.05) of the Mann-Whitney U test comparing the mathematical reasoning skill performances of preschool children who were taught with the MoNE Preschool Curriculum (2013) showed that there was no significant difference according to gender.

No significant difference was found in the posttest scores in the measurement (U=25,0, p<.05) and data analysis-probability (U=14,0, p<.05) list and in the posttest scores of induction (U=25,5, p<.05) and deduction (U=21,5, p<.05) dimensions in the measurement list according to gender. A significant difference was also not found in the posttest scores of deduction dimension's length and weight (U=2635, p<.05), area and volume (U=21,0, p<.05), sequencing time (U=22,5, p<.05), and induction dimension's testing (U=21,0, p<.05) and comparing word problems (U=23,5, p<.05) skills according to gender.

In addition, there was no significant difference in the posttest scores of induction (U=13,5, p<.05) and deduction (U=21,0, p<.05) dimensions in the data analysis-probability list, the posttest scores of induction dimension's knowing the properties of shapes (U=25,5, p<.05), and making graph (U=15,0, p<.05) skills, and posttest scores of induction dimension's examining pictures and guessing the situation in the picture (U=26,5, p<.05), reading graphs and telling the results (U=20,5, p<.05) and specifying probability (U=17,0, p<.05) skills according to gender.

## Conclusion

The study findings supported the first hypothesis, "The performance of the mathematical reasoning skills of preschool children who were taught with the Montessori Method integrated with cooperative learning is higher than the children who were taught with the MoNE Preschool Curriculum (2013)."

The main reason behind the significant improvement in the length-weight and area-volume measurement skills in the measurement list in the posttest data can be considered as the lesson plans developed with the Montessori Method integrated with cooperative learning strengthened the interaction in children and encouraged them to learn effectively. In a similar study, Nisa, Ariyanto, and Asyhar (2019) examined the effect of Montessori education on the mathematical thinking skills of children in early childhood. The aforementioned study, which included skills such as measuring the length and weight of an object and understanding mathematical concepts, revealed the effect of Montessori education and supports the findings of the present study. By working in cooperation, the lesson plans developed additionally, and cooperative learning supported children to reinforce these concepts, which they concretized in their minds with the help of the Montessori materials. The fact that Clements (2019) stated that cooperative learning is effective in the development of basic mathematical skills in his study, in which he examined the acquisition of these skills in preschool children, supports the present study's findings.

The reason for the significant difference in the time sequencing skill in the measurement list can be explained by the integrated application addressing children's individual differences. Charlesworth (2011) argued that the concept of time as a measurement concept is difficult for children to acquire. Skills such as classification, sequencing, and establishing a part-whole relationship are prerequisites for acquiring the concept of time in the preschool period. In this respect, it can be stated that Montessori materials visually concretize difficult-to learn abstract concepts such as time, and cooperative activities enable children to establish cause-and-effect relationships between events more easily and facilitate the understanding of concepts such as 'today', 'tomorrow', and 'yesterday'. According to Lyons (2022), in so many ways, cooperative games align with Montessori's insightful views on education. Also, Clements (2022) concluded that preschool children exhibited all peer cooperation behaviors, there was preliminary evidence of supportive behavior in pairs, and children's counting scores increased. Brožová (2022) states that Montessori activities used in mathematics education are suitable for personalization, responsibility, and flexibility. The results of many different studies (Siljehag & Allodi, 2023; Hanish et al., 2023; Jin & Moran, 2023) show that collaborative studies used in preschool education increase interaction between children, support positive peer relationships, and provide a frequency of coordinated behaviors. The mentioned studies show that collaborative activities integrated with Montessori education improve mathematical reasoning skills by contributing to both individual and social development, similar to the result of this study.

The reason for the significant difference in testing and comparing word problem skills in the measurement list can be interpreted as the children using Montessori materials testing their mistakes without the need for any other external control and producing alternative solutions to problems by improving their self-expression skills with the help of cooperative activities. In his study examining the mathematical skills of preschool children, Faryadi (2017) revealed that the group who were taught the Montessori Method had more advanced problem-solving skills than the group who were taught the traditional curriculum. Bahatheg (2010) examined the effect of the Montessori Method on creative problem-solving skills in a study conducted in a preschool with 24 students and put forth that there were significant differences between groups in terms of problem-solving capacities. Also, Gentaz and Richard (2022) concluded that the problem-solving skills of children who were educated with the Montessori approach were higher than those who received traditional education. Lyman and Foyle (1988) explained the importance of using the cooperative learning method in preschools and the first years of elementary school. The study concluded that the use of this method over a long period of time is meaningful in the development of communication, active role-playing, problem-solving, and probability thinking skills in children. Jin and Moran (2021) examined teachers' views on preschool children's problem-solving skills based on cooperation in their study. The participating teachers stated that cooperative learning is effective in developing problem-solving skills. This is in line with the results of the present study.

The reason behind the significant difference in the knowing the properties of shapes skill in the data analysis and probability list can be interpreted as the children's learning basic mathematical concepts with the support of materials that develop their senses, and then working in cooperation with their friends and making the learning permanent. In their study examining Montessori materials, Shatri, Bajraj, Berisha, and Kendusi (2021) stated that children are more interested in concrete things than abstract things and that the use of these didactic materials, which have many different forms such as shape, size, and weight, by educators would be beneficial in facilitating the learning process. Lillard and Else-Quest (2006) also revealed that mathematical thinking skills are more advanced in children who use Montessori materials. Zippert et al. (2019) determined that children who are more interested in cooperative play in early childhood explore more advanced mathematical concepts and engage in verbal mathematics works, as well as basic skills such as shape, spatial, and pattern. Also, Goss (2022) stated that children have ample opportunities to engage with challenging math problems, and challenging problems require spatial reasoning. Engaging activities enable children to reason mathematically in a broad range of ways and develop a range of spatial skills. In this direction, the findings of the aforementioned studies are in parallel with the results of the present study.

The reason for the significant difference in making graphs, reading graphs and telling the results, guessing the situation in the picture, and specifying probability in the data analysis and probability list can be interpreted as the children who learned basic mathematical concepts with the Montessori Method applications integrated with cooperative learning improving their skills like estimation, reasoning, logical probability, and evaluation of results. Aktaş Arnas (2012) listed the mathematical skills acquired in preschool education as classification, one-to-one matching, comparison, ranking, number concept, operation concept, geometry and spatial thinking, measurement, and graphs. As can be seen in this direction, the skills of making graphs, reading graphs, and telling the results in children are acquired after basic mathematical skills. Children learn all these skills as a prerequisite when making graphs. In his study, Charlesworth (2005) expressed that children's data collection and interpretation skills develop by collecting data throughout their lives and showing the results with a simple graph. In addition, the 2000 publication by the National Council of Teachers of Mathematics (NCTM) describing the mathematical skills and processes acquired in schools includes data analysis and probability as the final stage in the content standards. Data analysis and probability skills, which are acquired after number and

operation, algebra, geometry, and measurement skills, include statistical reasoning, analyzing data, and making inferences and predictions based on it. In this direction, it can be stated that this skill is acquired at the end of a very comprehensive process for children in the preschool period, and thus observing and integrating the effective aspects of different methods and techniques and using them in the education process will meet children's different interests and demands and will support their individual learning speeds from different aspects. Tan, Harji, and Lau (2011) supported this research's results with their idea that an interactive, collaborative, and supportive learning environment, such as structuring with peers and adults, helps to overcome learning barriers as well as anxieties and elevates learners to a higher level of development as they gain conceptual and procedural knowledge.

The scores of the posttest used in the present study did not support the second hypothesis, "Mathematical reasoning skills performance of preschool children who were taught with the Montessori Method integrated with cooperative learning shows a significant difference according to gender," and the third hypothesis, "Mathematical reasoning skills performance of preschool children who were taught with the MoNE Preschool Curriculum (2013) shows a significant difference according to gender."

There are many studies in the literature examining mathematical skills according to gender (Beller & Gafni, 1996; Bierman, Torres, Domitrovich, Welsh, & Gest, 2009; Slot, Bleses, & Jensen, 2020). Mathematical anxiety not being at a high level for both genders, and the teachers of both groups not having a prejudice against any of the genders about their acquisition of mathematical skills, may be the reason why no significant difference was observed in the acquisition of mathematical skills in the present study. In their study, Tovazzi and Caprara (2019) examined the Montessori Method, mathematics education, and gender differences. They stated that teachers' prejudices are effective in influencing the interests and attitudes of male and female students towards mathematics. In this respect, they argued that the potential results on mathematical concepts in schools where the Montessori Method is used may be equal for both genders. They explained this by stating that the Montessori teacher's role is to be an observer in the education process and that his or her personal characteristics do not affect children. The results of the aforementioned study support the findings of the present study.

The present study's finding that the mathematical reasoning skills of children did not differ according to gender was also supported by the study conducted by Klein, Adi-Japha, and Hakak-Benizri (2010). In their study, they examined the effect of gender differences on verbal, spatial, and mathematical interaction variables. According to the results of this study, which was conducted with 80 children aged 5-6 years attending preschool education institutions, no significant difference was found between girls and boys in terms of their mathematical, verbal, and spatial skills. Harris (2005) made a similar study by integrating Montessori education with music and examining the effect of this education on mathematics achievement in terms of gender. The fact that Montessori education enriched with music did not show a significant difference according to the gender variable supports the findings of the present study. However, in his study, in which he used tests based on mathematical reasoning at national standards, Becker (1990) stated that there was a significant gender difference in contrast to the studies conducted in preschools. When students' gender differences in the subject area and item type are examined, girls had more difficulty in the field of algebra and boys in the section with mixed questions. Thus, this finding does not support the findings of the present study.

## Limitations and Recommendations

During the implementation phase of the study, one child from the experimental and control groups was excluded from the study at the request of their parents. In addition, more children can be studied to increase the generalizability of the study.

The Montessori Method, which is applied in early childhood, can be integrated with different education and training techniques. By using teaching techniques integrated with relevant materials, the effects of the child on other developmental areas can be investigated.

## Author (s) Contribution Rate

Researching the idea and the method that will lead to the results second author at the stage of designing and supervising; third author at the stage of following the progress and organizing the execution of the study; the necessary place to study; resources; provision of tools; and evaluation of findings during the finalization phase. The first author contributed to the study.

## Conflicts of Interest

The authors declare that they have no conflict of interest.

## Ethical Approval (only for necessary papers)

This study was approved by the Kırklareli University Institute of Health Sciences Ethics Committee on August 6, 2018 (Decision No. 09).

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# Developing Political Literacy of Social Studies Teacher Candidates for Citizenship Education

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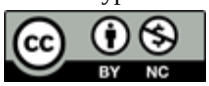

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# Developing Political Literacy of Social Studies Teacher Candidates for Citizenship Education**

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## Abstract

In a rapidly developing and advancing world, citizens are expected to be involved in politics and help their administrators and politicians. Although the concept of political literacy has an old history, it has become popular today. It has been included as a skill in the 2018 and 2023 social studies curricula in Türkiye. Considering the relevant national literature and the results of the needs analysis conducted within the scope of this research, it is seen that social studies teachers and teacher candidates don't know political literacy and don't have political literacy knowledge, skills, and values as necessary. They, who are expected to raise politically literate individuals, have to be politically literate citizens or teachers in order to be successful. This research, produced from a doctoral thesis, was aimed at improving the political literacy of social studies teacher candidates. So, a political literacy education program was prepared within the scope of action research, one of the qualitative research designs, and political literacy education was given to improve the political literacy of teacher candidates. After the training, which lasted about three and a half months, the effectiveness of the program in developing political literacy and the views of teacher candidates on it were tried to be revealed.

**Keywords:** Citizenship education, political literacy, social studies, teacher candidates

## Introduction

The relationship between politics and social studies, handled with an interdisciplinary approach, is so significant that it cannot be ignored. Social studies make great use of political science in terms of raising effective citizens. According to Akhan (2013), it's a course that allows students to develop positive views of the political system, become active citizens, and gain participatory skills. Politics, with an undeniably important effect on society and the individual (Pacho, 2014), is important for the concept of citizenship. In order for individuals to participate as citizens in society, they need to have some basic knowledge (Dudley & Gitelson, 2002). However, they are expected to have skills and values while using knowledge, as well as basic knowledge. According to Tam (2016), a citizen who lacks political understanding will be much more open to malicious propaganda and provocation.

Political literacy is a type of literacy that has a very wide scope. Every subject that concerns society and citizens can be the subject of political literacy by being associated with the concept of governance. Collins (1992) stated that all literacy is political, thus demonstrating the inclusiveness of political literacy. According to Hacker (2000), it is individuals' choosing and accepting the right thing by approaching political issues objectively despite their own ideology. Kruse (2018) stated that political literacy has different meanings depending on what is meant by politics and discussed political literacy as three types of skills: 1) political literacy, which refers to the political process; 2) political literacy, which refers to political structures, institutions, and governance; and 3) policy literacy, which refers to political or political content (p. 10). It is the ability of individuals to develop their own political values and put them into practice (Brett et al., 2002). It does not only include political knowledge.

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** This study was carried out from Asst. Prof. Dr. Selda Şan's PhD thesis titled "developing political literacy of social studies teacher candidates for citizenship education" under the supervision of Prof. Dr. Cemil Öztürk and Assoc. Prof. Dr. Ahmet Katılmış.

When the literature is examined, it is seen that this literacy includes political skills and values as well as political knowledge (see Advisory Group on Citizenship, 1998; Badlan, 2016; Chrastka, 2017; Kruse, 2018; Triwardani & Wiendijarti, 2016). Because political literacy is a way of life as well as having knowledge (Ljunggren & Unemar Öst, 2010), Political literacy is not just about political knowledge about how institutions work (Flinders, 2016) and consists of a combination of knowledge, skills, and values (Crick, 2000; Triwardani & Wiendijarti, 2016). Political literacy is the ability of individuals to be active and participate in politics using this combination (Badlan, 2016). It is basically being able to analyze and solve existing stories and problems (Douglas, 2002). Political literacy is having basic political knowledge and critical thinking skills about political processes (Selanik Ay &Yavuz, 2016). When considered in more depth as a concept, political literacy is to deal with how governance or power is used and how it should be used in every social structure where the concepts of governance and power/authority exist, and how these structures or institutions work or should work through knowledge, skills, and values (Crick & Lister, 1978; Crick & Porter, 1978). Political literacy, the cornerstone of the democratic process, enables citizens to participate in the public sphere and gain critical awareness (Badlan, 2016). It helps to understand different perspectives and eliminate prejudices by raising awareness (Douglas, 2002).

When the relevant literature is examined, it is seen that there are not many studies on this concept, although the concept of political literacy is not a new concept (Huddleston & Rowe, 2006). It is understood that the existing studies are mostly theoretical studies and literature reviews. It is also seen that the first studies were mostly from Britain and were aimed at political education. Later, studies on political literacy aimed for citizenship education, and it continues today (see Crick & Lister, 1978; Crick & Porter, 1978; Minogue, 1980; Advisory Group on Citizenship, 1998). Although different definitions have been given in the studies, it can be said that it is agreed that this concept is a combination of knowledge, skills, and values. Looking at the relevant studies in the international literature, it is seen that there are studies on citizenship education, political literacy and political education (Advisory Group on Citizenship, 1998; Bochel, 2009; Borovoi, Patel & Vlaev, 2013; Brocklehurst, 2015; Brodie-Mckenzie, 2015; Carr & Thesee, 2018; Carrington & Short, 1987; Cassel & Lo, 1997; Collins, 1992; Crick, 2000; Crick, 1978; Crick & Lister, 1978; Crick & Porter, 1978; Davies, Mizuyama, Ikeno, Parmenter & Mori, 2013; Demaine, 2014; Douglas, 2002; Dudley & Gitelson, 2002; Espie, 1999; Head, Hill, Lockyer & MAcdonald, 2015; Horvath, 2018; Hunter & Rack, 2016; Janoski & Gran, 2002; Kotze, 1989; Kruse, 2018; Lund & Carr, 2008; Maitles, 2009; Minogue, 1980; Offen, 2017; O'Toole, Marsh & Jones, 2013; Perveen & Awan, 2017; Pessima, 1997; Preira dos Santos, 2014; Preston, 1989; Rack, 2016; Tam, 2016). However, among these, it is seen that there are almost no theoretical and practical studies on teacher training. It is seen that there are very few studies on political literacy in Turkiye, and the existing ones are mostly done by social studies educators (Aslan, 2019; Demir, 2019; Faiz & Dönmez, 2016; Görmez, 2018; İnan, 2016; İnan & Tarhan, 2018; Kara & Tangülü, 2017; Kuş, 2013; Şan, 2019; Şan & Gölgesiz Gedikler, 2020; Tarhan, 2019). In 2018, "political literacy" was included as a skill for the first time in the Social Studies Curriculum (Ministry of National Education [MEB], 2018). In this context, it is important to educate politically literate social studies teachers both in order to raise good teachers as teachers and citizens. As a politically literate person, teachers can educate politically literate students easily. Kara and Tangülü (2017) and Görmez (2018) concluded that social studies programs have outcomes related to political literacy. However, it is understood from the relevant studies that social studies teacher candidates should receive political literacy education in terms of knowledge, skills, and values. Faiz and Dönmez (2016) concluded that the political literacy knowledge, skills, and affective tendencies of social studies teacher candidates are moderate. Tarhan (2015) concluded that social studies teacher candidates do not consider themselves politically literate and that the education they have received throughout their lives is not aimed at improving their political literacy. Kuş and Tarhan (2016) concluded that social studies teachers did not include policy-related issues in their lessons, although they stated that political issues are necessary and should be taught in social studies courses. Demir (2019) suggested that current political issues should be discussed and frequently included in the social studies teaching undergraduate program in order for social studies teacher candidates to become politically literate. When the related studies are examined, it is seen that they are generally aimed at determining the political literacy status and levels of teachers/pre-service teachers and getting opinions (see Akhan, 2013; Aslan (2019); Çınar (2019); Dağ & Koçer, 2019; Faiz & Dönmez, 2016; Görmez, 2018; İnan, 2016; İnan, 2019; İnan & Tarhan, 2018; Kara & Tangülü, 2017; Kuş, 2013; Kuş & Tarhan, 2016; Şan, 2019; Şan & Gölgesiz Gedikler, 2020; Tarhan, 2015; Tarhan, 2019). In addition, when the relevant national literature is examined, it is seen that the political literacy levels of social studies teacher candidates and teachers are not very good, and observed social studies teachers do not include current political issues in the classrooms (see Akhan, 2013; Faiz & Dönmez, 2016; Kuş & Tarhan, 2016).

Douglas (2002) states that it is very important to conduct studies on political literacy for teacher candidates for both citizenship education and teacher education. Because, as Brett et al. (2002) stated, social studies teachers have difficulties in preparing meaningful learning activities within the scope of political literacy. Examining the

relevant literature, it's clearly seen that there are many gaps in the field of political literacy in terms of both citizenship education and teacher training. It is clearly seen that political literacy is a fairly new concept for the Turkish education system, and studies on political literacy at all educational levels are quite limited. In 2018, the concept of political literacy was included as a skill in the Social Studies Curriculum prepared by the Ministry of National Education Board of Education and Discipline (see Ministry of Education, 2018). Social studies teachers are also expected to be politically literate in order to effectively teach children political literacy, which is a very new concept in terms of the Turkish Education System in the program. For this reason, the question titled "How can we develop political literacy, focused on citizenship education, in social studies teacher candidates?" constitutes the problem of the research. In this context, answers to the following sub-questions are sought:

1. How does political literacy education, developed with a focus on citizenship education, improve the political literacy of social studies teacher candidates?

2. What are the opinions of the social studies teacher candidates on political literacy education focused on citizenship education?

## Method

This research, aiming to prepare the political literacy education program and examine the political literacy development of pre-service teachers within the scope of improving the political literacy of social studies teacher candidates, has been handled within the framework of the qualitative research paradigm. Action research, a participatory action research type aiming to implement a new approach in education, constitutes the model of this research.

Within the scope of the criterion sample, the study group of the research consisted of twenty (22) social studies teachers studying at the Ege University Faculty of Education in the 2018–2019 academic year, choosing the New Approaches in Social Studies course, studying in the second grade, and not having sufficient knowledge about political literacy. However, the data of 20 social studies teacher candidates has been used in the study since two participants don't allow their data to be used. Participants have been coded as P1, P2, P3,... P20. Information about the participants is given in Table 1.

Table 1. Information About Participants

| Participants | Gender | Age | Participants | Gender | Age |
|---|---|---|---|---|---|
| P 1 | Female | 20 | P 11 | Male | 20 |
| P 2 | Female | 20 | P 12 | Female | 20 |
| P 3 | Female | 20 | P 13 | Female | 20 |
| P 4 | Female | 20 | P 14 | Male | 20 |
| P 5 | Female | 20 | P 15 | Female | 20 |
| P 6 | Female | 20 | P 16 | Female | 20 |
| P 7 | Male | 21 | P 17 | Male | 23 |
| P 8 | Female | 20 | P 18 | Female | 20 |
| P 9 | Female | 20 | P 19 | Male | 20 |
| P 10 | Female | 20 | P 20 | Male | 20 |

As seen in Table 1, the study group for the research consists of fourteen (14) female and six (6) male students within the scope of the needs analysis. Eighteen (18) of the participants were twenty (20) years old; one was twenty-one (21); and one was twenty-three (23) years old. Thus, diversity was achieved in terms of gender and age.

Within the scope of diversification (triangulation), interview, observation, student reflective diary, self-evaluation forms, researcher reflective diary, 2N forms (What did I know? - What did I learn?) and student work/activity sheets were used in the research. Expert opinions were taken for each data collection tool, and necessary corrections were made. Content analysis and descriptive analysis were used in the analysis of the data. 2N forms, individual interviews, student worksheets, and student reflective diaries were analyzed by content analysis; observation, researcher's diary, and self-evaluation forms were analyzed with descriptive analysis. A certain part of the data was analyzed by a second researcher (Dr. Between the analyses of the two researchers, Miles & Huberman's (1994, p.64) reliability formula was used. It has been concluded that the reliability of each piece of data is sufficient and high.

The research topic was determined as the first step in the research. As a second step, a literature review and needs analysis were made. As the third step, an action plan was prepared and implemented. In the fourth step, data were collected and analyzed. This process continued systematically and regularly. As the fifth step, the results were evaluated and reported. Interviews were made in the needs analysis carried out within the scope of these steps, and the 2N form "what did I know?" part was applied. A detailed conclusion was reached by scanning the relevant literature. In the needs analysis, it was seen that social studies teacher candidates have low political literacy knowledge, skills, and values; they do not know political literacy, and there is no activity or course on political literacy in the undergraduate program. As a result of the scanned literature, it was seen that there are studies showing that the situation is the same in Türkiye. After identifying the problem or subject and performing a needs analysis, political literacy dimensions were tried to be revealed for about 2 and a half years. Then, a political literacy education model was prepared in accordance with the dimensions, and the activities were presented to expert opinions. Action research steps were followed, and a 13-week action plan was created. During the political literacy training, lasting for about three and a half months, analyses were made during the process; deficiencies or problems were shared with the validity committee or advisory committee every week, and the process continued with the necessary changes. The activities carried out are given in Table 2.

Table 2. Knowledge of activities

| Week | Activity name | Lesson Time | Week | Activity name | Lesson Time |
|---|---|---|---|---|---|
| 1th week | Management in the family | 2 | 8th week | Form of government in the world: Does monarchy or republic work the same in every country? | 2 |
| 2nd week | Management in school | 2 | 9th week | World Management, Refugee Issues, and Aylan Baby | 4 |
| 3rd week | Management and rights in social life: Being a student in a minibus | 2 | 10th week | | |
| 4th week | Sexual abuse draft law and political participation | 2 | 11th week | Politicians, managers, and representatives | 2 |
| 5th week | Olive Grove Draft Law and Political Participation | 2 | 12th week | World leaders are discussing | 2 |
| 6th week | Is the March for Justice a right? | 2 | 13th week | Examining different newspapers: Political concepts and examination of them | 2 |
| 7th week | Parliamentary revitalization | 2 | | | |

The same knowledge, skills, and values are tried to be developed in all of the activities in which different methods and techniques are used that center the discussion. The information desired to be developed in all activities is as follows: how the administration is, how power is used, the relationship between media and politics, knowledge of political concepts, the impact of decisions on society, and political participation and its impact. The political literacy skills that are desired to be developed in all activities are as follows: Empathy, political participation, political thinking, and using political language. The political literacy values that are desired to be developed are as follows: Tolerance, justice, giving importance to free thought.

## Findings

In the thesis, the data obtained from each data collection tool was analyzed under separate headings and in accordance with the nature of action research for 13 weeks, week by week. Because the analyses are very comprehensive and long, some sample analyses obtained from data collection tools are included in this study. In order to summarize the development of political literacy, analyses for 13 weeks obtained from self-assessment forms and student reflective diaries, especially for the first and last weeks, were included.

**How does political literacy education, developed with a focus on citizenship education, improve the political literacy of social studies teacher candidates?**

Table 3. The domains of Political Literacy: 2N Form - What did I know?

| Codes | Participants | f |
|---|---|---|
| Policy | P1, P2, P4, P5, P6, P8, P12, P17, P20 | 9 |
| Society and Individual | P3, P5, P7, P9, P10, P12, P13, P15, P18 | 9 |
| Politics | P11, P13, P15, P16, P17 | 5 |
| Education | P1, P13, P15, P16 | 4 |
| Media/Press | P1, P5, P15, P20 | 4 |
| Economy | P12 | 1 |
| Environment | P12 | 1 |
| Citizenship | P16 | 1 |
| Law | P9 | 1 |

When the current knowledge of the social studies teacher candidates in the field of political literacy is examined in the 2N form, it can be seen from Table 3 that the most repeated political literacy areas by the participants are politics (f9), society and individuals (f9), and politics (f5). In addition to these, education (f4), media/press (f4), environment (f1), economy (f1), law (f1), and citizenship (f1) are also stated as domains of political literacy. K14 left this part blank.

After the training 2N form "What did I learn?" shows that participants agree on the main areas of political literacy (Table 4).

Table 4. The Domains of Political Literacy: 2N Form - What did I learn?

| Codes | Participants | f |
|---|---|---|
| Management/Administration | P1, P2, P3, P4, P5, P7, P8, P9, P10, P11, P12, P13, P15, P16, P18, P20 | 16 |
| Society and individual | P2, P3, P4, P6, P7, P9, P12, P13, P14, P15, P17, P18, P19, P20 | 14 |
| Politics | P2, P4, P5, P8, P10, P11, P13, P15, P16, P17, P19 | 11 |
| Media | P5, P14, P15 | 3 |

According to Table 4, after political literacy education, the fields of political literacy are stated as administration, society and individuals, politics, and media. The most repeated political literacy domains were management and administration (f16), society and individuals (f14), and policy and politics (f11), respectively.

Table 5. How Should Power Be Used?: 2N form - What did I know?

| Category and code | Participants | f |
|---|---|---|
| *A democratic attitude* | | |
| Should be used democratically | P2, P4, P5, P6, P10 | 5 |
| Should be used for social benefit | P1, P2, P10, P20 | 4 |
| Should be used away from oppression | P1, P16, P18 | 3 |
| Should be used fairly/impartially | P1, P8 | 2 |
| Should be used in accordance with human rights and freedoms | P1, P2 | 2 |
| Should be used in accordance with the situation | P6, P9 | 2 |
| Should be used as a unifying | P7 | 1 |
| Should be used for the benefit of the state | P2 | 1 |
| Should be in accordance with the will of the society | P12 | 1 |
| Should be used in a balanced and efficient way | P13 | 1 |
| Should be used in accordance with the pluralist understanding. | P15 | 1 |
| Should be used with indulgence | P16 | 1 |
| Should be used with justice | P18 | 1 |
| Should be used by the majority | P19 | 1 |
| *An undemocratic attitude* | | |
| Should be used without being felt | P11 | 1 |
| Should be used based on enforcement | P17 | 1 |
| *Meaningless/blank* | P3, P14 | 2 |

Looking at Table 5, it is seen that the use of force before education is handled under two categories: democratic attitude (n16, f26) and anti-democratic attitude (f2). Two participants left blanks or used meaningless expressions.

Table 6. How Power Should Be Used?: 2N Form - What did I learn?

| Codes | Participants | f |
|---|---|---|
| Based on justice | P1, P2, P3, P5, P6, P7, P8, P9,10, P11, P12, P13, P16, P17, P20 | 15 |
| Based on democracy | P1, P2, P4, P5, P8, P9, P10, P11, P14, P15, P16, P17, P18, P19 | 14 |
| Based on equality | P1, P2, P4, P6, P8, P9, P10, P11, P13, P17, P20 | 11 |
| Based on social benefit | P5, P7, P9, P12, P13, P18, P19 | 7 |
| Based on empathy | P4, P6, P9, P10, P12, P13 | 6 |
| Based on respect | P4, P8, P10, P12, P13, P20 | 6 |
| Should be out of oppression | P1, P9, P10, P15, P18 | 5 |
| Based on human rights | P9, P14, P15, P20 | 4 |
| Based on free thought | P8, P9, P12, P18 | 4 |
| Based on love | P10, P12, P20 | 3 |

According to Table 6, after the training, the participants stated that the use of power should be based on justice (f15), democracy (f14), equality (f11), social benefit (f7), empathy (f6), respect (f6), freedom from oppression (f5), appropriate for personal rights (f4), based on the importance of free thought (f4), and love (f3). Almost all of the participants stated that power should be used according to democratic and political literacy values. It is seen that the level of knowledge has increased quite well compared to the pre-training period.

Table 7. Results and Effects of Political Participation: 2N Form - What did I know?

| Category and code | Participants | f |
|---|---|---|
| *Positive results* | | |
| Contributing to democracy | P7, P18 | 2 |
| Reaching a wide range of different sounds | P2, P12 | 2 |
| to be accepted | P10, P13 | 2 |
| Changing the current system | P5, P16 | 2 |
| Use of force for unity | P12 | 1 |
| Change | P11 | 1 |
| Achieving truth/equality/justice/goal | P9 | 1 |
| Being an interrogator | P1 | 1 |
| Changing the given political decision | P16 | 1 |
| *Negative consequences* | | |
| Being marked | P2, P15, P20 | 3 |
| Being exclusion/rejection | P10, P13 | 2 |
| Passing power to the wrong people | P3, P17 | 2 |
| May cause an argument/fight | P6, P7 | 2 |
| The given vote is not deserved | P8 | 1 |
| *Meaningless / left blank* | P4, P14, P19, P20 | 4 |

Looking at the available knowledge on the results of political participation in Table 7, positive (f11) and negative results (f8) are grouped under 2 categories. Although each of them stated different results, it may not be said that they gave strong answers. Four of them stated that political participation has both positive and negative consequences. Contributing to democracy (f2), reaching wide areas of different voices (f2), and changing the current system (f2) are the most repeated positive results of political participation. Marking (f3), exclusion or rejection (f2), transfer of power to the wrong person by voting (f2), possible arguments or fights (f2), and undeserved votes (f1) are stated as negative consequences of political participation.

Table 8. Results of Political Participation: 2N Form - What did I learn?

| Category and code | Participants | f |
|---|---|---|
| Positive results | | |
| *Consequences for impact on politics/politicians* | | |
| Withdrawal of decisions made | P1, P3, P4, P5, P6, P7, P8, P9, P10, P11, P14, P15, P16, P18, P19, P20 | 16 |
| Editing/amending the decision | P1, P2, P7, P9, P16, P17, P19 | 7 |
| Guiding managers to be fair | P6, P4, P7 | 3 |
| Directing administrators | P9, P14, P19 | 3 |
| Statement from the authorities | P2 | 1 |
| Facilitating the entry into force of the decision | P19 | 1 |
| Preparation of draft laws | P2 | 1 |
| Being noticed by management | P12 | 1 |
| *Consequences for impact on society* | | |
| Making a voice in the media | P1, P8, P16, P18 | 4 |
| Making a voice in the community | P8, P9, P12, P15 | 4 |
| Providing social benefit/awareness | P12, P13, P16, P17 | 4 |
| Causing social change | P3, P6, P8 | 3 |

Looking at Table 8, all participants stated that political participation had positive results after political literacy training. They stated that with political participation, the decisions taken by the politicians can be withdrawn, rearranged, or changed; new decisions can be enacted or new draft laws can be made; and those in the administration can respond to the public's reaction.

Student worksheets were evaluated with the “Political Literacy Activity Evaluation Rubric." Student studies were evaluated in terms of political literacy knowledge, skills, and values and were generally evaluated as "poor," "medium," "good," and "very good."

| Table 9. Quality of student worksheets | | f |
|---|---|---|
| Quite good | Olive Grove Draft Law<br>Management and Rights in Social Life<br>Is the March for Justice a Right?<br>Parliamentary Revitalization<br>Management in the World<br>World Management and Syrians<br>Syria Issue and Debate<br>Politicians and Managers<br>World Leaders are Discussing<br>I'm Looking At Different Papers | 10 |
| Good | Management at School<br>Sexual Abuse Draft Law | 2 |
| Medium | Management in the family | 1 |
| Poor/Weak | - | |

According to Table 9, the activity in the first week is moderate, the activity in the second and fourth weeks is good, and the activities in the following weeks are at a very good level. From the middle to the end of the 13th week, it is understood that the pre-service teachers are in a very good situation in terms of political literacy knowledge, skills, and values.

In the news analysis within the scope of the terrorist incidents in France and New Zeland, K6 focused on tolerance and empathy by using political thinking skills: *“Trump, thinking about this situation in line with his own interests without empathy and saying "it wouldn't be like this if they have guns" in order to contribute to his country's economy and arms sales shows that he speaks without empathy. The Prime Minister of New Zealand, on the other hand, wearing Muslim clothes, starting her speech with a hadith of our Prophet (Muhammed), and attending the Friday prayer emphasize unity and solidarity. She does this even though she is a Christian. It shows that she is on the side of the Muslims. Unity in the same body means one's pain means all of us."*

In another student worksheet or activity, P2 evaluated the Greek deputy's speech, which contained extreme grudges and hatred towards the Turks, as follows: *"He could not use his freedom of thought and expression properly. Because while expressing our thoughts, it should be within the framework of respect and tolerance, without violating the rights of others. There is no freedom of thought or expression by humiliating or insulting someone."* P2 focused on tolerance, respect, human rights, and freedom of thought and expression.

In another student worksheet/activity K3, describing the relationship between media and politics with pictures, it stated that political party leaders hold the media in their hands and impose their own ideas through the media, and they do not allow the media to be free.

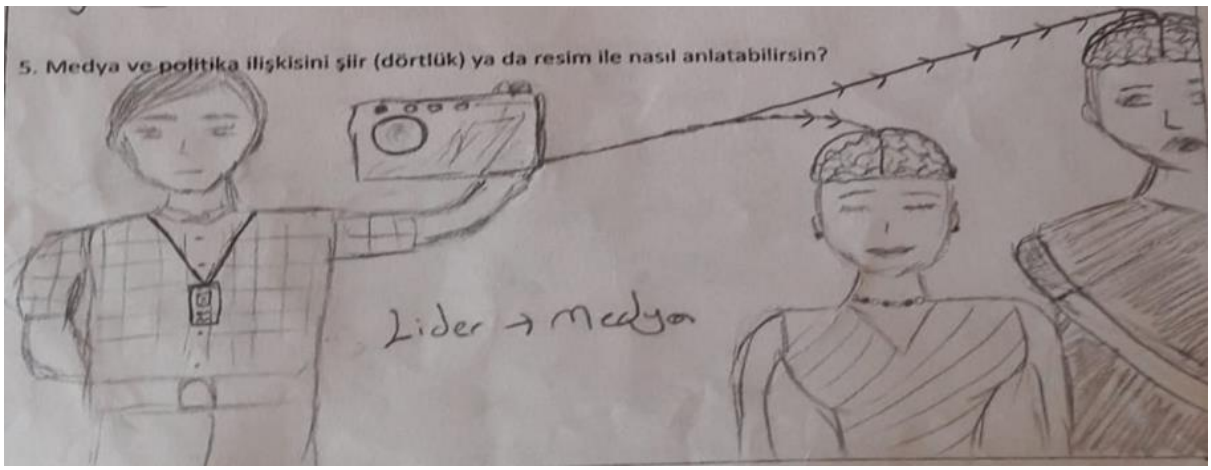


Figure 1. The relationship between media and politics according to K3 (Lider: Leader, Medya: Media)

K3: *"The media has to be fair. The news presented by the media is important. So it has to be fair. When using the media, it is necessary not to criticize a side while glorifying a section. The language it uses must be soft and tolerant. (...) Certainly, the media has to be free. It also has to reflect every segment and every event."*

Participants were observed during each activity week. It was observed that they hesitated in the first weeks and did not participate in the lesson. As a result of the interviews with them and the decision taken by the validity committee, the camera in the classroom was removed. Moreover, as they started to trust the researcher, it was observed that they participated in the activities, and over time, they improved their empathy, political thinking, political participation, using political language skills, and the values of tolerance, respect, justice, and free thought.

A self-assessment form was distributed to each student, and they rated items based on their own political literacy knowledge, skills, and values on a weekly basis. Since it is very comprehensive, only the self-assessments of the first and last weeks for some knowledge, skills, and values are given in Table 10.

Table 10. Self-assessments of some knowledge, skills, and values

| | I learned / Yes | Partially learned / Partially yes | I didn't learn / I didn't use |
|---|---|---|---|
| Knowledge on the use of power | | | |
| 1th week | P11, P14, P16, P17, P20 | P2,P3,P4,P5,P6,P7,P10,P12,P13,P15, P19, | P1, P8, P9, P18 |
| 13th week | P1, P2, P3, P5, P6, P7, P9, P10, P12, P13, P14, P15, P16, P17, P18, P19, P20 | - | - |
| Knowledge on the impact of participation in a decision/political issue | | | |
| 1th week | P3, P6, P11, P12, P13, P14, P20 | P1, P2, P4, P5, P7, P9, P10, | P3, P6, P11, P12, P13, P14, P20 |
| 13th week | P1, P2, P3, P5, P6, P7, P9, P10, P12, P13, P14, P15, P17, P18, P19, P20 | P16 | |
| Media and political relationship knowledge | | | |
| 1th week | P11, P17 | P4, P7, P8, P10, P14, P15, P16, P18, P20 | P1, P2, P3, P5, P6 |
| 13th week | P1, P2, P3, P5, P6, P7, P9, P10, P12, P13, P14, P15, P16, P17, P18, P19, P20 | - | - |

| | | | |
|---|---|---|---|
| Empathy skill: Looking at events from different people's perspectives | | | |
| 1th week | P2, P3, P8, P11, P14, P16, P17, P20 | P5, P6, P7, P10, P12, P18 | P1, P4, P9, P13, P15, P19 |
| 13th week | P1, P2, P3, P5, P6, P7, P9, P10, P12, P13, P14, P15, P16, P17, P18, P19, P20 | - | - |
| Political participation skills: Willingly participate in discussions | | | |
| 1th week | P3, P11, P14, P16, P17 | P2, P6, P7, P10, P12, P18, P19, P20 | P1, P4, P5, P8, P9, P13, P18 |
| 13th week | P1, P2, P3, P5, P6, P7, P9, P10, P12, P13, P14, P15, P16, P17, P18, P19, P20 | - | - |
| Critical thinking skill: Questioning the impact of political decision on others | | | |
| 1th week | P1, P3, P11, P13, P16, P17 | P2, P5, P6, P7, P8, P9, P10, P12, P19, P20 | P4, P14, P15, P18 |
| 13th week | P1, P2, P3, P5, P6, P7, P9, P10, P12, P13, P14, P15, P16, P17, P18, P19, P20 | - | - |
| The Skill of using political language: Using political concepts correctly | | | |
| 1th week | P8, P11, P17, P20 | P1, P3, P6, P7, P10, P12, P13, P14, P16 | P2, P4, P5, P9, P15, P18, P19 |
| 13th week | P1, P2, P3, P5, P6, P7, P9, P10, P12, P13, P14, P15, P16, P17, P18, P19, P20 | - | - |
| The value of justice: Addressing injustice on a political issue | | | |
| 1th week | P3, P11, P12, P13, P14, P17 | P1, P2, P5, P6, P7, P16, P20 | P4, P8, P9, P10, P15, P18, P19 |
| 13th week | P1, P2, P3, P5, P6, P7, P9, P10, P12, P13, P14, P15, P16, P17, P18, P19, P20 | - | - |
| The value of tolerance: Patiently listening to different opinions when discussing | | | |
| 1th week | P2, P4, P6, P10, P11, P12, P15, P16, P17, P19, P20 | P1, P3, P5, P7, P8, P9, P13, P14, P18 | - |
| 13th week | P1, P2, P3, P6, P7, P9, P10, P12, P13, P14, P15, P16, P17, P18, P19, P20 | P5 | - |
| Freedom/free thought: Care about free thought | | | |
| 1th week | P2, P3, P8, P9, P11, P12, P13, P17, P19, P20 | P1, P5, P6, P7, P14, P16, P18 | P4, P10, P15 |
| 13th week | P1, P2, P3,P5, P6, P7, P9, P10, P12, P13, P14, P15, P17, P18, P19, P20 | P16 | - |

When Table 10 is examined, the participants think that they have improved their political literacy in terms of knowledge, skills, and values. Although some participants consider themselves to be much better than they are, it is evident that they have improved and progressed considerably in the observations and interviews. In the worksheets, they also reflected their knowledge, skills, and values, which they developed very well, especially in the 5th week, in the activity. Student and researcher reflective diaries also show a significant improvement after the 4th and 5th weeks.

Student reflective diaries were analyzed for 13 weeks in separate weeks. When looking at the part of "What did I learn?" the first and last week, it is seen that they improved their political knowledge, skills, and values.

Table 11. The First Week: Student Reflective Diary - What did I know?

| | Participants | f |
|---|---|---|
| *Knowledge* | | |
| Knowledge of concepts | P5, P6, P7, P8, P12, P13, P16 | 7 |
| Use of power | P3, P9, P10, P12, P16 | 5 |
| Impact of the decision on people/society | P10, P15, P16 | 3 |
| Democratic management of the family | P6, P7 | 2 |

Table 12. The Thirteenth Week: Student Reflective Diary - What did I learn?

| | Participants | f |
|---|---|---|
| *Knowledge* | | |
| Media and political relationship | P1, P2, P3, P5, P6, P9, P10, P12, P13, P14, P15, P16, P19 | 13 |
| The impact of the media on society/perception management | P2, P5, P9, P10, P15, P16 | 6 |
| Use of power | P6, P10, P14, P15 | 4 |
| Knowledge of concepts | P6, P14 | 2 |
| Impact of political decisions on society | P14 | 1 |

When Tables 11 and 12 are examined, it is understood that their current knowledge and the number of participants learning in accordance with the subject of the week have increased.

There is a similarity between the researcher's and the student's reflective diaries. Week 1 In the researcher's reflective diary, it was noted that the participants remained passive towards the dimensions of political literacy. From the 4th and 5th weeks, more positive notes began to appear in the researcher's diaries. For example, in the 11th week, it was pleasant to have a very enjoyable, entertaining, and creative environment in the classroom due to creative drama, to use political literacy skills and values correctly, and to have high participation. It was stated that there was no unpleasant situation, but only one participant did not like writing. In the thirteenth week, the researcher noted that the class participation was very good, and advanced answers were given for the dimensions of political literacy. In the last 8 weeks, the presence of an environment compatible with political literacy skills and values and the voluntary participation of the participants without the insistence of the researcher were noted as pleasant situations.

**What are the opinions of the social studies teacher candidates on political literacy education and activities developed with a focus on citizenship education?**

One-on-one and face-to-face interviews were done with ten of the 20 pre-service teachers participating in political literacy training.

Table 13. Opinions of participants on their political literacy status after the political literacy training

| | Participants | f |
|---|---|---|
| *Political literacy status* | | |
| I am a politically literate individual | P3, P5, P11, P12, P13, P14, P15, P16, P17, P19 | 10 |
| I am not politically literate | - | - |
| *The impact of political literacy education* | | |
| Yes / Evolved | P3, P5, P11, P12, P13, P14, P15, P16, P17, P19 | 10 |
| None / Not developed | - | - |

According to Table 13, at the end of the political literacy training, all of the participants see themselves as politically literate individuals. They stated that political literacy education is effective in these situations or that it improves their political literacy status.

P16: *"Until I came to this course, I wouldn't call myself racist, but when I was commenting on a subject, I used to judge without thinking about the other side, without using my empathy skill. Yes, it would even reach the trial stage. After taking this course, I see that I have become a different person. That's why I call myself politically literate."*

Table 14. Opinions of social studies teacher candidates on what they learned after education

| | Participants | f |
|---|---|---|
| Knowledge of concepts | P3, P5, P11, P12, P13, P15, P17, P19 | 8 |
| Political participation/impact of it | P3, P12, P13, P14, P15, P17, P19 | 7 |
| Media and political relationship | P3, P5, P12, P14, P17, P19 | 6 |
| How to use power | P3, P11, P12, P15, P17 | 5 |
| Political literacy values | P3, P11, P12, P15, P17 | 5 |
| Political literacy skills | P3, P11, P14, P15 | 4 |

| | | |
|---|---|---|
| Impact of political decisions on society | P15, P12, P19 | 3 |
| How decisions should be made | P15, P19 | 2 |
| Political literacy and its field | P14, P17 | 2 |
| How politicians/managers should be | P3, P15 | 2 |

According to Table 14, in the political literacy education course, they stated that they learned concepts such as political participation, power, administration, and democracy (f8); political participation and the effect of political participation (f7); the relationship between media and politics (f6); how power should be used (f5); political literacy values (f5); political literacy skills (f4); how to make decisions (f2); political literacy and its field (f2); and how politicians and managers should be (f2).

P14: *"I learned the relationship between media and politics; I learned what political literacy is. I never knew power. I learned how to use power. I learned how to use it. Then I learned about the fields of political literacy. I learned things like this."*

Table 15. After the training, social studies teacher candidates' gained/developed skills

| | Participants | f |
|---|---|---|
| Empathy | P3, P5, P11, P12, P13, P14, P15, P16, P17, P19 | 10 |
| Political thinking | P5, P11, P12, P13, P14, P16, P17, P19 | 8 |
| Using political language | P3, P5, P11, P12, P14, P16, P17 | 7 |
| Political participation | P3, P5, P12, P13, P14, P16, P19 | 7 |

According to Table 15, they gained or developed empathy (f10), political thinking (f8), using political language (f7), and political participation skills (f7) in the political literacy education course.

K3: *"I am a political participant. But not by shouting, breaking, or getting angry while doing this political participation. For example, by empathizing with the skills of political participation (IIII), using a softer language, or using the media, I realize political participation. I use critical language."*

Table 16. After the training, social studies teacher candidates' gained or developed values

| | Participants | f |
|---|---|---|
| Tolerance | P3, P5, P11, P12, P14, P15, P16, P17 P19 | 9 |
| Justice | P3, P5, P11, P12, P13, P14, P15, P16, P19 | 9 |
| freedom/free thought | P3, P5, P13, P12, P14, P17, P19 | 7 |
| Respect | P3, P12, P13, P14, P16, P17, P19 | 7 |
| Equality | P3, P13, P14, P15 | 4 |
| Democracy | P3 | 1 |
| Love | P12 | 1 |
| Peace | P14 | 1 |

According to Table 16, they stated that they gained or improved the values of tolerance (f9), justice (9), freedom/free thought (f7), respect (f7), equality (f4), peace (f1), democracy (f1), and love (f1).

K16: *"Justice comes first. Because, as I said, I always made one-sided comments. I used to interpret what was right for me as always fair for me. I learned the concept of tolerance. As I just mentioned, I couldn't tolerate someone with a different opinion much more than normal. But after taking this course, when I had conversations and discussions with people with opposite views, I thought it helped me in terms of tolerance. I don't interrupt the conversation when the other person is talking about being respectful. I am waiting for him to voice his thoughts because I would like the same action to be taken against me. (...) It clearly gave me these because I think I was lacking in these issues before."*

Table 17. Likes and dislikes of social studies teacher candidates in political literacy education

| | Participants | f |
|---|---|---|
| *Favorite statuses* | | |
| Being informed about current events | P12, P13, P15, P16 | 4 |
| Playing role of deputies | P3, P5, P16 | 3 |
| Bringing/involving political participation in the course | P11, P13, P14 | 3 |
| The course makes the student active | P3, P17 | 2 |
| The lesson is effective/fun | P13, P19 | 2 |
| Developing a sense of empathy | P3, P16 | 2 |
| Having different opinions | P5, P19 | 2 |
| Having activities related to student rights | P15, P16 | 2 |
| Allowing conscious individuals to grow | P14 | 1 |
| Expressing thoughts easily | P3 | 1 |
| Supporting activities with different materials | P5 | 1 |
| The activities being related to Türkiye | P15 | 1 |
| intellectual development | P12 | 1 |
| Simplifying complex events | P12 | 1 |
| Writing/learning concepts by writing | P16 | 1 |
| *Undesirable situations* | | |
| Writing/filling data collection tools | P3, P11, P12, P14, P17, P19 | 6 |
| Not everyone is participating in the lesson | P5, P15, P16 | 3 |

Table 17 shows that the situations that are liked in the political literacy education lesson are much greater than the ones that are disliked. It is seen that they enjoy the course in general, but they don't like the situation of writing too much for research.

All participants stated that this political literacy education has to be included in the social studies undergraduate program. The reasons are presented in Table 18.

Table 18. The necessity of including political literacy education in the social studies undergraduate program according to social studies teacher candidates

| | Participants | f |
|---|---|---|
| To be conscious, politically literate, good, and equipped teachers and citizens | P3, P5, P11, P12, P15, P19 | 6 |
| To be able to participate politically | P11, P12, P13 | 3 |
| To be a citizen who believes in equality | P5, P14 | 2 |
| To be inquiring citizens | P11, P19 | 2 |
| Having a close relationship with social studies | P13, P16 | 2 |
| To be a fair citizen | P5 | 1 |
| To be an active citizen | P14 | 1 |
| To be a tolerant/respectful citizen | P14 | 1 |
| Being a practical/student-centered course | P17 | 1 |

In Table 18, it's seen that Political Literacy Education has to be included in the social studies undergraduate program to be politically literate citizens and teachers (f6) and to be able to participate politically (f3). Moreover, it is important to educate citizens who believe in equality, think critically, and are active and fair.

Table 19. The importance of involving media in political literacy education according to social studies teacher candidates

| | Participants | f |
|---|---|---|
| Analyzing the media with political thinking | P3, P13, P15, P16, P17, P19 | 6 |
| Media conveying the policy to the public | P11, P12, P13, P17, P19 | 5 |
| Political participation through social media/media | P12, P13, P16 | 3 |
| Media as a communication tool between the government and the public | P5 | 1 |

According to social studies teacher candidates, media should be included in political literacy education because, by analyzing the media with political thinking (f6), the media conveys the policy to the public.

Table 20. Use of different methods and techniques in political literacy education according to social studies teacher candidates

| | Participants | f |
|---|---|---|
| Those who find it positive/effective | P3, P5, P11, P12, P13, P14, P15, P16, P17, P19 | 10 |
| Those who find it negative/ineffective | - | - |

As can be seen in Table 20, social studies teacher candidates found it positive or effective to use different methods and techniques such as question-answer debate, parliamentary debate, opposite panel, brainstorming, drama, and the six-hat thinking technique within the scope of political literacy education.

## Results and Discussion

In this study, it has been concluded that social studies teacher candidates have a very significant improvement in political literacy knowledge, skills, and values, and they are politically literate at a good level after Political Literacy Education (POLOKE). However, Faiz and Dönmez (2016) concluded that the political literacy knowledge, skills, and affective tendencies of social studies teacher candidates are moderate. Hunter and Rack (2016) concluded that young people do not have political literacy skills. Tarhan (2015) stated that the education that pre-service teachers received throughout their lives was not effective in making them politically literate, and they did not see themselves as politically literate individuals. However, in this study, it has been concluded that social studies teacher candidates see themselves as politically literate individuals after POLOKE.

In the study, it was concluded that social studies teacher candidates have positive views about POLOKE and that this education is important in social studies teaching and teacher education. According to them, political literacy is very important for both citizenship education and teacher education in order to raise effective, active, and well-equipped teachers or citizens. Douglas (2002) also finds it quite important to conduct studies on political literacy in the fields of citizenship education and teacher education. Löfström, Virta, and Van den Berg (2010) defined political literacy as a form of literacy that is within the scope of social studies. For this reason, it has come to the conclusion that political literacy and politics should be included in social studies aimed at citizenship education. Akhan (2011) also concluded that politics is important in social studies and should be known by social studies teacher candidates.

In political literacy education, using different methods, techniques, and activities, putting the student at the center, including active participation and focusing on discussion, is seen as positive and effective by pre-service teachers. The use of different methods and techniques based on discussion makes the lesson fun. According to Dougles (2022), some citizenship educators have stated that the civics lesson can be knowledge-based and even boring. So Dougles (2002) states that this situation can be eliminated with the inclusion of political literacy in the program.

## Recommendations

It is important to increase studies on political literacy, a very new concept in Turkey. This research, carried out within the scope of Social Studies teacher education, can be carried out with primary and secondary school students in the social studies course.
This research was carried out within the scope of Social Studies teacher education, and it was concluded that teacher candidates improved their political literacy. With the aim of citizenship education in education faculties, this research can also be carried out in other teacher education undergraduate programs.
In research on political literacy, it is recommended not to use the camera because it prevents participation.
It is recommended to create discussion environments in the classroom and to make the participants active by using different methods and techniques based on discussion.
Political literacy should be included as an elective course in the Social Studies Teacher Education program, or it is suggested that political literacy activities should be included in courses such as Citizenship, New Approaches in Social Studies, and Social Studies Teaching.
Studies and in-service trainings related to political literacy education for social studies teachers can be carried out by cooperating with Social Studies field experts who do adequate studies on political literacy.

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# Middle School Students' Cognitive Perceptions of Cycles of Matter and Environmental Problems: A Word Association Test

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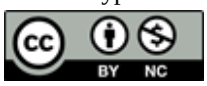

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# Middle School Students' Cognitive Perceptions of Cycles of Matter and Environmental Problems: A Word Association Test

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## Abstract

This study employed a word association test to determine middle school students' cognitive perceptions and misconceptions of the key concepts regarding "cycles of matter and environmental problems." The study adopted descriptive research in survey model. The sample consisted of 457 eighth-grade students from four middle schools affiliated with the Ministry of National Education (MoNE) in the central district of Muş province in the 2020-2021 academic year. Data were collected using a word association test developed by the researcher. The test addressed eight key concepts: “water cycle,” “nitrogen cycle,” “oxygen cycle,” “carbon cycle,” “ozone layer,” “global warming,” “greenhouse effect,” and “ecological footprint.” The data were analyzed using content analysis. Concept networks were created based on participants’ responses. Participants associated “water cycle,” “nitrogen cycle,” “oxygen cycle,” “carbon cycle,” “ozone layer,” “global warming,” “greenhouse effect,” and “ecological footprint” with “evaporation,” “lightning,” “photosynthesis,” “carbon dioxide,” “ozone hole,” “melting of glaciers,” “global warming,” and “humans,” respectively. Participants did not make adequate associations with oxygen cycle, which was one of the key concepts. It was found that participants did not know enough about the key concepts from the sentences they wrote, preventing them from making scientific statements. They mostly had unscientific and superficial remarks and misconceptions. Within the scope of the research, it is recommended that teachers create effective learning environments where they can use different methods and techniques to help students eliminate misconceptions.

**Keywords:** Cycles of matter, Environmental problems, Misconceptions, Cognitive perception, Word association test

## Introduction

Environmental problems have escalated and come to threaten all large industrial nations worldwide since the Industrial Revolution. At first, environmental problems were seen mainly in terms of the pollution of separate areas of the environment. However, today, they negatively affect social life. Therefore, environmental problems have become a popular topic of research and discussion (Görmez, 2007). Climate change, global warming, rapid population growth, technological developments, and industrialization have made it necessary to prioritize environmental issues in every field. Environmental problems affect social life more and more. Therefore, countries have introduced measures and policies to mitigate their adverse effects. In addition, value judgments have been instrumental in raising public awareness of living beings and sustainable settings (Özkan, 2008). Environmental problems have been long ignored because they progress too slowly to recognize their adverse consequences. This is particularly evident in cycles of matter. At first, we hardly understand the consequences of our unconscious interventions in the cycles of matter because nature heals itself. However, we have faced numerous environmental problems because we are destroying nature at an unprecedented rate. For example, significant changes in the carbon cycle have led to environmental problems that threaten humanity, such as global warming, air pollution, and the destruction of wetlands. We still do not know the consequences of significant changes in the nitrogen cycle (Gökmen & Solak, 2015). Environmental pollution is increasing rapidly and continuously due to rapid population growth, unplanned urbanization, wars, pesticides, artificial fertilizers, and chemicals. Air, water, and soil pollution is a significant threat to the survival of organisms (Ministry of Environment, 1998).

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One of the leading causes of environmental problems is a lack of awareness and knowledge. People who are not environmentally conscious do not recognize that they hold the Earth in trust for future generations (İnanç & Kurgan, 2000). On the other hand, the key to the survival of states is sustainable natural resources. Therefore, educating people, institutions, and organizations about the environment is crucial. We should also educate children to transform them into eco-friendly individuals (Tombul, 2006). In recent years, educators have focused on the concept of environmental education. According to educators, environmental education aims to turn students into eco-friendly individuals who act consciously toward the environment, develop a critical perspective in their interactions with the environment, and do their best to leave future generations on a livable planet (Doğan, 1997). In this context, educational institutions are places where people develop cognitive, affective, and psychomotor skills (Topkaya, 2016). In 1993, the European Parliament emphasized that teachers and schools played a critical role in developing and implementing environmental education and policies (Stokes, Edge, & West, 2001). Since then, curricula have started to address environmental education. In Turkey, environmental education is mainly taught in science classes (Özata-Yücel & Özkan, 2013). Environmental education should primarily focus on the importance and current state of the environment and possible environmental problems. Environmental education should be provided for all ages, at all levels, and in both formal and non-formal education (Nalçacı & Beldağ, 2012).

Environmental education starts in a child's home and immediate neighborhood. What children learn from their parents forms the basis of their future moral, cognitive, affective, and psychomotor behaviors. According to developmental psychologists, children develop mental sensitivity toward the environment and delve into the interaction between humans and nature at the age of 9 or 10, which corresponds to primary school years (Armağan, 2006). Primary education is the first and most crucial step in environmental education because young people are part of and affected by environmental problems. Therefore, young people need to gain knowledge and develop awareness and sensitivity toward the environment (Erol & Gezer, 2006). In this context, middle school students should also be provided with environmental education. The science curriculum in Turkey was revised in 2018 in line with the relationship between science and the environment. The curriculum includes the topic of "Cycles of Matter and Environmental Problems," which covers the basic concepts of ecology. We should determine how students perceive those concepts because students with environmental awareness are more likely to understand the leading causes of environmental problems and offer solutions. Therefore, this study focused on middle school students' cognitive perceptions of cycles of matter and environmental problems. Data were collected using a word association test, which is a helpful and practical instrument for revealing what people think of concepts. In other words, word association tests are effective tests that help us understand how people perceive and comprehend concepts (Özata-Yücel & Özkan, 2014). In a word association test, the participant is presented with a concept and then asked to write down the words that come to mind. This helps the researcher identify the participant's perceptions of that concept (Atabek Yiğit, Balkan Kıyıcı, & Yavuz Topaloğlu, 2019). Researchers use metaphors, illustrations, interviews, concept maps, concept cartoons, and word association tests to determine how well students know and perceive concepts (Ahi & Alisinanoğlu, 2016; Akgün, Duruk & Gülmez Güngörmez, 2016; Cardellini & Bahar, 2000; Çelik, 2020; Ertürk, 2017; Polat, 2013; Kayhan, 2019; Kızılay, 2020; Seçgin, Yalvaç & Çetin, 2010; Selçuk & Yılmaz, 2017; White & Gunstone, 2000). However, only a few researchers have investigated how students perceive cycles of matter. Moreover, they have focused on the effect of different methods and techniques on the teaching cycles of matter (Ercan, Girgin, & Atılboz, 2017; Gökmen, & Solak, 2015). Scientists address cycles of matter and environmental problems extensively. However, the topic is imbued with misconceptions. Therefore, we should identify students' cognitive perceptions of cycles of matter and environmental problems before we expect them to attain achievement in that regard. Research shows that students know little about cycles of matter and have misconceptions about them. Research also shows that they have difficulty understanding cycles of matter and find them hard to grasp (Çetin, 1998; Ercan et al., 2017; Özkan, 2001; Öztaş, 2005). Students cannot achieve permanent and meaningful learning because they mostly receive theoretical education and, therefore, cannot associate what they learn with what they see (Öztaş, 2005) There is only a small body of research on cycles of matter and environmental problems, although we should address human-induced and global environmental problems due to changes in cycles of matter. We should also address cycles of matter and environmental problems together to understand the problems we face and find solutions to them (Nacaroğlu, Bektaş, & Kızkapan, 2020). This is the first study to investigate middle school students' cognitive perceptions of cycles of matter and environmental problems. We think this study will fill a gap in the literature and pave the way for further research. We also think that our results will help authorities take measures to raise students' awareness of environmental problems and develop policies to mitigate their adverse impacts.

### Research Objective

This study used a word association test to determine eighth graders' perceptions and misconceptions regarding cycles of matter and environmental problems. The following are research questions:

1. What kind of cognitive perceptions do eighth graders have regarding cycles of matter and environmental problems?
2. What kind of misconceptions do eighth graders have regarding cycles of matter and environmental problems?

## Method

### Research Model

This study adopted a descriptive survey model as a research design, aiming to reveal the cognitive structures of students through word association tests. The descriptive survey model is a research approach that aims to describe in depth a situation that exists in the past or today (Karasar, 2014). In survey research, current situations, conditions, and features are tried to be revealed in every aspect, and "what" is described. It includes processes such as interpretation, evaluation, and reaching generalizations to be applied to new situations by analyzing and explaining the data (Şen, 2010). Since this research aims to determine the cognitive structures and misconceptions of secondary school students regarding the subject of matter cycles and environmental problems, it was deemed appropriate to use this model.

### Study Group

The sample consisted of 457 (214 female and 243 male) eighth graders from four public middle schools in a province in the Eastern Anatolia Region in the 2020–2021 academic year. Table 1 shows the participants' descriptive characteristics.

Table 1. Descriptive Characteristics

| School | Gender | Frequency | Total |
|---|---|---|---|
| School A | Female | 51 | 112 |
| | Male | 61 | |
| School B | Female | 22 | 55 |
| | Male | 33 | |
| School C | Female | 72 | 154 |
| | Male | 82 | |
| School D | Female | 69 | 136 |
| | Male | 67 | |

Participation was voluntary. Participants were recruited using criterion sampling, which is a purposive sampling method. The primary purpose of criterion sampling is to recruit a sample that satisfies a set of predetermined criteria (Patton, 2015). Criterion sampling is a time- and cost-efficient method by which researchers select participants most suited to the research purpose (Yıldırım & Şimşek, 2013). The Science Curriculum in Turkey (2018) addresses the topic of "cycles of matter and environmental problems" in the eighth grade [MoNE, 2018]. The main criterion was recruiting students familiar with the concepts of cycles of matter and environmental problems. Therefore, the sample consisted of eighth graders.

### Data Collection

Data were collected using a word association test. Researchers use word association tests to determine how people make associations between concepts (Atasoy, 2004). A word association test consists of four steps. First, the researcher identifies key concepts. Second, she investigates how respondents associate the key concepts with other important words. Third, she checks the key concepts' number, type, scientific nature, and associated power. Fourth, she focuses on the power of the cognitive structure to determine how well the respondents have learned the concepts (Çetin, 2010). In this study, the researcher developed the word association test based on expert feedback. The test addressed eight key concepts derived from the science curriculum. Those key concepts were "water cycle," "nitrogen cycle," "oxygen cycle," "carbon cycle," "ozone layer," "global warming," "greenhouse effect," and "ecological footprint" (MoNE, 2018). The test consisted of two parts. The first part consisted of items on the research procedure and demographic characteristics. The second part consisted of eight

concepts written five times in a row with a blank space in front of them. Participants were asked to write down the words that occurred to them when they heard the concepts. The stimulus key concepts were written one after the other to prevent participants from giving a chain response. They were also asked to respond within a certain time limit (Polat, 2013). In this way, participants returned to the stimulus keyword after each response, which prevented them from making off-topic associations (Ekici & Kurt, 2014). A page was reserved for each concept. Participants were also asked to write a sentence about the key concepts to determine how much they knew about them and whether they had misconceptions about them (Nacaroğlu & Bozdağ, 2020). The researcher visited each school on different days and collected data in each classroom at different times. She gave each participant one minute to answer each concept. Afterward, she analyzed all participants' responses. Figure 1 shows a sample word association test page.

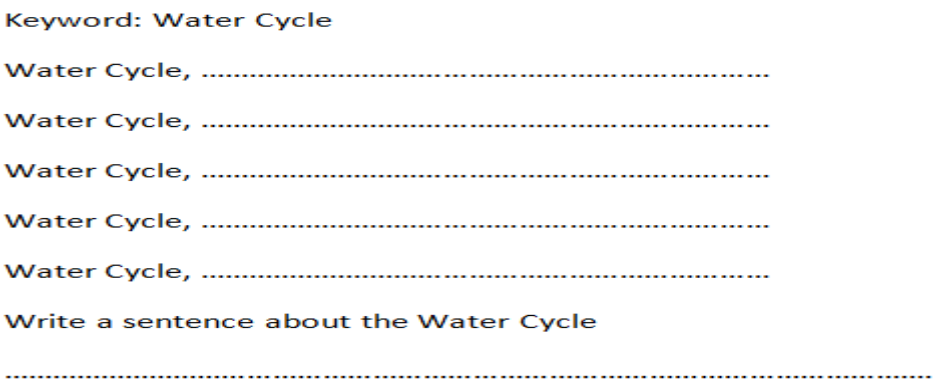



Figure 1. A sample word association test page

**Data Analysis**

The data were analyzed using content analysis. Researchers employ content analysis to develop concepts and categories to explain the data. Content analysis involves the following steps: (1) analyzing data and (2) collecting similar data under categories. A content analysis begins with coding and ends with categorizing (Yıldırım & Şimşek, 2018). In this study, the data were analyzed based on the number of responses, words, and semantic associations (Atasoy, 2004). The researcher and two experts independently analyzed and compared the data at different times. The data were analyzed based on the steps identified by Bahar, Johnstone, and Sutcliffe (1999). The researcher assigned each participant a code (P1, P2, P3, etc.). She listed the responses, determining frequency values, cutoff ranges, and corresponding response words. Next, she developed concept networks and established their validity and reliability. She used the cutoff points technique to develop the concept networks based on the frequency of words derived from the key concepts. According to this technique, the cutoff point is set 3-5 below the word with the highest repetition frequency. Afterward, the cutoff point is moved down a certain range each time to add to the concept network (Bahar et al., 1999). The first cutoff point was ≥180, after which the cutoff point was moved down to ≥20 each time. Lastly, the concept networks corresponding to each cutoff interval were shown in different colors. Figure 2 shows the concept of network colors corresponding to each cutoff point and interval.

| Cut-off Point | Concept Network Color |
|---|---|
| 180-Above | Pink |
| 179-160 | Purple |
| 159-140 | Yellow |
| 139-120 | Green |
| 119-100 | Blue |
| 99-80 | Red |
| 79-60 | Orange |
| 59-40 | Brown |
| 39-20 | Turquoise |
| 19-10 | Navy blue |

Figure 2. Cutoff Points and Concept Network Colors

The researcher and two experts categorized and compared all the sentences made by participants. They continued to analyze them until they reached a consensus. They used Ercan, Taşdere, and Ercan's (2010)

method to group the sentences into four categories: (a) scientific sentences, (b) unscientific sentences or superficial sentences, and (c) sentences with misconceptions. A scientific sentence is a sentence that is scientifically true and associated with the key concepts. An unscientific or superficial sentence is an everyday-life and emotional sentence that is not scientifically true and is not associated with key concepts. A sentence with misconceptions is a sentence that contains misconceptions (Balbağ, 2018) (see Table 3). Direct quotes were used to provide an accurate and coherent picture of participants' perceptions and to improve reliability. Lastly, the "Blank" category was used when participants did not make any sentences about the key concepts.

## Results

The results were presented in tables and figures. Table 2 shows the key concepts, the number of responses, the most frequently repeated word for each key concept, and their frequency.

Table 2. Number of Responses Given to Keywords

| **Key Concept** | **Number of Words** | **Most Frequent Word for** | **Frequency** |
|---|---|---|---|
| Greenhouse Effect | 202 | Global warming | 62 |
| Global Warming | 190 | Melting of glaciers | 88 |
| Ecological Footprint | 171 | Humans | 50 |
| Water Cycle | 150 | Evaporation | 228 |
| Ozone Layer | 146 | Ozone hole | 71 |
| Carbon Cycle | 137 | Carbon dioxide | 150 |
| Nitrogen Cycle | 124 | Lightning | 135 |
| Oxygen Cycle | 98 | Photosynthesis | 209 |
| **Total** | **1218** | | **993** |

Participants generated 1218 words about the key concepts. The most common word for "water cycle" was "evaporation" (f=228). The most common word for "nitrogen cycle" was "lightning" (f=135). The most common word for "oxygen cycle" was "photosynthesis" (f=209). The most common word for "carbon cycle" was "carbon dioxide" (f=150). The most common word for "ozone layer" was "ozone hole" (f=71). The most common word for "global warming" was "melting of glaciers" (f=88). The most common word for "greenhouse effect" was "global warming" (f=62). The most common word for "ecological footprint" was "humans" (f=50). Participants generated the highest and lowest number of words for "greenhouse effect" (f=202) and "oxygen cycle" (f=98), respectively.
According to their cutoff points and intervals, other words with ten or more frequencies were shown as concept networks. The words under each key concept are presented in the figures below according to their cutoff points and intervals.

Figure 3 shows the concept network for the frequencies with a cutoff point of ≥180.

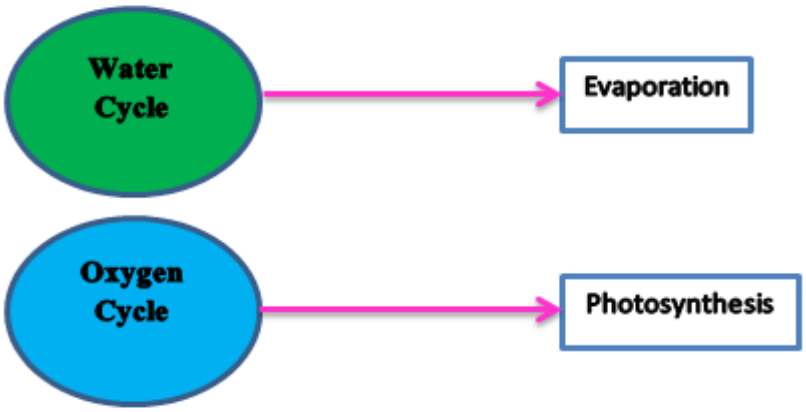



Figure 3. Concept network for the frequencies with a cutoff point of ≥180

"Water cycle" and "oxygen cycle" had frequencies with a cutoff point of ≥180. Participants associated "water cycle" and "oxygen cycle" mostly with the words "evaporation" and "photosynthesis," respectively. Moreover,

"evaporation" was the most frequently repeated word. However, a relationship was not established between response words and other keywords.

Figure 4 shows the concept network for the frequencies with a cutoff point of 179 to 160.

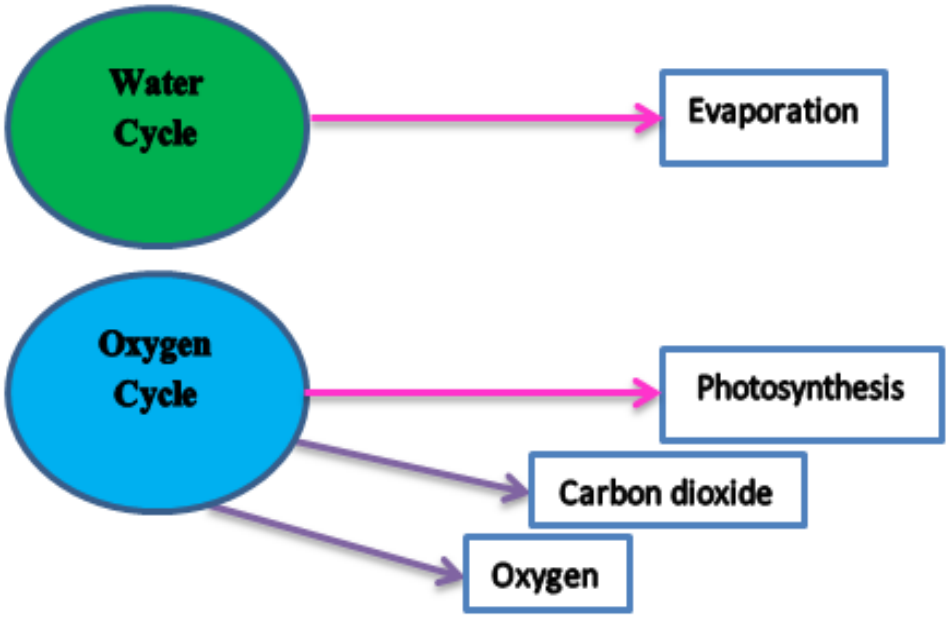



Figure 4. Concept network for the frequencies with a cutoff point of 179 to 160

"Oxygen cycle" was at the cutoff point of 160 to 179. Participants associated the concept of "oxygen cycle" with "oxygen" and "carbon dioxide." There was no association between response words and other keywords.

Figure 5 shows the concept network for the frequencies with a cutoff point of 159 to 140.

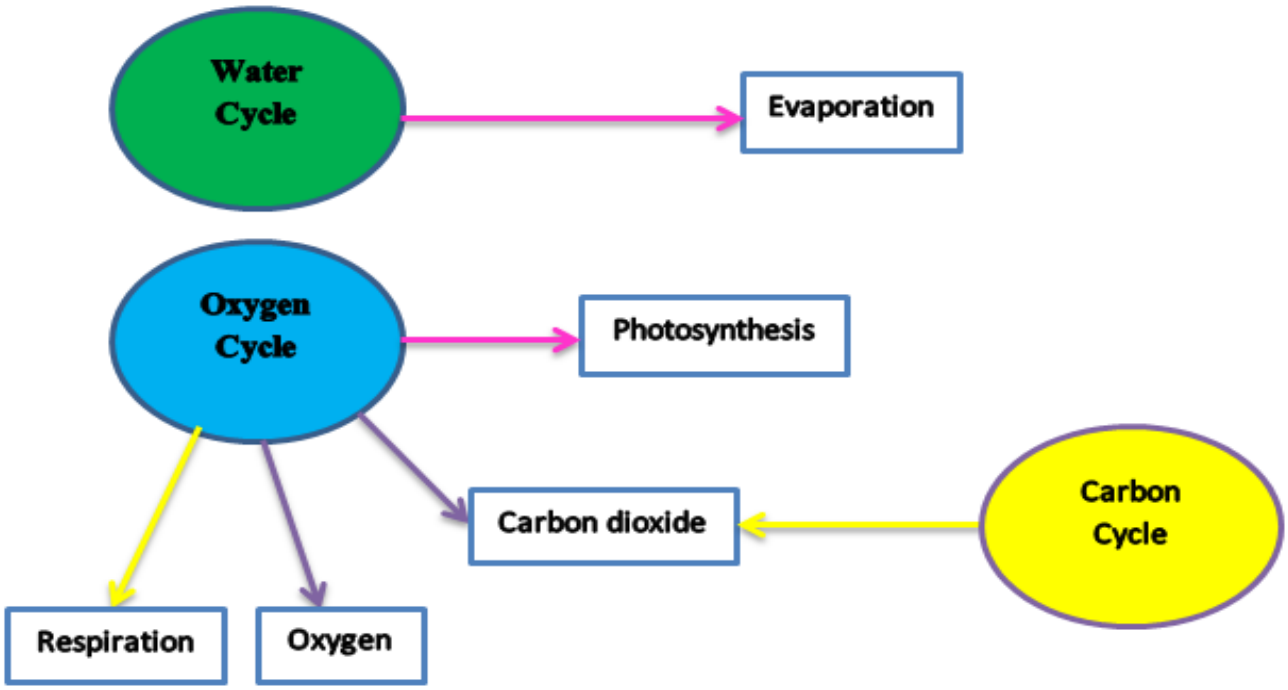



Figure 5. The concept network for the frequencies with a cutoff point of 159 to 140

"Carbon cycle" was at the cutoff point of 159 to 140. Participants associated both the key concepts of "oxygen cycle" and "carbon cycle" with "carbon dioxide." They associated the "oxygen cycle" with "respiration."

Figure 6 shows the concept network for the frequencies with a cutoff point of 139 to 120.

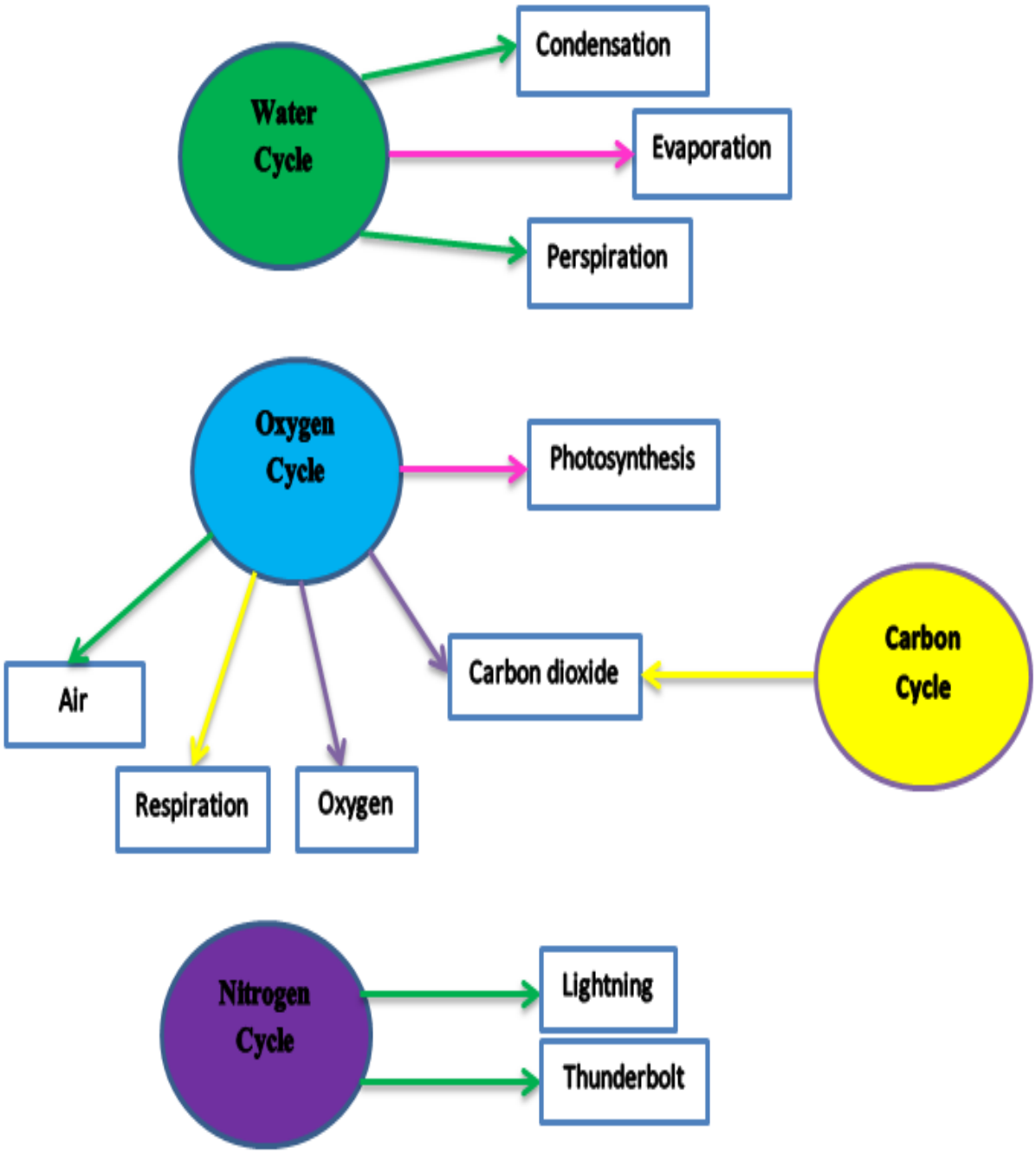



Figure 6. The concept network for the frequencies with a cutoff point of 139 to 120

"Nitrogen cycle" was at the cutoff point of 139 to 120. Participants associated "nitrogen cycle" with "lightning" and "thunderbolt." They associated "water" with "condensation" and "perspiration," while they associated "oxygen cycle" with "air." There was no association between response words and other keywords.

Figure 7 shows the concept network for the frequencies with a cutoff point of 119 to 100.

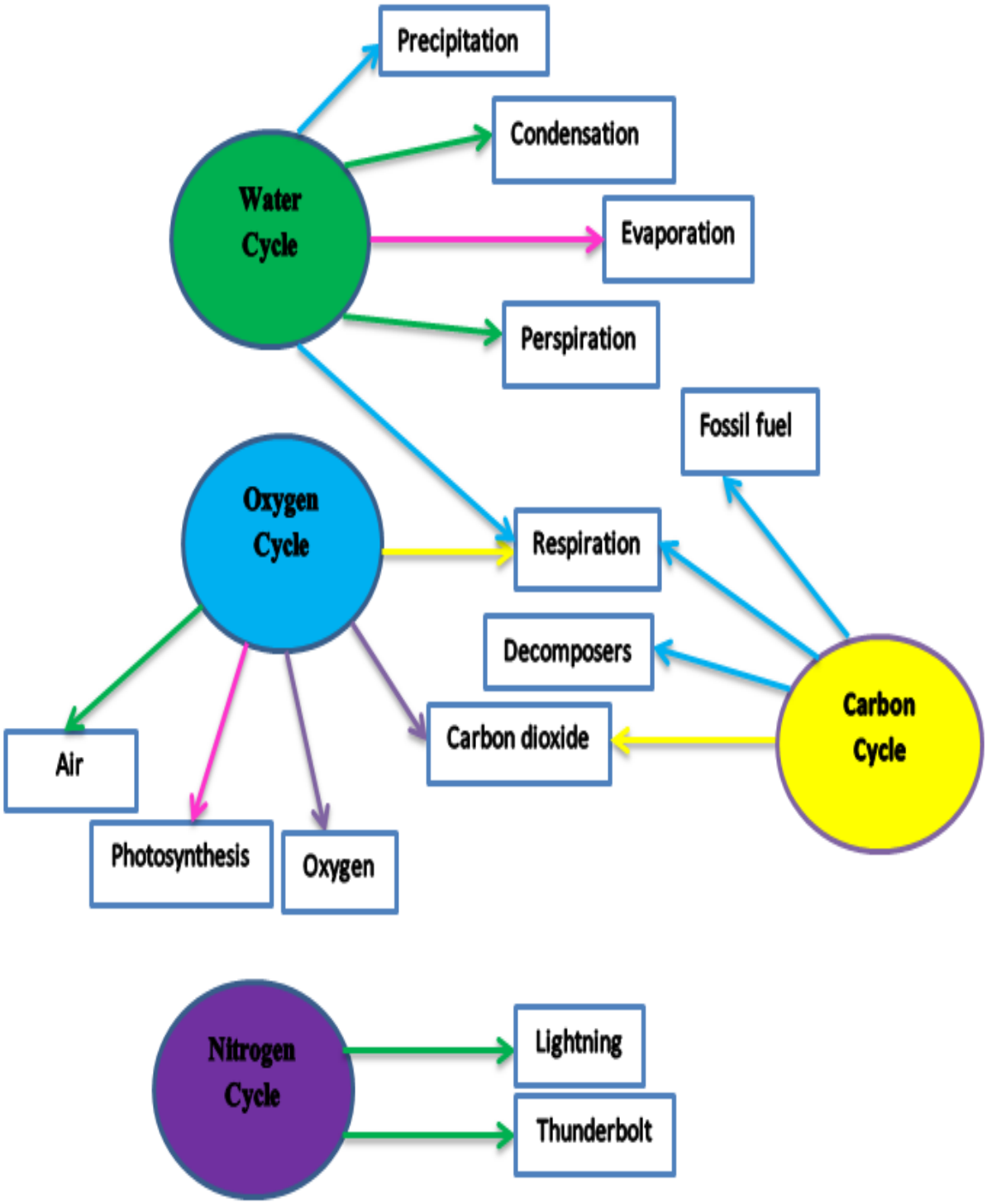



Figure 7. The concept network for the frequencies with a cutoff point of 119 to 100

Neither did participants generate new key concepts, nor did they associate the key concepts with each other. However, they associated "respiration" with it the most. They associated the “water cycle” with “precipitation,” while they associated the “carbon cycle” with “fossil fuel” and “decomposers.”

Figure 8 shows the concept network for the frequencies with a cutoff point of 99 to 80.

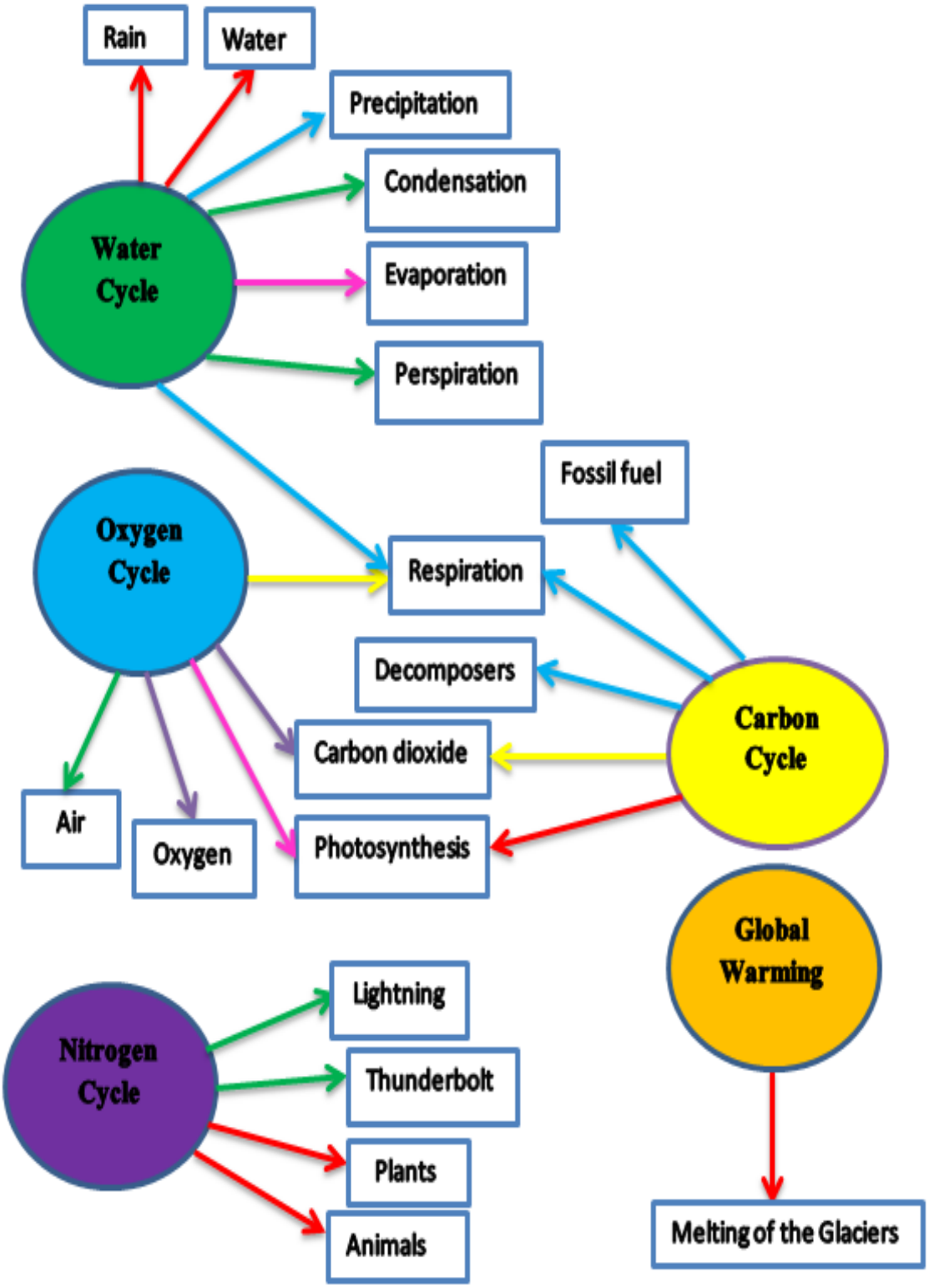
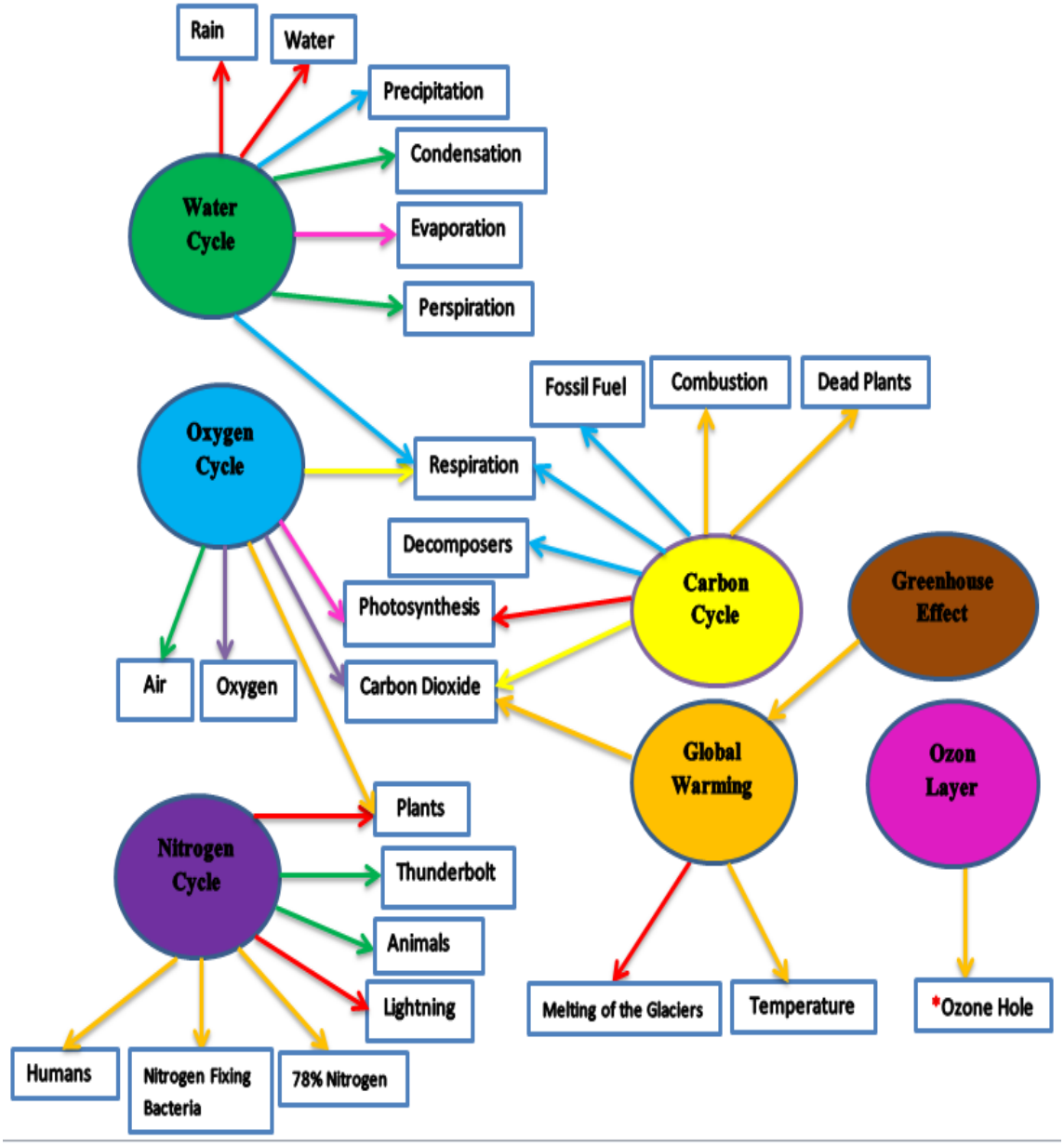



Figure 8. The concept network for the frequencies with a cutoff point of 99 to 80

Participants developed the key concept of "global warming" and associated it with the "melting of glaciers." They associated the key concept of the "nitrogen cycle" with "animals" and "plants," while they associated the "water cycle" with "rain" and "water." They associated the "carbon cycle" with "photosynthesis." There was no association between response words and other keywords.

Figure 9 shows the concept network for the frequencies with a cutoff point of 79 to 60.

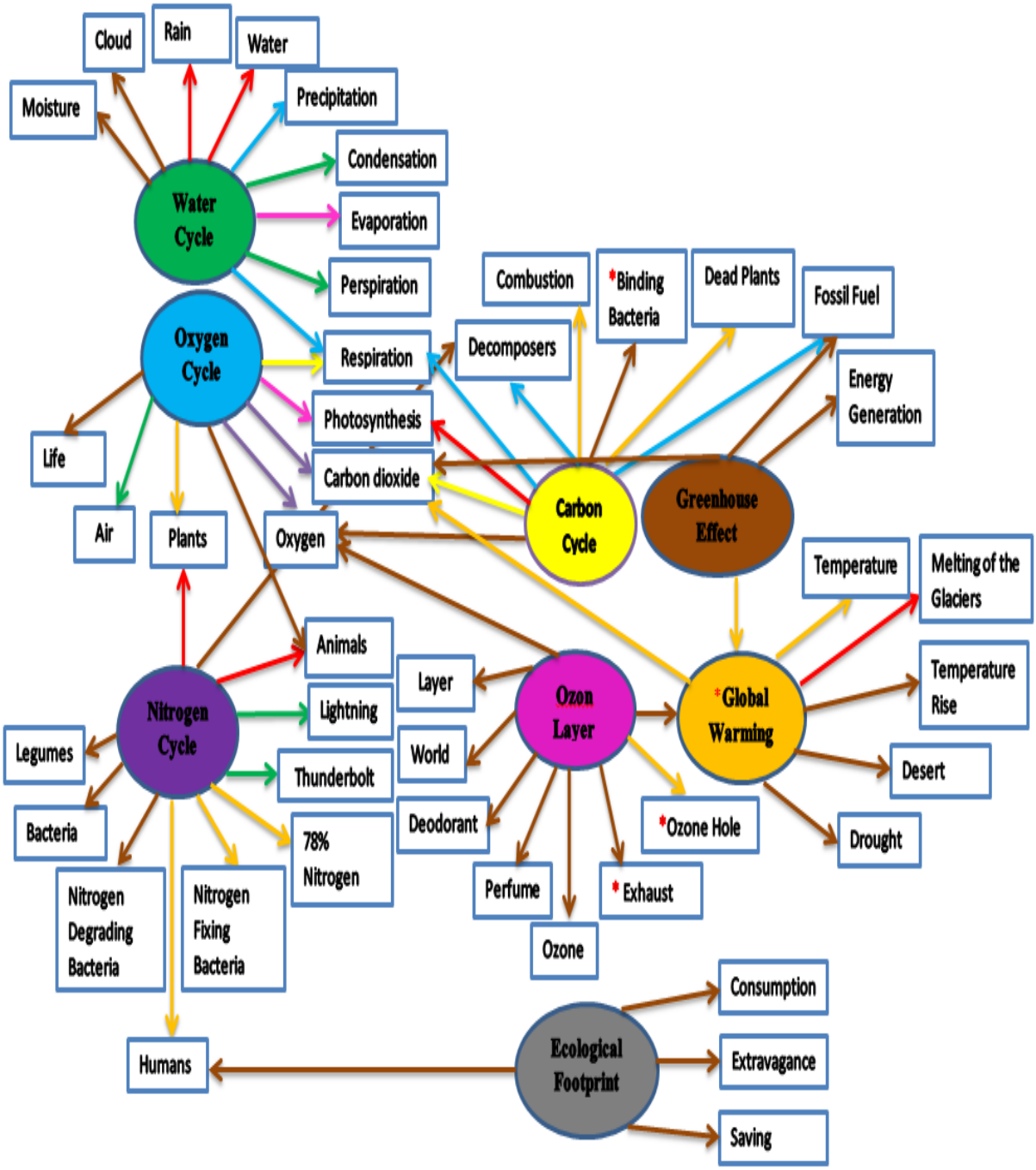



***Note:*** *"*" indicates misconceptions.*

Figure 9. The concept network for the frequencies with a cutoff point of 79 to 60

Participants developed the key concepts of the "greenhouse effect" and "ozone layer." For the first time, they associated two key concepts: the "greenhouse effect" and "global warming." They also associated the key concept of the "ozone layer" with the "ozone hole." We can state that participants had a misconception regarding the "ozone hole" because the ozone layer is a natural layer of gas consisting of ozone, a molecule containing three oxygen atoms. As is known, when a substance is in the gaseous state, it has gaps between the molecules. We can talk about the dilution or thinning of a gaseous substance rather than a hole. Participants associated the "nitrogen cycle" with "nitrogen-fixing bacteria," "78% nitrogen," and "humans." They associated the "carbon cycle" with "dead plants" and "combustion." They associated "global warming" with "temperature" and "carbon dioxide." They associated the "oxygen cycle" with "plants." Most participants generally associated the key concepts of "carbon dioxide" and "respiration" with each other. They also associated "plants" and "photosynthesis" with each other. Participants generated keywords regarding the key concepts.

Figure 10 shows the concept network for the frequencies with a cutoff point of 59 to 40.




***Note:*** *"*" indicates misconceptions*

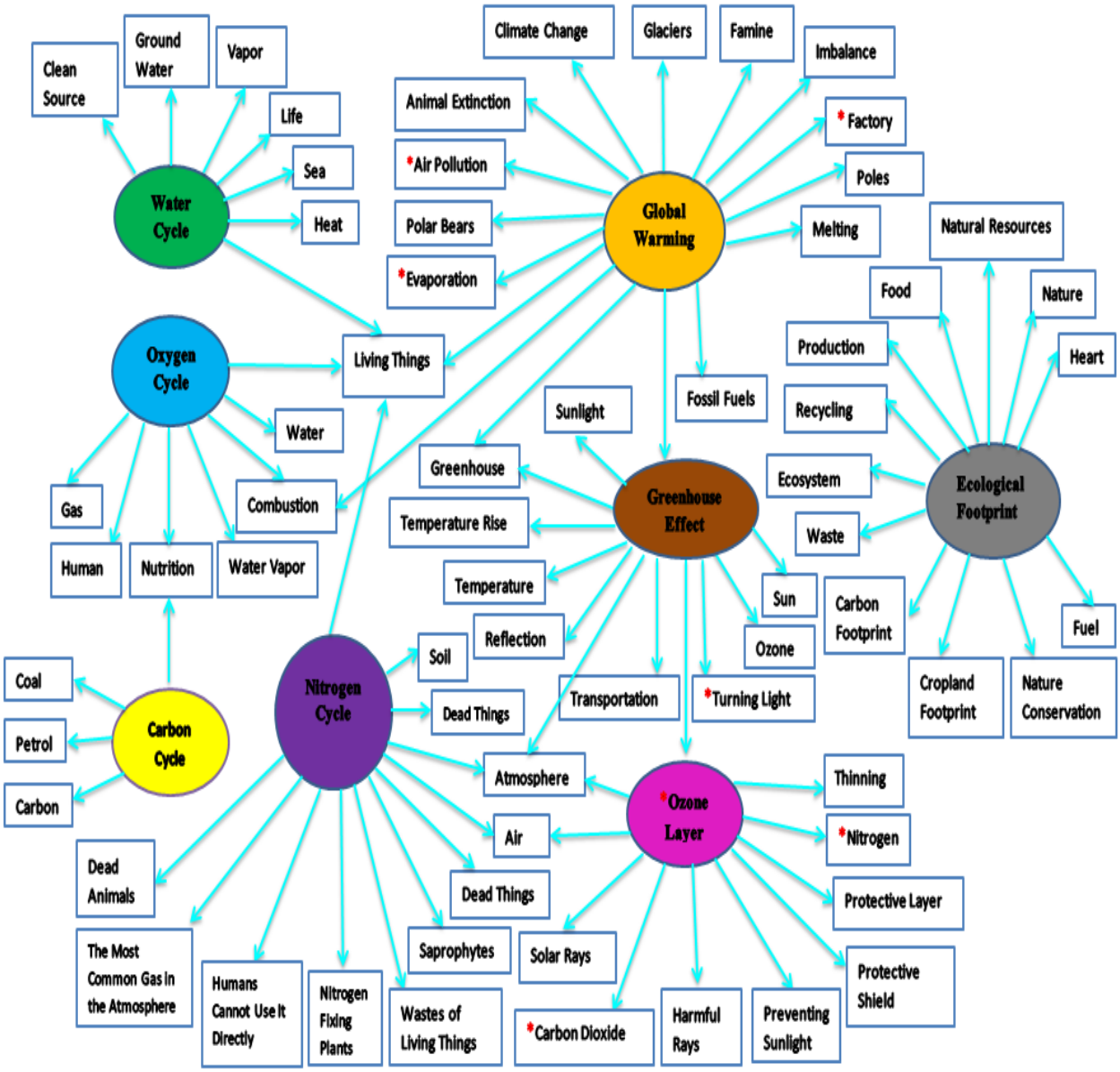
Figure 10. The concept network for the frequencies with a cutoff point of 59 to 40

For the first time, all key concepts were included in the concept network at the cutoff point of 59 to 40. Participants associated the concept of "global warming" with the concepts of "ozone layer" and "greenhouse effect." They still had misconceptions. For example, they talked about "exhaust" and "global warming" when they heard the concept of the "ozone layer." Exhaust gases (water vapor, carbon dioxide, etc.) cause a greenhouse effect, which leads to global warming. On the other hand, what causes the thinning of the ozone layer is chlorofluorocarbons (CFC), hydrofluorocarbons (HCFC), halons, etc. Therefore, the fact that participants associated "exhaust" with the "ozone layer" indicated that they had a misconception. Another misconception was that they viewed the "ozone layer" as the cause of "global warming." They also had a misconception about the "carbon cycle," as they associated it with "nitrogen-fixing bacteria." Although "nitrogen-fixing bacteria" is related to the "nitrogen cycle," no data suggests that those bacteria fix carbon. Participants generated the key concept of "ecological footprint" for the first time. They associated it with "humans," "consumption," "saving," and "extravagance." They also associated "humans" with the "nitrogen

cycle." Most participants generated associations with "carbon dioxide." Participants stated keywords and key concepts at the cutoff point of 59 to 40.

The figures for the cutoff intervals of 39–20 and 19–10 presented only the key concepts and words because, otherwise, the figures looked too complicated.

Figure 11 shows the concept network for the frequencies with a cutoff interval of 39 to 20.

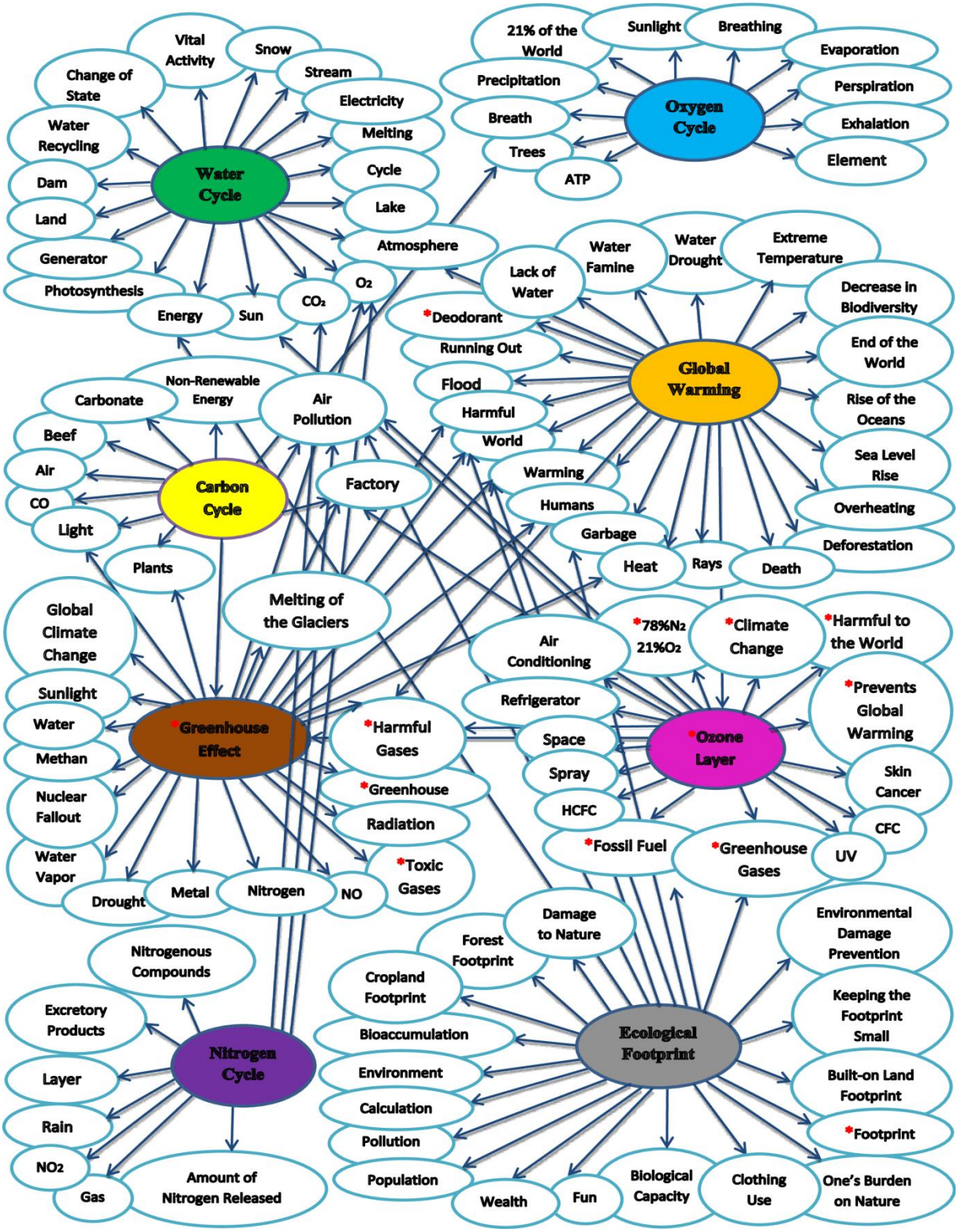



***Note:*** *"*" indicates misconceptions.*

Figure 11. The concept network for the frequencies with a cutoff interval of 39 to 20

Participants generated associations with all key concepts but "ecological footprint." They associated "global warming" with the "greenhouse effect." They associated the "greenhouse effect" with the "ozone layer." They still had misconceptions, as they viewed the "greenhouse effect" as the cause of the thinning of the ozone layer. Similarly, they associated "nitrogen" and "carbon dioxide" with the "ozone layer," which was another misconception. Another misconception was that they associated the "turning light" with the "greenhouse effect." They probably meant "reflected light" by "turning light." They generated words related to the basic elements of the concept of "ecological footprint" and the types of ecological footprints.

Figure 12 shows the concept network for the frequencies with a cutoff interval of 19 to 10.




***Note:*** *"*" indicates misconceptions.*

Figure 12. The concept network for the frequencies with the cutoff interval of 19 to 10

Participants addressed all the key concepts and associated them with one another. However, they still had misconceptions regarding the key concepts of "global warming," "greenhouse effect," and "ozone layer." They associated "global warming" with "deodorant" and "ozone layer," which was a misconception because global

warming has nothing to do directly with the ozone layer. It is the deodorants that adversely affect the ozone layer. Another misconception was that participants associated the "ozone layer" with "greenhouse effect," "greenhouse gases," "fossil fuels," "prevents global warming," "climate change," "78%N2 21%O2," and "harmful to the world." Fossil fuels and greenhouse gases are related to the greenhouse effect, while climate change results from global warming. In addition, not every gas released by the combustion of fossil fuels damages the ozone layer. The fact that participants associated the "ozone layer" with "harmful to the world" was another misconception because the ozone layer acts as an invisible shield that protects us from harmful ultraviolet radiation from the sun. Moreover, oxygen and nitrogen are two gases in the atmosphere. Therefore, we can state that participants had misconceptions in that regard. Lastly, participants associated the "greenhouse effect" with "harmful and toxic gases," which was another misconception because not every gas that causes a greenhouse effect is toxic or harmful. For example, water vapor (H2O(g)) is a nontoxic gas that causes a greenhouse effect. Such overgeneralizations led participants to make misconceptions. Participants knew the keywords about the ecological footprint and the types of ecological footprints. However, they confused it with "footprint," resulting in a misconception.

Participants tried to sound scientific in their sentences, but they either used the wrong concepts or confused them with one another.

Table 3. Quotations

| **Key Concept** | **Scientific Sentences** | **(f)** | **Unscientific or Superficial Sentences** | **(f)** | **Sentences with Misconceptions** | **(f)** | **Blank (f)** |
|---|---|---|---|---|---|---|---|
| **Water Cycle** | P40: Earth's water evaporates and enters the atmosphere, forming clouds. Later, this water vapor condenses and descends to the Earth as precipitation.<br>P115: The water cycle keeps the amount of water on Earth balanced.<br>P413: Earth's water evaporates and mixes with the air, forming clouds, and then condensing water vapors descend back to the Earth as precipitation. | **31** | P8: Earth's water evaporates, rises into the air, and comes back as rain.<br>P142: Evaporation of water resources on Earth and respiration and perspiration made by living beings.<br>P200: The water evaporates, goes to the clouds, and then reaches the Earth as rain. | **149** | P34: Condensation of water on Earth is part of the water cycle.<br>P58: The condensation of vapors, such as water vapor, going up and coming down again is called the water cycle.<br>P229: We drink water, and our urine goes into the sewer, and then it is cleaned, and we drink it again. | **71** | **206** |
| **Nitrogen Cycle** | P140: Legumes incorporate nitrogen through nitrogen-fixing bacteria in their roots.<br>P304: Both bacteria and lightning and thunder are involved in nitrogen fixation.<br>P448: nitrogen-fixing bacteria bind nitrogen gas to produce nitrogenous compounds. | **114** | P153: In the nitrogen cycle, nitrogen is introduced into the soil by things like lightning.<br>P411: Nitrogen cycles between air and soil.<br>P434: Nitrogen passes from the soil to the plant and from the plant to all living things through the food chain thanks to | **60** | P344: The nitrogen cycle is caused by too much deodorant.<br>P454: Storms are caused by the nitrogen cycle.<br>P143: An increase in nitrogen causes global warming.<br>P413: Only through lightning does nitrogen pass directly into the soil. | **61** | **222** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | lightning and thunder. | | | | |
| **Oxygen Cycle** | P39: Plants carry out photosynthesis and release oxygen into the atmosphere. Oxygen passes to living organisms through respiration. Water vapor produced by respiration is released into the atmosphere. It condenses in the atmosphere, becomes liquid, and is used again in photosynthesis.<br>P125: Producers take in carbon dioxide and produce oxygen during photosynthesis.<br>Consumers use oxygen and release carbon dioxide into the atmosphere.<br>P322: Photosynthesis and respiration are part of the oxygen cycle. | **46** | P122: Respiration and combustion produce carbon dioxide, while photosynthesis produces oxygen.<br>P130: The oxygen circulation between the living and non-living environment is called the O2 cycle.<br>P222: People and animals get fresh air thanks to the oxygen cycle. | **135** | P184: The oxygen cycle is the layer that surrounds the Earth, separating harmful light.<br>P123: The oxygen cycle is the layer below the layer of the atmosphere.<br>P455: The oxygen cycle is when the clouds meet, and the rain clouds come down to Earth. | **44** | **232** |
| **Carbon Cycle** | P29: Decomposers break down dying organisms and release them back into the atmosphere as carbon and carbon dioxide.<br>P83: The carbon dioxide released by the combustion of fossil fuels and respiration goes back into the atmosphere.<br>P330: Carbon in carbon dioxide gas passes into food through photosynthesis. | **25** | P8: Gases released from the combustion of non-renewable energy sources contribute to the carbon cycle.<br>P189: Fossil fuels and respiration release carbon back into the atmosphere.<br>P326: Humans and plants play a very important role in the carbon cycle. | **88** | P9: The circulation of inorganic substances, such as water, oxygen, and carbon, between living and non-living environments is called the carbon cycle.<br>P39: Overheating of the Earth due to harmful rays entering the Earth from the ozone layer due to burning fossil fuels.<br>P259: The carbon cycle results from the reaction of carbon dioxide and oxygen. | **62** | **282** |
| **Ozone Layer** | P60: As the ozone layer thins, ultraviolet rays reach the Earth.<br>P131: The ozone layer acts as a filter for ultraviolet rays.<br>P225: Thinning of the | **28** | P268: The ozone layer protects us from bad sunlight.<br>P295: The ozone layer is thinning, which means danger is | **29** | P11: The ozone layer is a layer that covers the Earth.<br>P145: There would be global climate change if it weren't for the ozone layer.<br>P178: If the ozone layer is depleted, the | **124** | **276** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | ozone layer leads to health problems. | | imminent.<br>P404: Too much deodorant is harmful. | | world is exposed to the greenhouse effect, which causes global warming. | | |
| **Global Warming** | P280: The increase in temperature in the world due to the increase in greenhouse gases in the atmosphere is called global warming.<br>P293: The use of fossil fuels causes an increase in greenhouse gases in the atmosphere, which results in a rise in the Earth's temperature and global warming.<br>P331: The increase in the world's temperature due to the increase in greenhouse gases in the atmosphere is called global warming. | **75** | P182: A great danger awaits the Earth because of global warming. Threats such as extinction and disruption of ecological balance will be the death of the Earth.<br>P199: Extreme heat destabilizes the Earth. It can also lead to a bad life for people.<br>P419: Global warming negatively affects the lives of many living things. | **71** | P136: Global warming occurs when more sunlight reaches the Earth as the ozone layer becomes thinner.<br>P164: Gases accumulating in the upper layer of the Earth's nitrogen layer pierce the ozone layer, and harmful rays reach the Earth, which is called global warming.<br>P204: Global warming is a weather event that occurs due to the harmful rays produced by the thinning of the ozone layer warming our world. | **82** | **229** |
| **Greenhouse Effect** | P21: The greenhouse effect is the effect of the sun's rays being trapped by greenhouse gases in the Earth's atmosphere.<br>P284: The greenhouse effect increases temperatures on the Earth's surface, which causes global climate change.<br>P348: Greenhouse gases in the atmosphere prevent the Earth from getting too hot or too cold. | **38** | P50: The greenhouse effect is one of the big problems for our world.<br>P187: With the increase in greenhouse gases, the greenhouse effect is a problem that affects all living things.<br>P302: harmful solar radiation is reflected by gases in the atmosphere, which is harmful. | **36** | P45: The greenhouse effect results from harmful gases piercing the ozone layer.<br>182: The greenhouse effect causes acid rain and poses many threats.<br>P350: The ozone layer becomes thinner because of the greenhouse effect. | **123** | **260** |
| **Ecological Footprint** | P11: The ecological footprint shows the damage everyone does to the Earth and how many earths they will need if they continue to harm it.<br>P140: Ecological footprint is a method used to calculate how much a population burdens nature with carbon dioxide, etc.<br>P345: Ecological | **24** | P39: If we save or do not, we can increase or decrease our ecological footprint.<br>P45: The smaller our ecological footprint, the smaller our damage to the world.<br>P188: The more we reduce | **79** | P194: The remains of living things from the past are called ecological footprint.<br>P199: An ecological footprint is the long-lasting remains of a living thing.<br>P201: Ecological footprint is the study of the remains of living things.<br>P230: The first footprint in space is | **80** | **274** |

| | | | |
|---|---|---|---|
| | footprint is a scientific measure that calculates how much space we need to reproduce natural resources and recycle waste. | environmental damage, the smaller our ecological footprint will be. | still there. |

Participants did not fill in the blanks for many key concepts (Table 3). More than half of the participants did not write any sentences about the "carbon cycle" (f=282 and 61.7%). Less than half of the participants did not write any sentences about the "water cycle" (f=206 and 48.5%). The results showed that almost half the participants did not know enough to write anything about the key concepts. Participants wrote scientific sentences mostly about the nitrogen cycle (f=114), global warming (f=75), oxygen cycle (f=46), greenhouse effect (f=38), water cycle (f=31), ozone layer (f=28), carbon cycle (f=25), and ecological footprint (f=24). Participants knew scientific facts about the nitrogen cycle but lacked scientific knowledge regarding most of the key concepts. Participants wrote down unscientific or superficial sentences mostly about the water cycle (f=149), oxygen cycle (f=135), carbon cycle (f=88), ecological footprint (f=79), global warming (f=71), nitrogen cycle (f=60), greenhouse effect (f=36), and ozone layer (f=29). These results showed that participants had unscientific or superficial opinions about the key concepts. Participants expressed misconceptions mostly about the ozone layer (f=124), greenhouse effect (f=123), and global warming (f=82). Only forty-four participants expressed misconceptions about the oxygen cycle.

## Conclusion and Discussion

This study employed a word association test to determine middle school students' cognitive perceptions of eight key concepts regarding cycles of matter and environmental problems. Participants generated 1218 words for the key concepts. Considering the sample size, we can state that participants did not generate many words. Most participants could not write sentences about the key concepts. These two results showed that participants did not know enough about the key concepts. Çelikler and Topal (2011) also found that students lacked adequate knowledge of key concepts regarding the cycles of matter. Oztas (2014) reported that students were mostly unaware of fundamental ecological phenomena (cycles of matter, etc.) and had misconceptions about global environmental problems (global warming, greenhouse gases, acid rains, etc.). Çimer (2012) determined that the greatest challenge for most students was to learn the cycles of matter. On the other hand, Bilgiç (2019) found that students grasped the cycles of matter and their significance in life. Research shows that preservice teachers know little about global environmental problems (Azapagic, Perdan & Shallcross, 2005; Bahar, 2000; Cirit & Aydemir, 2021; Güven, 2013; Jeffries, Stanisstreet & Boyes, 2001; Makki, Khalick & Boujaoude, 2003). The results showed that our participants did not know much about the cycles of matter and environmental problems, probably because they go over that topic in the last weeks of the semester (MoNE, 2018) when they have to prepare for high school entrance exams. Our participants generated the highest number of words for the greenhouse effect, global warming, and ecological footprint. On the other hand, they generated the lowest number of words for the oxygen, nitrogen, and carbon cycles. These results showed that participants knew more about environmental problems than the cycles of matter. This is probably because they hear about environmental problems in daily life and on the news.

Participants associated the key concepts with the right words until the cutoff interval of 79 to 60. However, they associated the ozone layer with a hole, which was a misconception. In the following cutoff intervals, they associated the ozone layer, global warming, and greenhouse effect with the wrong words, indicating that they had misconceptions. Their sentences showed that they had more misconceptions about global environmental problems (ozone layer, global warming, and greenhouse effect) than the other key concepts, suggesting that they underwent wrong conceptual learning. Some examples of misconceptions were "the gases that cause greenhouse gases cause the depletion of the ozone layer" and "the greenhouse effect or global warming causes the depletion of the ozone layer." The other examples were "the depletion of the ozone layer causes the greenhouse effect or global warming" and "the gases that cause the greenhouse effect are harmful or toxic." Research shows that students from different grade levels have similar misconceptions regarding global environmental problems (Boyes & Stanisstreet, 1993; Jeffries, Stanisstreet, & Boyes, 2001; Kılınç, Stanisstreet, & Boyes, 2008; Meadows & Wiesenmayer, 1999; Österlind, 2005). On the contrary, Durmuş and Sert (2022) stated in their study that prospective teachers correctly interpreted global warming in their cognitive structures. Cirit and Aydemir (2021) focused on students' perceptions of environmental problems and reported three results. First, students viewed the depletion of the ozone layer as a hole. Second, they believed that global warming and the depletion of the ozone layer affected each other. Third, they thought that environmental problems caused one another. Kahraman (2020) investigated students' views of global environmental problems and reported three

findings. First, students had difficulty defining the greenhouse effect scientifically. Second, they believed that the greenhouse effect was exacerbated by sprays, deodorants, plastic bags, and cigarettes. Third, they associated the greenhouse effect with the thinning of the ozone layer. Kaya, Ateş, and Kılıç (2019) addressed preservice students' perceptions of global environmental problems and reported three findings. First, preservice teachers could make scientific sentences about global warming. Second, they achieved conceptual learning but thought that the depletion of the ozone layer and deodorants caused global warming. Third, they believed that the depletion of the ozone layer caused global warming. Erdoğan and Özsevgeç (2012) reported that students associated the ozone layer with global warming and believed that we could prevent global warming if we wore less perfume and deodorant. Students have this misconception because the media (Internet, magazines, books, animations, videos, and images) affects how they perceive global environmental problems (Khalid, 2003; Shepardson, Niyogi, Choi, & Charusombat, 2011). Pekel (2019) determined that eighth-grade science textbooks contained numerous misconceptions and unscientific information regarding the nitrogen cycle, global warming, the greenhouse effect, and the ozone layer. Unverified information from various sources also causes students to develop misconceptions about environmental problems. Our participants focused mostly on the steps, settings, and elements of the cycles of matter. For example, they generated the words "perspiration," "evaporation," and "condensation" (steps). They talked about the atmosphere, lakes, and rivers (settings). They addressed the sun, clouds, and heat (elements). They had the same trend when it came to the nitrogen, carbon, and oxygen cycles. They mostly made unscientific or superficial sentences about those cycles. However, they had fewer misconceptions regarding them. In other words, they tried to explain the cycles of matter with simple and unscientific sentences. This result showed that they had superficially learned those key concepts. Research also shows that students from different grade levels know relatively little about the cycles of matter (Çelikler & Topal, 2011; Derman & Yaran, 2017). Abasız (2019) found that students knew about the cycles of matter to a certain extent and tried to explain them with simple and scientific sentences. Participants chose words regarding the important components of ecological footprints and different types of ecological footprints. For example, they focused on "humans," "recycling," and "natural sources" (important components) or "carbon footprint," "cropland footprint," "forest footprint," and "built-on land footprint" (types of ecological footprint). Most participants made unscientific or superficial sentences with misconceptions.

The results showed that although participants generated the right words regarding the key concepts of cycles of matter and environmental problems, they had numerous misconceptions in their sentences. These results showed that they had limited scientific knowledge about the key concepts and generated the right words based on what they learned from different sources. However, one needs academic knowledge to construct scientific sentences. Therefore, our participants had difficulty making scientific sentences and had numerous misconceptions because they used unscientific information or misinformation from different sources. In other words, participants had limited perceptions of the key concepts of cycles of matter and environmental problems. Participants made more cross-connections between the key concepts when we gradually lowered the cutoff point. This is probably because the cycles of matter and environmental problems affect each other. Environmental problems caused by human activities disrupt the cycles of matter. A disruption in one step of the cycle of matter causes environmental problems.

## Recommendations

Based on the results obtained from the research, some suggestions are made. Teachers should use word association tests to measure students' prior knowledge before moving on to the next topic and to assess how much they have acquired new knowledge after teaching. Teachers should use various audio-visual materials (figures, animations, videos, etc.) in multimedia that appeal to more sensory organs to help students better understand the topic and explain it scientifically. More research is warranted to better understand how students from different grade levels perceive cycles of matter and environmental problems. Researchers should focus on current misconceptions and misinformation regarding cycles of matter and environmental problems. Teachers should provide effective learning settings where they can use different methods and techniques to help students dispel their misconceptions and refute misinformation.

## Limitations

This research is limited to eighth-grade students in the study group. The concepts in the word association test are limited to the key concepts in the subject "Matter Cycles and Environmental Problems."

## Ethical Approval

The study was approved by the Scientific Research and Publication Ethics Committee of Muş Alparslan University (Date: January 14, 2021, No. 910). Permission was obtained from the Muş Provincial Directorate of National Education (Date: April 27, 2021, No. 10764). This study has not been published or presented as an abstract or full-text paper anywhere. All students were briefed on the research purpose and procedure and were informed that participation was voluntary. Informed consent was obtained from those who agreed to participate. The study adhered to the rules specified by the Directive on Scientific Research and Publication Ethics of Higher Education Institutions.

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# The Level of Metacognıtıve Awareness of Prımary School 4th Grade Students Predıctıng Theır Academıc Achıevement

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# The Level of Metacognitive Awareness of Primary School 4th Grade Students Predicting Their Academic Achievement*

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## Abstract

This study was conducted to reveal the role of 4th grade students'level of metacognive awaness in predicting their academic achievement. The Relational Survey Method, one of the quantitative data collection methods, was used in the study. The study group was selected through random sampling method. It consists of 526 fourth grade students working in five different primary schools affiliated to the Directorate of National Education in the province of Niğde during the 2021-2022 academic year. The "Metacognitive Awareness Scale for Children (MCAS-C) A-form, the personal information form and the academic achievement test were used as data collection tools of the study. The Construct Validity of the Metacognitive Awareness Scale was examined, and the Exploratory Factor Analysis (EFA) was applied. When the data analyzed based on selected variables, the SPSS 25 program was used for the Quantitative Data Analysis. In the study, the Mann Whitney U-test was used for the variables of gender, the pre-school education status, and the Kruskall Wallis test was used for the variables of the parental education status, the economic status and the number of siblings. In terms of the variables of the study, a significant difference was found between the level of metacognitive awareness and gender, the pre-school education status, the parental education status, the economic status of the family and the number of siblings. A Structural Equation Model (SEM) was created to test the academic achievement model and analyses were performed with the IBM AMOS 23 programme. According to the findings of the study, metacognitive awareness, which was assessed through the Metacognitive Awareness Scale, has a moderate, positive and direct effect on academic achievement.

**Keywords:** Academic achievement, Metacognitive Awareness Scale, Structural Equation Modelling.

## Introduction

The faster development of science and technology compared to the past causes a change in the skills expected from individuals. During the education process, missions that can keep pace with developments are imposed. During this development process, individuals are expected not only to learn the information they need, but also to be aware of their own learning, to find the information they need within the knowledge, to use this information in different areas, to understand what and how much they know, to discover how to learn best for themselves, to be open to innovations, to be productive and creative (Akgündüz, Aydeniz, Çakmakçı, Çorlu, Öner ve Özdemir, 2015). Metacognitive Awareness Skills are needed to raise individuals in accordance with the requirements of the age in education and to achieve the goals.

Today, the rapid developments in science and technology compared to the past have necessitated a change in the skills expected from individuals. This situation has imposed new missions on the education and training process and raising individuals with skills appropriate to the human profile of our age has become the main objective. Individuals are expected not only to learn the information they need, but also to be aware of their own learning, to discover the information they need among the knowledge, to use this information in appropriate areas, to be aware of what and how much they know, to discover how they learn best for themselves, to be open to innovations, to be productive and creative (Akgündüz et al., 2015). In the related literature, these characteristics are generally expressed as Metacognitive Awareness Skills. In educational systems, Metacognitive Awareness Skills are needed to raise individuals in accordance with the requirements of the era and to achieve the goals.

For the realisation of 21st century learnings, Metacognition, which is accepted as a basic skill (Horvathova, 2019), appears as a driving force in the formation of students' self-regulated learning behaviours in the

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education and training process (Winne & Perry, 2000). For this reason, students should be active during the education and training process. To support the Metacognitive development of students, an education process should be followed in which students can acquire problem solving skills, critical thinking, communication skills and the qualities of being open to co-operation and having responsibility and leadership.

According to Williams, Atkins, and Otero (2009), the concept of Metacognition; started with Flavell's study on children's intelligence in 1976 by including the term "Metamemory" for the first time about children's cognitive abilities. Metacognition, which is described as thinking about one's own thinking, is defined as the awareness and organisation of thinking processes that students use in planned learning and problem-solving situations (Flavell, 1976; Brown, 1978). Flavell used the concept of metacognition for social cognition, problem solving, memory, attention, language acquisition, writing, reading comprehension, verbal persuasion and verbal transfer of information (1979). According to Shanahan (1992), it is the understanding and control of cognitive activity; according to Butterfield, Albertson and Johnston (1995), it is the understanding of variables affecting cognition and controlling cognition with small examples. Metacognition skills and academic achievement are interrelated concepts. To improve the learning levels of individuals in school environments, it increases their cognitive and motivational motivation related to problem solving strategies during the reading, writing and problem-solving process, and enables them to think and gain awareness.

Metacognition has become a subject of study in different areas in the literature. It is seen that there are some studies on metacognition in the literature like The effect of metacognition on individuals' attitude (Ataalkın, 2012), Metacognitive knowledge and skills (Nişan & Temel, 2023), Self-efficacy perception (Açıkgül & Tuhan, 2023; Kurtuluş & Öztürk, 2017; Mandıracı, 2023; Oğuz & Kutlu Kalender, 2018; Şahin, Kırmalı, & Kayır, 2022; Türkben, 2022), Effects on achievement in different fields and problem solving skills (Arslan & Çelik, 2022; Çulha, 2022; Karakelle, 2012), Awareness levels (Ayar, 2022; Çalgıcı & Ogan Bekiroğlu, 2021; Doğan & Tuncer, 2017; Göçer, 2014; Kaplan & Aykut, 2022; Kapucu & Öksüz, 2015; Kontaş, Özcan, Yıldız, & Kardaş, 2023; Mert & Baş, 2019; Özdil & Demir, 2022). It was observed that studies on metacognitive awareness were mainly conducted on teacher education (Kallio, Kallio, Virta, K., Iiskala, & Hotulainen, 2021; Whitebread & Neale, 2020), for primary school students (Çini, Malmberg, & Jarvela, 2020; Teng, 2022), for second level of primary education students (Bağçeci at al., 2011; Kaya, 2019; Nerse, 2021; Özkaya, 2022; Varlı & Sağır, 2019, Premachandran & Jaleel, 2016), for secondary education level students (Bektaş Bedir & Dursun, 2019; Hong-Nam et al., 2014; Kallio et al., 2018; Rapchak, 2018) and for university students (Alkan & Açıkyıldız, 2020; Hughes, 2019; Özturan Sağırlı, Baş, & Bekdemir, 2020; Öztürk & Açıl, 2020; Kaplan & Aykut, 2022). However, rapidly changing technology and conditions reveal the necessity of developing metacognitive skills in students from an earlier age (Özcan, 2007). According to the studies, it is seen that the studies on the primary school level are limited and the studies on predicting academic achievement are insufficient (Ayar, 2022; Bakkaloğlu, 2020; Yurtbakan, 2023).

It is important for individuals to know how to learn as well as what to learn (Çakıroğlu, 2007). When we look at the PISA exam conducted internationally, it is seen that it helps to determine the self-learning levels of students and to carry out studies on raising the determined levels (Preliminary National Report of the Programme for International Student Assessment, 2010). For this purpose, the countries participating in the PISA exams project are expected to provide students with metacognitive awareness skills and enable them to adapt to the developing and changing conditions in society as individuals. Because individuals with Metacognitive Awareness are more successful in the problem-solving process and can easily reach the result (Zorbozan, 2021). Since international examinations are becoming more and more important with the development of science and technology, it is necessary to pay attention to strategies and studies in which metacognition and metacognitive awareness are formed. When the studies conducted were examined, it was revealed that there was a significant relationship between Metacognitive Awareness Skills and academic achievement (Güleç, 2023; Memiş & Arıcan, 2013; Sawhney & Bansal, 2015; Vosniadou, Darmawan, Lawson, Van Deur, Jeffries, D., & Wyra, 2021). Students being aware of when to act strategically and when not to act strategically and being conscious in the process for learning to be effective will lead them to be successful (Özsoy, 2008).

There is a need to increase the studies in which metacognitive skills of primary school students influence predicting academic achievement. In this study, the level of students' metacognitive awareness skills predicting academic achievement is examined. It is aimed to increase the level of academic achievement by analysing the variables affecting academic achievement. In the study in which the metacognitive awareness skills of fourth grade primary school students are examined in terms of different variables (gender, whether they have pre-school education or not, paternal and maternal education, economic status and number of siblings); metacognitive awareness is emphasised and the answers to the following questions are sought to investigate the effect of metacognitive awareness on the level of academic achievement. Does the Metacognitive Awareness of fourth grade primary school students.

1.Differ significantly in terms of gender, pre-school education, parental education, economic status and number of siblings or not?

2.Predict their general academic achievement level?

3.Predict their achievement levels in Turkish, mathematics, science and technology, and Social Sciences Courses?

**Method**

In this part of the study, information about the participants included in the study, the scales used to collect data, data collection and analysis are presented. The ethics committee permission for this study was obtained from the Student Affairs Department of the Necmettin Erbakan University Rectorate dated 30/12/2021 and numbered 134738 with the decision number E-61900286-20-40519417. In addition, the application permissions of the scales used were obtained from the authors.

**Study Model**

This study, in which the effect of metacognitive awareness skills on the prediction of students' academic achievement in primary school fourth grades was examined, was conducted with the Correlational Research Model, one of the quantitative types of research. The purpose of the Correlational Research Model is generally to describe the situation related to the study topic, usually collecting information from large masses. In this study, it was tried to determine the effect of metacognitive awareness skills on students' gender, whether they had pre-school education or not, parental education status, economic status of the family and number of siblings, and the effect of Metacognitive Awareness Skills on students' academic achievement in terms of courses (Turkish, mathematics, science and technology, social studies). Since this study aims to reveal possible relationships among selected variables, a Correlational Research Model was used.

**Study Group**

The study consists of 526 primary school fourth grade students affiliated to the Ministry of National Education in the province of Niğde during the 2021-2022 academic year. In this study, the Simple Random Sampling Method was used. The reason why the Simple Random Sampling Method was preferred in the study is that in determining the sample, representing the universe, everyone has an equal probability of being included in the selection. While there is an independent and equal chance for all units existing in the universe to be selected for sampling, it is also economical in terms of saving resources and time for the researcher (Büyüköztürk et al. 2021).

**Data Collection Tools**

In line with the purpose and design of the study, "the Personal Data Inventory, the Metacognitive Awareness Scale and the Academic Achievement Test" were used by the researcher as data collection tools throughout the study.

**Metacognitive Awareness Scale**

The "Metacognitive Awareness Scale", which was developed by Sperling, Howard, Miller, and Murphy (2002) for the third and ninth grade levels and whose validity and reliability study was conducted by Karakelle and Saraç (2007) was used to measure the students' metacognitive skills. During the factor analysis conducted for the "Metacognitive Awareness Scale Form A", two dimensions have emerged. The first of these dimensions was formed as a triple Likert type which includes the dimensions of organisation of cognition (3,6,7,8,8,9,10,11) and knowledge of cognition (1,2,4,5,12). The items of MA1, MA6, MA7, MA8, MA9, MA10, MA11 constitute the first dimension and the items of MA1, MA2, MA4, MA5, MA12 constitute the second dimension.

To determine the reliability of the scale, the Cronbach's Alpha reliability test was applied. According to Fornell and Larcker (1981), the Combined Reliability (CR) coefficient should be 0.70 and above, and in another study, the Cronbach's Alpha (CA) coefficient, which measures internal consistency in social sciences, is higher than 0.70, indicating that it is reliable (Gürbüz & Şahin, 2014). The Cronbach's Alpha value of the Metacognitive Awareness Scale was calculated as 0.745. The Cronbach's Alpha value of the first factor in the scale was 0.653 and the Cronbach's Alpha value of the second factor was 0.615. In the studies, it was emphasised that to use a Likert-type scale, the reliability coefficient should be as close to 1 as possible (Tezbaşaran, 1997) and the factor common variance of the items being close to 1 or above 0.66 indicates that it is a good solution for the study, but it is generally difficult to meet these values in practice (Büyüköztürk, 2002). According to the statistical analyses conducted for this study, the reliability of the scale was found to be at a good level, and it was considered safe to use it.

Table 1. Confirmatory Factor Analysis (CFA) Fit Values Related to the Metacognitive Awareness Scale

| Indices | Model value | Acceptable limits | Result |
|---|---|---|---|
| $\chi$ 2 /df | 2,591 | ≤5 Acceptable Fit, ≤3 Perfect Fit<0 | Perfect Fit |
| RMSEA | 0.056 | ≤ 0.10 Poor Fit, ≤ 0.08 Good Fit, ≤ 0.05 Excellent Fit | Perfect Fit |
| GFI | 0.97 | 0.85-0.89 Acceptable Fit, ≥ 0.90 Good Fit | Good Fit |
| AGFI | 0.96 | 0.85-0.89 Acceptable Fit, ≥ 0.90 Good Fit | Good Fit |
| CFI | 0.96 | ≥ 0.90 Acceptable Fit, ≥ 0.95 Good Fit, ≥ 0.97 Excellent Fit | Good Fit |
| IFI | 0.97 | ≥ 0.90 Acceptable Fit, ≥ 0.95 Good Fit, ≥ 0.97 Excellent Fit | Good Fit |
| TLI(NNFI) | 0.95 | 0.90 Acceptable Fit, ≥ 0.95 Good Fit | Good Fit |

The $X^2$/df value obtained in the study was found to be 2.591. This result indicates that the model is statistically significant. An IFI value of 0.95 and above, which considers both the sample size and the complexity in the model, indicates a good fit (Şimşek, 2007). The model fit indices (CMIN/df= 1.87, CFI=0.96, TLI=0.95, IFI= 0.97, RMSEA= 0.056) of the scale confirmed by the factor analysis of the metacognitive awareness scale show that the proposed two-factor model is compatible and acceptable with the data. These results showed that the predicted organisational structure (two-factor model) of the metacognitive awareness scale was confirmed.

**Personal Data Inventory**

To compare the students in this study, a personal information questionnaire was used, and questions were asked about the gender of the students, whether they attended kindergarten or not, their parents' education level, the number of siblings, and the economic status of the family.

**Academic Achievement Test**

In the study, to determine the effect of students' metacognitive awareness skills on academic achievement and to evaluate the effectiveness of the subjects determined by the Ministry of National Education, an academic achievement test prepared by considering the gains of November in the fourth grade of primary education was used. A 90-question essay exam prepared in line with the gains in November from the essays in the Ministry of National Education question pool consisting of questions from the fourth-grade science and technology, mathematics, social studies and Turkish lessons was applied. With the expert opinion, some questions were removed from the test, considering the attention span of the students. In line with the suggestions of the experts, 40 questions were selected as 10 questions in Turkish language, 10 questions in mathematics, 10 questions in science and 10 questions in social studies and the academic achievement test was applied. The correct answer given by the participants to each item was entered as 1 point, the wrong answers were entered as 0, and each correct question was calculated as 2.5 points in the achievement score and the statistical processing was performed. The average KR21 reliability value of the academic achievement test was found to be 0.901. A KR21 value between 0.70 and 0.99 is considered high in terms of reliability (Büyüköztürk et al. 2021). As a result of the analysis of the academic achievement test, the item difficulty index was 0.65 and the questions were at an easy level (0.60 - 0.79). The average discrimination index was found to be very good (≥0.40 very good) with a value of 0.48. The fact that the discrimination power of the test is very good can be said to be successful in distinguishing between the students who know and those who do not know.

**Data Collection**

The necessary permissions were obtained from the researchers who developed and adapted the scale for the use of it in the study. Before collecting the data required for the study, the necessary permission was obtained for the documents to be used in the study according to the decision of the Research and Publication Ethics Committee of the Necmettin Erbakan University Institute of Educational Sciences. The data collection was carried out face-to-face in the province of Niğde during the 2021-2022 academic year between April and June in accordance with the determined sample. During the data collection, the participants were informed about the purpose and content of the study and were told that participation in the study would be voluntary. It was stated that the study was conducted in accordance with the principle of confidentiality.

**Data Analysis**

Before conducting the analyses in the study, the skewness and kurtosis values were calculated to determine whether the data obtained from the scales met the normality assumption and it was determined that the distribution of the scores related to the metacognitive awareness scale was not normal ($p < 0.05$), but when the skewness and kurtosis values calculated according to the total scores were examined, it was found that the kurtosis and skewness coefficients were between +2 and -2, emphasising that the scores showed a normal

distribution (Pallant, 2001). Therefore, it was decided to use the T-test and variance analysis from the parametric measures in the analysis of the data.

In the study, the metacognitive awareness of fourth grade primary school students was analysed according to gender and whether they were educated in kindergarten or not. When the normal distribution table was analysed, the sig value was below 0.05. Since metacognitive awareness skills did not show normal distribution according to gender and whether they received education in kindergarten or not, the Mann Whitney U-Test was applied.

Table 2. The Mann Whitney U-Test Table Showing the Metacognitive Awareness of Fourth Grade Primary School Students According to Gender and Whether They Receive Education in Kindergarten or Not

| | | N | Mean Rank | Sum of Rank | U | p |
|---|---|---|---|---|---|---|
| Gender | Girls | 259 | 276,08 | 71505,00 | 31318,00 | 0,060 |
| | Boys | 267 | 251,30 | 67096,00 | | |
| Education Level | Educated in kindergarten | 472 | 271,18 | 127998,50 | 9117,500 | 0,001 |
| | Not educated in kindergarten | 54 | 196,34 | 10602,50 | | |

The analysis presented in the table 2 shows that the metacognitive awareness of primary school fourth grade students does not show statistically significant difference according to gender (U=31318,00: p<0,05), but it shows statistically significant difference according to the status of attending kindergarten. (U=9117,500: p<0,05). When the mean ranks are analysed, it is seen that the students who attended kindergarten (mean rank=271,18) are higher than the students who did not attend kindergarten (mean rank=196,34).

According to the normal distribution table of the metacognitive awareness skills of primary school fourth grade students, parental education status, economic status of the family and the number of siblings in the family, the sig value is below 0.05, so it does not show a normal distribution. In addition, the Kruskal Wallis Test was applied because there were more than two categories.

Table 3**.** The Kruskal Wallis Table of Fourth Grade Primary School Students' Metacognitive Awareness Skills According to Parental Education Status, Family Economic Status and Number of Siblings in the Family

| | Item | N | Mean Rank | df | $X^2$ | p |
|---|---|---|---|---|---|---|
| Mother's Education Status | Literate | 40 | 215,29 | 4 | 25,348 | 0,000 |
| | Primary School | 63 | 202,34 | | | |
| | Secondary School | 77 | 238,79 | | | |
| | High School | 122 | 269,88 | | | |
| | University | 223 | 293,29 | | | |
| Father'sEducation Status | Literate | 34 | 227,60 | 4 | 15,312 | 0,004 |
| | Primary School | 44 | 233,45 | | | |
| | Secondary School | 58 | 218,79 | | | |
| | High School | 101 | 251,90 | | | |
| | University | 289 | 285,32 | | | |
| Economic Status of the Family | Poor | 13 | 162,04 | 2 | 22,153 | 0,000 |
| | Middle | 199 | 232,33 | | | |
| | Good | 314 | 287,46 | | | |
| Sibling Order in the Family | First | 38 | 252,67 | 3 | 8,214 | 0,042 |
| | Second | 247 | 273,45 | | | |
| | Third | 175 | 258,80 | | | |
| | More | 59 | 211,96 | | | |

It was determined that the metacognitive awareness of primary school fourth grade students showed a statistically significant difference according to their mother's education status ($X^2$=25,348: p < 0,05) and the difference was between the secondary school-university groups. When the metacognitive awareness skills of primary school fourth grade students were analysed according to their father's education status, it was determined that there was a statistically significant difference ($X^2$=15,312: p < 0,05) and the difference was between the secondary school-university groups according to their father's education status. When the metacognitive awareness skills of fourth grade primary school students were analysed according to their economic status, it was determined that there was a statistically significant difference ($X^2$=15,312: p < 0,05) and that the difference was between the medium-good and poor-good groups. When the metacognitive awareness skills of primary school fourth grade students were analysed according to the number of siblings in the family, it was determined that there was a statistically significant difference ($X^2$=8,214: p < 0,05) and that the difference was between 2-4 and 3-4 groups according to the number of siblings in the family.
In the study, structural equation modelling (SEM) analyses were performed to test the model established for the prediction of academic achievement by metacognitive awareness skills. To check whether the fit values of the model tested within the scope of the study are at the desired levels, it is necessary to check whether the fit values are among the values accepted in the literature (Schumacker & Lomax, 2004).

Figure 1**.** Structural Equation Modelling of the Effect of Students' Metacognitive Awareness Skills on Academic

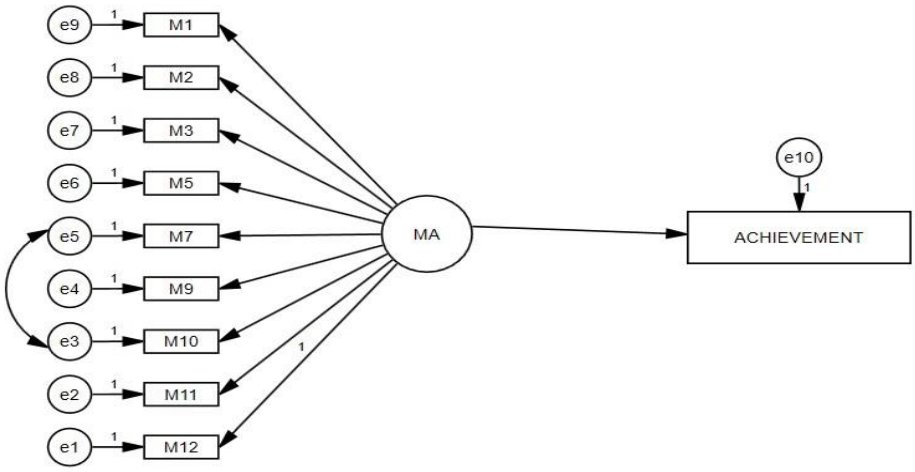



Table 4. Goodness of Fit Values for the Model

| **Indices** | **Model value** | **Acceptable limits** | **Result** |
|---|---|---|---|
| χ 2 /df | 1.89 | ≤5 Acceptable Fit, ≤3 Perfect Fit<0 | Perfect Fit |
| RMSEA | 0.041 | ≤ 0.10 Poor Fit, ≤ 0.08 Good Fit, ≤ 0.05 Excellent Fit | Perfect Fit |
| GFI | 0.97 | 0.85-0.89 Acceptable Fit, ≥ 0.90 Good Fit | Good Fit |
| AGFI | 0.96 | 0.85-0.89 Acceptable Fit, ≥ 0.90 Good Fit | Good Fit |
| CFI | 0.96 | ≥ 0.90 Acceptable Fit, ≥ 0.95 Good Fit, ≥ 0.97 Excellent Fit | Good Fit |
| IFI | 0.96 | ≥ 0.90 Acceptable Fit, ≥ 0.95 Good Fit, ≥ 0.97 Excellent Fit | Good Fit |
| TLI(NNFI) | 0.95 | 0.90 Acceptable Fit, ≥ 0.95 Good Fit | Good Fit |

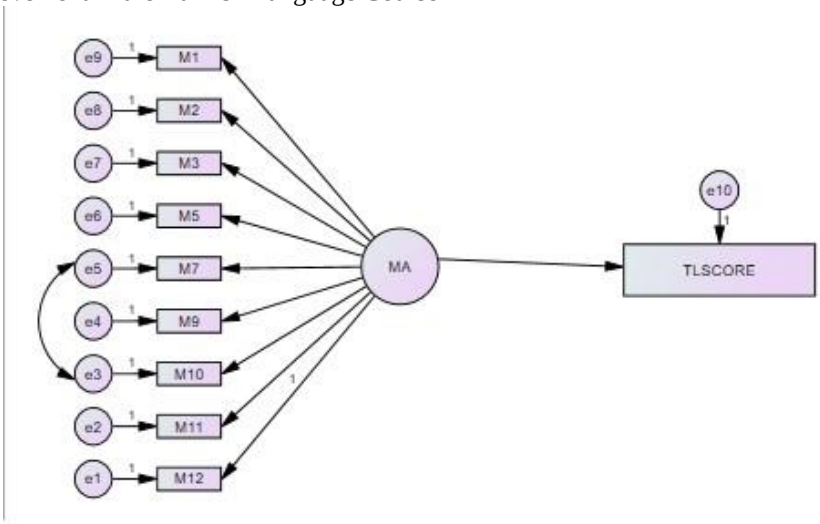
In the structural equation analysis conducted for the prediction of academic achievement by metacognitive awareness skills, the Model Fit Indices were found as χ2/df=1,89, RMSEA=0.041, GFI=0.97, AGFI=0.96, CFI=0.96, IFI=0.96 TLI=0.95. As a result of the structural equation analysis conducted for this study, the goodness of fit values obtained in the analyses were found to be between good and excellent.

Table 5. The Effect of Students' Metacognitive Awareness Skills on Academic Achievement

| | **Estimate** | **β** | **Standard Error** | **T** | **p** |
|---|---|---|---|---|---|
| MA---ACHIEVEMENT | 41.50 | 0.35 | 7.40 | 5.61 | *** |

According to Table 5, when the effect level between the MA and ACHIEVEMENT variable was examined, the standardised path coefficient was found to be $\beta = 0.35$ ($p < 0.05$) and the effect was at a medium level. A one unit increase in the metacognitive awareness skill level causes a 0.35-unit increase in the ACHIEVEMENT score.

Figure 2. A Structural Equation Modelling of the Effect of Students' Metacognitive Awareness Skills on Academic Achievement in the Turkish Language Course



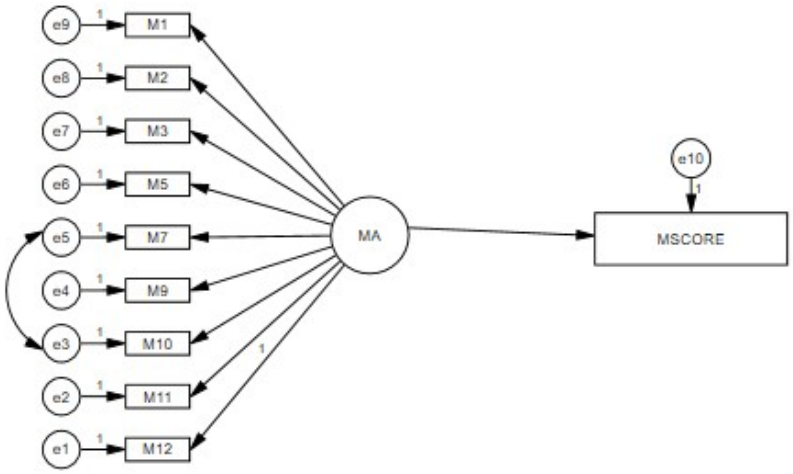

In the structural equation analysis in which metacognitive awareness skills of fourth grade primary school students predicted the level of academic achievement in the Turkish Language Course, the model fit indices of the scales were found as $\chi 2/df=1.89$, RMSEA= 0.041, GFI=0.98, AGFI=0.96, CFI=0.96, IFI= 0.96 TLI=0.95. As a result of the structural equation analysis conducted for this study, the goodness of fit values obtained in the analyses were found to be good and excellent.

Table 6. The Effect of Students' Metacognitive Awareness Skills on Academic Achievement in the Turkish Language Course

| | Estimate | β | Standard Error | T | p |
|---|---|---|---|---|---|
| MA---TLSCORE | 41,50 | .35 | 7.40 | 5.61 | *** |

When the level of impact between the MA and the TLSCORE variable was examined, the standardised path coefficient was found as $\beta = 0.35$ ($p < 0.05$) and the effect of the MA level on the TLSCORE (Turkish Language Score) was found to be at a moderate level. A one unit increase in the Metacognitive Awareness Skill level causes a 0.35-unit increase in achievement in terms of Turkish Language score.

Figure 3**.** A Structural Equation Modelling of the Effect of Students' Metacognitive Awareness Skills on Academic Achievement in the Mathematics Course



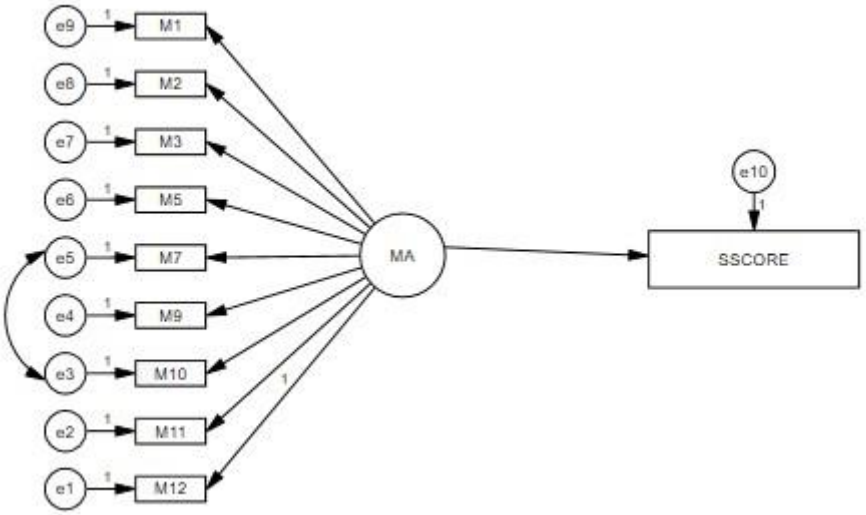
In the structural equation analysis in which metacognitive awareness skills of fourth grade primary school students predicted the mathematics course achievement level, the model fit indices of the scales were found as $\chi 2/df=1.85$, RMSEA=0.040, GFI=0.98, AGFI=0.96 CFI=0.96, IFI=0.96 TLI=0.95. When the goodness of fit values obtained in the analyses because of the structural equation analysis conducted for this research are examined, it is seen that the values are good and excellent.

Table 7. The Effect of Students' Metacognitive Awareness Skills on Academic Achievement in the Mathematics Course

| | Estimate | β | Standard Error | T | p |
|---|---|---|---|---|---|
| MA---MSCORE | 10,80 | 0.31 | 2.13 | 5.04 | *** |

Analysing the level of effect between the MA and the MSCORE variable, the standardised path coefficient was found as $\beta = 0.31$ ($p < 0.05$), and the level of MA was found to have a moderate effect on the MSCORE (mathematics score). A one unit increase in metacognitive awareness skill level causes a 0.31-unit increase in achievement in terms of maths score.

Figure 4**.** Structural Equation Modelling of the Effect of Students' Metacognitive Awareness Skills on Academic Achievement in the Science and Technology Course



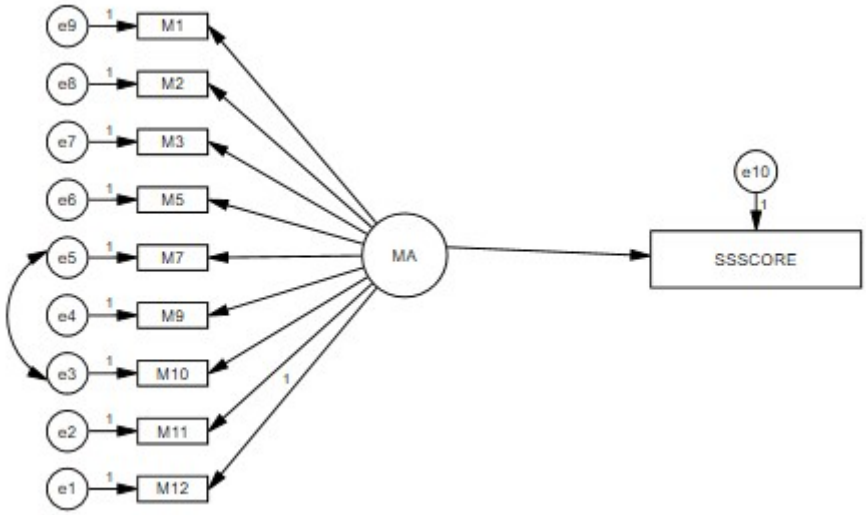

In the structural equation analysis in which metacognitive awareness skills of fourth grade primary school students predicted the achievement level of science and technology course, the model fit indices of the scales were found as $\chi 2/df=1.69$, RMSEA=0.036, GFI=0.98, AGFI=0.97, CFI=0.97, IFI=0.97, TLI=0.96. When the goodness of fit values obtained in the analyses because of the structural equation analysis conducted for this study are examined, it is seen that the values are good and excellent.

Table 8**.** The Effect of Students' Metacognitive Awareness Skills on Academic Achievement in the Science and Technology Course

| | Estimate | β | Standard Error | T | p |
|---|---|---|---|---|---|
| MA----SSCORE | 8.96 | 0.23 | 2.19 | 4.07 | *** |

When the level of effect between the MA and the SSCORE variable was examined, the standardised path coefficient was found as $\beta = 0.23$ ($p < 0.05$), and the effect of the MA-level on the SSCORE (Social Sciences Score) was found to be moderate. A one unit increase in the metacognitive awareness skill level causes a 0.23-unit increase in achievement in terms of science and technology score.

Figure 4**.** Structural Equation Modelling of the Effect of Students' Metacognitive Awareness Skills on Academic Achievement in Social Sciences Course




In the structural equation analysis in which metacognitive awareness skills of fourth grade primary school students predicted the achievement level of the Social Sciences Course, the model fit indices of the scales were found as $\chi 2/df$=1,61, RMSEA=0.034, GFI=0.98, AGFI=0.97, CFI=0.97, IFI=0.97, TLI=0.96. When the goodness of fit values obtained in the analyses because of the structural equation analysis conducted for this research are examined, it is seen that the values are good and excellent.

Table 9. The Effect of Students' Metacognitive Awareness Skills on Academic Achievement in the Social Sciences Course

| | Estimate | β | St. Hata | T | p |
|---|---|---|---|---|---|
| MA----SSSCORE | .11 | .30 | 2.13 | 5.006 | *** |

When the level of effect between the MA and the SSSCORE variable was examined, the standardised path coefficient was found as $\beta = 0.30$ ($p < 0.05$) and the level of MA was found to have a moderate effect on the SSSCORE (Social Sciences Score). A one unit increase in the metacognitive awareness skill level causes a 0.30-unit increase in achievement as the Social Sciences Score.

## Results and Discussion

The analysis presented in the previous section shows that the Metacognitive Awareness Skills of fourth grade primary school students did not show a statistically significant difference according to Gender. Among the studies in the literature; Akdağ (2014), Alkan and Açıkyıldız (2020), Aydın (2022), Bağçeci et al. (2011), Kandal and Baş (2021), Sarpkaya, Arık and Kaplan (2011), Şahin, Kırmalı and Kayır (2022) and Zorbozan (2021) stated that the Gender factor did not have a significant difference on Metacognitive Awareness Skills. In contrary to these studies, when the studies of Baltacı (2018), Bakioğlu, Küçükaydın, and Karamustafaoğlu (2015), Dilci and Kaya (2012), Khan and Panth (2017), and Yenice, Özden, and Hiğde (2017) are examined, it is seen that they support the finding that the gender variable is affected. According to the studies, there is no common opinion on the change in Metacognitive Awareness Skills according to Gender. While evaluating the data because of the analyses and examining whether the gender distribution of the students participating in the study affected this process, it was seen that the gender distribution was balanced (259 girls, 267 boys). It is thought that the fact that the Gender factor does not affect this process may be since primary school fourth grade students are not aware of Metacognitive Awareness Skills or that this skill has not developed due to not being supported by in-class activities.

Another conclusion of the study is that the Metacognitive Awareness Skills of fourth grade students who attended kindergarten before starting primary education were better than those of students who did not attend kindergarten. Based on this result, it can be stated that kindergarten education positively affects Metacognitive Awareness Skills. In the literature, it is believed that Metacognitive Awareness develops in individuals from a

very young age (Chatzipanteli, Grammatikopoulos, & Gregoriadis, 2014). There are studies showing that individuals' knowledge about metacognitive strategies develops metacognitive strategies especially during the early childhood and the primary education period (Hong, Peng, & Rowell, 2009). In the study conducted by Gürefe (2015), it was determined that the Metacognitive Awareness Skills of primary school students who received pre-school education were better than those who did not receive pre-school education. For this reason, it is thought that the education received by individuals may affect their Metacognitive Awareness levels.

In the study, it was determined that the Metacognitive Awareness of students whose mother and father education levels were secondary school and above was higher than those who were primary school and only literate. Kaya and Fırat (2011) examined the metacognitive skills of fifth and sixth grade students in terms of parental education level and found that there was a significant difference in favour of mothers with university and high school education level and fathers with university and secondary school education level. In another study, Atay (2014) examined the metacognitive awareness of secondary school students according to their parents' education level. As the data of the study showed, there was a significant difference in metacognitive awareness in favour of the university graduate mother and the high school and university graduate father. Another study supporting these results was conducted by Ocak, Karakuyu and Küçükçınar (2023) and it was found that when the attitudes of secondary school students towards the English course were examined in terms of metacognitive awareness levels, the difference was in favour of students whose mother's educational status was primary school and whose father's educational status was university.

When the metacognitive awareness skill levels of fourth grade primary school students were analysed according to the economic status of the family, it was found that the metacognitive awareness of students with "good" economic status of their families was higher than those with "medium and poor" level. Similarly, Balcı (2007) found that the metacognitive awareness of students at lower socio-economic level was lower than that of students at a medium and higher socio-economic level. However, there are also studies in which the economic status of the family does not statistically affect the level of metacognitive awareness (Arslan & Çelik, 2022; Karslı, 2015).

When the Metacognitive Awareness Skill levels of primary school fourth grade students were examined according to the number of siblings variable, it was statistically determined that the Metacognitive Awareness levels of students with 2 and 3 siblings were statistically significant and higher than the students with more siblings or single siblings. According to the result obtained, it can be said that the decrease in the interest shown by families to their children as the number of siblings increases also affects Metacognitive Awareness. In the literature, it is seen that there are studies in which similar findings are obtained with this research. In the study conducted by Yaşar Ekici and Balcı (2018), it was found that in the sub-dimension of the need to control thoughts in the metacognition scale, the metacognition levels of students with more than one sibling were higher than those with 1 sibling.

The analyses conducted for the study revealed that Metacognitive Awareness Skills predicted students' general academic achievement by 35%. In summary, Metacognitive Awareness Skills were found to predict academic achievement positively. In the literature; Ataalkın (2012), Alkan and Açıkyıldız (2020), Bağçeci et al. (2011), Ekici, Ulutaş and Atasoy (2019), Çalgıcı (2018), Çakır and Yaman (2015), Ghonsooly, Khajavy and Mahjobi (2014), Sökmen and Kılıç (2016) examined the effect of metacognitive awareness on academic achievement in their studies and, they found that it affected positively.

Another conclusion drawn from the analysis is that Metacognitive Awareness Skills predicted Turkish course achievement by 26%. According to this result, it can be said that students with high metacognitive awareness will also have high achievement scores in the Turkish course. It was seen that the cognitive awareness strategy positively increased students' cognitive awareness skills, reading comprehension success and students' attitudes towards the course during the Turkish Language Course. Faridah, Setyaningrum, and Falakha (2022) examined whether the metacognitive strategy instruction "CALLA" affects students' reading comprehension and reading awareness, and it was observed that students to whom the metacognitive strategy method was applied had significantly higher scores. In the study of Aktaş (2013), in which the effect of attitude and metacognitive skills on the academic achievement level of the Turkish Language Course of students studying in the Primary Education Department of Classroom Teaching at the Faculty of Education was examined, it was revealed that the academic achievement level of the Turkish Language Course was positively affected.
It can be stated that the effect of Metacognitive Awareness Skills on the mathematics course achievement is 25%, and accordingly, it can be said that students with high metacognitive awareness skills also have high mathematics course achievement scores. In Eke's (2019) study to examine secondary school students' mathematics-oriented risk-taking behaviours, their metacognitive awareness levels and their relationship with

mathematics achievement, it was found that the metacognitive awareness level predicted academic achievement by 24.3%; In Topçul's (2019) study examining the effect of metacognitive awareness levels and logical thinking skills of secondary school students on academic achievement in mathematics courses, there were significant and positive relationships between the metacognitive awareness levels and the logical thinking skills of secondary school students and academic achievement. In Kaplan and Duran's (2015) study examining the use of metacognitive strategies by secondary school students with different academic achievement levels in the process of studying mathematics, all sub-dimensions of metacognition were analysed. In the study conducted by Kurtuluş and Öztürk (2017) to determine the effect of metacognitive awareness level of secondary school students and mathematics self-efficacy perception on mathematics achievement, it was found that the metacognitive awareness level of secondary school students differed significantly according to the Gender, the Grade Level and the Mathematics School Report Score variable and that it affected the mathematics achievement by 47%.

The effect of metacognitive awareness skills on science and technology course achievement was found to be 25%. Accordingly, it can be said that students with high metacognitive awareness skills may also have high science and technology course achievement scores. Özkaya (2022) examined the effect of teaching with the STEM Framework on students' creativity, metacognitive awareness and academic achievement and concluded that Metacognitive Awareness Skills increased academic achievement. As a result of the study conducted by Aydın (2022) to prepare the basis for an effective learning environment for motivation and metacognitive awareness in the science course, it is seen that students' motivation to learn science varies significantly according to Gender, the Experimentation Status, the Participation in the Science Project, the Use of Science in Daily Life, the Grade Level and the Mean Score of the Science Course. To assess the metacognitive awareness of secondary school students and understand its correlation with their learning levels, Çalgıcı and Ogan-Bekiroğlu (2021) conducted a study. They aimed to unveil the relationship between science achievement scores, general weighted grade point averages, and TEOG exam scores. The findings of their research indicated that the metacognitive awareness of secondary school students is notably high, exerting a significant influence on their learning outcomes. They also concluded that students with high metacognitive awareness use some metacognitive skills more while learning, and that students who know their mental processes and control their cognition can learn better and that activities for the development of metacognition can increase academic success. Ataalkın (2012) examined the effects of metacognitive strategies on students' metacognitive awareness, metacognitive skills, academic achievement and attitudes towards science and technology course when metacognitive strategies are used, especially for students (5th grade) who have just entered the third semester (the period when metacognitive strategies can be developed and used). As a result of the research, it was seen that the use of strategies that enable the development of metacognitive skills during the science and technology course improved students' metacognitive skills and increased their attitudes towards the science and technology course and increased their academic achievement.

The effect of Metacognitive Awareness Skills on the Social Sciences Course achievement was found to be 25%. Based on this result, it can be said that students with high metacognitive awareness may also have high Social Sciences achievement scores. Because the Social Sciences Course is a verbal course, which is boring for some students and easily forgotten by them, Kuru (2022) stated in his studies; in which he aimed to make teaching during Social Sciences Courses colourful, to ensure that individuals are responsible for their own learning, to help them see their deficiencies and to help them make inferences about how they can learn better; that teaching practices using metacognitive strategies increased students' awareness and their competence to use metacognitive strategies. Pullu and Kazu (2023) examined the effect of using strategies that develop metacognitive skills on the acquisition of values and attitudes towards the fourth grade Social Sciences Course in primary school and concluded that the use of strategies that develop metacognitive skills has a positive effect on the academic sense of the Social Sciences Course.

## Recommendations

Considering the results obtained from our study, it is seen that many factors affect Metacognitive Awareness Skills. Determining these factors as Metacognitive Awareness Skills will positively affect both cognitive and academic development of individuals.

- This study revealed that metacognitive awareness skills contribute to the academic achievement of primary school fourth grade students. Therefore, to increase the academic achievement of primary school students, it is necessary to focus on factors affecting metacognitive awareness and factors affecting metacognitive awareness.
- Many factors should be taken into consideration when designing activities to develop metacognitive awareness skills for primary school students. Although gender does not appear to be an important

factor for children, can be done by since they attend kindergarten, that their parents have received education, the economic status of the family, and the number of siblings in the family.

- For disadvantaged students in regions where the education level of parents is low, the interaction between teachers and parents can be increased and families can be closely involved in their children's education. In designing activities to develop or increase the metacognitive awareness skills of primary school students, can be done by considering the economic situation.
- In this study, only the effect of metacognitive awareness on academic achievement in primary school 4th grades was examined and data were collected accordingly. It can be analysed whether the metacognition levels differ between the grade levels in the same school. The study is a quantitative study and the extent to which metacognitive awareness predicts academic achievement was examined. This study can be transformed into a mixed-method study by supporting it with interviews with families, students or teachers. There are much fewer qualitative studies on metacognitive awareness. For this reason, data can be collected and evaluated by using the qualitative research design.
- In this study, the effect of metacognitive awareness on academic achievement in primary school 4th grades was examined and data were collected accordingly. The study can be carried out among different grade levels, and it can be benefited from different provinces and schools.
- It can also be converted into a longitudinal study by working with the same students from the first to the fourth grades of primary school, considering the changes in metacognitive awareness skills.

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## Author (s) Contribution Rate

This study was produced END doctoral dissertion and IK was her adviser of doctoral studies.

## Conflicts of Interest

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

## Ethical Approval (only for necessary papers)

Ethical permission (November 12, 2021, date and 2021/532 number) was obtained from the Ethics Commitie of Social and Humanity Science Research of Necmettin Erbakan University for this research.

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# Examining Teacher and Administrator Perspectives on the Career Steps in Teaching

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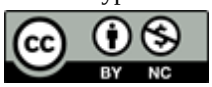

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# Examining Teacher and Administrator Perspectives on the Career Steps in Teaching

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## Abstract

The purpose of this research is to examine the opnions of teachers and school administrators regarding the Regulation of Teaching Career Steps published by the Ministry of Education. The study group of the research, designed within the framework of the phenomenology research model, one of the qualitative research approachess, consists of a total of 17 participants, taking into account the criterion of having worked as a teacher for ten years or as a specialist teacher for ten years in one of the provinces in the Southeastern Anatolia Region in the 2022-2023 Academic year. Research data were collected through face to face semi-structured interview form developed by the researchers. In the analysis of the research data, content analysis was used. Research findings have reached conclusions such as that teaching career steps are insufficient in terms of developing teachers economic, social and personal rights, don't contribute to Professional development, applications are insufficient, the exam is simple, applications will create duality and cause differences among teachers, it shows that the regulation of teaching career steps should be redesigned and solution proposals should be developed to make teachers economic, social and personal rights more comprehensive.

**Keywords:** Career, Teaching career steps, School administrator, Teacher

## Introduction

Education can be defined as a process aimed at ensuring an individual's social adjustment and imparting the new knowledge and skills required by the age. As societies continually evolve, the knowledge and skills expected from individuals also undergo changes in parallel with this development. Fostering a good citizen and a good person is a common goal of all education systems for the advancement of society (Gömleksiz & Akyıldız, 2012).

The progress of societies and the attainment of the well-being levels of developed countries are primarily based on the healthy functioning of education systems. When looking at developed countries, it is observed that they possess a well-prepared education plan along with a teaching staff that is specialized and has acquired specific qualifications (Özan & Kaya, 2009). Whether students can learn in schools, determining the expected outcome in education, and ensuring that educational institutions have the qualities students desire are achieved through the hands of teachers (Urfalı, 2008). The success of the system emphasizes the quality of the teaching profession. The better the quality of the teacher, the better the quality of education provided in schools. Therefore, to cultivate good students, it is essential to have teachers who are experts in their field and are of high quality (Seferoğlu, 2003).

Teaching is considered a profession that requires specialized knowledge and skills (Şişman & Taşdemir, 2008). A teacher is also an individual who shapes the future of society, is a lifelong learner, seizes every opportunity, continuously renews oneself, and holds a respected and significant position in society (Erdem, 2013). They are individuals who, through their attitudes, knowledge, and habits, serve as examples to students and mold them into exemplary individuals. Therefore, teaching goes beyond having expertise in a subject or the authority to control a classroom; it means being individuals with the ability to build humane relationships with the people they teach (Köktaş, 2003). Additionally, they bridge the gap between the world of children and young people

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and that of adults, facilitating understanding between students and their families. They play both an academic role and that of a character educator for students (Kıncal, 2000).

Some resources are required for production in educational services. In the education system, the most crucial resource is human resources (Şişman & Taşdemir, 2008). The structure and operation of schools, which constitute human resources, vary from country to country. Within the school, there are teachers, administrators, and other staff in various roles and statuses in terms of structure and operation (Ada, 2013). Having the qualifications related to be a teacher has been considered sufficient for appointment to specific roles and statuses. Therefore, when it comes to human resources in education, teachers are the first to come to mind (Şişman, 2016).

Various practices focusing on pre-service and in-service training have been implemented worldwide and in Turkey to enhance the quality of teacher education. These practices include, at times, the creation of postgraduate completion programs, providing pedagogical formation to teachers from different disciplines, or utilizing in-service training programs as different approaches. These efforts aim to elevate teachers to a better level both qualitatively and quantitatively (Gündoğdu & Kızıltaş, 2008). Completing higher education is not the end of professional development for teachers; it is the beginning of a developmental process within the profession. The purpose of this developmental process is to assist teachers in the development of their students and contribute to their own professional development, i.e., their career (Bakioğlu & Dervişoğulları, 2016).

Career, in everyday conversations, refers to an individual's experiences related to progress and success in their professional and work life, as well as the roles they undertake throughout this work experience (Bilgin, 2014). At the same time, a career means the work success based on the expertise employees want to have and achieve, encompassing all the tasks personnel perform throughout their lives (Dolgun, 2012). For some, a career emerges as a result of chance or fate, representing the position related to the work one has engaged in throughout their life (Özgen & Yalçın, 2015). Additionally, it is an honorable pursuit that one enters with aspirations of progress in their youth and continues until retirement (Tortop, Aykaç, Yayman, & Özer, 2013).

Individuals make significant efforts to build a career. Individuals striving to make a career and achieve success in their chosen career path need to determine their career paths. In this context, correctly identifying career paths and areas of expertise is crucial for individuals (Atalay, 2021).

The changing world and rapidly growing economy have led to the emergence of different professions. Therefore, it is observed that each profession has a different specialization area to adapt to the times. After completing medical education, doctors receive the title of medical doctor. They can continue their professional careers with this title or specialize after completing specialization training (Açıkgöz, Ekemen, Zorlu, Yüksel & Ayoğlu, 2019). The industrial revolution provided opportunities for specialization in the field of architecture. As advancements occurred in production, specialization became crucial in the professional field. With specialization, the knowledge and skills required in the field of architecture have also diversified (İlerisoy & Aycı, 2019). However, the situation appears to be different in the teaching profession. In Türkiye, according to the "Regulation on Candidate Teaching and Teaching Career Steps" published in the Official Gazette dated 12.05.2022 and numbered 31833, teaching is divided into three career steps: teacher, specialist teacher, and head teacher. Those who successfully complete the candidacy period are appointed as teachers. Those with at least ten years of service, who complete the professional development activities of specialist teaching, and meet the conditions for becoming a specialist teacher according to this regulation can become specialist teachers. Those with at least ten years of experience as specialist teachers, who complete the professional development activities of head teaching, and meet the conditions for becoming a head teacher according to this regulation can become head teachers (MEB, 2022). Thus, to satisfy teachers and align their priorities in enhancing their careers and motivation, there is a need to converge expectations. In some cases, teachers may need support through training, counseling, coaching, etc. (İbicioğlu, 2011).

When the literature is examined, it is concluded that, based on the regulation introduced in 2005, teachers holding the titles of specialist and head teacher take on more responsibilities, make efforts in their profession, and have a positive impact on other teachers due to the findings obtained in research (Demir, 2011). In a study, it was found that despite the belief that the promotion system in career steps would improve the quality of teachers, the participation of both male and female teachers in this system was limited. As a result, doubts were raised about the necessity of the promotion system in career steps for teacher quality (Özan & Kaya, 2009). In another study on the topic, it was concluded that school administrators are not favorable to the implementation of specialist teaching and find the criteria for selecting specialist teachers inadequate (Göksoy, Sağır & Yenipınar, 2014). Another study indicated that the establishment of career steps contributes to the professional

development of teachers (Kaplan & Gürkan Gülcan, 2020). In a similar research, it emerged that the implementation of the promotion system in the teaching profession would not elevate social status (Ural, 2007). Yet another study revealed that those who want to increase or decrease the impact of the exam scoring agree. The opinion that the career steps exam should include subject-related questions is emphasized (Kazoğlu, 2014).

In accordance with the Regulation on Teaching Career Steps, teachers who qualified based on the multiple-choice exam coordinated by the Ministry of National Education (MEB) and conducted by the Student Selection and Placement Center (ÖSYM) in 2005, a single and unique occurrence, have advanced in the teaching career steps and have also gained additional points for promotion to managerial positions. This exam has not been conducted again. The relevant regulation was revisited years later and reorganized and published in the regulation of 2022. In the latest regulation, career steps are influenced not only by the exam but also by the documents obtained by the teacher, the training received, and the projects participated in. Teachers pursuing a thesis or non-thesis master's degree are exempt from the exam. Additionally, there is a limitation based on seniority. It is observed that this regulation has been a subject of discussion in the public and among teachers for a long time. There has been no consensus among teachers, and discussions by education sector unions on the subject have been consistently on the agenda. The uncertainty of professional development and career planning is significant for teachers. It is believed that the opinions of teachers regarding the career steps addressed in this regulation will contribute to the resolution of problems.

*Research Objective:* The primary objective of this research is to examine the opinions of teachers and school administrators regarding the Regulation on Teaching Career Steps published by the Ministry of National Education. In line with this main objective, answers are sought to the following questions from teachers and school administrators:

1. What are the opinions of teachers and school administrators regarding the teaching career steps in terms of improving the economic, social, and personal rights of teachers?

2. What are the opinions of teachers and school administrators regarding the teaching career steps in terms of the professional development of teachers?

3. What are the opinions of teachers and school administrators regarding the trainings specified in the teaching career steps regulation?

4. What are the opinions of teachers and school administrators regarding the exam specified in the teaching career steps regulation and the planned exam?

5. What are the opinions of teachers and school administrators regarding the career steps specified in the teaching career steps regulation?

6. What are the opinions of teachers and school administrators regarding the effects of organizing the teaching profession according to career steps on our education system?

7. What are the opinions of teachers on how they can be made more willing for professional development?

## Methodology

### Research Model

In this research, adopting the phenomenological research model from qualitative research approaches, the study explores the opinions of teachers regarding the teaching career steps outlined in the Teacher Profession Law. Phenomenological research aims to question and reach the essence of experiences related to a phenomenon. In this regard, experience is crucial in phenomenological research, distinguishing it from other qualitative research methods conducted through interviews. Unlike other basic qualitative research methods, interviews may not always focus on questioning experiences. For instance, to uncover the meanings attributed to teaching by someone who has never been a teacher, you can collect data through interviews, but you cannot reveal their experiences as a teacher. Therefore, this research is not a phenomenological study but rather a basic qualitative research. However, if you attempt to grasp the meanings attributed to teaching based on the experiences of someone who has been a teacher, then it becomes a phenomenological study (Ersoy, 2019). In this study, teachers who have ten years of teaching experience, including ten years as specialist teachers, were chosen as

the phenomenon. The experiences and opinions of teachers about the teaching career steps that open the way to becoming a specialist teacher or head teacher were interpreted and reflected in the study.

**Study Group**

The study group of the research consists of teachers working in official educational institutions affiliated with the Ministry of National Education in one of the provinces in the Southeastern Anatolia Region during the 2022-2023 academic year, in accordance with the research model. The study group was determined using a purposive sampling method called "criterion sampling." Criterion sampling involves selecting the sample based on criteria predetermined by the researcher. The criteria for sampling can be created by the researcher or can be based on a pre-existing criterion list (Baş & Ukturan, 2017). The main criteria for this study are having ten years of teaching experience or ten years of specialist teaching experience in official educational institutions affiliated with the Ministry of National Education. Following these criteria, participants in the research were determined by seeking the opinions of specialist teachers, and teachers with experience related to the Teacher Profession Law were identified. Face-to-face interviews were conducted with the identified teachers, providing brief information about the purpose and method of the research. All teachers who agreed to the face-to-face interview voluntarily participated in the research. Accordingly, the research was conducted with 17 participants who have ten years of teaching experience or ten years of specialist teaching experience in official educational institutions affiliated with the Ministry of National Education.

**Data Collection and Analysis**

The research data were collected through a semi-structured interview form developed by the researcher. Semi-structured interviews allow researchers to outline the main points of a specific topic and also ask questions relevant to their own areas, while providing flexibility during the interview to adapt to new situations that may arise (DiCicco-Bloom & Crabtree, 2006). Semi-structured interviews can be conducted one-on-one in a question-and-answer format or with multiple individuals in a group setting. When conducted with a single person, the researcher has the opportunity to delve deeper into the person's responses and opinions (Güler, Halıcıoğlu & Taşğın, 2015). In the research, a semi-structured interview form developed by the researcher was used to determine the teachers' views on the subject. The interview questions were prepared in line with the research's purpose, based on a review of the literature and obtaining expert opinions. To ensure clarity and comprehensibility of the expressions in the prepared interview form, a pre-application was conducted with a teacher. The interview form, shaped by expert opinions and the results of the pre-application, consists of two parts. The first part includes demographic information with 4 questions. The second part contains 7 open-ended questions.

All interviews were individually conducted face-to-face by the researcher on pre-determined dates after contacting the teachers in advance. The interviews took place at the schools where the participants were employed and lasted approximately 50-60 minutes. In this context, research data were collected through the semi-structured interview form provided to the participants.

In the analysis of research data, content analysis was employed. Content analysis is fundamentally about bringing together similar data into specific concepts and themes, and organizing and interpreting these concepts in a way that the reader will understand (Yıldırım & Şimşek, 2021). In this research, the notes taken by the researcher during the interviews, as well as the data obtained from the interview form, were transcribed verbatim into the interview form without any alterations in a computer environment. Each interview form for each participant was individually read and evaluated. Based on the sub-objectives and interview questions of the research, a thematic framework was created for data analysis. To ensure the reliability of the research, expert opinions were sought to confirm whether the opinions given under the themes in the research matched those themes. Considering the evaluations of the researchers and the expert regarding the opinions that should be included in the themes, the numbers of "agreement" and "disagreement" were determined. The reliability of the research was calculated using the formula of Miles & Huberman (1994) (Reliability = [Number of Agreements / (Total number of Agreements + Disagreements)] X100). Depending on the size and range of the coding schema, it was observed that there was a 90% and above agreement between the assessments of the researcher and the expert. Thus, the desired level of reliability was achieved. In this reliability study specific to the research, a reliability rate of 94% was obtained. In the final stage, the opinions of the teachers were interpreted within the framework of the identified themes, presented with quotes, and supported by the study. Due to the confidentiality of the participants' identities, participants are referred to by code names "Ö1, Ö2, Ö3,... Ö17" instead of their real names in the research report.

## Findings and Interpretation

### Data Related to the First Sub-Problem

The first question of the semi-structured interview form is "Do you think teacher career stages aim to improve teachers' economic, social, and personal rights, and why?" When the data related to the first sub-problem is examined, sub-codes are reached as developes, partially developes, and do not developes.

**Table 1.** *Objectives of Teaching Career Ranks*

| | f | % | Example Sentences |
|---|---|---|---|
| 1. Developes | 2 | 12 | Ö17: "Yes, because it is based on experience." |
| 2. Partially developes | 5 | 29 | Ö6: "Partially yes. However, the extent of its success is debatable. While it can be argued that it has achieved its goal more economically, I do not think it has succeeded in achieving its goal socially and in terms of rights." |
| 3. Does not develop | 10 | 59 | Ö2: "No, because I think it lacks in terms of personal and economic rights." |
| **TOTAL** | **17** | **100** | |

When the data related to the first sub-problem in Table 1 is examined, 12% of the participants stated that teaching career ranks develop teachers' economic, social, and legal rights by providing experience. 29% expressed that although it achieves its economic goal, it partially develops in terms of social and legal rights, citing reasons such as not affecting retirement, teachers not being sufficiently informed, the need for expansion in scope, and the necessity of making improvements not only in the economy. 59% state that the teaching career ranks are insufficient in improving teachers' economic, social, and legal rights, expressing opinions such as the need for a more comprehensive law and alternative practices instead of exams, indicating that it does not develop.

### Data Regarding the Second Sub-Problem

The second question of the semi-structured interview form is: "Do you think that the career steps in teaching contribute to the professional development of teachers, and why?" When examining the data related to the second sub-problem, the sub-codes are identified as "contributes, partially contributes, and does not contribute."

Table 2. *The Contribution of Teaching Career Steps to Teachers' Professional Development*

| | f | % | Example Sentences |
|---|---|---|---|
| 1. Contributes | 1 | 6 | Ö15: "We encountered many new concepts that will contribute to teachers." |
| 2. Partially contributes | 2 | 12 | Ö17: "As the years of experience increase, it can be a career step." |
| 3. Does not contribute | 14 | 82 | Ö8: "I don't think that the career steps in teaching contribute to the professional development of teachers. Because the provided trainings were limited to watching videos, which inevitably forced teachers to pretend as if they had watched those videos. Instead, this process could have been completed through hands-on training." |
| **TOTAL** | **17** | **100** | |

When examining the data related to the second sub-problem presented in Table 2, it is observed that 6% of the participants stated that the teaching career steps contribute to the professional development of teachers by introducing them to new concepts that will benefit teachers. 12% expressed the opinion that career steps contribute partially to the professional development of teachers, citing the need for practical studies instead of theory and the lack of environment and materials for practical applications. However, 82% of the participants agreed that the provided training did not contribute to teachers, emphasizing that the training was limited to

watching videos, which were watched forcefully. They mentioned that the training sessions ended with an exam, and the professional law only focused on career steps, damaging the professional reputation.

**Data Regarding the Third Sub-Problem**

The data regarding the third sub-problem were examined, and the sub-codes were determined as not suitable for its purpose, too intense, not necessary, can be improved, sufficient, and insufficient.

Table 3. *Evaluation of the Training Programs Included*

| | | f | % | Example Sentences |
|---|---|---|---|---|
| 1. | Not suitable for the purpose | 2 | 12 | Ö13: "The content of the training programs does not align with the realities of the field. The training provided in the programs is far from meeting the real needs of teachers." |
| 2. | Too intensive | 2 | 12 | Ö8: "I find it seemingly useful, but I can say that useful topics get lost in such an intense program within a short period." |
| 3. | Not necessary | 2 | 12 | Ö17: "I find it very unnecessary." |
| 4. | Can be improved | 2 | 12 | Ö11: "Correct studies, but I think they are not sufficient; practical applications in the field should be one-to-one." |
| 5. | Adequate | 3 | 17 | Ö9: "Good theoretically." |
| 6. | Insufficient | 6 | 35 | Ö12: "There were deficiencies in the practical knowledge because the information written in the school conditions was difficult to implement at the same time." |
| | **TOTAL** | **17** | **100** | |

When the data regarding the third sub-problem in Table 3 is examined, 12% of the participants state that the content of the training programs does not align with the realities of the field, citing this as a reason for being inadequate for its purpose. 12% express that the intensive program causes the disappearance of the main topics. 12% indicate that it is unnecessary. 12% express that the training programs are not interesting enough, the studies are not sufficient, and the practices need to be increased, suggesting that they can be improved. 17% state that the training programs are sufficient, while 35% believe that the regulation was hastily made, the implementation does not align with the training programs, and therefore, they are inadequate.

**Data Regarding the Fourth Sub-Problem**

The data for the fourth sub-problem, obtained from the fourth question of the semi-structured interview form, which is "How do you evaluate the exam conducted for the teaching career ladder?" was examined. The data revealed the following sub-codes: inclusive, incompatible with education, formality, simple, and unnecessary.

Table 4. *Evaluation of the Conducted Exam*

| | | f | % | Example Sentences |
|---|---|---|---|---|
| 1. | Comprehensive | 2 | 12 | Ö13: "Considering the quality of the provided education and societal expectations, it was an exam that met the expectations." |
| 2. | Incompatible with education | 2 | 12 | Ö9: "Irrelevant to the given training program." |
| 3. | Formality | 2 | 12 | Ö6: "The ease of the exam has prevented it from being selective." |
| 4. | Simple | 5 | 29 | Ö8: "The exam was quite simple. It seemed more like an assessment of reading skills rather than evaluating the candidates' knowledge. Conducting such an exam for the sacred profession of teaching would, in my opinion, further diminish the respect for the teaching profession in society." |
| 5. | Unnecessary | 6 | 35 | Ö11: "Unnecessary. Our knowledge and experience cannot be measured with a single exam." |
| | **TOTAL** | **17** | **100** | |

When examining the data for the fourth sub-problem presented in Table 4, 12% of the participants expressed that the conducted exam was inclusive, taking into account the quality of the provided education and societal expectations. Another 12% stated that the exam was incompatible with the education. Additionally, 12% believed that the exam was easy and did not measure the required level, indicating that it was a formality. Furthermore, 29% thought that the exam did not achieve its purpose, as it assessed reading skills rather than knowledge, making it a simple exam. Finally, 35% argued that the exam did not measure knowledge and experience, and considering factors such as the impact of the exam on the quality of teaching, they deemed it unnecessary, proposing to evaluate experience and years of service instead.

**Data Regarding the Fifth Sub-Problem**

The fifth question of the semi-structured interview form is 'Could you please write your opinions on the practices related to the career stages in the Regulation on Internship and Career Stages of Teaching Career?'. Based on these data, the subcodes have been identified as 'adequate,' 'unapplicable,' 'not inclusive,' and 'dysfunctional.'

Table 5. *Opinions on the Practices*

| | | f | % | Example Sentences |
|---|---|---|---|---|
| 1. | Sufficient | 2 | 12 | Ö14: "It is good for teacher development." |
| 2. | Not applicable | 4 | 24 | Ö10: "I think the regulation is coercive." |
| 3. | Not comprehensive | 5 | 29 | Ö13: "There is a general consensus in the community that it is a regulation far from meeting the expectations of teachers." |
| 4. | Ineffective | 6 | 35 | Ö2: "I believe that the implementation of career ladder practices in the regulation will disrupt harmony and order within schools and among the teaching staff." |
| | **TOTAL** | **17** | **100** | |

When examining the data regarding the fifth sub-problem presented in Table 5, 12% of the participants stated that the practices are sufficient for teacher development. 24% expressed that the applied regulation is imposing, making it unworkable. 29% mentioned that it is a regulation far from meeting the expectations of teachers, the training in practice is lacking in evaluation, and it is not inclusive due to not including every teacher regardless of years of experience. 35% indicated that these new practices, being incomplete and disrupting order within the school, are dysfunctional.

**Data Regarding the Sixth Sub-Problem.**

The sixth question of the semi-structured interview form is "What are your thoughts on the effects of organizing the teaching profession according to career steps on our education system?" According to this, partial effectiveness, improvement, and negative contribution have been identified as sub-codes.

**Table 6.** *The Effects of Career Steps on Our Education System*

| | | f | % | Example Sentences |
|---|---|---|---|---|
| 1. | Partially effective | 1 | 6 | Ö6: "There will be partially positive results. However, education is a whole. It should be supported from all aspects." |
| 2. | Improves | 3 | 18 | Ö8: "I think there will be positive effects if it is done meaningfully and made effective." |
| 3. | Negative Contribution | 13 | 76 | Ö7: "Creating differences among teachers can have a negative impact." |
| | **TOTAL** | **17** | **100** | |

When examining the data provided in Table 6 regarding the sixth sub-problem, it is observed that 6% of the participants believe that there will be partially positive results, and 18% express that if effectively implemented, it could positively improve the education system. However, 76% of the participants agree that organizing the teaching profession according to career steps may create differences among teachers, and this situation could have negative effects on our education system.

**Data Regarding the Seventh Sub-Problem**

The seventh question of the semi-structured interview form is "In your opinion, how can teachers be made more willing for professional development?" According to the data, sub-codes have been identified as valuing their opinions, increasing their training, recognizing their contributions, and improving their benefits.

**Table 7.** *Motivating Teachers for Professional Development*

| | f | % | Example Sentences |
|---|---|---|---|
| 1. Valuing their opinions | 2 | 12 | Ö1: "Valuing teachers." |
| 2. Increasing training opportunities | 3 | 18 | Ö7: "By undergoing practical trainings." |
| 3. Valuing their contributions | 3 | 18 | Ö16: "By soliciting their opinions. It would be more successful if based on voluntariness." |
| 4. Improving their welfare rights | 9 | 52 | Ö2: "Every teacher is already an expert in their field; therefore, if teachers' professional and economic rights are at a sufficient level, their professional development will increase accordingly." |
| **TOTAL** | **17** | **100** | |

When examining the data related to the seventh sub-problem in Table 7, 12% of the participants express that valuing teachers and considering their opinions are essential to making teachers' professional development more willing. 18% mention that various forms of training, such as practical workshops and seminar programs throughout the year, can contribute to creating more energetic, scientific, critical, and collaborative teaching staff. Another 18% suggest that by seeking teachers' opinions, considering contributions, and operating on a voluntary basis, their professional development can be made more willing. Finally, 52% agree that improving teachers' professional and economic rights will increase their motivation for professional development.

## Discussion and Conclusion

The developments and changes in educational activities necessitate teachers to enhance and renew themselves (Kaya, 2007). For these reasons, the Ministry of National Education of Türkiye has undertaken various efforts to increase the quality of the teaching profession, encourage teachers to engage in scientific research, and make the teaching profession more productive, aiming to transform it into a career profession (Deniz, 2009). One of these regulations is the 'Regulation on Candidate Teaching and Teaching Career Stages,' published in the Official Gazette in 2022. Gathering the opinions of teachers and school administrators regarding observations, findings, potential challenges, and proposed solutions related to this regulation has been deemed important. The expressed views within the scope of the research are considered valuable data for the study and may provide insights to researchers interested in similar topics.

The main purpose of the research is to examine the opinions of teachers and school administrators regarding the Career Stages Regulation for Teaching, published by the Ministry of National Education. When the findings related to the opinions on "the views of teachers on the career stages of teaching in terms of improving their economic, social, and personal rights" are examined in line with the aim of the research, it is observed that most teachers and school administrators express that improving the economic, social, and personal rights of teachers is distant, and some parts of the practices are positively evaluated. In the literature review on the subject, it is found that due to the lack of continuity and unplanned implementation of this regulation, it could not fully serve its purpose (Demir, 2011). Additionally, the opinion has emerged that teachers cannot elevate their social status in terms of respect, recognition, and success (Ural, 2007). There are problems related to status, economic, social, and personal rights in human resources in education (Şişman & Taşdemir, 2008). These problems negatively affect the performance of teachers, hindering the realization of the goals of education and reducing job satisfaction (Erdem, 2010).

When examining the findings related to the opinions on "the views of teachers on the career stages of teaching in terms of contributing to the professional development of teachers," it is observed that most participants express that the "Regulation on Candidate Teaching and Teaching Career Stages" published in the Official Gazette dated May 12, 2022 (No: 31833) did not contribute to the professional development of teachers. They mention that teachers are subjected to exams after the training, the training consists only of watching videos, and the training provided by this regulation is inadequate. Other research results in the literature support the

findings of this research, indicating that the career stages of teaching do not contribute to professional development. According to Gümüşeli (2005), the primary purpose of the career stages of teaching is to contribute to teachers' professional development and enhance their qualifications. However, due to the simplicity and formality of the exams conducted at the end of these trainings, it is stated that they do not contribute to professional development. Kaplan and Gülcan (2020) also obtained results in their research indicating that career stages would not contribute to the professional development of teachers and would disrupt job sharing.

When examining the findings related to the opinions on "the training included in the teaching career stages regulation," it is observed that there is a consensus among participants that the training is inadequate due to significant differences between the training and practices, failure to achieve its purpose, lack of interest, and the creation of these programs without careful consideration. Some participants, however, expressed that the training programs are sufficient. Similar results are found in other studies when examining this focus of opinions. In particular, Özdemir, Doğan and Demirkol (2022) stated that remote education is prone to misuse, and it cannot be precisely determined whether participants watch the training videos. Dağlı (2007) concluded that seniority should be a fundamental element in career stages, objective criteria should be used in evaluating performance, face-to-face in-service training should be given great importance, and career advancement should be achieved through postgraduate education.

When examining the findings related to the opinions on "the exam included in the teaching career stages regulation and planned to be conducted," it is evident that opinions highlighting the simplicity, unnecessary nature, and lack of compatibility with education are prevalent. The conclusion is drawn that the exam does not measure teachers' knowledge, lowers the quality of teachers, fails to achieve its purpose, is a formality, and is incompatible with education, and it is considered simple. Opinions also emerge suggesting a focus on experience rather than the exam, considering years of service, and making domain and regulatory knowledge prerequisites. This situation is similar to Kocakaya's (2006) proposal for incorporating performance-based objective criteria instead of an exam in career stages. The deficiencies such as the absence of questions related to subject knowledge and not considering experience in the exam resemble the opinions of teachers about the past expert teacher exam, as observed in the studies of Dağlı (2007).

When looking at the findings regarding the opinions on "the practices related to the teaching career stages in the regulation," most participants expressed views that these practices are dysfunctional, non-inclusive, and impractical for teaching career stages. Particularly, they mentioned that the practices are imposed by a regulation, do not meet expectations, lack adequate evaluations, do not consider experience, have deficiencies, and may lead to divisions within schools. However, some participants stated that the mentioned practices are sufficient for teacher development. Other studies in the literature support these research findings, suggesting that the practices related to teaching career stages are inadequate. In Çelikten's (2008) study, it was anticipated that the practices related to teaching career stages in the regulation would lead to problems in supervisor-subordinate relationships and intra-organizational hierarchy, create negative emotions and attitudes among teachers, cause division among teachers, and lead to groupings. Turan (2007) also found in his study that teachers expressed dissatisfaction with the process of promotion and career development in teaching career stages, indicating that the process did not meet their expectations. The overall dissatisfaction of teachers reflects the shortcomings in the career development process. Additionally, teachers have negative views about the limited number of expert teacher and chief teacher positions and the continuation of this practice in the future. Based on all this data, it can be concluded that the process in teaching career stages, involving confusion in supervisor-subordinate relationships among teachers who are not expert or chief teachers, not meeting teachers' expectations, being implemented with deficiencies in the regulation, and the likelihood that the practices in teaching career stages will not continue, leads to a negative reception of these practices.

When examining the findings related to opinions on "the effects of organizing the teaching profession according to career stages on our education system," it is observed that some participants believe it will result in partially positive outcomes, making it partially effective. On the other hand, some participants expressed that if the practices become more meaningful, they could improve our education system. However, a significant number of participants seem to agree that creating differences among teachers (such as titles, salary differences, and creating divisions among teachers) would ultimately have a negative impact on the education system. When reviewing the literature in the focus of research findings, two main problems stand out in Turkish education system: the problem of training teachers and the problem related to the professional development of trained teachers. It has been emphasized that a teacher having a good career is possible by ensuring that they are well trained both before and during service, taking advantage of opportunities for professional development (Şahin,

2008). Therefore, many administrators and teachers partly believe that organizing the profession according to career stages could be beneficial (Küçük & Aksakal, 2007).

'Views on How Teachers Can Be Made More Willing for Professional Development' were examined, and the majority of participants expressed a common opinion that teachers can be made more willing for professional development by improving their financial benefits, acknowledging their contributions, increasing training opportunities, subjecting them to various seminar programs, and valuing their opinions. Other studies in the literature support the findings of this research. In the study conducted by Özdemir, Doğan and Demirkol (2022), it was concluded that there is no benefit other than a salary increase related to the material gains that teachers will obtain in career ladder applications. According to Cerit (2021), the Hawthorne studies resulted in the conclusion that salary does not increase efficiency as expected.

In conclusion, it is observed that teachers and school administrators have a negative attitude towards the career levels in teaching. They attribute this negativity to teachers not improving their economic, social, and personal rights. They express that in-service training being conducted online does not contribute to their professional development. They find the training programs inadequate because they believe they do not have practical implications. They consider the exam unnecessary, as they think it is simple and does not measure knowledge. Overall, they believe that the practices would create a division among teachers, rendering them ineffective. They argue that it would have a negative impact on the education system. Finally, the consensus is that, for professional development, it is crucial to first improve the teachers' personal rights.

## Recommendations

Based on the obtained results, the following recommendations can be made:

- A more comprehensive regulation can be issued to improve teachers' economic, social, and welfare rights.
- Face-to-face training for professional development can be planned, ensuring practical applicability.
- New regulations can be implemented to align education programs with their intended goals, making them usable in practice, and ensuring they are not overly burdensome.
- Instead of relying solely on exams, assessment and evaluation based on experience and years of service can be considered.
- Meaningful and effective programs can be added to Turkish education system.
- More effective legal regulations can be established for the professional development of teachers.

## Author (s) Contribution Rate

The contribution rates of the authors are equal.

## Conflicts of Interest

There is no conflict of interest.

## Ethical Approval

In this study, all the rules specified within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive" were adhered to. Additionally, approval for this study was obtained from the Dicle University Social and Human Sciences Ethics Committee with the decision number and date of 452833 on 23.02.2023.

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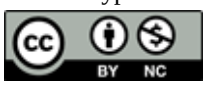

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# Examination of Roma Primary School Students' Sense of School Belonging*

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**Abstract**
Examining the sense of belonging among Roma elementary school pupils is the goal of this study. 121 fourth-grade Roma kids and 44 parents made up the study's participants. One of the mixed-method designs, the convergent mixed design, was chosen for the investigation. Quantitative and qualitative data are gathered concurrently in this design. Analyses and descriptions of quantitative data come first, followed by analyses and interpretations of qualitative data. Selçuk and Güner's (1999) Sense of Belonging Scale was applied to Roma students in the study's quantitative component. One of the qualitative research designs, the case study design, was applied in the qualitative section. 10 open-ended questions developed by consulting experts were posed to parents of Roma as part of the qualitative dimension. Along with the quantitative results, the responses from the parents were analyzed and evaluated. The study's findings support the notion that Roma primary school kids have a strong sense of school belonging. Additionally, it was discovered that girls had a considerably higher degree of school belonging than boys.

**Keywords:** Equal opportunity in education, Roma students, Sense of school belonging

## Introduction

The most important responsibility of the social state is to provide equal rights to all its citizens in all areas in accordance with the principle of equality, regardless of language, religion, color, ethnic origin, socio-economic status, health, or educational status. One of these rights is education. In order for human beings to lead a life worthy of their dignity in society, all individuals, regardless of their socio-economic level, gender, ethnic origin, language, religion, etc., must receive a certain level of education. For this reason, the phenomenon of the "social state" is emphasized on every platform in order to ensure that the right to education is recognized as the most fundamental human right and provided equally to all individuals. For the same reason, all social states consider education among their primary duties and aim to ensure that all citizens receive education under equal conditions.

The right to education is the most fundamental right that all members of society should enjoy equally. In many countries around the world, some groups of people are not able to enjoy this right properly due to problems in the education system, socioeconomic disadvantages, social stigmatization, exclusion, and marginalization. Roma are one of these communities (Çetin, 2017). Since Roma are always characterized by aggression, violence, crime, and pollution, they face prejudice in the society they live in (Bhopal, 2011) and are most often subjected to discrimination and exclusion by others (Bhopal & Myers, 2016; Cudworth, 2008; Derrington, 2016; Hamilton, 2018; Macura-Milovanović, Munda, & Peček, 2013; Tor, 2017). The main cultural problem Roma face in terms of education is that they do not send their children to school (Bedmar & León, 2012; Bhopal, 2011; Derrington, 2016). Roma students therefore face serious problems accessing education. A significant number of Roma children either do not attend school at all or drop out (European Economic and Social Committee, 2009). Where access is provided, they face unemployment and exclusion, even if they have a good education (Rodgers, 1995). For this reason, Roma parents seem reluctant to send their children to school. As a result, it is not possible to improve the situation (Bhopal and Myers, 2016; Gould, 2017; İlik, 2016). Since Roma students, like other children, are a part of society, their sense of belonging to school was a matter of curiosity and the inspiration for this study.

* This study is a part of the doctoral thesis prepared by the first author under the supervision of the second author.

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### General Information on Roma

It is generally believed that the Roma dispersed from their homeland in India between the 5th and 15th centuries (Liebich, 2007). There is no clear and precise information in the literature on why the Roma left their homeland in India (Kenrick, 2006). Fraser (2005) argues that if a people is a group of individuals with a common culture, language, and ancestry who live together and who can be easily distinguished from other human communities by certain characteristics, then the Roma lost their identity as a people a long time ago and became differentiated over time. Thus, although the Roma share a common ethnic origin in terms of linguistic and morphological characteristics, they cannot be called a homogeneous people due to the existence of many subgroups (Halwachs, 2005).

Although many different views have been put forward about the origins of the Roma, their origins have only been identified following recent research based on their language (Fraser, 2005). Roma are present in almost every region of the world, with more than 10 million of them living in Europe (Bačlija, 2008). Arayıcı (2008) states that there are approximately 30-40 million Roma worldwide, of which 10-15 million live in European countries. With this number, Roma constitute the largest minority in Europe and, at the same time, the most vulnerable ethnic group (Bobakova et al., 2015).

Historically marginalized in every country in the world, the mass extermination of the Roma occurred in Germany during the reign of Adolf Hitler. Glajar and Radulescu (2008) state that during the so-called "Roma Genocide" in Germany, some 500,000 Roma were exterminated, and according to different sources, up to two million, either by burning them in gas chambers or by using them as guinea pigs in medical experiments (cited in Kurtuluş, 2012). Going even further, the Nazis went back three generations from their time and massacred everyone of Roma ancestry. Years after these massacres, the 3rd World Roma Congress convened in Göttingen in 1981, with the massacre of Roma in Nazi Germany as the top agenda item. At this congress, Roma demanded reparations from Germany, but their demands went unanswered (Hancock, 2002).

In Europe, Roma are seen as a marginalized community (Çetin, 2017), and they live their lives struggling against this prejudice. The invented myths about Roma as lazy, thieves, kidnappers, parasites, etc. are used as a basis for justifying these prejudices. These are all found in folk tales, beliefs, and proverbs within European culture that reinforce anti-Roma sentiments (Hancock, 1991, cited in Avara and Mascitelli, 2014). Roma are among the disadvantaged groups in the regions where they live, particularly in Europe. In all countries where they live, they face violence, exclusion, inequality, hate speech, and discrimination, as well as many problems in the areas of basic human rights such as health, education, housing, and employment.

### The Importance of the Sense of Belonging to the School

The importance of students' sense of belonging to school, its development, and its close relationship with other returns of education have been the subject of many studies, especially in foreign literature. Most of these studies focus on the effect of a sense of school belonging on students' academic achievement. Adelabu (2007), Anderman (2002), Booker (2006), Cemalcılar (2010), Finn (1989), Goodenow (1992a, 1992b, 1993a), and Osterman (2000) revealed that a sense of belonging to school is positively related to high achievement, academic motivation, and academic self-efficacy and negatively related to school dropout. Anderman (2002) found positive relationships between students' sense of belonging to school and their grade point averages, while Hagborg (1994) found that students with a high sense of belonging to school had higher academic achievement and were more favorable towards their schools. A similar study was conducted by Isakson and Jarvis (1999), and as a result of the study, students with a high sense of belonging to their schools showed higher academic achievement.

## Method

This chapter provides information about the inspiration phase of the research, the research model, the participants, and the methods and techniques used in data collection and analysis.

### Inspiration Phase

In the process of determining the research topic, the researcher and the counselor exchanged ideas on various issues. In these interviews, especially socioeconomically disadvantaged primary school students' sense of belonging to school was emphasized. The school where the researcher teaches is located in a neighborhood where Roma families live. According to the researcher's observations, children from these families feel the difficulties of life more and are excluded, stigmatized, or marginalized by other children. In addition, the researcher's school has a large number of these students (45 percent). In addition, according to the year-end statistics in the e-school system, almost all (94 percent) of the students who were absent, dismissed, or dropped out of school due to being out of school age were Roma students.

As the researcher worked as a classroom teacher and administrator in this school for many years, she had the opportunity to get to know the students, their families, and their socio-economic and cultural conditions closely. During this process, the researcher observed that students who were absent or who dropped out of school were usually the children of Roma families. When starting primary school, Roma families strive to have their children enroll in a better school and in a class with a better teacher. At first, students attend school with excitement and enthusiasm. In the following period, however, the negative attitudes of the pupils towards school caught the attention of the researcher. This led him to ask the following questions:
:
-Why do Roma pupils who start primary school with great enthusiasm become absent or drop out later on?
-Why do these students not succeed academically overall?
-Why are children directed to work life at an early age?
-Why do parents marry off their children at an early age and break their ties with school?
In line with these questions, the researcher wondered about the effects of variables such as friends, teachers, etc. that connect Roma children to school, develop a sense of belonging in them, and motivate them to belong to school. In light of all these, the researcher decided to carry out this research in order to investigate in depth the situations that affect Roma children's belonging to school, to reveal their reasons, and, if possible, to discover ways to eliminate this situation.

**Research Methodology**

The mixed method was preferred. In mixed-method studies, quantitative and qualitative research approaches are used together. Patton (2002) stated that quantitative and qualitative approaches can be used together to examine a research problem in depth. In the mixed method, data are collected by using quantitative and qualitative approaches together to understand the problem of the research, and these data are analyzed and integrated (Creswell, 2012).
Accordingly, in the planning phase, we determined the problem statement for the research. Then we decided that the research could be conducted in a mixed model. In the implementation phase, we collected, analyzed, and interpreted the data. In the evaluation phase, we presented and reported the results of the research.
Mixed-method research, which is frequently used in educational research, is classified under four main headings: explanatory mixed method, parallel mixed method, embedded mixed method, and exploratory mixed method. Yıldırım and Şimşek (2013) state that phenomena and events are not simple and one-dimensional. Therefore, the researcher should use multiple methods to understand the phenomena and events. For a rich and holistic understanding of the truth, facts and events should be analyzed in both quantitative and qualitative dimensions. Thus, quantitative and qualitative methods were used together in this study in order to understand the research problem in depth. The quantitative and qualitative data obtained were analyzed by comparing and relating them.

**Research Design**

In this study, a convergent mixed method design, which is one of the mixed method designs, was used. Creswell and Creswell (2021) state that the purpose of this design is to collect quantitative and qualitative data simultaneously in order to understand the research problem, to combine these data, and to use the results. The reason for this is that the weaknesses or deficiencies in one data form are balanced with the other data form in order to explain the research problem in detail. In this design, the researcher collects quantitative and qualitative data simultaneously, analyzes the collected data separately, and compares the results with the analysis of both data sets. Then, he or she determines whether the results support each other or not. The researcher's direct comparison of the two data sets ensures the convergence of data sources.
In this design, the researcher gives equal priority to quantitative and qualitative data and collects quantitative and qualitative data simultaneously during the research. Finally, he or she compares these results to reveal whether the two data sets have similar or different results. This comparison can take different forms. The most common comparison approach is to present quantitative and qualitative results side by side in the findings section. For example, the researcher first presents the quantitative results and supports these results with qualitative quotations to confirm them. Another approach is to combine quantitative and qualitative data in a table. For this purpose, the researcher can show qualitative themes and quantitative statistical results in the columns that overlap with these topics. The third approach is to transform one of the data sets into a form that can be directly compared with the other. For example, the qualitative themes generated during the interview process are quantified and given scores according to their frequency. These scores are then compared with the scores in other measurement tools that deal with the same ideas in the themes. The power of the convergent mixed method design stems from the fact that the advantages of quantitative and qualitative data forms can be combined and used. Thus, while quantitative data provide generalizability, qualitative data provide information about themes, contexts, and environments (Creswell & Creswell, 2021). In this study, quantitative data were

supported by qualitative data, themes were formed, and quantitative and qualitative results were given side by side in the discussion section, which is the most common.

**Quantitative Dimension**

The researcher preferred to use the survey model in the quantitative dimension of this research because it is suitable for the subject and purpose of the research. In a universe consisting of many elements, the research model conducted on the whole universe or a group of samples taken from it in order to reach a general judgment about that universe is called a survey model. This approach is one that reveals a past or present situation as it exists without any change. Survey models conducted with large groups are studies in which an individual's attitude towards any phenomenon or event is investigated (Karasar, 2016). In general, the objectives in survey models are expressed with question sentences. The answers received from these questions are usually reported in the form of frequency degrees and percentages of the respondents. One of the important advantages of the survey model is that it gives us a lot of information about the findings we obtain from a sample consisting of many individuals (Büyüköztürk et al., 2020). Researchers are interested in how the opinions or characteristics they obtain with these question sentences are distributed among the participants in the sample rather than what the source is (Fraenkel & Wallen, 2006). It shows the survey models defined by Karasar (2016, pp. 77-87). The researcher used the case study survey model, one of the survey models defined by Karasar (2016), in the quantitative dimension of this research because it is appropriate for the subject and purpose of the research.

Yin (1984) emphasizes that the survey model is a research method that investigates a current phenomenon in its own reality, where the boundaries between the phenomenon and the content in which it is located are not clearly separated and where there is more than one data source (cited in Yıldırım & Şimşek, 2013). Karasar (2016) states that research conducted with the case study survey model provides more detailed and realistic information than research conducted with general survey models. Similarly, Hopkins (1980) states that survey models are frequently used in in-depth research of social units such as institutions, societies, groups, and individuals. In addition, the case study survey model can be used as a preliminary study to determine the important variables of the studies to be conducted with general survey models (Karasar, 2016). It is also known that the stages of case study research are the same as the stages of qualitative research (Büyüköztürk et al., 2020).

In this study, the Sense of Belonging Scale developed by Selçuk and Güner (1999) was used to measure Roma primary school students' sense of belonging to their school. This scale consists of a single dimension and 24 items. The Sense of Belonging Scale is a Likert-type scale with three-stage answers as "Always", "Sometimes," and "Never." Before the scale was applied, expert opinions were obtained by consulting three faculty members together with the researcher's supervisor about the suitability of this scale for the purpose of the research. The experts stated that the questions on the scale in question could be used in the research since they were suitable for the purpose of the research.

**Qualitative Dimension**

In the qualitative part of this research, a case study design, one of the qualitative research designs, was used. Yin (2009) states that a case study is needed in order to understand a complex social phenomenon in depth. Yin (2009) draws attention to the importance of "what, how, why, where, and who" questions in a case study and states that "what," "how," and "why" questions are used more frequently, especially in qualitative research conducted with a case study design.

In this study, a semi-structured interview form was developed in addition to Selçuk and Güner's (1999) scale. Before the implementation part of the study, a pilot study was conducted with two Roma parents to test the comprehensibility of the questions. The validity and reliability of the research were increased by adding the experiences of the parents about the children and the school to the answers given by the Roma students to the questions on the scale. The opinions of three faculty members from the field of educational sciences were taken about the content of the prepared questions, whether they serve the purpose of the research, their suitability in terms of the scope of the research, and their comprehensibility in terms of grammar rules. In line with the opinions received, one of the questions was removed on the grounds that it did not serve the purpose of the research. The number of questions was reduced from 15 to 10 by combining the questions with the same type of content. In addition, adjustments were made to the questions in terms of grammar and the comprehensibility of sentences. It was aimed at enriching the findings of the research by asking the parents of the students to tell about their children's experiences with their teachers at school. Participation in the study was voluntary. In this context, although an appointment was made for the interview, four parents did not come to the interview, postponing the appointment each time, and as a result, interviews could not be conducted with these parents.

**Participants**

The participants of this study were Roma fourth-grade primary school students and their parents who were studying in primary schools (five primary schools) with a high concentration of Roma students in Konya

province during the 2021-2022 academic year. In addition, some non-Roma students and their parents were also interviewed in order to create field notes. In addition, the views of teachers and administrators were sought in order to obtain information about the academic achievement, school and peer relationships, and school attendance of Roma students.

The criterion sampling method, which is one of the purposive sampling methods, was preferred in the selection of participants. The criterion sampling method is the creation of a sample from people, objects, events, or situations with the qualities determined in relation to the problem of the research (Büyüköztürk et al., 2020). In accordance with the problem of the study, this method was preferred because the participants of the study consisted of Roma students and their parents.

**Roma Students Participating in the Study**

The research was conducted with 121 students—52 girls and 69 boys. Due to the high absenteeism of Roma students and their absence from school, the unwillingness of some students to participate in the research, and the lack of permission of some students' parents, not all Roma students in schools could be reached. Therefore, the research was conducted with a group of participants who were very difficult to reach. The problem of absenteeism was observed in all schools within the scope of the research. In fact, the classroom teachers interviewed stated that most of the Roma students in their classes were absent a lot during the year and that some of them came to school for a week at the beginning of the year and were never seen again. The reason for this was reported to be that boys were working in different jobs to contribute to the family budget and girls were helping their mothers with housework, taking care of younger siblings at home, and getting married at an early age. In addition, negative attitudes of teachers working in one school were also encountered. Except for this school, the administrators and teachers of all the other schools visited made the place, students, and parents ready for the interview. This situation was reflected in the researcher's diary dated March 7, 2022, as follows:

"The teachers of X primary school, where I went to do my practice, asked me why I was conducting such research, especially about Roma students. They asked why other students were not included in the research and whether they thought that this research would have negative effects on Roma students. They said that it would have a negative impact on their lessons and that the students would not want to be interviewed by me. Even though I told them that this was scientific research, that there were similar studies in the literature, that the research questions were not offensive to the students, and that the research would not have any negative effects on the students, none of the teachers in this school allowed me to interview the Roma students in their classes. Considering my voluntary participation in the research, I left this school without collecting data."

Table 1 presents the gender, education level, age, and occupation information of the parents who participated in the interviews within the scope of the research. As seen in Table 1, the participants in the qualitative part of the research consisted of a total of 44 parents, 25 male and 19 female. Nine of the male parents were primary school dropouts, seven were primary school graduates, two were secondary school graduates, four were secondary school dropouts, two were high school dropouts, and one was a high school graduate. Seven of the female parents were primary school dropouts, seven were primary school graduates, three were middle school dropouts, one was a middle school graduate, and one was a high school dropout. Twelve of the male parents are peddlers, nine are scrap dealers (paper, plastic, metal, and goods), two are real estate agents, one is a gallery owner, and one is an entertainment sector employee. All of the female parents are housewives. It was observed that the participating Roma parents were not very keen to be interviewed. However, when it was stated that the identity information of their children and themselves would be kept confidential, the participants answered the questions. For the sake of systematic organization, the interviewed parents and their children were coded with the same number. For example, S1 was used to symbolize "Student 1" and P1 was used to symbolize "Parent 1."

Table1: Roma Parents Participating in the Study Table

| ***Sequence No*** | ***Gender*** | ***Education Level*** | ***Age*** | ***Job Occupation*** |
|---|---|---|---|---|
| P1 | M | Primary school dropout | 26 | Scrap dealer |
| P2 | M | Primary school dropout | 28 | Hawker |
| P3 | M | Primary school dropout | 25 | Hawker |
| P4 | M | Primary school | 30 | Scrap dealer |
| P5 | F | Secondary school | 23 | Housewife |
| P6 | M | High school | 32 | Property Agent |
| P7 | F | Primary school | 23 | Housewife |
| P8 | F | Primary school dropout | 20 | Housewife |
| P9 | M | Primary school | 37 | Scrap dealer |

| | | | | |
|---|---|---|---|---|
| P10 | M | Primary school | 33 | Scrap dealer |
| P11 | M | Secondary school dropout | 28 | Scrap dealer |
| P12 | F | Primary school dropout | 24 | Housewife |
| P13 | F | Primary school | 25 | Housewife |
| P14 | M | Secondary school dropout | 44 | Entertainment sector |
| P15 | F | Primary school | 29 | Housewife |
| P16 | M | Primary school dropout | 23 | Hawker |
| K17 | M | Primary school dropout | 35 | Hawker |
| P18 | F | Primary school | 27 | Housewife |
| P19 | M | Secondary school dropout | 30 | Hawker |
| P20 | F | Primary school | 25 | Housewife |
| P21 | M | Primary school dropout | 29 | Scrap dealer |
| P22 | M | High school dropout | 33 | Car dealer |
| P23 | F | Secondary school dropout | 28 | Housewife |
| P24 | M | Secondary school | 25 | Hawker |
| P25 | M | Secondary school dropout | 30 | Scrap dealer |
| P26 | F | Primary school | 27 | Housewife |
| P27 | M | Primary school dropout | 32 | Scrap dealer |
| P28 | F | Primary school dropout | 28 | Housewife |
| P29 | F | Primary school dropout | 24 | Housewife |
| P30 | F | Primary school | 35 | Housewife |
| P31 | M | Primary school | 33 | Hawker |
| P32 | M | Secondary school dropout | 28 | Hawker |
| P33 | F | Primary school dropout | 28 | Housewife |
| P34 | F | Primary school dropout | 25 | Housewife |
| P35 | F | Primary school dropout | 29 | Housewife |
| P36 | M | Primary school | 44 | Hawker |
| P37 | M | Primary school | 26 | Hawker |
| P38 | F | High school dropout | 25 | Housewife |
| P39 | F | Secondary school dropout | 27 | Housewife |
| P40 | M | Primary school | 30 | Hawker |
| P41 | M | Primary school dropout | 25 | Scrap dealer |
| P42 | M | High school dropout | 29 | Tradesmen |
| P43 | F | Secondary school dropout | 30 | Housewife |
| P44 | M | Primary school dropout | 41 | Hawker |

**Data Collection**

In the research, tools and techniques suitable for obtaining both quantitative and qualitative data were used. The "Sense of Belonging Scale," developed by Selçuk and Güner (1999), was used as the quantitative data collection tool. The scale consists of 24 items and one dimension. The scale was applied after obtaining the necessary permissions from the authors. In order to examine the factor structure of the Sense of Belonging Scale, exploratory factor analysis using the principal component analysis method was conducted. When the results of Barlett's test of sphericity were analyzed, it was seen that the data met the assumption of sphericity ($\chi^2$ (276 = 2704.073, $p < 0.001$). As a result of the analysis, a one-factor structure with a KMO value of 0.88 and explaining 43.88% of the total variance was obtained. The Cronbach Alpha internal consistency value of the Sense of Belonging Scale was calculated at 0.938. When the corrected item-total correlation values and the new Cronbach's Alpha coefficient values obtained when the item was deleted were examined, it was determined that all items on the scale worked at a good level and there was no item that needed to be removed from the scale.

For the qualitative part of the study, a semi-structured interview form consisting of open-ended questions for Roma parents was used. Karasar (2016) defines semi-structured interviewing as a technique in which the

researcher prepares an interview form that includes the questions that the researcher plans to ask in advance and elaborates the participants' answers with probing questions according to the natural flow of the interview, allowing the individual to freely give the answers they want to the questions asked. In this study, the participants were also asked additional probing questions. These questions are given in brackets in the interview form. Before the quantitative data on the scale were collected from the students, they were chatted with, and it was aimed to obtain reliable and realistic data from them in this way. In the qualitative process, the answers to the questions in the semi-structured interview form consisting of open-ended questions were evaluated as the data of the research. In addition, the researcher utilized observations, field notes, audio recordings, and conversational interviews to ensure data diversity. Field notes were also taken from non-Roma parents, students, teachers, and administrators. A case study is widely used in scientific research. A case study is the researcher's in-depth description of a phenomenon with certain boundaries over a certain period of time through various means (observation, interviews, visual and audio materials, documents, and reports) and revealing themes based on this situation (Creswell and Creswell 2021). In accordance with this definition, the opinions of the parents were obtained through the following semi-structured questions:

The questions asked of Roma parents during the parent interviews were as follows:
1. Why did you choose this school for your child's education?
2. What was the attitude of the school administration toward you when you enrolled your child in school?
3. How was the classroom teacher's behavior towards you and your child during the training?
4. What are your general opinions about the school your child attends? Would you prefer this school again?
5. Would you recommend the school where your child is studying to another friend's child? Why?
6. What are the most important qualities that the school your child attends provides for your child? Does the school fulfill your expectations? Why?
7. Have your children had any negative experiences at school? If so, tell us about them.
8. When your child comes home, what kind of information about school does he or she share with you? (positive and negative events with his or her friends, teacher, or school administration; winning and losing in class and school competitions)
9. How are your child's friendships? Does he/she bring his/her friends' home [for homework, for getting to know them, for dinner invitations]?
10. Are there any activities, practices, etc. that you would like teachers and administrators to carry out at school in order for your child to adopt the school?

Data collection is part of the research plan and the next stage of the research question. At this stage, researchers sometimes take part outside the process, and sometimes they are a part of the research. The participant researcher collects data from different sources that will illuminate the topic under investigation (Stringer, 2008). In the convergent mixed design, which is the method of this research, quantitative and qualitative data collection techniques are used simultaneously (Creswell, 2012). The purpose and design of the research were taken into consideration in the use of the data collection tools employed in this research. In addition, the research was enriched by obtaining data by using various data collection techniques and was carried out in accordance with the quantitative and qualitative data collection approaches.
In the preparation of the interview questions, expert opinion was taken and questions were prepared to examine Roma students' sense of belonging to the school. For the implementation of the Semi-Structured Interview Form and the Sense of Belonging Scale, the researcher first obtained the necessary legal permissions from Necmettin Erbakan University and then from Konya Provincial Directorate of National Education. Afterwards, the researcher went to the schools to be interviewed with the school administrators and asked the parents to fill out the Parental Consent Form, and permission was obtained from them. The students were taken one by one to an empty classroom, library, or counseling room, and interviews were conducted with them. Thus, it was aimed at increasing the validity and reliability of the data. During the interviews, a preliminary conversation was held to get information about the students, and field notes were kept. These field notes were organized and presented in the "Findings" section. The questions on the scale were explained to the students one by one and asked verbally, and their answers were recorded.
In the research, pilot interviews were first conducted to test the comprehensibility of the parent interview questions. Afterwards, the feasibility of obtaining appropriate answers for the purpose of the research was tested, and then the questions were finalized and the interviews were started. Stewart and Cash (1985) state that the interview method is an interactive communication process in the form of asking and answering predetermined questions for a purpose.

**Collecting Data from Students**

In line with the purpose of the study, a chat environment consisting of current and family issues was created before the individual interviews with the students. In the meantime, information about the student and his or her

family was collected, and small field notes were obtained. Thus, the participants were ensured to be in a sincere environment. Afterwards, general information about the Sense of Belonging Scale was given, and the students were asked if there was any part that was not understood. Since some students did not want the interviews to be recorded with voice recorders, field notes were taken during the interviews with them. The interviews were conducted in the school library, the empty classroom, and the interview room of the counseling service. The questions on the scale were asked to the students one by one, and the answers were recorded by the researcher for reliability.

### Collection of Data from Parents

Due to the nature of the research design, parent interviews were conducted simultaneously with student interviews. Before the interviews with the parents, the parents were briefly informed about the research and were informed that the interviews were voluntary by signing the Participant Consent Form. In order to prevent time constraints, interviews were conducted by making appointments with the volunteer parents. In this process, there were also parents who made an appointment but did not come. Open-ended questions consisting of 10 questions prepared in advance by taking expert opinion were asked in the interviews that started in a chat atmosphere with the parents who came to the appointment. In addition to the questions, the opinions of the parents were obtained by asking probing questions. Interviews with parents who had time constraints were recorded on a voice recorder with their permission. These interviews lasted 5 hours, 17 minutes, and 25 seconds in total, and 25 pages of raw data were obtained from these recordings.

### Analyzing the Data

In the quantitative part of the research, SPSS was programmed. The descriptive results obtained from this analysis program are presented in tables in the relevant section. The content analysis method was used in the evaluation of the qualitative data in the research, and the findings were formed by analyzing the collected data in depth. The main purpose of content analysis is to identify the main concepts and relationships that can explain the data collected during the research (Cohen, Manion, & Morrison, 2007). The raw data obtained by transcribing the audio recordings of the audio-recorded parent interviews, the information collected from the interview forms, and the field notes were evaluated by the content analysis method.

## Findings

### Quantitative Findings

General Trends Related to Sense of Belonging to School

Firstly, the general tendency related to each statement in the Sense of Belonging Scale was examined. Afterwards, the answer to the question "How is the students' sense of belonging to school in general?" was sought. In addition, students' levels of sense of belonging to school were also compared according to gender factors. Table 2 presents the general results of the Sense of Belonging Scale.

Table 2. Results Related to Sense of Belonging Scale

| **Statements** | | **Never *f* (%)** | **Sometimes *f* (%)** | **Always *f* (%)** |
|---|---|---|---|---|
| **1.** | I always receive sympathy and understanding from my teacher. | 2 (1.7) | 15 (12.4) | 104 (86) |
| **2.** | I don't get along well with my friends. | 88 (72.7) | 22 (18.2) | 11 (9.1) |
| **3.** | I'm very happy to be in this class. | 2 (1.7) | 10 (8.3) | 109 (90.1) |
| **4.** | My friends don't understand me. | 97 (80.2) | 17 (14) | 7 (5.8) |
| **5.** | I enjoy the class excursions very much | 2 (1.7) | 13 (10.7) | 106 (87.6) |
| **6.** | If I had the opportunity, I would like to leave this school and go to another school. | 111 (91.07) | 10 (8.3) | --- |
| **7.** | My friends share their secrets with me. | 2 (1.2) | 41 (33.9) | 78 (64.5) |
| **8.** | I am afraid to talk to my teacher. | 104 (86) | 15 (12.4) | 2 (1.7) |
| **9.** | I'm afraid of losing one of my friends and teachers. | 2 (1.7) | 16 (13.2) | 103 (85.01) |
| **10** | My teacher is interested in everything I do in class. | 4 (3.3) | 42 (34.7) | 75 (62) |
| **11** | I have trouble making friends in this class. | 96 (79.3) | 20 (16.5) | 5 (4.1) |

| | | | | |
|---|---|---|---|---|
| **12** | I miss my friends and teachers a lot during school holidays. | 2 (1.7) | 39 (32.2) | 80 (66.01) |
| **13** | I am proud to be a student in this class. | 2 (1.7) | 19 (15.7) | 100 (82.6) |
| **14** | My teacher is only interested in my homework. | 102 (84.3) | 17 (14) | 2 (1.7) |
| **15** | My teacher always asks me questions I don't know. | 104 (86) | 16 (13.2) | 1 (0.8) |
| **16** | I don't feel like a member of this class. | 104 (86) | 15 (12.4) | 2 (1.7) |
| **17** | I like to play games in the garden with my friends during breaks. | 6 (5) | 15 (12.4) | 100 (82.6) |
| **18** | I like to do cluster work with my friends. | 9 (7.4) | 20 (16.5) | 92 (76) |
| **19** | Nothing in this class is important to me. | 106 (87.6) | 14 (11.6) | 1 (0.8) |
| **20** | My teacher asks me to help her with some tasks in the classroom. | 6 (5) | 21 (17.4) | 94 (77.7) |
| **21** | I prefer to work alone instead of in groups in lessons. | 86 (71.1) | 25 (27.7) | 10 (8.3) |
| **22** | When I get into trouble, my friends come to my aid immediately. | 3 (2.5) | 18 (14.9) | 100 (82.6) |
| **23** | Everyone in our class knows each other by name. | 2 (1.7) | 13 (10.7) | 106 (87.6) |
| **24** | It is important for me that our class is more successful than other classes. | 3 (2.5) | 14 (11.6) | 104 (86) |

*Gender Differences Regarding Sense of Belonging to School*

As a result of the analyses conducted in the quantitative dimension of the study, it was determined that Roma primary school students' sense of belonging to school was generally at a high level. The total mean score of the Sense of Belonging Scale was calculated as 67.72 ± 6.88. In addition, the independent sample t-test conducted to examine whether there was a significant difference between the mean scores of boy and girl students showed that the belonging scores of girls were significantly higher than those of boys (t (119) = 3.78, p <). The findings are presented in Table 3.

Table 3. Comparison of Students According to Gender

| **Gender** | **n** | **Centre.** | **S** | **95% Confidence Interval** | | ***t*** | ***p*** |
|---|---|---|---|---|---|---|---|
| | | | | **Lower Limit** | **Upper Limit** | | |
| Girl | 52 | 70.12 | 3.95 | 1.80 | 6.58 | 3.466 | p < .001 |
| Boy | 69 | 65.93 | 8.00 | | | | |

Table 3 shows that among Roma primary school students, girls have a higher level of sense of belonging to school than boys. This finding coincides with the majority of the studies on the sense of belonging to school in the literature (Adelabu, 2007; Aşlamacı & Eker, 2016; Cheung, 2004; Cheung & Hui, 2003; Goodenow, 1992b; Goodenow & Grady, 1993; Nichols, 2008; Sarı, 2012; Sarı, 2013).

**Qualitative Findings**

The majority of the parents interviewed in the qualitative part of the study stated that they were very satisfied with their children's schools, that they liked their children's class, friends, and teachers very much, and that they and their students did not experience any negativity because they were Roma. Some parents, on the other hand, stated that their children and themselves had experienced some negativity, but that they liked their class, their friends, and their teacher very much. It was observed that the educational level of the parents of the students in the study was quite low. In addition, it was found that the rate of absenteeism and school dropout was high, and the rate of educated parents among the parents was very low. Since parents generally work as peddlers, scrap dealers, paper collectors, in the entertainment sector, etc., it is understood that mothers are generally responsible for the education of children. In the parent interviews, it was found that the most important reason for Roma children to drop out of school is that they are directed to work at an early age and have early marriages. It is understood that girls in Roma families are burdened with the mother's duties, such as cleaning the house, cooking, and caring for young children, and are gradually prepared for marriage by their mothers, leading to school absenteeism and eventually dropping out of school. It was also observed that the literacy rate among adults and elderly Roma is very low. In order to provide for the household, boys are employed in various jobs to help their fathers. For this reason, children do not have a family elder as a positive role model.

Themes were formed by utilizing the experiences of Roma parents, face-to-face interviews with students, and field notes taken. The opinions of two experts were utilized in the development of the themes. In this part of the

research, six main themes were formed by analyzing the answers given by the parents in the interviews with the parents of Roma students, interviews with teachers, students, and administrators, field notes, and voice recordings.

These themes are as follows:
1. School satisfaction,
2. Roma poverty,
3. School absenteeism and dropouts,
4. Social stigmatization,
5. Social exclusion,
6. Social inclusion and cohesion.

*School Satisfaction*

P25 related to this theme: "I make a living as a scrap dealer. I myself graduated from this school. Although my father was poor at the time, my teachers and friends did not exclude me from this school. They did not discriminate. Since it is the school in our neighborhood, all of them are children of families with poor financial situations. At the same time, since there are many Roma students, we never feel like strangers in this school. The lack of discrimination is one of the reasons why we prefer this school. When I ask my child, "Are you happy with your school? Tell me if there is something that upsets you at school." He says that he loves his school very much and that he has not experienced anything negative so far. Anyway, when a child goes to school reluctantly, you know that there is a negative situation. Our child always goes to school willingly," and drew attention to the influence of school administrators on school preference.

*Roma Poverty*

During the implementation, the researcher approached a Roma parent and asked her if she would like to answer the questions after a small conversation. Seeing the papers in the researcher's hand, the parent was curious about the purpose of the questions. The researcher stated that she was researching Roma primary school students' sense of belonging to school and that she would ask questions related to this subject. The researcher was able to convince the parent by assuring him that his and his child's identities would be kept confidential and that their names would never be disclosed. Before the researcher started the questions, P16 stated that her student S16 was absent a lot at school. When asked about the reason, he said, "Teacher, I am a primary school dropout. I could not study, so we chose this school so that my child could study. My child loves the teacher very much, and I think the teacher loves our child. But even the child noticed that if other students did not go to school, even for a day, the teacher would immediately call their families and ask why they did not come to school. Our child also heard that the teacher called the parents of his friends. When he himself did not go to school, he would call me and ask me if the teacher had called you. I tell him yes so that he doesn't get upset. He is happy when I say so. However, if our child does not go to school, even for a week, the teacher neither calls nor asks. When this happens, our child gets very upset. P16 also stated that her situation was not good, and therefore she could not meet some of her child's needs. He also stated that he could not give pocket money to his child and that his child could not shop in the canteen, which made him very upset. In the interviews with non-Roma students, it was found that the child was also excluded and not liked by his/her friends and that they did not include him/her in their games. In the analysis of the Sense of Belonging Scale, it was found that S16 had a low sense of belonging to the school. P16: Although parents are normally not allowed to enter the school, there is a Roma parent who carries his student's bag to the classroom and is allowed to enter the school. The security guard does not let us in through the teacher's entrance. But when that parent comes, he enters the school with his child through the teacher's entrance and goes to the classroom. That parent is very rich. He helps the school a lot. For this reason, he gives privileges only to that parent. At first, the researcher did not want to believe these statements of P16. However, as a result of his observations, he realized that what the parent told him was true. Then, in order to analyze in depth, he identified the class where the parent's child was and interviewed the teacher. She first asked the teacher whether the child of a rich Roma parent was excluded from the class. The teacher stated that the child was not excluded by his classmates; on the contrary, he was the most popular student in the class, and all the students wanted to make friends with him. He even emphasized that when the class plays a game, that student chooses the players as the leaders. Since the researcher was curious about this child's sense of belonging to the school, he asked him the questions in the Sense of Belonging Scale. From the answers given by S45, it was found that his sense of belonging to the school was high. The class teacher stated that the father of this student often brought gifts and clothes to the students in the class, and that his father brought the student to school in the latest model car and carried his bag to his class. When the researcher asked the teacher whether it was forbidden for parents to enter the school, the teacher said, "Normally it is forbidden, but this family is allowed, teacher. The principal gave instructions to the security guard, and only this parent could enter from the teacher's entrance to the classroom. When the researcher asked if there were any other Roma students in the

class, the teacher replied that there were, but it was not clear whether they were present or absent. When asked about S16, she said, "Oh, my teacher, it is already clear that he will not study. What happens if he comes to school? What happens if he doesn't? His family is indifferent and ignorant, and his presence and absence are not clear. It can be said that if teachers' exclusion and stigmatization of students are continuous, students' sense of belonging to the school will be damaged, which may lead to absenteeism and school dropout.

*School Absenteeism and Dropout*

When P40 was told that school absenteeism and dropout are common situations among Roma students, he said, "Hodja, what you say is true. It was exactly the same in our time. Because I was a very problematic student, my father used to take me with him to sell shoes. Rather than causing problems at school and giving me a headache, I would keep an eye on my child, and if he misbehaved, I would deal with him. Like me, my child is also very naughty. The vice principal often calls me to school. Your son swore, fought, and was very naughty. Take him to another school. Where should I take him? Which school would accept us? Wouldn't the principal and vice principal of the school I go to call the old school and ask why you sent this student? I am a traveling salesman and teacher. I sell clothes, shoes, and children's clothes. We have a house inherited from my father. Thank God, I support my family. I take the boy with me so that he can learn the trade. That's why I don't send him to school much. There is no punishment anyway. I want to keep an eye on him so he won't get me in trouble. Anyway, who among the Roma has studied and become very rich so that our son can study too? School, education, and civil service are very distant things for us.

With the answer given by P40, it is understood that some of the parents do not give voice to school absenteeism due to the safety of their children and their contribution to the family budget. In the scale analysis results of S40, it was found that the sense of belonging to the school was at a low level. Within the scope of this theme, it is seen that factors such as Roma families not giving the necessary importance to education, not being able to play the role of being a parent at school, economic inadequacies, seeing their sons as a means of bringing income to the home and consequently employing them in various jobs, employing their daughters in housework and marrying them at an early age, social exclusion, and stigmatization are important factors in school absenteeism and school dropout.

*Social Stigmatisation*

When S31 was asked whether he had any problems at school, he said, 'Teacher, we call non-Roma students 'Geben'. We get along well with the Geben. We get along very well, especially in games. There are no problems. I have only one complaint, teacher. My father supports us by selling mobile shoes. Can you find a stable job for my father? I'd be very happy then. My father is very tired. And teacher, if a student loses something in class, the Gebens and the teacher immediately start looking for the culprit among us Roma students. The teacher first searches our bags. Then he looks at us as if we had stolen it and tells us that theft is a bad thing. This 'offends' us. But when it is proven that we are innocent, no one comes and apologizes to us. Apart from that, our teachers, friends, and administrators love us very much, and we are satisfied with them all." Based on S31's opinion, it was found that some Roma students face a stigmatization problem due to their ethnic identity.

*Social Exclusion*

The researcher asked S12 whether he had experienced a negative incident with his non-Roma friends. S12 looked the researcher in the eye and said, "I have a teacher, but I am ashamed to tell her." When asked why, the researcher saw that the child blushed. When the researcher said, "Tell me, why are you ashamed of me? There is nothing to be ashamed of." The child gathered courage and started to tell the following incident: "Teacher, I have a classmate whom I like very much. One day, while we were playing outside, he said to me, "Let's go to my house and have lunch together." Then he said that we would go out on the street again and continue playing. I was very surprised at first, but then I immediately said okay. I was so happy that my friend invited me to his house. Their house was still in our neighborhood. But they lived in an apartment building. There was a lift in their apartment. I love riding the lift. Anyway, we got in the lift, pressed number 4, then went down again, then up and down again. I had so much fun. Then we got off the lift at their floor. The doors were open. I guess because it was summer, his mom had left the door open so that the house would be cool. Then my friend called her mom and said she was calling me home. My friend's mother shouted at my friend very harshly from inside: "Don't bring that Gypsy boy to our house; I will kill you!" I felt so bad. I put on my shoes again and ran down the stairs. My friend was also very upset and called quietly behind me, but he was not to blame. He was my best friend at school again. Our teacher even called us the inseparable, marvelous duo. I didn't even get on the lift that day when I was going downstairs. I felt as if it were a crime to even get on that lift anymore. I went down the stairs so fast. Two by two... I still see my friend at school, but it's hard for me to accept invitations again. I've

never felt so bad in my life. Teacher, we're not Gypsies; we're Roma. If she came to us, my mom would never behave like her mom. I am sure of that."

*Social Inclusion and Cohesion*

When the researcher asked the child how he or she was getting along with his or her school and friends, he or she said, "I love my friends and school very much. My friends love me very much, too. Teacher, recently it was the birthday of a friend of mine who is not from our neighborhood, that is, "geben." My friend told me that she had organized a birthday party at home; her mother had made a birthday cake, and she wanted to celebrate it with all our classmates. When I asked her if I was invited, she said, "Aren't you my classmate?" I was very happy when he said, "Of course you are invited." He invited all my classmates to the birthday party, including me. For the first time in my life, I was going to go to a friend's house and celebrate his birthday. I wore the suit I wore at my circumcision. I put on clean socks and shoes and went to their house with the gift I bought. My friend and his mother welcomed us very well. We celebrated our friend's birthday with my classmates, ate cake, drank tea, and had a lot of fun. I will never forget those moments with my friends for the rest of my life. I am thinking of organizing a party for my friends when my birthday approaches. I will invite all my classmates. I hope they will all come." Here, what S79 said and the word "us" she used show that she felt herself as a valuable part of her class. At the same time, the behaviors and attitudes of his friend and his family towards S79 show that he was accepted and adopted. In the analysis of S79's Sense of Belonging Scale, it was found that his sense of belonging to the school was high.

## Discussion and Conclusion

In this study, Roma primary school students' sense of belonging to school was analyzed. The results of the Sense of Belonging Scale showed a general tendency, and Roma primary school students' sense of belonging to school was found to be at a high level. In addition, it was concluded that the school-belonging scores of girls were higher than those of boys. When the literature is analyzed, it is seen that the results of the majority of the studies show that girls have a higher level of sense of belonging to school than boys. In general, the fact that girls' participation in extracurricular social activities is higher than that of boys increases their sense of belonging to school (Fullarton, 2002). In this study, it was concluded that Roma parents felt that some of the school administrators and teachers treated them well and that their children's attachment to the school increased (due to these attitudes of the teachers).

It can be said that the theme of Roma poverty, which was created as one of the other qualitative findings of the research, is one of the critical results of the research. Poverty among Roma is intertwined with being Roma (Obrovská and Sidiropulu Janků, 2021). Research has shown that the general public's view that Roma as a community do not attach the necessary importance to education is wrong and that the main problem for Roma children is poverty (Akkan et al., 2011; Önen, 2013). As in every country, there are problems in the education system in Turkey. Poor students and their parents are the ones who are affected by these problems the most and at the highest level. When the phenomenon of exclusion, marginalization, and stigmatization is added to this poverty, Roma students experience this problem of education at a high level. One of the valuable findings of this research is that wealthy Roma parents can violate the general rules of the school if they donate to the school and the students, buy gifts for the students, and that wealthy Roma students can be the favorite students. On the contrary, it can be said that the real problem is poverty, as the poor Roma parents and students are treated as if they do not exist, the Roma students are not included in the games by the other students, and they are excluded.

The study found that Roma primary school students are directed to work at an early age and forced to leave school through marriage. Girls help their mothers with housework at home, while boys work for their fathers or relatives and contribute to the family budget. Thus, it has been determined that they become detached from school and drop out of school over time by being absent from school.

The qualitative findings of the study revealed that Roma primary school students are subjected to social stigmatization. Teachers, administrators, students, and parents stigmatized Roma students as "thieves, fighters, and swearers." In cases of theft at school and in the classroom, Roma students' bags were searched first, and Roma students were stigmatized as the ones who started the fight, regardless of whether they were boys or girls. It has been determined that a Roma student who is present in a fight environment, even for the purpose of separating the fight, is immediately labeled as a criminal. It was also found that Romani children were found to speak abusive language to each other inside and outside the school and were stigmatized as abusive by other parents. Despite this stigmatization, Roma primary school students were found to have a high sense of belonging to school.

The qualitative findings of this study also revealed that Roma parents and Roma primary school students are sometimes excluded and marginalized by other students, parents, teachers, or administrators. As a result of these findings, it was concluded that parents' efforts to choose a good teacher and the excitement of their students starting school gradually disappeared in the following periods of the school. The most important factor in this

was found to be the prejudices and attitudes of teachers and administrators towards Roma students. However, despite all these negative situations, it was observed that Roma primary school students had a high level of sense of belonging to the school.

In addition to this exclusion and stigmatization, as a positive result of the research, it was found that there were also schools where social inclusion (integration) and cohesion were experienced. In one of the schools where the research was conducted, students sharing their belongings with a Roma student and the marbling artwork of a Roma student being hung in the classroom by the teacher were indicators of social inclusion and integration. In addition, the good feelings of a Roma student who was invited to a birthday party were good examples of social inclusion and integration. It was found that Roma students who experienced social inclusion (integration) by their teachers and friends positively affected their sense of belonging to the school. Teachers reported that students who experience social inclusion and integration are happy in the classroom and have high academic achievement. From the findings of the study, it was concluded that the positive approach of teachers and school administrators towards parents positively affects students' sense of belonging to school.

## Recommendations

As a result of the results and experiences gained in the research, the following can be suggested:

- First of all, it would certainly be useful to design activities in all segments of society, including schools, to prevent the use of discourses that divide society, such as marginalization, exclusion, stigmatization, and prejudices. Therefore, unifying and inclusive policies for Roma citizens should be developed.
- Measures should be taken to prevent negative and unnecessary concepts such as exclusion, stigmatization, marginalization, and prejudice based on ethnic differences from turning into social inequalities. The measures taken can be implemented not only in education policies but also in all state policies in line with the definition of the social state.
- One of the factors that keep the sense of belonging to school high is good relationships at school and satisfaction with the school environment. In parallel with this, if schools focus on giving students a sense of belonging to school, significant progress can be made in solving students' emotional and behavioral problems.
- The simplest solution to increase Roma students' sense of belonging to school would be to allocate funds to schools located in areas where Roma families are concentrated.
- Educators are, of course, the ones who can control the experiences of exclusion, stigmatization, and marginalization that Roma primary school students experience. The research findings show that school administrations, teachers, other students, and their parents can consciously or unconsciously cause Roma students and their parents to experience these negative experiences. Therefore, in order to prevent this discriminatory attitude, the most important element in education—teachers and their qualifications—can be scrutinized.
- These negative experiences may occur because teachers do not receive adequate and qualified training on inclusive education. Therefore, teachers should be informed about Roma before and during their service. For this reason, teachers should treat Roma students the same way they treat other students and avoid exclusionary, marginalizing, and stigmatizing behaviors.
- One of the important issues related to Roma primary school students is the elimination of inequality of opportunity in education and the implementation of necessary activities for school inclusion. Roma families with low educational and socio-economic status are not able to participate effectively in school and are unable to provide the support at home that the school expects. Therefore, the lack of access to most legal rights and opportunities for Roma primary school students, which is parallel to the poverty of Roma children, is one of the most important problems to be solved. By addressing these problems, educational policies and programs can be developed that provide equal opportunities for all students. Necessary measures can be taken by the state to ensure that all citizens have equal access to these opportunities.
- Curriculum at the level of children and young people could include topics on anti-discrimination. The inclusion of topics related to Roma culture and Roma-oriented issues in these curricula could have a positive impact on social cohesion and integration. In addition to the curriculum, information and awareness-raising activities and memorable projects can be developed for Roma citizens. Introducing the cultural richness of Roma citizens in these projects could also be of great importance.
- It was found that most Roma primary school students do not have actual work habits and do not have a room or a suitable environment at home to study in. Despite these disadvantages, these students have a high sense of belonging to the school, which suggests that they could be offered more opportunities for education. Keeping

open social activity areas such as libraries or classrooms with computer and internet facilities where poor Roma children can spend time after class hours, study, and have access to computers and the internet can contribute to strengthening their sense of belonging to the school. It is also recommended that these practices be implemented in areas where Roma children live in large numbers.

- Being seen as worthless, excluded, and treated as if they do not exist is one of the ugliest behaviors that can be shown to people. Seminars and in-service trainings on inclusive education can be provided for school administrators and teachers in order to prevent these behaviors towards Roma citizens.
- In the light of the data obtained, it is possible to conclude that the educational perceptions of Roma families should be changed and that these families should be supported to become socioeconomically stronger. The artistic and sporting talents of Roma students should be brought to light, and Roma children should be encouraged to get together more with their non-Roma peers. Teachers who work with Roma students could also be included in training programs on how to approach Roma students.

### Author (s) Contribution Rate

Both researchers contributed at every stage of the research.

## Conflicts of Interest

There was no conflict of interest with any institution or person in the realization of this research.

## Ethical Approval

Ethical Approval Ethical Permission (09/07/2021-2021/419) was obtained from Necmettin Erbakan University for this research.

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## Abstract

The aim of the study is to adapt the "Maker-Based Technological Pedagogical Content Knowledge" scale developed by Ku et al. (2021) for pre-service science teachers into Turkish. The study group for the research consists of 188 pre-service science teachers studying at the Department of Science Education at three state universities in Istanbul. This study was carried out using an exploratory sequential design, one of the mixed method typologies. As a result of confirmatory factor analyses, it was seen that the scale, which was adapted into Turkish, consisted of 7 sub-dimensions and 27 items, as in the original. These 7 sub-dimensions consist of Content Knowledge, Pedagogical Knowledge, Technological Knowledge, Pedagogical Content Knowledge, Technological Content Knowledge, Technological Pedagogical Knowledge, and Technological Pedagogical Content Knowledge. The Cronbach Alpha Reliability Coefficient of the scale is .948. The validity of the scale was confirmed via confirmatory factor analysis. As a result of confirmatory factor analyses, it was seen that the scale, which was adapted into Turkish, consisted of 7 sub-dimensions and 27 items, as in the original ($X^2$ =718.83, df=303, p= 0.00), and the $x^2$/df value for model fit was found to be 2.37, RMSEA: .080, RMR: .0498, SRMR: .0759, IFI: .966, NFI: .942, NNFI: .960 and CFI: .965. Because all fit values are in acceptable levels, the scale is usable and valid. The results of the study show that the adapted scale is a valid and reliable scale that can be used to measure the Maker-Based Technological Pedagogical Content Knowledge of pre-service science teachers.

**Keywords:** technological pedagogical content knowledge, maker movement, digital production tools, pre-service teachers, scale adaptation

## Introduction

Today, which is described as the digital age, it has become compulsory for teachers to integrate technology into educational environments (Wu, 2013). In this respect, with the increase in value given to the use of technology in teacher education, it is expected that teachers' pedagogical and content knowledge competencies, as well as their ability to use technological knowledge together with these competencies—in other words, their Technological Pedagogical Content Knowledge (TPACK)—will have been developed (Koehler et al., 2007). This is because TPACK (Mishra & Koehler, 2008), which is expressed as the most important factor affecting technology integration in education, enables teachers to make their lessons more understandable and to help their students use technology efficiently (Jen et al., 2016).

The idea that teachers should integrate technology into teaching is not new. Mishra and Koehler (2006), who improved the work done by Shulman (1986), developed the TPACK model by adding the technology element to the concept of Pedagogical Content Knowledge. Later, Harris et al. (2009) updated the model by adding "context information" to the first TPACK model (Figure 1).

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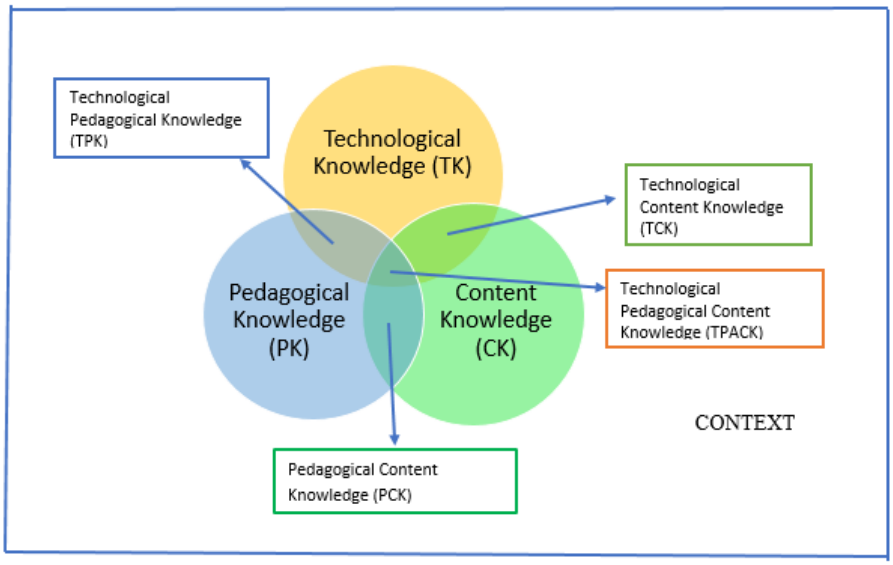


Figure 1. TPACK and types of information (Koehler & Mishra, 2009)

According to this model, there are three interconnected types of knowledge: Technological Knowledge, Pedagogical Knowledge, and Content Knowledge, and all these types of knowledge are affected by contextual knowledge (Harris et al., 2009). In the model, Content Knowledge (CK) refers to basic knowledge about the subject to be learned or taught in different disciplines such as science, history, art, or astrophysics; Pedagogical Knowledge (PK) refers to knowledge about methods and practices in the teaching and learning process; and Pedagogical Content Knowledge (PCK) expresses the knowledge with which teaching strategies will be taught. Technological Knowledge (TK) refers to the knowledge of using new and old technologies such as books, chalk, blackboards, internet and digital video; Technological Content Knowledge (TCK) refers to the knowledge of choosing the most appropriate technology to be used in teaching the subject; Technological Pedagogical Knowledge (TPK) refers to the knowledge of understanding how teaching and learning change when certain technologies are used; and, Technological Pedagogical Content Knowledge (TPACK), which is defined as a type of knowledge that is different from and be-yond the combination of Technological, Pedagogical and Content Knowledge, is explained as the knowledge of choosing appropriate technology and pedagogical techniques according to the learning needs of students. Contextual Knowledge, on the other hand, means that technological, pedagogical, and content knowledge are embodied in specific learning and teaching contexts (Harris et al., 2009; Koehler et al., 2013; Koehler & Mishra, 2009; Mishra & Koehler, 2008; Öztürk et al., 2020; Yanpar Yelken et al., 2013).

In the last ten years, many TPACK measurement tools have been integrated into educational environments, and the TPACK performances of pre-service teachers have been evaluated (Baran & Canbazolu Bilici, 2015; Kaleli & Yılmaz, 2015; Ku et al., 2021). By using TPACK measurement tools, besides pedagogical content knowledge, the performances in the application of technologies such as information and communication technologies (Kadıoğlu-Akbulut, Çetin-Dindar et al., 2020), interactive whiteboards (Bilici & Güler, 2016; Jang & Tsai, 2012), augmented reality (Jwaifell, 2019), and robotics (Yanış & Yürük, 2021) to teaching have been investigated. In our study, unlike others, the use of digital production tools is defined as technological knowledge. Digital production tools first came to the fore in 2008 when Stanford University launched the "FabLab@School" project (Blikstein, 2013). The tools mentioned here are the technologies enabling design and production, such as 3D printers, laser cutting and CNC machines, Arduino, Lego sets, and applications (Anderson, 2012; Blikstein, 2013; Ku et al., 2021; Lang, 2017; Schon et al., 2014).

Digital production tools are one of the technologies that are rapidly being integrated into educational environments as the maker movement develops and its potential is understood (Berry et al., 2010; Chan & Blikstein, 2018; Leinonen et al., 2020). The Maker Movement, on the other hand, is a movement that combines the Do It Yourself [DIY] culture and technology, based on the philosophy of learning by doing, where students create concrete or digital products to build knowledge, and where problem solving and content are associated with the real world (Schon et al., 2014). Maker refers to a person who tends to create products with technology and materials by tinkering with the world around her (Lang, 2017). It is stated in the literature that the Maker movement is closely related to project-based, design-based, and problem-based learning approaches (Chan & Blikstein, 2018; Moro et al., 2020; Smith et al., 2015). In addition, having systematically examined the studies

on the maker movement and education in recent years, Schad and Jones (2019) have found that Maker-Based learning is considered together with STEM in more than half of the student-centered studies at the K–12 level. This is because the digital production tools used in Maker-Based learning are typically directly related to the learning and practice of STEM disciplines (Blikstein, 2013).

In order to reveal the educational potential of Maker, it is necessary to understand the ideas and new perspectives that it brings to the education system. In this regard, Edgar Tolson states that learning in the process does not occur with hands; hands only serve to shape, and the actual learning takes place with the mind (Lang, 2017). In Maker-Based learning, the goal is not just for students to produce end products. Maker-Based learning aims to give individuals the opportunity to use their new knowledge, which they have constructed in their minds by creating schemas, to create and test a product to solve a problem, and to use this product in the development process. In short, Maker-Based learning should focus on using and developing cognitive, affective, and psychomotor skills in a way that complements each other (Moro et al., 2020).

When viewed at the national level, an adaptation study of TPACK scale for primary school pre-service teachers (Kaya et al., 2013), STEM-Pedagogical Content Knowledge scale (Akçay & Avcı, 2022), Educational Robotics TPACK Self-Efficacy scale (Yanış & Yürük, 2021), Information and Communication Technologies-TPACK scale (Kadıoğlu-Akbulut et al., 2020) and TPACK self-efficacy scale development study for pre-service science teachers (Canbazolu Bilici et al., 2013; Kiray, 2016), Adaptation of 21st century skills-oriented TPACK scale for pre-service teachers in different branches (Alpaslan et al., 2021), TPACK self-efficacy scale study for pre-service mathematics teachers (Çetin & Erdoğan, 2018), TPACK scale development study for pre-service and actual social studies teachers (Akman & Güven, 2015) and the study of developing the TPACK-Deep scale for pre-service Turkish language and literature teachers (Yurdakul et al., 2012) were carried out in our country.

In their study with 339 pre-service teachers, Alpaslan, Ulubey, and Ata (2021) aimed to adapt the TPACK scale focused on 21st-century skills into Turkish. There are nine factors on the scale: PK, CK, TK, PCK, TPK, TCK, TPACK, Management, and Innovative Behavior. Confirmatory factor analysis was performed for the construct validity of the scale and Rasch analysis for its validity and reliability. As a result of the study, it was determined that the adapted scale was valid and reliable. In addition, it was revealed that pre-service teachers believed that they had sufficient knowledge of content and pedagogical issues, but their knowledge of technology and integrating it with pedagogical and context knowledge was at a satisfactory level. Canbazoğlu et al. (2013) carried out a comprehensive scale development study to determine self-efficacy beliefs for TPACK. The study was conducted with 808 pre-service science teachers. As a result of the study, a valid and reliable scale consisting of 52 items of 10-point Likert type was developed under 8 factors: PK, CK, PCK, TK, TCK, TPK, TPACK, and CK.

When the literature is examined, no study has been found in which the TPACKs of pre-service science teachers are examined with a Maker-Based approach. Teachers with Maker-Based TPACK can create teaching environments for their students to embody, build, and share their work in a safe environment (Blikstein, 2013) and improve their technological literacy with their innovative design and problem-solving abilities (Ku et al., 2021). Therefore, it becomes necessary to examine the Maker-Based TPACK levels of pre-service science teachers at the national level before starting their professional lives. For this reason, this study aims to adapt the "Maker-Based Technological Pedagogical Content Knowledge" scale developed in 2021 by Ku et al. who define the role of technology knowledge in TPACK as digital production tools, into Turkish in a way to measure the TPACK level of pre-service science teachers. It is anticipated that this tool will be a valuable measurement tool in teacher education in the future. This is because with this measurement tool, it will be ensured that pre-service teachers can understand their abilities, realize their shortcomings, and evaluate their performances.

## Method

This study was carried out using an exploratory sequential design, one of the mixed method typologies. In the exploratory sequential design, firstly, qualitative data are collected and analyzed. According to the results obtained, the data is tested with quantitative methods in the second part of the research (Creswell & Plano Clark, 2014). Exploratory sequential design is an approach in mixed methods research where the researcher begins by exploring qualitative data and subsequently uses these findings in the quantitative research dimension (Creswell, 2014). In the process of developing a measurement tool, it is necessary to employ qualitative methods initially and then quantitative methods to create better-expressed and more comprehensive closed-ended questions for the development of scale items. The use of qualitative research is emphasized for generating hypotheses, and quantitative methods are required for testing these hypotheses (Bryman, 2006).

### Participants

The study group for this research consists of 188 pre-service science teachers studying at three state universities in Istanbul. Participants were determined by using the purposive sampling method, one of the non-random sampling methods. 32 male (17%) and 156 female (83%) pre-service teachers participated in the study carried out in the 2021–2022 academic year. Participants consist of 12.8% 1st year (24 participants), 21.3% 2nd year (40 participants), 44.1% 3rd year (83 participants), and 21.8% 4th year (41 participants) university students, and they voluntarily participated in the study. The rule in the literature that it is necessary to work with a sample group that is five times the number of items in the scale whose validity and reliability will be determined was taken into consideration in the study (MacCallum et al., 1999).

### Ethical Consent of the Research

Research permission for this scale adaptation study was obtained from the Istanbul University-Cerrahpaşa Social and Human Sciences Research Ethics Committee on April 14, 2021, with the number E-74555795. During this study, all the rules specified within the scope of the Higher Education Institutions Scientific Research and Publication Ethics Directive were complied with.

### Procedure

In the process of adapting the Maker-Based Technological Pedagogical Content Knowledge (TPACK) Scale to Turkish, the following stages were followed in accordance with the research methodology: Identifying the need clarified by Seçer (2013); Determining the appropriate measurement tool; Building the translation team; performing forward and backward translations; Conducting language validity, creating the first version of the scale, and piloting it; Creating the first draft form, factor analysis, reliability and validity analyses, and finalization of the scale (Table 1).

Table 1. Scale adaptation stages

| **Stages of the Exploratory Sequential Pattern Method** | **Scale Adaptation Stages** |
|---|---|
| Qualitative Data Collection and Analysis of Data | Identifying the need<br>Determining the measuring tool<br>Building the translation team<br>Performing forward and backward translations |
| Development of the scale | Conducting language validation<br>Creating the first version of the scale and piloting it<br>Creating the First Draft Form |
| Quantitative Data Collection and Analysis of Data | Factor analysis<br>Reliability and validity analyses<br>Finalization of the scale |
| Reporting | Final version of the Maker-Based TPACK Scale |

*Identifying the Need*

An existing Turkish measurement tool that could measure the Maker-Based TPACK knowledge of pre-service science teachers was searched in the relevant literature, but it was found out that there was no current and valid scale to meet the need.

*Determining the Measuring Tool*

In the scale development process, if an appropriate measurement tool is available in another culture, intercultural adaptation of that scale will be more convenient in terms of cost and time, and it will be effective for future cross-cultural comparison studies (Hambleton & Patsula, 1999; Şeker & Gençdoğan, 2014). In this context, it was decided to adapt the Maker-Based Technological Pedagogical Content Knowledge (TPACK) Scale developed by Ku et al. (2021) in order to eliminate this deficiency in the literature and to measure the Maker-Based technological pedagogical content knowledge level of pre-service science teachers. One of the

researchers who developed the original scale, Dr. Kuen-Y Lin, was contacted via email, and permission was obtained for the adaptation of the scale.

The original form of the scale consists of 7 sub-dimensions and 27 items; these are: Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK) (Table 2). The internal reliability coefficient of the sub-dimensions of the original scale was between .72 and .86. The Cronbach Alpha value for the entire original scale was calculated as 0.95. The scale items are in 5-point Likert type: completely disagree (1), disagree (2), undecided (3), agree (4), and completely agree (5).

Table 2. Psychometric properties of the original scale

| **Sub-scales** | **Number of items** | **Items** | **Cronbach Alpha** |
|---|---|---|---|
| Content Knowledge | 3 | 1-2-3 | .79 |
| Pedagogical Knowledge | 4 | 4-5-6-7 | .81 |
| Technological Knowledge | 5 | 8-9-10-11-12 | .79 |
| Pedagogical Content Knowledge | 4 | 13-14-15-16 | .80 |
| Technological Content Knowledge | 4 | 17-18-19-20 | .85 |
| Technological Pedagogical Knowledge | 3 | 21-22-23 | .72 |
| Technological Pedagogical Content Knowledge | 4 | 24-25-26-27 | .86 |
| **Total** | **27** | | **.95** |

*Building the Translation Team*

In the selection of experts who would translate the scale, 8 expert translators consisting of researchers who have extensive knowledge of both languages, who have at least doctoral education in science education, and who have knowledge about the measured structure were determined. A Turkish language expert was also included in the translation team to determine the suitability of the Turkish language and grammatical structure in the creation of the Turkish form of the scale.

*Performing Forward and Backward Translation*

The items of the original scale were first translated into Turkish by four experts who are fluent in Turkish and English. Then, the scale items, which had been translated into Turkish, were translated back to the original language by four different field experts. The compatibility between the items in the forward and backward translation processes of the scale was examined, and linguistic and conceptual evaluations of the scale items were made by the relevant commission. In addition, in order to ensure the content validity of the scale, an evaluation was made by the commission regarding the extent to which the scale represents the subject it aims to measure and whether the quality intended to be measured is measured or not. In this study, the opinions of field experts were taken for content validity, and the opinions of linguistic experts were taken for face validity. For content validity, the suitability of the scale items for the pre-service teachers was examined by the expert group, and it was determined that the pre-service teachers were at a level that they could understand and answer the scale items. As a result of the examinations, necessary changes were made, and the final version of the scale was created for the Turkish form.

*Conducting Language Validity*

In order to determine the language validity of the scale, the original form and the Turkish form of the scale were applied to 31 pre-service teachers who were in the 3rd year (junior) of a state university, studying at the English Language Teaching Department. As a result of the analysis, the Pearson Correlation Coefficient (r) was determined to be .975, and it was determined that there was a high and significant relationship between the original form of the scale and the translated form. Likewise, the t value ($t(29) = -1.702$, $p = .088$) we found as a

result of the paired samples t-test analysis for the language validity of the scale was smaller than the t value (t(29) = 2.045) in the table, which means that there is no significant difference between the original English version of the scale and the adapted Turkish version.

*Creating the First Version of the Scale and Piloting It*

As a result of the analyses made, the first form of the scale consisting of 27 items was created. The first draft form of the scale was applied to 15 science teacher candidates within the scope of the pilot study. At this stage, it is aimed at determining the readability, intelligibility, and average response time of the scale items, detecting expressions that are not understood or not clear by the pre-service teachers, and detecting spelling mistakes. After this stage, the scale was made ready for application and examination for factor analysis.

## Findings

### Construct Validity

In scale development and adaptation studies, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) are performed to determine the construct validity of the scale. EFA helps to determine what kind of relationship there is between the items in a measurement tool and the sub-dimensions of the scale. CFA, on the other hand, is a statistical process performed to determine whether the model or structure previously revealed by EFA has been confirmed (Yaşlıoğlu, 2017). Since an existing model is tested in scale adaptation studies, researchers recommend direct Confirmatory Factor Analysis (CFA) be used (Hambleton & Patsula, 1999; Seçer, 2013; Gözüm & Aksayan, 2003). In this study, the LISREL 9.10 package program was used to evaluate the DFA results.

Before CFA, Kaiser-Meyer-Olkin (KMO) analyses were performed to determine the adequacy of the sample size and Barlett's Test of Sphericity analyses to determine whether the data were normally distributed. As a result of the analysis we conducted to determine the suitability of the data collected from the sample group to which the scale was applied for factor analysis, the Kaiser-Meyer-Olkin (KMO) value was found to be .915 and the Bartlett's test $X^2$ value was found to be 3980,395 ($p < .001$). The fact that the KMO value is greater than .90 in the study shows that the sample size is perfect for factor analysis. The significant result of Bartlett's test indicates that our data come from a multivariate normal distribution (Seçer, 2013).

*Confirmatory Factor Analysis (CFA)*

The compatibility of the Maker-Based Technological Pedagogical Content Knowledge (Maker-Based TPACK) Scale with Turkish culture was examined by the first-level CFA. As a result of the CFA carried out to determine the model fit of the Maker-Based TPACK Scale, it was seen that the scale, which was adapted into Turkish, consisted of 7 sub-dimensions and 27 items, as in the original. The chi-square fit value of the factor structure formed as a result of the analyses was found to be significant ($X^2 = 718.83$, $df = 303$, $p = 0.00$) and the $x^2/df$ value for model fit was found to be 2.37 (Figure 2).

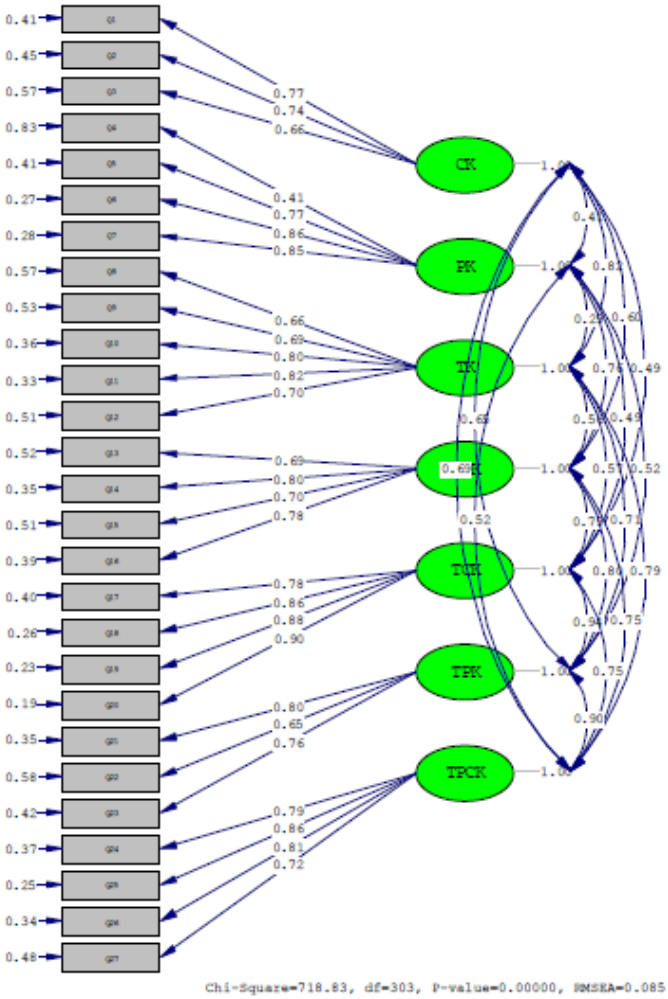


Figure 2. Standardized CFA analysis of item correlations in Maker-Based TPACK logic

When Figure 3 is examined, it is seen that the fit indexes of the Maker-Based TPACK Scale, which consists of 27 items and 7 sub-dimensions, are significant ($X^2$ =718.83, df=303, p= 0.00, $X^2/df$ = 2.37). Since the fit indexes of the model were good, no modification was made between the items.

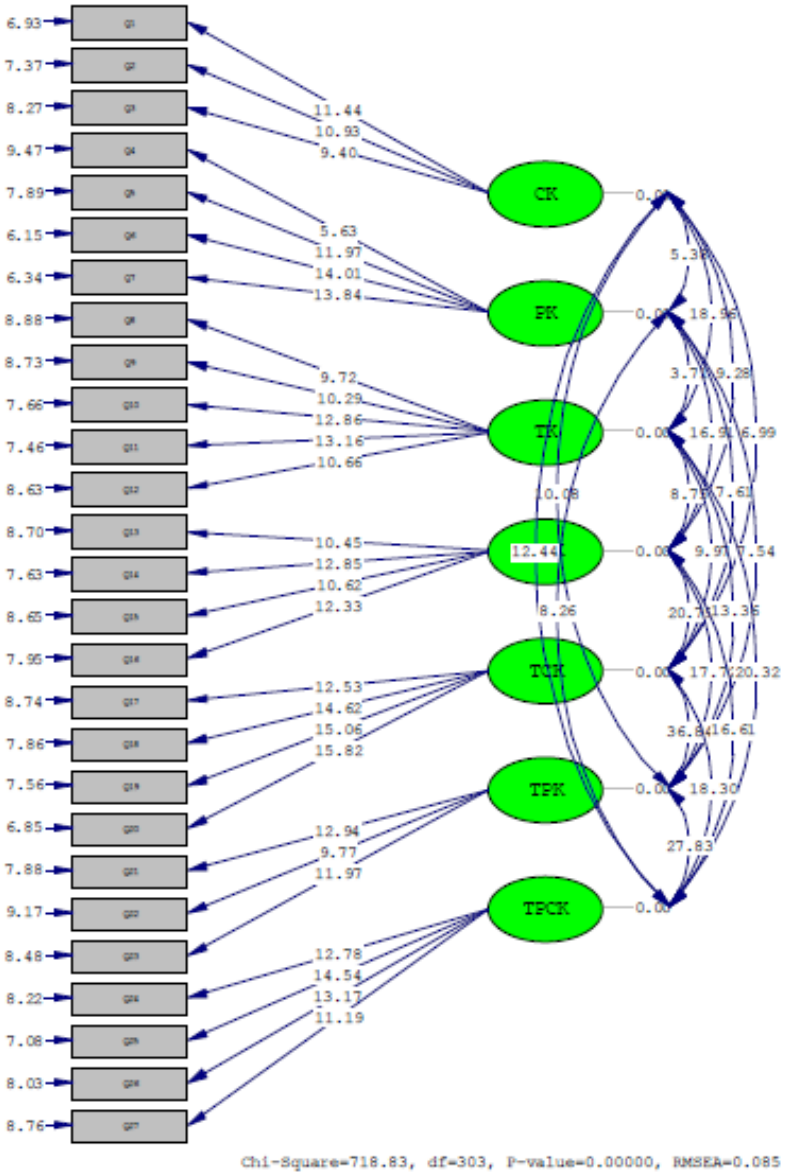


Figure 3. The t values of the item correlations of the Maker-Based TPACK scale

Model fit index values of the Maker-Based TPACK scale show that RMR (Root Mean Square Residual), CFI (Comparative Fit Index), NNFI (Non-Normed Fit Index), and IFI (Incremental Fit Index) values have a perfect fit level, while model fit indexes of Chi-Square Goodness (Chi-square fit test), RMSEA (Root Mean Square Error of Approximation), SRMR (Standardized Root Mean Square Residual), NFI (Normed Fit Index), and RFI (Relative Fit Index) values have acceptable fit levels. The obtained Chi-square fit index (2.37) shows that the sample from which the data was collected has a high agreement with the population (Yaşlıoğlu, 2017). The fit index values of the adapted Maker-Based TPACK Scale are presented in Table 3.

Table 3. Fit index values obtained as a result of the DFA of the Maker-Based TPACK Scale

| **Index** | **Perfect Fit Criteria*** | **Acceptable Compliance Criteria*** | **Research Finding** | **Result** |
|---|---|---|---|---|
| $x^2/df$ | 0-2 | 2-3 | 2.37 | Acceptable Fit |
| RMSEA | ≤ .05 | ≤ .08 | 0.080 | Acceptable Fit |
| RMR | ≤ .05 | ≤ .08 | 0.0498 | Perfect Fit |
| SRMR | ≤ .05 | ≤ .08 | 0.0759 | Acceptable Fit |
| CFI | ≥ .95 | ≥ .90 | 0.965 | Perfect Fit |
| NNFI | ≥ .95 | ≥ .90 | 0.960 | Perfect Fit |
| NFI | ≥ .95 | ≥ .90 | 0.942 | Acceptable Fit |
| IFI | ≥ .95 | ≥ .90 | 0.966 | Perfect Fit |
| RFI | ≥ .95 | ≥ .90 | 0.933 | Acceptable Fit |

*Brown, 2006; Hu & Bentler, 1999; Kline, 2005; Seçer, 2013

*Correlation Coefficients for Maker-Based TPACK Scale and Sub-Dimensions*

Correlation coefficients were calculated in order to determine the relationship between the Maker-Based TPACK scale and the seven factors that make up the scale. As seen in Table 4, the correlation coefficients of the factors and the whole scale range between .639 and .874, indicating that there is a strong positive correlation.

Table 4. Correlation values between Maker-Based TPACK Scale and sub-dimensions

| | **CK** | **PK** | **TK** | **PCK** | **TCK** | **TPK** | **TPACK** |
|---|---|---|---|---|---|---|---|
| Maker-Based TPACK | .731** | .639** | .805** | .818** | .820** | .850** | .874** |

**Correlation is significant at the 0.01 level.

**Findings Related to Reliability Analysis**

The reliability index of the Maker-Based TPACK Scale, which was obtained as a result of adaptation, was calculated as .948. It was determined that the reliability indexes of the sub-dimensions of the scale ranged from .763 to .911. When compared with the reliability indexes of the original scale, the adapted Maker-Based TPACK Scale seems to be compatible (Table 5).

Table 5. Reliability coefficients of the Maker-Based TPACK Scale

| **Sub-Dimensions** | **Reliability Coefficient of the Adapted Scale (α)** | **Reliability Coefficient of the Original Scale (α)** |
|---|---|---|
| Content Knowledge | .763 | .79 |
| Pedagogical Knowledge | .792 | .81 |
| Technological Knowledge | .850 | .79 |
| Pedagogical Content Knowledge | .829 | .80 |
| Technological Content Knowledge | .911 | .85 |
| Technological Pedagogical Knowledge | .790 | .72 |
| Technological Pedagogical Content Knowledge | .867 | .86 |

| | | |
|---|---|---|
| **Total** | **.948** | **.95** |

In order to determine the item discrimination degree in the scale, namely the validity, according to the scores of the participants, the difference in scores between the top 27% group and the bottom 27% group was analyzed with the independent sample t-test (Table 6). According to the results of the analysis, there is a statistically significant difference [$t(103) = -21.740$; $p < .05$] between the survey total scores of the lower and upper groups. While the survey score average of the upper group is 78.2157, the average score of the lower group is 112.1481. It can be said that the survey could measure the difference between the students in the lower and upper groups (Seçer, 2013).

Table 6. t-test results for the top 27% group and bottom 27% group of the scale

| **Groups** | **N** | **Average** | **SS** | **t** | **p** |
|---|---|---|---|---|---|
| The top 27% group | 51 | 78.2157 | 8.47187 | -21.740 | .00 |
| The bottom 27% group | 54 | 112.1481 | 7.51453 | | |

## Discussion and Conclusion

Adapting a scale that has been brought to the international literature to another language and culture has many benefits, such as obtaining common findings that can be easily understood by every reader, increasing the potential for generalization of the findings, providing ease of communication, obtaining comparable findings, and ensuring cooperation for international joint research (Şahin, 1994). With this point of view, and due to the absence of any scale for measuring the Maker-Based TPACK before, the "Maker-Based Technological Pedagogical Content Knowledge" scale developed by Ku, Loh, Lin, and Williams in 2021 was aimed at adapting into Turkish in a way to measure the TPACK level of pre-service science teachers. In order to ensure the language validity of the scale, the relationship between the Turkish version and the original version of the scale was examined after the translation and language experts' controls. As a result of Pearson Product Moment Correlation Analysis, it is seen that the Pearson Correlation coefficient (r) is .975 and language validity is provided. CFA was applied to test the accuracy of the 7 dimensions in the original version of the Maker-Based TPACK Scale and the dimensions in the Turkish version. As a result of the CFA performed to determine the model fit of the Maker-Based TPACK Scale, it is seen that the scale, which is adapted into Turkish, consisted of 7 sub-dimensions and 27 items, as in the original. These 7 sub-dimensions consist of Content Knowledge, Pedagogical Knowledge, Technological Knowledge, Pedagogical Content Knowledge, Technological Content Knowledge, Technological Pedagogical Knowledge, and Technological Pedagogical Content Knowledge. The Cronbach Alpha Reliability Coefficients of these sub-dimensions are .763, .792, .850, .829, .911, .790 and .867, respectively. The Cronbach Alpha Reliability Coefficient of the scale is .948.

In scale development and adaptation studies, both Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) are employed to assess construct validity. EFA helps identify relationships between measurement tool items and scale sub-dimensions, while CFA confirms the previously identified model or structure (Yaşlıoğlu, 2017). For scale adaptation, direct use of CFA is recommended by researchers (Hambleton & Patsula, 1999; Seçer, 2013; Gözüm & Aksayan, 2003). This study used LISREL 9.10 for CFA evaluation. Prior to CFA, Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity analyses ensured sample adequacy and data normality, respectively. Analysis results indicated a KMO value of .915 and a significant Bartlett's test ($X^2 = 3980.395$, $p < .001$), supporting the suitability of the data for factor analysis (Seçer, 2013).

As a result, the factors of the adapted version of the "Maker-Based Technological Pedagogical Content Knowledge" scale and the items under these factors have the same structure as the original scale. As a result of the analyses, the data collected within the scope of the study show that the adapted scale is a valid and reliable scale that can be used to measure the Maker-Based Technological Pedagogical Content Knowledge of pre-service science teachers. In Turkish literature, there is no measurement tool that evaluates the Maker-Based TPACKs of pre-service teachers. The Maker movement is becoming increasingly popular in Turkey as well as in the international arena. In particular, the establishment of the STEM & Maker Lab (http://www.hstem.hacettepe.edu.tr/en) at Hacettepe University, the establishment of a STEM laboratory (http://stemokulu.com/stem-lab/) at Istanbul Aydın University, and the start of maker trainings at the same university are strong indications of this fact. Considering that teachers, who play a key role in the dissemination

of Maker education, should develop their Maker-Based TPACK levels and examine this development before starting their professional lives, it is expected that the adapted scale will make a great contribution to the field.

## Recommendations

The scale presented in the study can be used to evaluate pre-service science teachers' maker-based TPACKs. It can also be used to determine to what extent various methods and techniques such as project-based learning, problem-based learning, and design-based learning affect maker-based TPACK. In future studies, in order to increase the generalizability of the adapted scale; validity and reliability analyses can be retested on the data to be obtained from pre-service teachers studying in different departments such as mathematics, social studies and preschool teaching.

**Author (s) Contribution Rate**
All authors contributed equally to the article.

**Conflicts of Interest**
There is no conflict of interest

**Ethical Approval**
Ethical permission (14/04/2021 with the number E-74555795) was obtained from Istanbul University-Cerrahpaşa Social and Human Sciences Research Ethics Committee for this research.

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## APPENDIX

**Appendix-1:** Turkish Version of Maker-Based TPACK Scale

| Kesinlikle Katılmıyorum | Katılmıyorum | Kararsızım | Katılıyorum | Kesinlikle Katılıyorum |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

| No | Madde | Kesinlikle Katılmıyorum | Katılmıyorum | Kararsızım | Katılıyorum | Kesinlikle Katılıyorum |
|---|---|---|---|---|---|---|
| 1 | Yeterli teknolojik bilgiye sahibim | | | | | |
| 2 | Teknolojiyi konu uzmanlarının gözünden değerlendirebilirim. | | | | | |
| 3 | Teknolojiyle ilgili içeriği keşfetme ve anlama konusunda daha derinlere inebilirim. | | | | | |
| 4 | Öğrencilere derinlemesine düşünmeyi öğretmek için zorlu görevler geliştirebilirim. | | | | | |
| 5 | Öğrencilerime uygun çalışma stratejileri benimsemeleri talimatını verebilirim. | | | | | |
| 6 | Öğrencilerimin çalışmalarını yönetmelerine yardımcı olabilirim. | | | | | |
| 7 | Öğrencilerimin çalışma stratejileri üzerinde düşünmelerine yardımcı olabilirim. | | | | | |
| 8 | Dijital üretim araçlarını verimli bir şekilde kullanabilirim. | | | | | |
| 9 | Farklı dijital üretim araçlarını kullanmayı kolayca öğrenebilirim. | | | | | |
| 10 | Dijital üretim araçlarını kullanırken, ilgili teknik sorunları nasıl ele alacağımı biliyorum. | | | | | |
| 11 | Dijital üretim araçlarıyla ilgili en son bilgileri anlayabiliyorum. | | | | | |
| 12 | İlgili dijital üretim araçlarını çalıştıran yazılımı (bilgisayar çizim yazılımı dahil) kullanabilirim. | | | | | |
| 13 | Gruplar halinde öğrenciler için yapımcı etkinlikleri planlayabilirim. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 14 | Öğrencilerime, grup oluşturucu etkinlikleri sırasında verimli tartışmalar yapmaları için talimat verebilirim. | | | | | |
| 15 | Dijital fabrikasyon araçlarını kullanmasam bile, öğrencilerin teknoloji eğitimi hakkındaki efsanelerine değinmeye yardımcı olabilirim. | | | | | |
| 16 | Dijital fabrikasyon araçlarını kullanmasam bile, öğrencilerin teknoloji hakkında İçerik Bilgisi edinmelerine yardımcı olmak için farklı yöntemler kullanabilirim. | | | | | |
| 17 | Öğrencilerime gerçek dünyadaki durumları tanıtmak için dijital üretim araçlarını kullanabilirim. | | | | | |
| 18 | Öğrencilerimin tasarım düşüncelerini ifade etmek için dijital üretim araçlarını kullanmalarını sağlayabilirim. | | | | | |
| 19 | Öğrencilerimin tasarım düşüncelerini test etmek ve ayarlamak için dijital üretim araçlarını kullanmalarını sağlayabilirim. | | | | | |
| 20 | Öğrencilerimin bilgilerini farklı şekillerde sunmaları için dijital üretim araçlarını kullanmalarını sağlayabilirim. | | | | | |
| 21 | Öğrencilerimin diğer öğrencilerle işbirliği yapmak için dijital üretim araçlarını kullanmalarını sağlayabilirim. | | | | | |
| 22 | Teknolojiyle ilgili üretici tabanlı öğretim etkinliklerini tasarlarken hangi dijital üretim araçlarının kullanılacağını biliyorum. | | | | | |
| 23 | Teknolojiyle ilgili çalışma içeriğini sunmak için uygun dijital üretim araçlarını kullanabilirim. | | | | | |
| 24 | Teknolojik içeriği öğretme sürecine teknolojiyi, dijital üretim araçlarını ve öğretim yöntemlerini uygun şekilde entegre edebilirim. | | | | | |
| 25 | Teknolojik öğretim içeriğimi ve yöntemlerimi ve ayrıca öğrencilerin çalıştığı içeriği geliştirmek için uygun dijital üretim araçlarını seçebilirim. | | | | | |
| 26 | Öğretim sırasındaki gözlemlerime dayanarak teknolojiyi, dijital üretim araçlarını ve öğretim yöntemlerini uygun şekilde entegre etmek için farklı öğretim stratejileri uygulayabilirim. | | | | | |
| 27 | Okulumdaki diğer öğretmenlere teknolojiyi, dijital üretim araçlarını ve öğretim yöntemlerini entegre etme konusunda yardımcı olabilirim | | | | | |


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# Investigation of Social Media Addiction in Terms of Social Appearance Anxiety and Social Desirability

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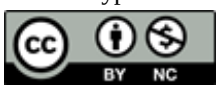


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## Abstract

When the studies are examined, it is seen that social media addiction (SMA) increases in adolescents with high social desirability and social appearance anxiety (SAA). For this reason, the aim of this research is to examine SMA in adolescents in terms of SAA and social desirability and to determine at what level social desirability and SAA predict SMA. The research was designed as a descriptive study in the relational survey model. A total of 484 students, 338 of whom were girls (69.8%) and 146 (30.2%) were boys studying at secondary school institutions in the central districts of Hatay province, participated in the study using the convenience sampling method. The Social Media Addiction Scale, the Social Appearance Anxiety Scale, and the Social Desirability Scale were used as data collection tools. The T test and multiple regression analysis were used in the analysis of the data. As a result of the research, it was found that SMA and social desirability do not differ by gender, and it was also seen that SAA differed significantly according to gender, and girls were more concerned about their social appearance. In consequence of the research, it was also found that social desirability and SAA significantly predict SMA.

**Keywords:** social media addiction, social appearance anxiety, social desirability, gender

## Introduction

Social media are online applications where people communicate and share with each other without time and space restrictions, meet new people, share their ideas, and participate in discussions (Bat and Vural, 2010; Kim, Jeong, and Lee, 2010). According to Merriam-Webster (2021), social media are forms of electronic communication (such as microblogging, websites, and social networking) wherein users create online communities by sharing information, opinions, private messages, and other content (such as videos). The fact that social media makes it easier to communicate with people all over the world in real time has led to the point that it has become a prominent daily communication method for individuals of all ages around the world (Lopez-Lizaraga, 2021). The media company We Are Social, which conducts research on digital life and reports on it, pointed out that in 2023, people in Turkey spent about 7.5 hours on the Internet and almost 3 hours on social media (Kara, 2023). It is noteworthy that, with the increasing use of the Internet, social media usage is also more frequent, especially among adolescents.

Adolescents spend more time online compared to adults and use the Internet more often for social interaction (Valkenburg and Peter, 2009). At the same time, adolescents express themselves more easily on social media, think that they belong to a group, and are socializing; therefore, they have a tendency to use social media more than necessary (Yavuz, 2018). Researchers state that this condition can lead to internet and social media addiction (SMA), which is one of the behavioral addictions (Echeburua and Corral, 2010; Kuss and Griffiths, 2011; Young, 1996). The increasing interest adolescents are developing in technology, their intensive use of technology, and the lack of foundation they have about the pros and cons of it are putting them in a hazard group for developing social media and internet addiction (Ceyhan, 2008; Treuer, Fabian, and Furedi, 2001; Widyanto and Mcmurran, 2004). The SMA is defined as "being overly busy with social media, having an intense desire to constantly stay connected, and spending as much time as to harm all other social activities, as well as education and work life and mental status" by Andreassen, Torsheim, and Pallesen (2014). On the other hand, He, Turel, Brevers, and Bechara (2017) suggested that SMA is a behavioral addiction that is characterized by the uncontrollable urge of an individual's social media usage to overshare important life events to the degree

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that his social and personal life is negatively affected. In a study conducted with adolescents by Doğrusever (2021), it was found that 20 percent of the participants in the study had SMA. In another study examining social media usage and SMA among adolescents, it was found that 34 percent of the adolescents showed a high level of SMA and that girls were more dependent on social media than boys (Guney and Tastepe, 2020).

In another study conducted by Bilgin (2018), it was pointed out that time spent on social media on a daily basis is positively and highly associated with SMA. Aslan and Yasar (2020) found that the three most frequently used social media networks are Instagram, Youtube, and Facebook, respectively. Girls use social media for keeping in touch with existing friends, listening to music, and sharing posts, while boys use social media to follow a group, play games, and meet new people. At the same time, it was found that boys have a higher tendency to develop SMAs compared to girls. It is seen that the studies on SMA differ depending on gender, and it is more preferred by adolescents to communicate and share on social media.

Social desirability, which is one of the variables in this subject, is defined as the desire to become acceptable in social or interpersonal relationships such as social acceptance, social approval, popularity, social status, and leadership (US National Library of Medicine, 2007; Transmitter: Kogar and Gelbal, 2015). The origin of the concept of social desirability derives from a common observation of pollsters, which dates back more than 70 years and implies that what respondents say may not be true or may not be completely true. It has been established that the response to questionnaires or scales shows a consistent deviation from reality, and the participants tend to show their own behavior positively (Johnson and Van de Vijver, 2003). Crowne and Marlowe (1964) suggested that the socially likable response is motivated by the "subjects' need to respond in culturally sanctioned ways." Apart from the people participating in the survey or scale, it has been observed that social desirability is also considered a personality trait (Erzen, Yurtcu, Ulu Kalin, and Kocoglu, 2021; Johnson and Van Vijver, 2003).

In this study, social desirability was considered a personality trait. It is stated that individuals with a high level of social desirability often tend to prefer the acceptable aspects of their social environment rather than their own thoughts (Phillips and Clancy, 1082; Transmitter: Erzen, 2021). Thus, individuals will reflect themselves with their positive aspects around them, trying to hide the undesirable ones. Therefore, the concept of social desirability shows parallelism with the concepts of approval seeking and positive evaluation (Ural and Ozbirecikli, 2006). It is believed that adolescents with high social desirability tend to meet their own needs in terms of social approval and acceptance by using social media more frequently. The adolescence period includes a period during which social development gains importance as much as the emotional, physical, and mental processes, and therefore the physical appearance of the adolescent becomes an important aspect (Harter, 1990; Akt. Soylu, Atik, and Ocalan, 2017).

This situation is explained by the concept of body image. Body image is what a person feels and thinks, and how they perceive their own physical image based on their psychological experiences (Cash, 1989; Moe, 1999). If a person's perceptions about his body are positive, it can be said that he has a positive body image; if these perceptions are negative, it can be said that he has a negative body image (Dogan, 2010). Researchers suggest that when adolescents have a negative body image and are unable to control their fears about their body shape, the anxiety they experience is similar to social anxiety, and this results in the arousal of social appearance anxiety. Furthermore, it is stated that the dissatisfaction they have about their own body shape during adolescence also creates concerns about their appearance (Lunde, Frisen, and Hwang, 2007; Smolak, 2004). Social appearance anxiety (SAA) has been expressed as “a type of social anxiety that arises from the stress or anxiety experienced by a person when his physical appearance is evaluated by his social environment.” (Hagger and Stevenson, 2010; Hart, Leary, and Rejeski, 1989). According to Levinson and colleagues (2013), it is defined as “the fear that a person will be evaluated negatively because of their appearance” (p. 126).

It is observed that adolescents who have SAA tend to use the internet and social media applications more because they are concerned about their own physical appearance (Boursier, Gioia, and Griffiths, 2020; Deng & Jiang, 2023; Eser, 2023; Gilik, 2016; Kocaman and Kazan, 2021). Social media also provides adolescents with opportunities, such as filtering their photos, etc., to make changes related to their own appearance. An adolescent who is concerned about his appearance can try to show himself or herself better on social media by using filtering programs and increasing his social likeability by sharing. This situation is thought to increase SMA in adolescents with high social desirability and social appearance anxiety. At the same time, it is thought that social media, which offers misleading options regarding adolescents' own body perceptions, may cause other psychological problems in adolescents. Adolescents may not like themselves in their face-to-face communication world as much as they do on social media and may withdraw from themselves. In this direction, investigating the variables of social appearance, anxiety, and social liking is also important in terms of

understanding adolescents. Also, when the literature is examined, it is seen that social media addiction and social liking variables have not been studied. At the same time, there were no studies in which social appearance anxiety and social liking variables were addressed together in adolescents. For this reason, it is expected that the study will contribute to the research on social media addiction. The aim of the research is to determine whether social media addiction differs depending on gender in adolescents and to examine at what level social desirability and social appearance anxiety predict social media addiction. Depending on the purpose of the research, answers to the following questions were sought:

1. Does social media addiction differ significantly depending on gender in adolescents?
2. Do social desirability and social appearance anxiety significantly predict social media addiction in adolescents?

## Method

### Research Model

The research is conducted among secondary school students based on the scores they acquire from the gender-based SMA scale, social anxiety scale, and social desirability scale to determine whether their scores differ significantly. Later, the relationship between SMA, SAA, and social desirability in adolescents was investigated within the scope of the study. In this context, the research is considered to be a descriptive study in the correlational survey model.

### Research Group

A total of 484 students, 338 of whom were girls (69.8%) and 146 (30.2%) were boys studying at secondary school institutions in the central districts of Hatay province, participated in the study in which the convenience sampling method, which is one of the non-probability sampling methods, was used. The ages of the students range from 14 to 29 (x=15.84, Dec=1.25). 134 of the students (27.7%) were 9th grade students, 151 (31.2%) were 10th, 121 (25%) were 11th, and 78 (16.1%) were 12th. 411 (84.9%) of the students participating in the study stated that they own a smartphone. At the same time, 193 (39.8%) of the participants reported that they were busy with their smartphones for 2 hours and less, 157 (32.4%) between 2-4 hours, 82 (16.9%) between 4-6 hours, and 52 (10.7%) 6 hours and more on a daily basis.

### Data Collection Tools

*Social Media Addiction Scale*

The Social Media Addiction Scale was developed by Ozgenel, Canpolat, and Eksi (2019) in order to determine the level of SMA among adolescents. The scale consists of a single-factor structure with nine variables. There are no reverse-coded factors in the quintuple likert type (1: Never, 5: Always). High scores obtained from the scale are accepted as an indicator of high SMA. An example item from the scale is "Although social media negatively affects my work, school, or family life, I continue to use social media extensively." The results of confirmatory factor analysis indicated that the model was well fit ($\chi 2/df$= 2.69, CFI= .95, RMR= .06, SRMR= .04, GFI= .93 and AGFI=.88. The internal consistency coefficient of the scale is reported as α=90, and it is also taken as α=.90 within the scope of this study.

*Social Appearance Anxiety Scale*

The Social Appearance Anxiety Scale (SAAS), which is also a quintuple Likert-type scale with 16 variables, was developed by Hart et al. (2008) with the aim of measuring the SAA of individuals. The scale includes cognitive, affective, and behavioral expressions related to the appearance anxiety of individuals. The scale includes items such as 'I worry people will judge the way I look negatively' and 'I get tense when it is obvious people are looking at me'. The Turkish adaptation of the scale was made by Dogan (2010) in a university sample. Once again, the validity and reliability studies of the scale were conducted by Dogan (2011) on adolescents. The results of confirmatory factor analysis indicated that the model was well fit ($\chi 2/df$= 2.96, RMSEA= .066, NFI=.93, CFI=.95, IFI=.95, RFI=.91, GFI=.93, and AGFI=.90). The Cronbach's alpha internal consistency coefficient of the scale, which has a one-dimensional structure, was reported as .91, and if the test-retest reliability coefficient is reported as .80. The Cronbach's alpha internal consistency coefficient calculated within the scope of this study is calculated as .96.

*Social Desirability Scale*

The scale which was developed by Erzen, Yurtçu, Ulu Kalin and Koçoğlu (2021) consists of a total of 15 variables aiming to determine the social liking levels of individuals. The 10 variables of the scale focus on acceptance and other 5 are the sub-dimensions of conspicuousness which are based in the quintuple likert type (1: I strongly disagree, 5: I strongly agree). The scale includes items such as 'The more I post on social media, the happier I am' and 'I will try every way to get more likes on social media'. There are no reverse-scored items on the scale, and it is believed that the level of desirability increases proportionally with the score obtained from the scale. The results of the confirmatory factor analysis of the structure, consisting of two factors and 15 items, showed that the factors showed structural adjustment ($\chi 2/df$= 2.50, GFI= .93, CFI= .92, AGFI= .91, RMSEA= .06). The Cronbach's alpha internal consistency coefficients of the scale for the acceptance sub-dimension are taken as .85, .75 for the conspicuousness sub-dimension, and .84 for the whole scale. Within the scope of this study, the consistency coefficients are taken as $\alpha$=.87 for the acceptance sub-dimension, $\alpha$=.84 for the conspicuousness sub-dimension, and finally $\alpha$=.90 for the whole scale.

**Procedure**

The sample of this study consists of students studying at four secondary education institutions located in the central districts of Hatay Province. The study was conducted by obtaining the Approval of the Ethics Committee (Decision No. 64548, dated September 29, 2022) from the Artvin Coruh University Scientific Research and Publication Ethics Committee in the Field of Artvin Coruh University Rectorate. Furthermore, the necessary permissions were obtained from the Hatay Provincial Directorate of National Education (dated April 7, 2022, and 474225269) within the scope of this study. At the implementation stage, the data from the scales used in the study were collected on a voluntary basis after explaining the purpose of the research to the students and providing them with all the necessary information about the scales.

**Data Analysis**

In order to prepare the data for analysis, the data of 524 students was reached within the scope of the study and examined; 40 data points with missing and extreme values were extracted from the sample, and a total of 484 data points were studied. For analyzing the provided data, a T-test was used to determine the relationship between the students' SMA, social appearence anxiety, and social desirability scores with the gender variable. Since the data exhibited a normal distribution, multiple regression analysis was used to determine the level at which students' social appearence anxiety and social desirability levels predicted their SMA. All the data were analyzed in the SPSS 22 program.

## Findings

Within the scope of the research, the values of the SMA scale, the social desirability scale, and the SAA scale were examined in terms of gender using the t-test. Table 1 shows the results of the analysis.

Table 1. The t-test results of scale scores

| | Gender | N | $\bar{x}$ | S | sd | t | p |
|---|---|---|---|---|---|---|---|
| 1. Social Media Addiction | Female | 338 | 18.36 | 8.38 | 482 | .478 | .633 |
| | Male | 146 | 17.99 | 6.96 | | | |
| 2. Social Appearance Anxiety | Female | 338 | 42.97 | 17.84 | 482 | .210 | .005 |
| | Male | 146 | 38.10 | 16.91 | | | |
| 3. Social Desirability | Female | 338 | 30.57 | 11.82 | 482 | .422 | .952 |
| | Male | 146 | 30.64 | 10.68 | | | |

When Table 1 is examined; the scores of SMA of students according to their gender [t(482)= 4788, p>.05] and social desirability [t(482)= .422, p.05] do not show significant differences. However, the scores of students' SAA [t(482)= .422, p<.01] scale show significant differences based on gender.

The average score on the SAA scale of female students (x = 42.97) is higher than that of male students (x= 38.10). According to this finding, it can be said that there is a significant relationship between gender and SAA. In the research, multiple regression analysis was used to find out the level of SAA and social liking and predict

their effects on SMA. In this context, the relationships between variables, Cronbach Alpha values, and descriptive statistics of the variables are presented in Table 2.

Table 2. Relationships between variables and descriptive statistics results

| Variables | 1 | 2 | 3 |
|---|---|---|---|
| 1.Social Media Addiction | 1 | | |
| 2. Social Appearance Anxiety | .33* | 1 | |
| 3. Social Desirability | .42* | .45* | 1 |
| Average | 18.25 | 41.50 | 30.59 |
| Standard Deviation | 7.97 | 17.69 | 11.48 |
| Cronbach Alfa | .90 | .96 | .90 |

*p<.001

In Table 2, when the relationship between the scales was analyzed: SMA and SAA (r =.33) and social desirability (r = .42), significant positive relationship was found between the two groups (p<.001). In addition, a significant positive relationship between SAA and social desirability (r = .45) was found. The results of the multiple regression analysis, which was conducted in order to find out the impact of SAA as predictors of SMA and social desirability, suggest that the two predictor variables explain 20% of the total variance in the scores of SMA (ΔR2=.20 p<.001) in a meaningful way. Table 3 shows the results of the multipe regression analysis.

Table 3. Results of multiple regression analysis

| Variables | Non-standard coefficients | | Standard coefficients | | | | | |
|---|---|---|---|---|---|---|---|---|
| | B | $SE_B$ | β | t | p | R | $R^2$ | F |
| Regression Coefficient | 7.856 | 1.016 | | 7.73 | .000 | | | |
| 1.Social Appearance Anxiety | .079 | .021 | .175 | 3.81 | .000 | .443 | .20 | 58.788* |
| 2. Social Desirability | .233 | .032 | .335 | 7.31 | .000 | | | |

*p<.001

When Table 3 is examined, based on the results of the multiple regression analysis that was conducted in order to investigate the impact social appearance anxiety and social desirability have on SMA, it can be understood that social appearance anxiety and social desirability explain approximately 20% of the total variant of SMA meaningfully. According to the standardized regression coefficients (β), the relative order of importance of the predictor variables on SMA is social liking (β= .335) and SAA (β= .275) respectively. When the t-test results related to the significance of the regression coefficients were examined, it was understood that social desirability (t= 7.31, p<.001) and SAA (t= 3.81, p<.001) are significant predictors of SMA.

## Results and Discussion

As a result of the research, it was found that SMA does not differ by gender. When we look at other studies examining whether SMA differs by gender, it is evident that different results have been obtained. In the study of Baz (2018) with university students, there was no significant difference in SMA according to gender. In another study conducted by Dogrusever (2019), it was also observed that there was no significant difference in the SMA of adolescents based on their gender. Meena, Soni, Jain, and Paliwal (2015) also stated that the use of social media platforms by youngsters does not differ by gender. These studies support this research's findings.

On the other hand, in the research conducted by Okumuş (2018) with middle school students, it was concluded that social media usage differs by gender and that girls spend more time on social media than boys. In the study conducted by Yayman (2019) with adolescents, the gender difference was also in favor of girls. In a study conducted by Shaw and Black (2008), SMA was also seen more among girls. Similarly, Guney and Tastepe (2020) found out in their study that girls' SMA levels are higher compared to boys. There are other studies proving that girls have a higher SMA tendency compared to boys (Deniz and Noise, 2018; Tutgun-Ünal, 2015; Yüksel-Sahin and Oztoprak, 2019). On the contrary, it has also been revealed by other research that male students use social media and the Internet more than girls and also develop addiction (Aslan and Yasar, 2020; Aydıner, 2017; Buyuksahin-Cevik and Celikkaleli, 2010; Ciftci, 2018).These studies show inconsistency with research findings. When all the studies are examined, it is seen that there are studies revealing that SMA both differs and doesn't differ by gender. This may be due to the sample and the time at which the mentioned studies

were conducted. Since both girls and boys have unlimited opportunities to access the Internet and social media in today's conditions, it is to be expected that there will be no significant difference in the usage of social media. As a result of the research, it has been observed that SAA differs significantly according to gender, and girls are more anxious about this matter. The study conducted by White (2013) supports the research findings. Concurrently, in the study of Boxwood, Seki, and Dilmaç (2019), SAA was higher in boys than in girls. It is also possible to come across studies indicating that boys' SAA is higher than girls' (Alemdağ, 2013; Doğan, 2009; Soylu, Atik, & Öçalan, 2017). These studies show inconsistency with research findings. The fact that SAA differs by gender may be due to the sample and the conditions in which the research was conducted.

One of the findings of the research is that social desirability does not differ significantly by gender. In the research of Kogar and Gelbal (2015), it was also seen that social desirability preferences did not differ by gender. This study supports the research findings. As to the study of Gedik and Toker (2018), it was found that social desirability is higher in girls than in boys. This study does not show consistency with the research results. Examining the literature, it stands out that studies on social desirability and gender are limited. Therefore, it can be said that more studies are needed to be conducted and interpreted in order to relate the two variables.

In consequence of the research, it was also found that social desirability and SAA significantly predict SMA. Seemingly, usage of social media has become a common daily activity, especially among adolescents who are engaged in sharing visual content. Taking and posting selfies on social media is one of the most popular activities among youngsters' social media usage. Nonetheless, greater exposure to visual content on social media can lead to more social comparisons and reinforcement of appearance concerns. Therefore, digital activities based on body image can facilitate individuals who are dissatisfied with their appearance to create and manage their best online self-presentation, potentially leading to problematic social media usage. When the literature was examined, no study was found in which social appearance anxiety and social desirability variables were studied together as predictors of social media addiction. Studies have been conducted mostly in a relational way, between social appearance anxiety and social media addiction. In a study conducted accordingly, it was found that boys' concerns about their own appearance are a predictor of problematic social media usage. Despite the higher level of SAA among girls, no results have been obtained at a level of addiction in social media usage (Boursier Gioia and Griffiths, 2020). In the study conducted by Gilik (2016), a positive correlation between internet addiction and SAA was noted. Isik (2019) revealed in his study that a positive correlation was observed between adults' social media usage, social appearance anxiety, and their eating attitudes. In the study of Kocaman and Kazan (2021), specifically Instagram addiction was examined, and a significant positive relationship was observed between high school students' Instagram addictions and SAA. Dikmen (2019), on the other hand, revealed in his research that internet addiction scores increased proportionally with the scores taken from the SAA scale. Altındis et al. (2017) found out in their study on social media networks and social appearance anxiety that youngsters who use social media are concerned about their social appearance. In Fidan's (2021) study, it was seen that SAA explained 65% of the total variance related to SMA.

Değirmenci's (2020) research among women using social media revealed that mood, appearance perception, and the effect social media has on their daily lives show a meaningful difference in how they feel about their SAA when they receive fewer likes. In the study of Şengönül and Aydın (2023), a significant difference was found between the SAA of young adults as well as the frequency of social media usage and the number of hours they spend on social media. In the study of Deng and Jiang (2023), it was concluded that influencer women who use social media have significantly higher social appearance anxiety than women who use social media less. In Eser's (2023) study, the relationship between social media use, social appearance anxiety, and social comparison variables in adolescents was examined, and a significant positive relationship was found between the participants' social media use and social appearance anxiety. In all the studies conducted on SMA and SAA, it has been seen that the two variables are related to each other or predict each other. There were no studies inconsistent with the research findings on social media addiction and social appearance anxiety. As a result, it is observed that SMA enhances SAA in adolescents and that there is a significant relationship between SAA and SMA, proving that it poses a risk to adolescents' mental health (Caner, Sezer Efe, & Başdaş, 2020; Çetinkaya, 2021).

When the literature is examined, it can be seen that there is no study between SMA and social desirability. As similar variables, it has been observed that studies were conducted between internet addiction and the need for social approval. In the study conducted by Hacıbayramoğlu (2021), it was seen that there are positive and significant relationships between internet addiction and the need for social approval. In the study of Aydoğmuş and Demir (2018), it was also found that there is a significant relationship between the need for social approval and problematic Internet usage. Examining the Social Desirability Scale Variables, statements such as "I go all lengths to get more likes on social media". "It's important to me to have people like my social media shares." "I

become happier as I share posts on social media." leap out. For this reason, it can be considered that adolescents who have a high level of social desirability use both social media and the Internet problematically.

## Conclusion

It was found that social media addiction does not differ by gender. Social desirability does not differ significantly by gender. Social desirability and social appearance anxiety significantly predict social media addiction.

## Recommendations

In the study, it was revealed that SMA is highly associated with SAA and social desirability. It may be appropriate for psychological counselors in schools to provide trainings and seminars on adolescents' body perceptions, as well as conduct activities and informative studies on the problematic use of social media and the Internet. Since it is seen that SMA has not been studied with the social desirability variable, the relationship between the two variables can be examined by conducting different studies on this subject. Other variables that predict SMA should also be investigated. Considering that this study was conducted using quantitative measurement tools, the effect of the study can be tested by conducting qualitative interviews with adolescents who have SMA. Due to the study being conducted on high school students, the results can be examined by working with different sample groups (primary school, secondary school, and university students).

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## Author (s) Contribution Rate

The 1st author contributed 50 percent, the second author 30 percent, and the third author 20 percent.

## Conflicts of Interest

There is no conflict of interest.

## Ethical Approval

The study was conducted by obtaining the Approval of the Ethics Committee (decision No. 64548 dated 29/09/2022) from the Artvin Coruh University Scientific Research and Publication Ethics Committee in the Field of Artvin Coruh University Rectorate.

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# Metaverse Risk Perceptions of Gifted Students

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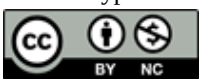

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# Metaverse Risk Perceptions of Gifted Students

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## Abstract

This research aims to examine the views of gifted secondary school students about the metaverse and their risk perceptions toward the digital environment. In this context, the study group, consisting of 55 gifted students, was determined through purposive sampling. A survey was used to collect participants' views on the metaverse, and the "Virtual World Risk Perception Scale" was used to measure the risks they felt in digital environments. A mixed-methods approach was used in this research. Content analysis was used in the qualitative data analysis, and the ANOVA test and t-test were used in the quantitative data analysis. The findings obtained in the analysis showed that students defined the metaverse as a virtual universe, virtual reality, commerce, and socializing place. It was seen that the place where they met this concept was social media. While the students stated that the use of the metaverse in education could have advantages, such as motivation, a fun learning experience, and a contribution to personal development, they also mentioned disadvantages, such as health problems, addiction, safety, ethics, and disconnection from real life. Virtual-world risk perceptions did not differ according to gender or class level. Students who did not have metaverse experience stated that the digital environment had a higher risk of corruption compared to those with experience.

**Keywords:** Education, Gifted and talented, Metaverse, Risk perception

## Introduction

Today's students have different characteristics from the past, and education methods and techniques have also changed. However, the 21st-century education environment is still similar to the environment that has been present since the early ages. Despite these changing conditions, new and effective approaches to education are needed instead of creating education programs with a traditional understanding.

Gifted students, who are known to be few in the general student population, have similar needs to their normal, developing peers. On the other hand, they have different educational needs arising from differences in abilities and interests. Gifted students need to structure the environments where their intellectual peers are present to enrich the program, differentiate it, group it, and include high-level thinking skills in the process (Emir, 2021).

Due to the educational needs of gifted individuals, there is a need for differentiation in education programs. The use of technology is a strategy that helps gifted students access the basic knowledge and standards of the field in their education programs. Online learning opportunities are crucial to meeting the needs of gifted students for depth and complexity in education. With online learning, a homogeneous grouping of gifted individuals can be achieved. Thus, the social relations of the students are also positively affected. On the other hand, gifted students need individualization. At this point, online learning provides students with the opportunity to work independently according to their own abilities and supports them to be autonomous learners (Potts, 2019; VanTassel-Baska, 1994).

Within the scope of technology integration in the metaverse environment, which has been the subject of curiosity recently, "Can the metaverse environment provide a new educational field for gifted students?" raises the question. The metaverse is a surreal universe that brings together physical reality and digital reality and has access to more than one person (Mystakidis, 2022). In the metaverse environment, education is expected to differentiate the environment and the teaching method, process, and product.
Traditional educational environments have some limitations. These are low self-perception, loss of attention in long meetings, students remaining passive in the learning process, and students' transfer of emotions being limited (Mystakidis, 2022).

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It is expected that the development and use of metaverse-based education models will reduce the limitations of two-dimensional platforms in education. Using three-dimensional software and computers supports students' abstract and complex thinking. At the same time, it will provide an active learning experience as the student will personally take part in the process (Mystakidis, 2022; Potts, 2019).

The virtual learning experience has an impact on individuals of all ages, starting in the pre-school period. Students are highly vulnerable to anticipated or unpredictable risks. The inclusion of the new metaverse in education, which is still in its formation stage, has some risks. It includes risks, advantages, and disadvantages (Arslankara and Usta, 2018; 2020). It is very worthwhile to discuss the risks of metaverse-based education beforehand. In this context, the advantages of metaverse-based education are given in Table 1.

Table 1. Advantages of metaverse-based education

- Eliminates traditional education limitations (Mystakidis, 2022).
- Provides active and collaborative learning experience (Diaz et al., 2020; Kye et al., 2021; Mystakidis, 2022).
- It provides a democratic atmosphere in education (Mystakidis, 2022).
- Eliminates geographical restrictions (Mystakidis, 2022).
- Participation in education opportunities can be provided on equal terms worldwide (Mystakidis, 2022).
- Provides the freedom to produce and share (Kye et al., 2021).
- New social communication and interaction space (Collins, 2008; Kye et al., 2021; Schlemmer & Backes, 2015).
- For rehearsal and implementation of activities with a high risk of failure and serious consequences (Bailenson, 2018).
- Develops abstract and complex thinking skills (Templeton & Kessinger, 2020).
- Scientific thinking skills are developed (MacCallum & Parsons, 2019).
- Provides a learning experience by increasing motivation (Tlili et al., 2022).

Although metaverse-based education offers opportunities for the educational environment and students, it can also contain potential threats. Understanding these threats is crucial in terms of determining the measures to be taken against negativity in the future. Possible threats of metaverse-based education are weaker social communication, violations of privacy, committing cybercrimes, harming identity development, and an inability to adapt to the real world (Kye et al., 2021).

Regarding these risks, educators and all stakeholders have a primary responsibility. The educators of the gifted should provide professional development within the scope of technology integration and should search for technological opportunities in education (VanTassel-Baska, 1994). To prevent the abuse of the metaverse, which is expected to be the educational environment of the future, some preventive studies should be conducted (Table 2).

Table 2. Measures to be taken against the risks of metaverse-based educational environments

- To transfer the augmented reality experience of teachers to education, technical support should be provided and appropriate vocational training should be provided (MacCallum & Parsons, 2019; Talan & Kalınkara, 2022; Tlili et al., 2022).
- To transfer the augmented reality experience of teachers to education, technical support should be provided and appropriate vocational training should be provided (Kye et al., 2021).
- Teachers should design their classrooms in collaboration with students to develop students' problem-solving skills and enable them to produce unique projects (Kye et al., 2021; Tlili et al., 2022).
- Platforms should be created to prevent misuse of data by students and improved security measures should be taken (Kye et al., 2021; Hovan George et al., 2021; Wisnu Buana, 2023).
- Metaverse-based education should be designed in an accessible and inclusive way for all students (Tlili et al., 2022).

When the literature is examined, some research with metaverse and educational content has been conducted. Since the metaverse is a developing environment in education, literature reviews are more common than experimental studies (Akpınar & Akyıldız, 2022; Alkan & Polat, 2022; Altunal, 2022; Göçen, 2022; Gülen, Dönmez, & İdin, 2022; Sarıtaş & Topraklıkoğlu, 2022; Tlili et al. 2022). A few surveys and experimental studies

are available. A few of them are as follows: MacCallum and Parsons (2019) examined teachers' attitudes towards this environment; Gündüz et al. (2022), on the other hand, focused on university students' perceptions of crypto art; and Özdemir et al. (2022) also investigated university students' views on the metaverse.
Quantitative studies on the metaverse and education are mostly conducted on university students and teachers. However, to our knowledge, no metaverse studies have been found for pre-higher education and gifted students. This research aims to examine the views of gifted secondary school students about the metaverse and their risk perceptions toward the virtual environment. In line with this main purpose, answers to the following questions were sought:

1. What are the opinions of gifted students about the metaverse?
2. Does the virtual world risk perception of gifted students differ in terms of gender and class level?
3. Does the virtual world risk perception of gifted students differ significantly according to their metaverse experiences?

The metaverse platform can be used to develop gifted education or to create new programs, thereby diversifying opportunities for gifted students. This study is crucial to understand the metaverse perceptions of gifted students and the risks they contain and to offer precautions and future solutions for these risks. In addition, this study aims to raise awareness about the metaverse in education and contribute to all education stakeholders.

## Method

### Research Model

The mixed method, which used quantitative and qualitative data collection techniques, was used in this research. The mixed method is the method in which the researcher adopts a quantitative and qualitative approach, collects and analyzes data, brings together the findings, and makes inferences about the future (Tashakkori & Creswell, 2007). The main reason for choosing the mixed method in the current research was to provide a more detailed and comprehensive understanding of the views and risk perceptions of gifted individuals regarding the metaverse than the information obtained through qualitative or quantitative methods alone (Creswell, 2008).

### Study Group

The study group for this research was formed by the purposive sampling technique. For in-depth information, students interested in technology who were willing to participate in this study were included (Büyüköztürk et al., 2016; Clark & Bryman, 2019), and 55 gifted secondary school students studying at a Science and Art Center in Istanbul in the 2022-2023 academic year were included in this study. Students were coded as S1, S2,..., S54, and S55 (Table 3).

Table 3. Descriptive Analysis Results of Students' Personal Information

| Variables | | f | % |
|---|---|---|---|
| Gender | Female | 23 | 41,82 |
| | Male | 32 | 58,18 |
| | Total | 55 | 100 |
| Grade Level | 6 | 20 | 36,37 |
| | 7 | 35 | 63,63 |
| | Total | 55 | 100 |

As shown in Table 3, 55 students participated in this study; 58.18% of the students were male (N= 32) and 41.82% were female (N= 23). 63.63% of the students were in the 7th grade (N= 35), and 36.37% of them were in the 6th grade.

### Data Collection and Analysis

In this study, an opinion survey on metaverse and metaverse-based education prepared by researchers was used to collect qualitative data. The survey consisted of two parts. In the first part, there were questions to reach demographic information, while in the second part, open-ended questions were included.

In addition, the adaptation of the "Virtual World Risk Perception Scale" (VWRPS) developed for high school students by Arslankara and Usta (2018) to the secondary school level was used to obtain quantitative data. VWRPS is a valid and reliable five-point Likert scale comprising 26 items and five sub-dimensions. The scale, adapted to the secondary school level, has 23 items. The names of these sub-dimensions are *virtual corruption,*

*virtual opportunity*, *virtual awareness*, *virtual depreciation*, and *virtual possibility*. The reliability coefficient of the scale was Cronbach's α= 0.87

Inductive content analysis of qualitative data was performed. Inductive content analysis is a technique used to reveal the relationships between themes and concepts by examining qualitative data using a coding method. In this process, there are stages, such as coding, creating a theme, establishing a code and theme relationship, and interpreting the findings (Yıldırım and Şimşek, 2016, p. 243).

To increase the validity and reliability of this research, expert opinions were obtained from two informatics and technology teachers for readability and intelligibility. For the same purpose, measures such as data collection and analysis, the criteria for choosing the method used and the adoption of the purposive sampling method, the voluntary participation of students, and direct quotations were taken (Yıldırım & Şimşek, 2016).

In the quantitative data analysis, the assumption of normality was tested first. The normality assumption is the basic statistical assumption required for the application of parametric tests (Thode, 2002). The Kolmogorov-Smirnov values, skewness, and kurtosis coefficients of the obtained data are given in Table 4.

Table 4. Normality tests for scores obtained from the VWRP scale

| Scale | x̄ | SD | Median | Kolmogorov-Smirnov | Skewness | Kurtosis |
|---|---|---|---|---|---|---|
| VWRP | 64.127 | 9.81 | 65 | .200 | .143 | -.233 |

VWRPS: Virtual World Risk Perception Scale

In Table 4, it was seen that the Kolmogorov-Smirnov value for the points students obtained from the VWRP scale was greater than .05 and that the skewness and kurtosis values were in the range of -1 to +1, which showed a normal distribution. In the analysis of the data obtained, it was decided to perform a dependent sample t-test and a one-way analysis of variance (ANOVA). Data collected to determine the risk perception levels of gifted secondary school students regarding the virtual world were analyzed with SPSS 26.00. The significance level was determined as .05.

## Results

### Findings on Qualitative Data

In this section, themes suitable for the survey questions were created, and codes were assigned to the answers given. Some of the answers were located under more than one code (Table 5).

Table 5. Distribution by Theme and Categories

| Theme | Categories |
|---|---|
| Information about the metaverse | Information type |
| | Other |
| Concept knowledge about the metaverse | Concept |
| Source of information about the metaverse | Not previously aware |
| | Environment |
| | Media |
| Metaverse experience | There is experience |
| | There is some experience |
| | No experience |
| Metaverse and education | Education |
| | Entertainment |
| | Other |
| Metaverse in education and the development of abilities | Technology |
| | The approach to education |
| | Personal development |
| | Other |
| Is metaverse-based education superior to traditional education? | Superior |
| | I do not know |
| | Not superior |
| Risks of metaverse-based education | Advantages |
| | Disadvantages |

Table 6. Findings related to students' knowledge about the metaverse

| Categories | Code | Participant code | N | Sample expressions |
|---|---|---|---|---|
| Information type | Virtual world/universe | S5, S15, S18, S19, S29, S31, S34, S40, S41, S46, S48, S50, S54, S55 | 14 | *S55: The metaverse is a universe in the virtual world.* |
| | Virtual Reality | S6, S8, S9, S11, S14, S23, S25, S35, S37, S39, S49, S53 | 12 | *S35: I know there is an online virtual reality platform.* |
| | Crypto | S3, S7, S17, S30, S47, S52 | 6 | *S52: NFTs is a platform where you can buy plots or items with virtual coins of our characters that others can see.* |
| | Existing program to socialize or meet with an avatar | S16, S42, S43, S45 | 4 | *S42: In a virtual universe, we can edit our avatar and access or share content, such as entertainment, business, or advertising.* |
| | The new technological world | S13, S26, S28 | 3 | *S28: The technology world was created with artificial intelligence.* |
| Other | No idea | S1, S2, S4, S10, S12, S20, S21, S22, S24, S27, S32, S33, S36, S38, S44, S51 | 16 | |

In Table 6, the categories and codes for the students' opinions under the theme of "metaverse knowledge" are given. While 16 of the students stated that they did not have any knowledge about the metaverse, it was seen that 39 students have different types of knowledge about the metaverse. When the information about the metaverse was examined, it was seen that 14 students define the virtual world/universe, 12 students define virtual reality, six students define crypto money and trading, four students define the metaverse platform as a place where avatars are created and socialized, meetings are held, and three students describe it as the new technological world

Table 7. Findings related to students' conceptual knowledge about the metaverse

| Categories | Code | N | % |
|---|---|---|---|
| Concept | AR-Augmented Reality | 34 | 61,8 |
| | XR-Extended reality | 8 | 14,5 |
| | NFT-Non-fungible token | 25 | 45.5 |
| | VR-Virtual Reality | 51 | 92,7 |
| | 3D- Three-dimensional | 52 | 94,5 |
| | Blockchain | 11 | 20 |
| | Crypto | 36 | 65,5 |
| | Horizon Worlds | 5 | 9,1 |

In Table 7, the answers given to the students who were asked to choose whether they knew the concepts related to the metaverse were examined. While almost all of the students stated that 94.5% knew the concept of 3D-three dimensions (N= 52) and 92.7% (N= 51) of VR-virtual reality, the least known concepts were Horizon Worlds 9.1% (N= 5) and XR-extended reality 14.5% (N= 8).

Table 8. Findings on the source of students' knowledge about the metaverse

| Categories | Code | N |
|---|---|---|
| Other | No idea | 4 |
| Environment | Family | 10 |
| | Friends | 16 |
| | School | 5 |
| Media | Social media | 38 |
| | TV | 26 |

Table 8 shows the students' statements about the sources from which they obtained information about the metaverse. There were expressions that entered more than one code in the students' answers. It was observed that most answers obtained information about the metaverse using social media (N= 38). It was seen that the place where the source of information about the metaverse was the least was school (N=5). Under the other theme, it was seen that four students stated that they had no knowledge of the metaverse before.

Table 9. Findings on students' metaverse experiences

| Categories | Code | Participant code | N | Sample expressions |
|---|---|---|---|---|
| No experience | There is no experience | S1, S2, S6, S9, S10, S11, S12, S13, S15, S17, S19, S20, S21, S22, S23, S24, S25, S29, S30, S32, S33, S34, S35, S36, S37, S39, S40, S41, S43, S44, S45, S48, S49, S51, S53 | 35 | *S35: In general, I have never been to an online virtual reality platform.* |
| There is experience | There is some experience | S4, S14, S31, S42 | 4 | *S14: I tried to do some things, but without success.* |
| | Crypto | S3, S7 | 2 | *S7: I created a crypto wallet and made a game on the site called Sandbox (1 Ethereum coin per hour for 100 active players), and I got 1.24 Ethereum coins. I bought NFT with it.* |
| | VR-Virtual glasses experience | S5, S28, S38, S54, S55 | 5 | *S55: I used virtual reality glasses.* |
| | Entertainment-Chat | S16, S18 | 2 | *S16: I played VRCHAT.* |
| | Entertainment-Game | S8, S26, S27, S46, S47, S50, S52 | 7 | *S46: If its experience as a metaverse counts, there is Roblox. I've been playing games about the metaverse for a while.* |

In Table 9, there are answers about the students' experiences with the metaverse. Thirty-five of the students stated that they did not have any experience, and 23 of the students stated that they had metaverse experience. Under the category of "Have Experience" it was seen that the students had the most experience with the game (N=7). It was stated that five of the students had experience with virtual glasses, two with crypto money, and two with chatting.

Table 10. Findings related to students' views on the metaverse and education

| Categories | Code | Participant code | N | Sample expressions |
|---|---|---|---|---|
| Education | Training with virtual reality glasses | S5, S9, S37, S39, S48 | 5 | *S37: For example, teachers will ask you questions and teach you virtually. You can see with virtual reality glasses, ask questions, and take lessons in virtual reality with avatars of famous scientists.* |
| | Education in augmented reality | S7, S8, S17, S23, S34, S35, S42 | 7 | *S35: Schools are digitally real in the metaverse. And, in this way, students with certain ailments are prevented from falling behind in education. Just like on the Zoom platform, when everyone turns their heads, they will see and maybe touch each other.* |
| | Virtual class | S3, S6, S11, S14, S15, S16, S17, S19, S25, S29, S30, S31, S32, S35, S36, S42, S45, S53, S55 | 19 | *S31: Virtual education opportunity* |
| Entertainment | Playing games | S17, S18, S25, S26, S54 | 5 | *S18: Minecraft education, Roblox Studio and Sandbox come to mind.* |
| Other | Education-oriented answers only | S1, S4, S10, S12, S13, S24, S27, S40, S41, S43, S50 | 11 | *S40: Internet training* |
| | Crypto | S2, S3, S54 | 3 | *S2: Virtual currencies, such as bitcoin.* |
| | No idea | S20, S21, S22, S28, S33, S38, S44, S46, S47, S49, S51, S52 | 12 | |

Table 10: Students' ideas about the metaverse and education, education, entertainment, and other categories are discussed. In the education category, the answers of 19 students were given under the virtual classroom, seven students were given augmented reality education, and five students were given the education code with virtual reality glasses. The opinions of five students fell under the categories of entertainment and playing games. In the last category, under the other heading, 12 people did not have an opinion, 11 people gave only education-oriented answers, and the opinions of three students were included under the crypto code.

Table 11. Findings regarding the effects of metaverse use in education on ability development

| Categories | Code | Participant code | N | Sample expressions |
|---|---|---|---|---|
| Technology | Use of computers | S1, S8, S13, S14, S15, S19, S41, S46 | 8 | *S41: Uses technological devices more easily. Can make new devices* |
| | Software | S3, S6, S16, S19, S24, S32, S36 | 7 | *S6: Adaptation to virtual reality, software knowledge.* |
| | Virtual reality/ learning in a digital environment | S2, S6, S9, S11, S31, S55 | 6 | *S2: It can better enhance the virtual environment.* |
| Personal development | Self-expression | S4, S35, S47 | 3 | *S35: On this platform, if there are social areas and workshops, students can participate in the activities here.* |
| | Visual perception and creativity | S3, S5, S17, S28, S48, S49, S50, S54 | 8 | *S48: There can be a great improvement in creativity.* |

| | | | | |
|---|---|---|---|---|
| | Virtual Experience | S7, S10, S13, S16, S17, S35 | 6 | *S7: It allows a medical student to experience surgeries virtually, and this gives experience.* |
| The approach to education | Love for education | S26, S27, S29, S40, S45 | 5 | *S26: Most likely, a lot of students would start to like the course or school because the metaverse is a separate world, and a lot of my peers, including myself, like technology, so they would like education more.* |
| Other | No idea | S12, S18, S20, S21, S22, S23, S25, S30, S33, S34, S37, S38, S39, S42, S43, S44, S51, S52, S53 | 19 | |

In Table 11, the answers about which skills can be developed with the use of the metaverse are technology, personal development, approach to education, and other categories. In the answers given under the technology category, the students' opinions were gathered under the codes of computer use (N= 8), software (N= 7), virtual reality, and learning in a digital environment (N= 6). Under the personal development category, students' opinions were included under the codes of self-expression (N= 3), visual perception and creativity (N= 8) and virtual experience (N= 6). Under the category of approach to education, the code of love for education was included (N= 5). In the other category, opinions were given with the code "I have no idea" (N= 19).

Table 12. Opinions on the comparison of metaverse-based education and traditional education

| Categories | Code | Participant code | N | Sample expressions |
|---|---|---|---|---|
| Superior | Entertaining | S3, S16, S17, S18 | 4 | *S16: Yes, there is no need to buy a book; it can be continued even if there are health problems. It would be a more fun and motivating system for students. Lessons would be easier to understand.* |
| | No reason | S10, S20, S34, S42 | 4 | *S10: It is superior, but the reason is uncertain.* |
| | Learning becomes easier because of an interest in technology | S6, S13, S15, S24, S26, S40, S41, S48 | 8 | *S24: It is superior because it will benefit present and future generations as it is closer to artificial intelligence.* |
| | It is not limited or compelling. | S1, S3, S5, S16, S27, S28, S31 | 7 | *S3: In my opinion, education is superior to the metaverse. Because the lessons will be more fun for the children as they are processed on the computer. The metaverse is not limited like a book.* |
| | Virtual experience opportunity | S7, S46 | 2 | *S7: The metaverse is superior, in my opinion. Students can benefit from the opportunity to experience it in a virtual environment.* |
| | It prevents the spread of diseases | S14, S17 | 2 | *S14: Yes. Because it is not done in a public area, it prevents negativity, such as infectious diseases.* |
| Not superior | Lack of face-to-face interaction | S4, S19, S36 | 3 | *S4: No, it's not superior. Because it is more important for children to explain themselves to the other person.* |
| | Traditional education is more effective | S9, S29, S30, S33, S35, S38, S39, S43, S45, S50, S53, S54 | 12 | *S45: I think not. Because school is more useful.* |

| | | | | |
|---|---|---|---|---|
| | Cause health problems | S8, S23, S32, S55 | 4 | *S8: No. 1st graders from Teams or Zoom couldn't even learn how to write, so overall, it's bad. Affects many people, such as impaired eyesight or an inability to learn.* |
| | Failure of students to adapt | S11, S25, S47, S49 | 4 | *S49: No because it can be more expensive; not everyone has the metaverse.* |
| | Equal value | S2, S21 | 2 | *S2: Equal* |
| Other | No idea | S12, S22, S37, S44, S51, S52 | 6 | |

The answers of the students about whether metaverse-based education was superior to traditional education are presented in Table 12. To the answers given under the category of "superior," easy learning (N= 8), not limited and challenging (N= 7), entertaining (N= 4), no reason (N= 4), virtual experience opportunity (N= 2), and disease prevention (N= 2) codes were located below. The answers given under the "not superior" category were that traditional education is more effective (N= 12), there is no face-to-face interaction (N= 3), it causes health problems (N= 4), students' inability to adapt (N= 4), and it has equal value. It was coded as (N= 2). The answers of six students were given under the code “I have no idea.

Table 13. Student views on the advantages of metaverse-based education

| Categories | Code | Participant code | N | Sample expressions |
|---|---|---|---|---|
| Experience and learning | It contributes to education/provides motivation | S1, S5, S8, S17, S26, S34, S36, S37, S40, S42 | 10 | *S5: People will understand more clearly because they see something more concrete.* |
| | Virtual Experience | S3, S6, S7, S10, S11, S25, S32, S35, S39, S48 | 10 | *S6: Students learn more about VR.* |
| | Contribution to personal and professional development | S4, S13, S24, S34 | 4 | *S4: Students learn to express themselves.* |
| | Entertaining learning experience | S28, S36, S40, S43 | 4 | *S40: Children learn more with pleasure.* |
| Access | Convenient and easy access to information | S7, S9, S14, S27, S28, S29, S31, S35, S39, S42, S45, S47, S48, S53, S54, S55 | 16 | *S7: The strength of this training is that it will be as close as a spectacle. It will enable us to gain experience by experiencing a situation virtually.* |
| | Less cost | S4, S15, S16, S45 | 4 | *S45: Students whose school is far away and do not have a car or cannot go by bus can easily receive an education.* |
| Productivity | Being productive | S34, S41, S54 | 3 | *S34: Provides the opportunity to learn languages. It allows users to create their own content.* |
| Other | No idea | S2, S12, S18, S19, S20, S21, S22, S23, S33, S44, S46, S49, S50, S51, S52 | 15 | |
| | No advantage | S30, S38 | 2 | |

Table 13 presents the answers of the students regarding the advantages of metaverse-based education. . The theme of the advantages of metaverse-based education included experience and learning, access, productivity, and other categories. Under the experience and learning category, there were student opinions with the codes of contribution to education and motivation (N= 10), virtual experience (N= 10), contribution to personal and

professional development (N= 4), and entertaining learning experience (N= 4). Under the access category, student answers were included under the codes of convenient and easy access to information (N= 16) and less cost (N= 4). The answers of three students in the productivity category were included under the code of being productive. The answers in the other category are "I have no idea" (N= 15) and "no advantage" (N= 2).

Table 14. Student views on the disadvantages of metaverse-based education

| Categories | Code | Participant code | F | Sample expressions |
|---|---|---|---|---|
| Health issue | Eye and physical illnesses | S3, S4, S8, S9, S15, S19, S26, S30, S34, S42, S54 | 11 | *S8: Fatigue from constantly staring at the computer* |
| | Addiction | S3, S10, S27, S30, S32, S54 | 6 | *S54: People can be addicted to the metaverse this time, too.* |
| | Inability to focus | S23, S42, S55 | 3 | *S42: Just like with Zoom, students may not be able to give their full attention.* |
| Security and ethics | Hackable | S5, S7, S16, S35, S36, S39, S40, S47, S55 | 9 | *S7: If there is no blockchain protection in Metaverse, Metaverse can be hacked. Education can be sabotaged.* |
| | Lesson sabotage | S7, S9, S15, S17, S19, S25, S29, S45 | 8 | *S25: Since this is a public platform, there will be people other than students; these people can cheat or bully because of their bad intentions because this platform is an international platform, and I don't think teachers can control it.* |
| | Cybercrimes increase | S14, S17, S23, S25, S31, S35, S36 | 7 | *S14: Crimes, such as cyberbullying, may increase.* |
| | Students make copies | S16, S47 | 2 | *S16: There may be problems, such as cheating in exams. It is more efficient to switch to physical space in exams.* |
| Educational difficulties | Difficulty of traditional education | S6, S10, S16, S27, S29, S37, S53 | 7 | *S6: It may be difficult to do things in traditional ways as they may spend time with too much technology.* |
| In terms of social-emotional | Disconnected from real life | S6, S11, S37, S41, S48 | 5 | *S6: Individuals can be cut off from real life.* |
| | Solitude and socialization problem | S4, S31, S36, S41, S50, S54 | 6 | *S41: In these periods, we already spend most of our time on the internet; if education is like this, our human relations and our connection with real life can be broken.* |
| Other | There is no disadvantage | S1, S2, S13, S18, S28, S43, S46 | 7 | *S2: There is no* |
| | No idea | S12, S20, S21, S22, S24, S33, S38, S44, S49, S51, S52 | 11 | |

In Table 14, students' views on the disadvantages of the metaverse-based education environment are given. Under the category of health issues, eye and physical health illnesses (N= 11), addiction (N= 6), inability to focus (N= 3) codes and student opinions were present. Under the category of security and ethical, hackable (N= 9), lesson sabotage (N= 8), cybercrime increase (N= 7), and students make copies (N= 2) opinions were provided. Under the category of educational difficulties, the difficulty of traditional education (N= 7) was expressed. The views under the category of social-emotional problems were disconnection from real life (N= 5) and socialization problem-solitude (N= 6). Under the other category, there was no disadvantage (N= 7) and an "I have no idea" (N= 11) code.

**Findings on Quantitative Data**

The descriptive analysis of the scores of the students participating in the present study on the VWRP scale and its sub-dimensions is given in Table 15.

Table 15. Descriptive analysis results of the study group regarding the distribution of VWRP scale and sub-dimensions

| | N | $\bar{x}$ | SD |
|---|---|---|---|
| VWRP | 55 | 64.127 | 9.81 |
| Virtual depreciation | 55 | 9.56 | 4.12 |
| Virtual corruption | 55 | 13.41 | 4.46 |
| Virtual possibility | 55 | 9.76 | 3.11 |
| Virtual awareness | 55 | 14.29 | 2.48 |
| Virtual opportunity | 55 | 17.09 | 2.50 |

As shown in Table 15, the average scores obtained from the Virtual World Risk Perception scale of the students were $\bar{x}$= 64.12 and the standard deviation SD= 9.81. The mean and standard deviation values according to the sub-dimensions of the scale were: virtual depreciation $\bar{x}$= 9.56 SD= 4.12; virtual corruption $\bar{x}$= 13.41 SD= 4.46; virtual possibility $\bar{x}$= 9.76 SD= 3.11; virtual awareness $\bar{x}$= 14.29 SD= 2.48; and virtual opportunity $\bar{x}$= 17.09 SD= 2.50.

Table 16. T-test results of the VWRP scale and sub-dimension scores by gender of the study group

| | Variables | N | $\bar{x}$ | SD | df | t | p |
|---|---|---|---|---|---|---|---|
| VWRP | Female | 23 | 61.52 | 4.88 | 53 | -1.698 | .095 |
| | Male | 32 | 66.00 | 4.21 | | | |
| Virtual depreciation | Female | 23 | 9.73 | 4.75 | 53 | .265 | .792 |
| | Male | 32 | 9.43 | 3.68 | | | |
| Virtual corruption | Female | 23 | 13.39 | 4.88 | 53 | -.037 | .970 |
| | Male | 32 | 13.43 | 4.21 | | | |
| Virtual possibility | Female | 23 | 8.69 | 3.09 | 53 | -2.234 | **.030*** |
| | Male | 32 | 10.53 | 2.94 | | | |
| Virtual awareness | Female | 23 | 13.17 | 2.56 | 53 | -3.034 | **.004*** |
| | Male | 32 | 15.09 | 2.11 | | | |
| Virtual opportunity | Female | 23 | 16.52 | 2.19 | 53 | -1.443 | .155 |
| | Male | 32 | 17.50 | 2.66 | | | |

To analyze the difference between the virtual world risk perceptions and sub-dimension scores of male and female students included in this study in Table 16, an independent sample t-test was conducted. According to the analysis results, while there was no significant difference between the virtual world risk perception total score and virtual depreciation, virtual corruption, and virtual opportunity sub-dimension scores of female and male students ($p>.05$, Table 13), there was a significant difference in virtual possibility and virtual awareness scores according to gender ($p<.05$, Table 13). When the virtual possibility scores of female students ($\bar{x}_{female}$= 8.69) compared to those of male students ($\bar{x}_{male}$= 10.53), it was also seen that the virtual awareness scores of female students ($\bar{x}_{female}$= 13.17) were lower than those of male students ($\bar{x}_{male}$= 15.09).

Table 17. T-test results of VWRP scale scores by 6th and 7th grade students in the study group

| | Variables | N | $\bar{x}$ | SD | df | t | p |
|---|---|---|---|---|---|---|---|
| VWRP | 6th grade | 20 | 67.00 | 9.23 | 53 | 1.667 | .101 |
| | 7th grade | 35 | 62.48 | 9.88 | | | |

As shown in Table 17, an independent sample t-test was conducted to analyze the difference between the 6th and 7th-grade students' virtual world risk perception scores. No significant difference was found in the virtual world risk perception of 6th and 7th grade students ($p>.05$, Table 17).

ANOVA results, which were conducted to determine whether students' risk perceptions differ significantly according to their metaverse experiences, are given in Table 18 below.

Table 18. ANOVA results of VWRP scale scores according to the metaverse experience of the study group

| | Variance Source | Sum of Squares | df | Mean of squares | F | p | Significant difference |
|---|---|---|---|---|---|---|---|
| VWRP | between groups | 473.00 | 2 | 236.500 | 1.720 | .189 | |
| | within groups | 7287.839 | 53 | 137.506 | | | |
| | Total | 7760.839 | 55 | | | | |
| Virtual depreciation | between groups | 49.347 | 2 | 24.673 | 1.478 | .238 | |
| | within groups | 868,180 | 52 | 16,696 | | | |
| | Total | 917,527 | 54 | | | | |
| Virtual corruption | between groups | 157.5 | 2 | 78.772 | 4.453 | **.016*** | No experience > There is experience |
| | within groups | 919.83 | 52 | 17.689 | | | |
| | Total | 1077.382 | 54 | | | | |
| Virtual possibility | between groups | 23,60 | 2 | 11,803 | 1,227 | ,302 | |
| | within groups | 500,32 | 52 | 9,622 | | | |
| | Total | 523,927 | 54 | | | | |
| Virtual awareness | between groups | 33.37 | 2 | 16.68 | 2.893 | .064 | |
| | within groups | 299.97 | 52 | 5.76 | | | |
| | Total | 333.345 | 54 | | | | |
| Virtual opportunity | between groups | .065 | 2 | .033 | .005 | .995 | |
| | within groups | 338.480 | 52 | 6.509 | | | |
| | Total | 338.545 | 54 | | | | |

***p<.05**

As can be seen in Table 18, the result of the ANOVA analysis did not show a significant difference in students' risk perceptions according to their metaverse experiences. (F= 1.720, p>.05). The students' virtual corruption sub-dimension scores differed significantly according to their metaverse experiences (F= 4.453, p<.05). According to the results of the LCD post hoc multiple comparison analysis, it was seen that the virtual corruption mean score of the students without metaverse experience ($\bar{x}_{noexperienced}$= 14.60) was statistically significantly higher than the virtual corruption mean score of the students with experience ($\bar{x}_{experienced}$= 10.81).

## Discussion, Conclusion and Recommendations

In this study, the views and perceptions of virtual risk regarding the use of the metaverse in the education of gifted individuals were discussed. The data collected from the students was analyzed, and the results were given in light of the findings.

In the present research, firstly, the following question was asked: *"What do you know about the Metaverse?"* Most of the students stated that they did not know about the metaverse. Other students defined the metaverse as a virtual universe, virtual reality, crypto money, creating avatars and making meetings, and the new technological world. Similar statements are also included in the literature on the metaverse. Schlemmer and Backes (2015) expressed the metaverse environment as the place where interaction and communication are provided with the use of avatars in the 3D virtual world. In some studies, it is stated that students create avatars for communication, identify crypto money with metaverse platforms (Özdemir et al., 2022), and use virtual money on virtual platforms (Tlili et al., 2022).

Secondly, students were asked to express their knowledge of the concepts related to the metaverse. The findings showed that the students who said that they did not know about the metaverse in the previous question actually had knowledge about many concepts related to the metaverse. In particular, it was concluded that almost all of the students had knowledge about the concepts of virtual reality and its three dimensions. In studies, metaverse technology is defined as an environment where the concepts of the virtual world and augmented reality come together (Tlili et al., 2022). In addition, although the concept of the metaverse is just entering our lives, it is evident that most of the students are familiar with many concepts related to this platform.

*"What is the source of information about the Metaverse?"* In the answers to this question, it was seen that most students had knowledge about the metaverse through the media (e.g., TV and social media), and the number of students who met the metaverse through school is less. While the use of the metaverse in education is expected, it is not known to what extent schools and teachers are ready to dominate this process. The findings obtained in this study suggest that students can adopt this platform, which they experience with their own efforts and curiosity, as a new-generation education environment. Diaz (2020) is of the opinion that the use of the metaverse will provide an interesting and effective platform for students and teachers.

When the students' views on their experiences with the metaverse are examined, it is seen that most of them have no experience. This result is consistent with the result of the study conducted by Talan and Kalınkara (2022), which found that the majority of university students do not have metaverse experience. The fact that most students do not have sufficient experience is thought to be because this field is still developing. It has been concluded that students with experience generally have experience with games, chatting, virtual glasses, and crypto money. It is thought that the first contact with gifted students for entertainment will have an impact on their perceptions of metaverse-based education.

The expressions that come to mind when students talk about the metaverse and education are virtual classrooms, education in augmented reality, and education in virtual reality. According to Tsai (2022), teachers and students evaluate the metaverse only as a virtual classroom, augmented reality, and virtual reality, and this evaluation will lead to limited use of universe creativity. Some students stated that it would consist of educational games. Getchell et al. (2010) also discussed that the metaverse environment is an opportunity for game-based learning. Scientific metaverse applications can be included in the institutions where gifted students receive an education. In addition, it can be suggested that other components of the metaverse should be included in training programs to gain an immersive experience.

*"Which skills does the use of the metaverse in education improve in students?"* The answers to the question were computer usage, software knowledge, adaptation to virtual reality and the digital environment, obtaining virtual experience, self-expression, visual perception and creativity, personal development, and having a positive approach to education.

Students think that metaverse-based education is superior to traditional education because it is more entertaining, not limited and challenging, provides a virtual experience, and prevents infectious diseases. Some students consider traditional education superior due to the lack of face-to-face interaction in the metaverse, health problems (e.g., sight, obesity, and addiction), and students' inability to adapt to the metaverse environment. In the study conducted by Potts (2019), gifted students stated that the difference between traditional education and the virtual classroom is very small.
Students expressed the advantages of metaverse-based education as follows: contributing to education, increasing motivation, obtaining virtual experience, contributing to personal and professional development, having an enjoyable learning experience, having comfortable and easy access to information, having less cost, and contributing to the productivity of students. In the literature, the use of the metaverse is recommended to increase student motivation (Jeon & Jung, 2021), and it is emphasized that education, especially with the metaverse, will provide easy access to individuals without time, space, or financial restrictions (Tlili et al., 2022). In the Talan and Kalınkara (2022) study, there are similar statements regarding university students' views on the advantages of a metaverse in education.

The opinions of gifted students on the disadvantages of using the metaverse in education are as follows: health problems (eye diseases due to prolonged screen exposure, obesity or physical diseases, increased addictions, problems with attention and focus), security and ethics (hackability, sabotage of the lesson, increase in cybercrime and making copies of students), difficulty in traditional education, and social-emotional problems (disconnection of students from real life, socialization problem, feeling of loneliness). In the study conducted by Potts (2019), gifted students stated that their virtual classroom experiences limited interaction with both their classmates and teachers. In another study addressing similar disadvantages, university students stated that in addition to these disadvantages, there was also the problem of access and the inability to convey their thoughts correctly (Talan & Kalınkara, 2022).

To prevent these disadvantages and threats, the metaverse education platforms should be structured before they are put into practice, and the rules of the new universe should be created by considering the benefit and value of the participants. Professional development of teachers and all education stakeholders regarding the metaverse universe should be ensured before implementation in the education process.

The "virtual possibility" and "virtual awareness" sub-dimensions of gifted students show significant differences according to gender. According to this result, it is understood that female students have less "possibility" and awareness of the virtual environment. It shows that male students can benefit from the opportunities of virtual environments more than female students. In the study of Dönmez and Doğan (2020), it is stated that male students have higher perceptions of virtual opportunities than females. It was concluded that the risk perceptions of the students did not show a significant difference according to the grade level. This is thought to be because the age groups of the students are very close to each other.

It was concluded that the "virtual corruption" risk perceptions of gifted students differ significantly according to their experience of the metaverse environment. It is understood that the risk perceptions of "virtual corruption" are higher in the students who do not have metaverse experience compared to the students with experience. This means that students with experience with the metaverse universe perceive the risks, such as being deceived in the virtual environment and communicating with people they do not know.

On the metaverse platform, it is crucial to recognize the risks and identify the threats beforehand. Therefore, policymakers, educators, parents, and children should take precautions and offer forward-looking solutions.

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## Author (s) Contribution Rate

The authors contributed equally to the article.

## Conflicts of Interest

There are no conflicts of interest regarding the publication of this paper.

## Ethical Approval

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