



The Effect of Drama Method on Students' Problem-Solving Achievement and Attitude in Mathematics Education

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Innovative studies in the field of mathematics education, especially in recent years, have focused on problem solving, emphasizing that it is a process skill that should be addressed at every grade level and in every area of mathematics. The fact that many national and international exams try to evaluate students' problem-solving skills is an indication of this importance. Heavy emphasis is placed on problem solving with the aim of improving students' skills in transferring the knowledge they learn at school to daily life and producing alternative solutions to the problems they may encounter in different situations. One of the methods used to achieve this aim is the drama method. Drama method can enable students to encounter problem situations in classroom environments. Students who encounter problem situations in the classroom environment become active in the process, internalize the problem and can produce appropriate solutions from different perspectives. In this context, the present study was conducted to examine the effect of teaching problems with natural numbers using the drama method on students' problem-solving achievement and problem-solving attitudes. A quantitative research method was adopted and a pre-test/post-test quasi-experimental design with a control group was used. The study was conducted with two sixth-grade classes of a public school in a province in the north of Turkey. Data were obtained using the Problem-Solving Achievement Test and Mathematics Problem-Solving Attitude Scale. Predictive statistics were used in the analysis of the obtained data. It was concluded that the drama method was effective on students' problem-solving skills and problem-solving attitudes.

Introduction

In today's world, direct access to information has become easier with rapidly developing technology, and structuring this information meaningfully and transforming it in ways that will support problem-solving skills has become much more important (OECD, 2024). So much so that problem solving has transformed from being merely a cognitive skill into a multifaceted competence encompassing collaboration, creativity, digital literacy, and critical thinking (OECD; 2024; Szabo et al., 2020). This transformation has made it necessary

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to update the approaches to problem solving, a domain that has played a central role in educational programs since the past (NCTM, 2000; OECD, 2025). In this context “Ministry of National Education of the Republic of Turkey [MoNE]” (2024) has based the general objectives of education at every level on problem solving. Furthermore, problem solving forms the basis of the curricula of other countries and many national and international exams (OECD, 2019; MoNE, 2024). In this context, the “Programme for International Student Assessment [PISA]” are increasingly attracting attention by placing significant emphasis on mathematical problem-solving skills (OECD, 2019). However, when reports on the PISA exams are reviewed, low scores in mathematics stand out. Students still have difficulties in transferring their knowledge to daily life and establishing connections between problems and real life in these exams (Hidayati et al., 2020; Kolubüyük, 2020; Lee, 2012; Mik-Meyer, 2020). It is important for students to gain real-life experience in learning environments, and one of the methods that can be used to achieve this aim is the drama method. The drama method provides students with opportunities to experience situations they may encounter in their daily lives based on fictional contexts in educational settings and to reflect on those situations (Archila et al., 2023). Thus, students witness firsthand how their knowledge and ideas can be transferred to real life (Morales Almazan, 2021; Pecaski, 2012).

In mathematical terms, the drama method enhances students’ mathematical reasoning, problem-solving, and creativity skills (Archila et al., 2023; Smyrnis & Ginns, 2016; Zenasni et al., 2019). Through the drama method, students can look beyond the immediate situation and establish new connections. Mellou (1994) stated that this constitutes a cognitive process related to imagination and contributes to the development of students’ problem-solving skills by helping them develop different perspectives. In this context, the use of the drama method in developing students’ problem solving skills are valuable.

The first step in the problem-solving process is to carefully read and understand the problem. Correctly understanding the problem is a critical step in being able to choose the right solution paths (Boonen et al., 2016; Schoenfeld, 1985). In this step, students need to visualize the problem as clearly as possible in their minds while solving it (Bates et al., 2021; Commodari et al., 2024; Sevgi & Karakaya, 2021). With the drama method, that visualization is taken a step further, enabling students to encounter real-life problems in the classroom environment (Archila et al., 2023). By enacting scenarios in which the selected problem arises, students can make the problem concrete. This process also enhances analysis and critical thinking, which are fundamental elements of problem solving (Morales Almazan, 2021; Pecaski, 2012). Furthermore, it encourages students to collaborate in solving the problems that arise in the assigned scenarios. Students participate in the solution-finding process by communicating with each other, sharing their ideas, and finding solution paths together. Thus, students can consider the problem from different perspectives and generate alternative solution paths (Archila et al., 2023; Kırmızı, 2022). All of these activities enable students to internalize the problem, thereby facilitating their understanding of it and their ability to complete the solution process (Çakır et al., 2019; Kırmızı, 2022; Pecaski, 2012).

Theoretical Framework

Problem solving

A problem is a challenge that an individual cannot overcome directly with his or her current knowledge or methods, requiring mental effort and cognitive processes for a solution to be reached (Mayer, 1992; Polya, 1957). By this definition, problem solving is a process in

which individuals use thinking skills, strategy development, and evaluation to overcome the problem situations they encounter (Newell & Simon, 1972; Schoenfeld, 1985). In today's education systems, great importance is placed on developing students' problem-solving skills. In particular, international assessment programs such as PISA measure students' abilities to understand and solve real-world problems, thereby encouraging education policies that focus on developing such skills (OECD, 2019). In this context, the MoNE has indicated the importance given to problem solving in the country's mathematics curricula with objectives including the aim of "raising talented individuals who can reason when faced with a problem, generate different perspectives, and act by making sense of the problem rather than using memorized formulas" (MoNE, 2024). Problem solving was first defined as a process of specific steps by Polya (1957). These steps are presented in Figure 1.



Figure 1. "Polya's problem solving steps"

Students need to visualize the problem as clearly as possible in their minds during the step of understanding the problem. Only in this way can students understand the problem more easily and transfer the necessary knowledge to the problem effectively (Archila et al., 2023). From this perspective, students who approach problems as real-life situations and try to solve them through experience will be able to advance through the steps of understanding and solving a problem. The drama method is one of the methods capable of attaining those outcomes.

Drama method

Drama is a form of learning that allows students to explore real or fictional situations through role-playing, improvisation, and staging (Heathcote & Bolton, 1995). San (1996) defined drama as the transformation of a word, thought, internal state, or event into action using various techniques and playful processes. The drama method is particularly effective in concretizing abstract concepts and making knowledge permanent (Archila et al., 2023; Disney & Li, 2022). It can present students with situations that require multidimensional thinking (Demir & Aslan, 2025; Verhoeff, 2017). Thus, it enables students to develop higher-order mental skills such as "critical thinking", "problem-solving", "creative thinking", and "decision making skills" (Archila et al., 2023; Şen et al., 2025; Papaioannou & Kondoyianni, 2022).

Drama method in education

Drama method, defined as a dynamic and interesting teaching method, has been considered as an effective approach for education systems in recent years (Arpentii, 2024; Demir and Aslan, 2025; Hidajati et al., 2025; Papaioannou and Kondoyianni, 2022). One of the most important factors in rise of this method in recent years is that the drama method caters to different learning styles, enriches the learning process, and allows students construct their knowledge through hands-on experience in fictional contexts (Adıgüzel, 2019; Arpentii, 2024; Hidajati et al., 2025; Wagner, 1998). Research shows that applying the drama method in education has many positive effects on students in "cognitive", "affective", "social", "linguistic", and "psychomotor domains" (Arpentii, 2024; Hidajati et al., 2025; Yıldırım, 2022). In this context, it can be said that the drama method facilitates the learning process by

enabling students to connect with real life (Archila et al., 2023; Terzi, 2019), supports them socially and emotionally by strengthening their critical thinking, empathy, and communication skills (Goodman, 2017; Şen, 2025).

Literature synthesis

Previous studies have described the drama method as a powerful and versatile pedagogical resource in education (Arpentii, 2024; Hidajati et al., 2025; Verhoeff, 2017). In educational processes, the drama method is not merely an instructional method that can be integrated into academically based courses; it also supports students' social development and empathy skills (Goodman, 2017; Kıvanç Öztuğ & Melek Ciner, 2017), orientation processes (Şen et al., 2025; Papaioannou & Kondoyianni, 2022), values education (Barcın Kara & Kuşdemir Kayıran, 2024), and efforts to address contemporary issues such as cyberbullying (Karaosmanoğlu et al., 2022; Lyngstad et al., 2021). Researchers have emphasized that the drama method is an effective tool for developing students' social skills, helping students adapt to new environments, combating cyberbullying, and supporting the processes of recognizing negative behaviors, developing empathy, and learning effective coping strategies (Goodman, 2017; Lyngstad et al., 2021). Due to its multifaceted nature, the drama method is able to support students' social and cultural development. Additionally, drama activities in education align with the principles of active participation and experiential learning, which are central to contemporary educational approaches. As a student-centered, interactive, and permanent learning tool, the drama method has been studied in the context of different educational subjects and at various educational levels, from preschool to higher education (Arpentii, 2024; Demir & Aslan, 2025; Hellemann, 2022; Hidajati et al., 2025; Manabe et al., 2023; Roth & Walshaw, 2019). In these studies, it has been determined that the drama method contributes not only to areas such as language teaching, environmental awareness, and citizenship education but also to fields like science and mathematics by enabling the concretization of abstract concepts, thereby deepening learning and enhancing academic achievement.

In particular, mathematics is often perceived by students as a boring and difficult subject weakly connected to daily life, which negatively affects the quality of the teaching process (Mik-Meyer, 2020; Evirgen & Yıldız-İkikardeş, 2019). The drama method stands out in this context as an approach that enables students' active participation, concretizes the learning process, and makes it possible for students to internalize mathematical concepts. Studies have argued that the drama method is effective in increasing students' academic success, enhancing their long-term learning, and developing positive attitudes toward the subject being taught in mathematics lessons (Akyazı & Kaplan, 2018; Lee et al., 2015; Morales-Almazan, 2021; Pecaski, 2012; Smyrnis & Ginns, 2016; Top & Top Güler, 2024; Ustaoglu-Bağcı & Ay, 2024). Additionally, there are many studies in the literature examining the effect of the drama method on students' problem-solving skills and attitudes (Bayrak and Akkaynak, 2020; Dereli, 2018; Disney and Li, 2022; Nurhasanah, 2022; Pecaski, 2012; Şenol Özyiğit, 2011; Tanriseven, 2000; Yılmaz, 2019). These studies generally conducted with preschool students to examine the effects of using the drama method on students' social problem solving skills, empathy skills, self-confidence, and self-perception (Bayrak & Akkaynak, 2020; Dereli, 2018; Goodman, 2017; Keklik, 2018; Lee et al., 2015; Yılmaz, 2019). There are limited studies examining the impact of the drama method on middle school students' problem solving achievement and attitudes in mathematics lessons (Palavan, 2017; Pecaski, 2012; Şenol Özyiğit, 2011). In this context, the aim of the present study is to examine the effect of teaching the topic of problems with natural numbers using the drama method on students' problem solving achievement and attitudes. For this purpose, the following research questions

and hypotheses were defined:

Research question: “Does the use of the drama method in teaching the topic of problems with natural numbers to sixth-grade students have an effect on their problem-solving achievement and problem-solving attitudes?”

- (1) Hypothesis 1: “Upon controlling for the pre-test achievement scores of the experimental and control groups, there will be a significant difference in the post-test problem-solving achievement scores between the groups.”
- (2) Hypothesis 2: “Upon controlling for the pre-test problem-solving attitudes of the experimental and control groups, there will be a significant difference in the post-test problem-solving attitudes between the groups.”

Method

Research Design

In this study, “a quasi-experimental pre-test- post-test design with a control group” was used as one of the quantitative research methods. Since unbiased assignments to the study existing groups were made, a quasi-experimental design was preferred (Bulduk, 2008). During the course of the study, the students in the experimental group were taught using the drama method and the students in the control group were taught without the drama method. Both groups were given the same problems and taught by the same teacher. Additionally entire teaching process was carried out according to the curriculum of the Turkish Ministry of National Education.

Study Participants

This study was conducted in two sixth-grade classes of a public school in northern Turkey. Using an unbiased assignment method one class was designated as the experimental group, while the other served as the control group. The cluster sampling method was utilized in this study. This method is applied in cases where researchers cannot directly select individual participants but have the opportunity to randomly select predetermined schools, classes, or groups (McMillan & Schumacher, 2014). All participants were informed about the study; it was explained that identifying information would only be seen by the researcher and would not be shared anywhere, and that the obtained data would be used only for the scientific purposes of the study. Table 1 provides information about the participating students in terms of gender and group sizes. As seen in Table 1, the groups were similar in terms of student numbers and gender distribution.

Table 1. Distribution of students by group and gender

Groups	n	Female	Male
Experimental Group	20	11	9
Control Group	22	10	12

Data Collection Tools

“The Problem-Solving Achievement Test” and “The Mathematics Problem-Solving Attitude Scale” were used as the data collection tools of this study. To evaluate the students’ problem-solving achievements, “The Problem-Solving Achievement Test” developed by “Çoban and Tezci (2019)” was utilized. This test consists of 12 multiple-choice questions, each with four possible options. During the process of developing this test, validity and reliability studies were conducted, and item analyses were performed (Çoban & Tezci, 2019). The item discrimination indices of the test were reported to range between .30 and .69 (Çoban & Tezci, 2019). Item discrimination index values of .30 and above indicate that the items are sufficient discriminators (Tekin, 2000). Therefore, it can be said that “The Problem-Solving Achievement Test” has sufficient discrimination (Çoban & Tezci, 2019). Additionally, the KR-20 reliability coefficient, which demonstrates a test’s reliability, was calculated for this study and found to be .72. Values above .70 indicate that a measurement tool has an acceptable level of reliability (Büyüköztürk, 2017). Thus, it can be said that the test used in this study possesses a good level of reliability. Moreover, “The Problem-Solving Achievement Test” is appropriate for the aims of this study as it aligns with the outcomes of the current curriculum and is based on “Polya’s problem-solving steps”.

To assess the students’ problem-solving attitudes, “The Mathematics Problem-Solving Attitude Scale (MPSAS)” developed by “Çanakçı and Özdemir (2008)” was employed. This scale is a “5-point Likert-type” instrument designed for middle school students. It contains 19 items with response options ranging from “completely agree” to “definitely disagree.” The scale includes cognitive, affective, and behavioral statements, and its validity and reliability were established in previous studies. In this study, the reliability coefficient (Cronbach’s alpha) was calculated as .82, with values above .70 indicating that a measurement tool has an acceptable level of reliability (Büyüköztürk, 2017). Thus, the MPSAS has a good level of reliability.

Validity and Reliability

“Validity and reliability” are fundamental and indispensable criteria for research-based studies (Fraenkel et al., 2012). In this context, to ensure validity and reliability in the present study, the following precautions were taken: the groups of participants were selected from existing classes through unbiased assignments, and the data collection tools and analysis methods were explained with clear and precise information. Since the implementations were carried out by the students’ mathematics teacher, potential dangers of bias were eliminated. In determining the duration of the research and the time interval between the “pre-test” and “post-test”, potential problems of recall and maturation were taken into account. Additionally, the validity and reliability of the measurement tools were previously confirmed as described above.

Implementation Process and Drama Lesson Plans

During the data collection process, students were first informed about problem-solving processes using the drama method, and the importance and necessity of the study were emphasized. It was stated that the data obtained from the implementations would not be used in any personal evaluations and the implementation results wouldn’t be graded in any way. Furthermore, it was explained that the data obtained from the implementations would be valuable for scientific research, and the students were asked to participate carefully and willingly in the implementations.

Lesson plans were prepared for teaching sixth-grade middle school mathematics lessons with the outcome of “Solves and constructs problems requiring four operations with natural numbers” using the drama method. These lesson plans were prepared by the first researcher, who has training in drama. The researcher created six drama plans related to the relevant outcome. The problems included in the drama plans were selected based on skill-based questions published by the MoNE’s General Directorate of Measurement and Evaluation for sixth-grade students. Before implementing the drama plans, opinions were obtained from two experts working in the field of drama in mathematics education and necessary corrections were made. This drama plans were then piloted by the researcher who would manage the actual implementation process in a different sixth-grade class of the same school. During the pilot implementation, the reliability of the data collection tools was tested, and they were found to be appropriate. Furthermore, the comprehensibility and duration of the drama plans were tested during the pilot implementation. Based on the data obtained in this process and taking into account expert opinions, the necessary adjustments were made, and the drama plans were finalized.

One of the drama plans was made simpler and more understandable, and the implementation time for each drama plan was determined to be two consecutive lesson hours. Subsequently, the actual implementation process began and was completed in six weeks. In the first week, “The Problem-Solving Achievement Test” and the MPSAS were administered to both groups for one 40-minute lesson each, and no other implementation was conducted that week. Over the following four weeks, experimental implementations were carried out two days a week for the first two weeks, each consisting of two consecutive 40-minute lessons. In the next two weeks, implementations were carried out one day a week, with each implementation consisting of two consecutive 40-minute lessons. In total, six different drama activities were conducted with the students over the course of 12 lesson hours. Each drama plan, including warm-up activities and the evaluation process, was completed in two consecutive lessons. In the final week, “The Problem-Solving Achievement Test” and the MPSAS were administered as post-tests to both groups for one 40-minute lesson each and the process was thus completed. The mathematics lessons for both the experimental and control groups were taught by the first researcher. By having the same teacher manage the process in both classes, the impact of external factors that could arise from the implementer was minimized.

The general purpose of the prepared drama plans is to ensure that students see problems not only as abstract structures based on operations, but also as meaningful and concrete structures that are related to real life. In this context, the drama plans were designed to present students with problem situations they may encounter in real life, encouraging them to generate possible solutions. For example, a drama plan based on "taximeter fare calculation" was developed in the drama titled "Taxi". In this drama process, students were expected to demonstrate their analytical thinking skills and appropriately apply their knowledge of unit pricing and ratio-proportion concepts. Similarly, the other drama plans were structured around real-life themes frequently encountered by students, including budget management, goal-savings discrepancy, and shopping expenses. In addition, each drama plan is designed to highlight values such as social responsibility and social cooperation. In this context, the drama activity titled “Don’t Forget the Street Animals” was developed to both foster students’ sense of social responsibility and support the development of their problem-solving skills. In conclusion, the drama plans were designed to develop students’ “problem-solving skills”, “social awareness”, and “problem-solving attitudes”.

Data Analysis

The study data were analyzed using “inferential statistical methods”. The assumption of normality of the data was tested before analysis (Table 2). According to Tabachnick and Fidell (2013), “values of skewness and kurtosis within the range of -1.5 to +1.5 are considered indicative of a normal distribution”. As seen in Table 2, the data of the present study met that criterion and were therefore considered to be normally distributed. Normality was also assessed with statistical tests. In this context, normality was also confirmed by the Shapiro Wilk test ($p > .05$) (Büyüköztürk, 2017). Consequently, parametric tests were deemed appropriate. To address the research questions and hypotheses, “independent samples t-tests” and “analysis of covariance (ANCOVA)” were used.

Table 2. “Problem-Solving Achievement Test” and “MPSAS” normality testing

	Group	n	Skewness	S.E.	Kurtosis	S.E.	Shapiro–Wilk (p)
Problem-Solving Achievement Test	Experimental Group, Pre-Test	20	-.450	.512	.332	.992	.281
	Experimental Group, Post-Test	20	-.143	.512	-1.064	.992	.206
	Control Group, Pre-Test	22	-.477	.491	-.064	.953	.162
	Control Group, Post-Test	22	-.140	.491	-1.359	.953	.063
Mathematics Problem-Solving Attitude Scale (MPSAS)	Experimental Group, Pre-Test	20	.558	.512	-.357	.992	.289
	Experimental Group, Post-Test	20	-.603	.512	.512	.992	.625
	Control Group, Pre-Test	22	.068	.491	-.285	.953	.700
	Control Group, Post-Test	22	.252	.491	-1.089	.953	.134

Results

Results Related to Problem Solving Achievement

Comparison pre-test results of experimental and control groups

Before the experimental study, an independent sample t-test was conducted to determine the statistical differences between the groups (Table 3). When Table 3 is examined, it is seen that the pre-implementation success scores do not differ significantly according to the group variable ($t = -.793$, $p = .43$, $p > .05$). Therefore, the groups can be considered homogeneous in their achievement levels prior to the experimental implementation.

Table 3. Pre-test scores of groups on the problem-solving achievement test

Variable	Group	n	m	SD	df	t	p
Achievement Test	Experimental	20	.45	.12	40	-.793	.43
	Control	22	.48	.13			

Analysis of post-test scores adjusted based on pre-test scores

Before conducting the main analysis, the assumptions of ANCOVA (“homogeneity of variances”, “linearity of the relationship between the covariate and the dependent variable”, and “homogeneity of regression slopes”) were tested and were confirmed to be satisfied, reflecting the data’s suitability for ANCOVA. Accordingly, descriptive statistics are presented in Table 4. As seen in Table 4, after controlling the effect of pre-test scores, the experimental group’s mean post-test score rose slightly from .75 to an adjusted mean of .76, whereas the control group’s mean post-test score fell from .57 to an adjusted mean of .56.

Table 4. Descriptive statistics for problem-solving achievement test pre-test, post-test, and adjusted post-test scores

Group	n	Pre-Test		Post-Test		
		<i>m</i>	<i>SD</i>	<i>m</i>	<i>SD</i>	<i>m*</i>
Experimental	20	.45	.12	.75	.16	.76
Control	22	.48	.13	.57	.18	.56

*: “Adjusted mean post-test score upon controlling for pre-test scores.”

The ANCOVA results are summarized in Table 5. An examination of Table 5 reveals “a statistically significant difference between the post-test mean scores of the experimental and control groups” [$F(1,39) = 49.828, p = .00, p < .05$]. When the adjusted mean post-test scores are compared, “the difference is seen to be in favor of the experimental group” ($m_{ex} = .76, m_c = .56, \eta^2 = .56$). These results indicate that the drama-based problem-solving activities conducted with the experimental group were effective and the effect size was large ($\eta^2 = .56$) (Büyüköztürk, 2017).

Table 5. ANCOVA results for adjusted problem-solving achievement test post-test scores

	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>p</i>	<i>EtaSquared</i>
Adjusted Model	1.175	2	.587	66.499	.000	.773
Intercept	.042	1	.042	4.775	.035	.109
Pre-test Covariate	.870	1	.870	98.540	.000	.716
Group	.440	1	.440	49.828	.000	.561
Error	.345	39	.009			
Total	19.854	42				
Adjusted Total	1.519	41				

Results Related to Mathematics Problem Solving Attitude

Comparison of the pre-test results of experimental and control groups

Before the experimental study, an independent sample t-test was conducted to determine any statistical differences between the groups (Table 6). When Table 6 is examined, it is seen that the pre-application MPSAS scores did not differ significantly according to the group variable ($t = -.642$, $p = .52$, $p > .05$). Therefore, the groups' attitudes toward problem solving were homogeneous prior to the implementation.

Table 6. Pre-test scores of groups on the MPSAS

Variable	Group	<i>n</i>	<i>m</i>	<i>SD</i>	<i>df</i>	<i>t</i>	<i>p</i>
Achievement Test	Experimental	20	2.74	.55	40	-.642	.52
	Control	22	2.86	.67			

Analysis of adjusted post-test scores based on pre-test scores

Prior to the main analysis, the assumptions of ANCOVA ("homogeneity of variances", "linearity of the relationship between the covariate and the dependent variable", and "homogeneity of regression slopes") were tested and confirmed, indicating that the data were suitable for ANCOVA. Accordingly, descriptive statistics are presented in Table 7. When the pre-test MPSAS scores were controlled, the experimental group's mean post-test score increased from 3.73 to 3.74 whereas the control group's mean post-test score remained unchanged.

Table 7. Descriptive statistics for pre-test, post-test, and adjusted post-test MPSAS scores

Group	<i>n</i>	Pre-Test		Post-Test		
		<i>m</i>	<i>SD</i>	<i>m</i>	<i>SD</i>	<i>m*</i>
Experimental	20	2.74	.55	3.73	.45	3.74
Control	22	2.86	.67	3.10	.45	3.10

*: "Adjusted mean post-test score upon controlling for pre-test scores."

The ANCOVA results are summarized in Table 8. The ANCOVA results presented in Table 8 show "a significant difference between the groups' mean post-test scores" [$F(1,39) = 19.852$, $p = .00$, $p < .05$]. When the adjusted mean post-test scores are compared, the "difference is seen to be in favor of the experimental group" ($m_{ex} = 3.74$, $m_c = 3.10$, $\eta^2 = .33$). These findings indicate that the drama-based problem-solving activities conducted with the experimental group had a significant impact on students' attitudes toward problem solving. The effect size was large ($\eta^2 = .33$) (Büyüköztürk, 2017).

Table 8. ANCOVA results for adjusted mean MPSAS post-test scores

	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>p</i>	<i>Eta Squared</i>
Adjusted Model	4.221	2	2.110	9.961	.,000	.,338
Intercept	19.286	1	19.286	91.029	.,000	.,700
Pre-test Covariate	.108	1	.108	.511	.,479	.,013
Group	4.206	1	4.206	19.852	.,000	.,337
Error	8.263	39	.212			
Total	499.723	42				
Adjusted Total	12.484	41				

Conclusion, Discussion, and Recommendation

This study examined “the effect of teaching problems with natural numbers using the drama method on students’ problem-solving achievement and attitudes.” It was determined that the drama method had a significant impact on both achievement and attitudes. A review of systematic studies on drama in the literature reveals that only a small portion of these studies focus on mathematics education (Durmaz, 2022; Şengün & İskenderoğlu, 2010). In the systematic review conducted by Durmaz (2022), studies published between 2003 and 2021 in international peer-reviewed scientific journals in the fields of mathematics education and creative drama were examined. Durmaz (2022) found that only a small portion of these studies were related to mathematics education, and that within this field, there was a particular focus on geometry and measurement. Durmaz (2022) also reported that most of these studies focused on results related to teachers and pre-service teachers. In this context, the current study contributes to the literature by examining the impact of the drama method on problem solving in mathematics education. Additionally, conducting the current study with middle school students is considered significant in this regard. The results showed that drama-based problem solving activities had a large effect size in developing students’ problem solving skills and attitudes. Yıldırım (2022) likewise reported that “The drama method had a significant effect on academic achievement and attitudes.”. Those results are consistent with present study.

Previous research in this field has shown that the drama method is effective in improving students’ problem-solving skills and attitudes (Bayrak & Akkaynak, 2020; Ceylan, 2014; Disney & Li, 2022; Keklik, 2018; Nurhasanah, 2022; Morales Almazan, 2021; Pecaski, 2012; Smyrnis & Ginns, 2016). This effectiveness can be linked to students’ internalization of problems through the roles they adopt during drama activities, their ability to approach a problem from different angles, and their development of alternative solutions. In this context, studies have noted that role-playing in “as if” scenarios can enhance mental flexibility and help students analyze and solve problems (Archila et al., 2023; San, 2002). Moreover, research has indicated that when students encounter real-life situations in drama activities, conduct investigations, continually share new information and ideas with their peers, and this interaction facilitates their understanding of the problem and thus eases the problem-solving process (Çakır et al., 2019; Keklik, 2018; Pecaski, 2012). Bolton (1998) described drama as a tool allowing students to gain authentic life experiences, noting that this approach promotes deep thinking and meaningful learning in problem-solving contexts. Similarly, It has been stated that drama provides students with the ability to apply and transform their knowledge

(Heathcote & Bolton, 1995). Keklik (2018) also further observed that during drama activities, students approached problem situations with realistic strategies, exerted greater effort, and felt more motivated to solve problems, whereas they struggled when the same problem was presented only on paper. Keklik (2018) suggested that such difficulties may arise from students' inability to relate paper-based problems to real-life contexts. In the present study, because real-life problems were incorporated into drama activities, students' problem-solving skills improved. These findings suggest that drama-based instruction can facilitate students' connection to real-life situations, enhance their problem-solving abilities, and simplify the problem-solving process.

Research has also shown that drama-based activities positively influence students' attitudes toward mathematics (Akyazı & Kaplan, 2018; Archila et al., 2023; Erdoğan, 2013; Öztürk, 2015; Roth & Walshaw, 2019). Roth and Walshaw (2019) found that students who initially exhibited negative emotions during drama activities shifted to a positive emotional state by the end of the experimental implementation. They emphasized that, especially in mathematics classes, emotional change does not occur without active engagement and that drama is highly effective in transforming students' negative attitudes into positive ones as they participate in tasks and assume roles. This effect may stem from drama's ability to alter students' perceptions of previously tedious learning processes and may make students' experiences more varied and comprehensible (Hidajati, 2025). Hidajati (2025) further noted that an appropriate instructional method can make the achievement of learning objectives easier. Likewise, Pakaya et al. (2020) reported that the drama method increased students' motivation and excitement for learning and that students responded positively to this approach. Barcın Kara and Kuşdemir Kayıran (2024) also found that drama was effective in concretizing in-class learning and fostering positive attitudes toward lessons. In the present study, by presenting problem situations within the framework of real-life scenarios, drama activities likely helped to concretize the problems, boost students' motivation, and foster positive attitudes toward the problem-solving process.

Archila et al. (2023) reported that the drama method encourages students to collaborate, think together, and work creatively while remaining solution-focused. They stated that drama helps students move from a black-and-white view of a subject to a more flexible and comprehensive perspective. This shift can increase students' motivation during problem-solving processes and foster positive attitudes (Archila et al., 2023). In the present study, students' active participation and collaboration throughout the drama activities likely contributed to their more positive attitudes. The freedom inherent in a drama-based learning environment may also have boosted the students' confidence, enabling them to propose solutions more freely and effectively. Wagner (1999) argued that drama in education is an effective way to develop students' critical thinking and decision-making skills. Engaging with problems through drama may therefore help students to adopt a more critical stance and generate alternative strategies for solving the problems. All of these are aligned with "21st-century skills" such as "communication", "collaboration", "creativity", and "critical thinking". Moreover, these skills are also aligned with the 5C framework ("Critical Thinking", "Creativity", "Communication", "Collaboration", and "Citizenship") proposed by the "Partnership for 21st Century Learning" (P21, 2019). Nurhasanah (2022) also explored the ways in which drama activities help students build seven crucial skills and ranked "critical thinking" and "problem-solving skills" as the most important. Thus, drama can be seen not only as a way to teach mathematical contents but also as an approach that integrates cognitive and affective skills within a flexible learning environment (Archila et al., 2023; Smyrnis & Ginns, 2016).

Recommendations for Practice and Future Research

By allowing students to act out real-life situations in the classroom, the drama method helps to concretize learning. In subjects such as mathematics that involve many abstract concepts, drama can support students in making those concepts more tangible and thus contribute to improved academic performance. Accordingly, teachers are encouraged to implement the drama method in mathematics lessons to enhance both academic achievement and students' attitudes toward the subject. To apply this method effectively, however, teachers should receive training in drama techniques. It is therefore recommended that schools offer in-service training programs and workshops to help teachers develop their drama-based instructional skills. Additionally, this study is limited to a six-week implementation conducted with sixth-grade students, and no data were collected regarding their individual experiences. In future work, researchers are advised to design studies using mixed-methods approaches to explore both the quantitative outcomes and the qualitative experiences of students in drama-based problem-solving activities.

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