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Effects of Primary School Students' Attitudes towards Mathematics on Problem-Solving

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Abstract: This paper main aims to determine how students' attitudes towards mathematics course affect problem-solving processes during a real mathematical problem-solving activity. Besides, the students' ability to use problem-solving steps and strategies are also revealed in this study. For the purposes of the research, the following questions are answered:"How do 4th grade students' attitudes towards mathematics?", "How do 4th grade students' success in mathematics tests?", "Do the students have knowledge of problem-solving strategies and problem-solving steps?", "Is there a relation between mathematics attitudes and problem-solving success?". The research was carried out with 100 randomly selected 4th grade students in a primary school in Istanbul. A mixed research method was used. The data were collected by using two different sources. "Attitude Scale towards Mathematics Course" scale which is included in the 4th Grade Mathematics Teacher Guide Book was used to determine the students' attitudes. A worksheet (test) prepared was used to assess students' problem-solving success. There are a total of 10 mathematical problems in the test. The data both from the test and the attitude scale were analysed. Based on the findings, it was found that the students' attitudes towards mathematics were generally positive. However, no statistically significant relation was found between the positive attitude towards mathematics and problem-solving achievements. Besides, this study explores that the students used a limited number of problem-solving strategies. They performed usually the application step of a problem-solving process.

Keywords: attitude, mathematics, problem-solving.

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1. Introduction

Primary education prepares individuals for life and higher education. Effective reasoning, critical thinking and problem solving are necessary mental skills for the realization of this preparation. Problem-solving and its related processes are crucial in achieving these abilities for mathematics lessons and their context (Özsoy, 2005). These thinking processes that lead individuals to the solving of the problems they face are used both in daily life and in each scientific field. According to the Future of Jobs Report (World Economic Forum, 2016) complex problem-solving is the main skill required in the future of jobs in 2020 (as cited in Akgündüz, 2018). This is the reason why national and international curricula emphasize the importance of students developing problem-solving skills and their relation to mathematics (Altun, 1998; Ministry of National Education [MEB], 2018; Van De Walle, Karp and Williams, 2016).

Mathematics, in a general sense, is a system composed of consecutive abstractions and, a process of generalization in which ways of thought and assessment find meaning together with the understanding, analysis, and evaluation of information (Baykul, 2006; Haylock & Cockburn, 2003). In this sense, mathematics includes many elements of problem-solving within itself.

On the other hand, a problem can also be defined as an obstacle where it is not possible to find an answer immediately and easy answer (Adair, 2000; Schoenfeld, 1992; Van De Walle, Karp and Williams, 2016). Both definitions suggest that it is essential for individuals to attain the ability to use higher processes of thought, which they gain through efficient mathematics education. There are two problem situations determined for mathematics lessons in primary schools; routine and non-routine problems. Routine (operational) problems are problems in which special data is added to an already solved problem or where a known example is followed step by step without any changes (Altun, 1998; Polya, 1990). While solving these type of problems students learn an algorithm related to the problem indirectly. When algorithms are processed without any calculation errors, it is most likely to reach the correct answer. This is why high-level information is not necessary for solving non-routine problems. Non-routine problems can be described as problems (unstructured) that cannot be solved with the processing of one or more correct algorithms and so the solver must follow a self-structured method to find a solution. According

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to Souviney (1989), these types of problems require high-level competencies such as organizing data, classification, deducing the relations between variables and developing multidimensional solution methods as well as having operational skills (as cited in Altun, 1998). Individuals are expected to act as effective problem solvers to successfully solve given problem situations. Problem-solving can be defined as the active and deliberate study of how to reach a logical solution by using a certain strategy. It can be inferred from this definition that problem-solving includes an extensive mental process as well as the ascertainment of the correct result (Baki, 2003; Polya, 1990). In this regard, the generally accepted problem-solving process in mathematics consists of four steps. These steps are the comprehension of the problem, preparing a suitable plan for the solution, the application of the plan and evaluating the solution (Polya, 1990). It is imperative for the success of the problem-solving process to operate these problem-solving steps. With that, success also demands certain different and clear approaches as well. These approaches are stated as problem-solving strategies. Some of the strategies used when solving a problem are: writing an equation, guessing and checking, drawing a picture, acting it out, using a model, making a table, looking for a pattern, making organized lists, trying a simpler form of the problem (Van De Walle, Karp and Williams, 2016). There are other factors that affect the process of problem-solving. Such variables as to whether the individuals have encountered with the same problem situation, if they possess the mental foundation necessary for solving the problem, or their interests, belief, and attitudes both, directly and indirectly, affect the processes of problem-solving (Lester & Charles, 2003; Van De Walle, Karp and Williams, 2016). Attitude, which happens to be one of the variables included in this study, involves cognitive and affective factors, also in a behavioral sense has an impact on problem-solving (Tavşancıl, 2005). It is supposed that mathematics is the main subject that the students usually have negative attitudes about. Furthermore, there are a large number of students who state that they have difficulties when they solve mathematical problems (Yıldızlar, 2001).

When the digital data of Programme for International Student Assessment concerning [PISA] the evaluation of both the mathematics and problem-solving skills of Turkish students are analyzed, it reveals that Turkey has scored 423 points in 2003, 424 points in 2006, 445 points in 2009, 448 in 2012 and a 420 in 2015 (Akgündüz, 2018; MEB, 2016b; MEB, 2016c; Organisation for Economic Co-operation and Development [OECD], 2003). Another study documenting Turkey's success rate in mathematics is Trends in International Mathematics and Science Study [TIMSS]- 2015 reports. According to the TIMSS results, Turkish students scored 483 points in a study evaluating the mathematics knowledge, practice and reasoning cognitive fields of fourth grade students (MEB, 2016a). The results of the reports reveal Turkey's improvement since 2012 and before in teaching our students problem-solving skills. Considering the decrease in problem-solving skills in 2015 and the scores of other countries that contributed to the study, it is possible to arrive at the conclusion that there is much more left to be done.

In the related literature, there have been many studies emphasizing the relation between attitudes and mathematical performance, and the effect of students' attitudes towards mathematics on problem-solving (Çaycı & Kılıç, 2017; Duran, Sidekli & Yorulmaz, 2018; Ismail, & Awang, 2008; Katrancı & Şengül, 2019; Mason, 2003; Özgen, Ay, Kılıç, Özsoy & Alpay, 2017; Schommer, Duell & Hutter, 2005; Uysal, 2007; Yücel & Koç, 2011). Nonetheless, there are certain studies that arrive at contrary conclusions such as attitude that does not influence student success in mathematics (Duran, Sidekli & Yorulmaz, 2018; Fraser & Butts, 1982; Papanastasiou, 2000; PISA, 2003 as cited in Akyüz & Pala, 2010).

Formal education is important in changing attitudes. This is why evaluating the students' attitudes towards certain subjects is regarded as important in the enhancement of the quality of education. In the related literature, there exists a limited amount of studies regarding the effect of primary school students' attitude towards mathematics on problem-solving (Kılıçkaya & Toptaş, 2017). In this issue, further study needs to be done.

The Aim of Research

This study aims to reveal how students' attitude towards mathematics lesson reflects on the problem-solving processes in the students' problem-solving process. For the purpose of the research, the following questions will be answered:

1-How do 4th grade students' attitudes towards mathematics?

2-How do 4th grade students' success in mathematics tests?

3-Do the students have knowledge of problem-solving strategies and problem-solving steps?

4-Is there a relation between mathematics attitudes and problem-solving success?

2. Research Methodology

Research Model

This study was conducted as a survey. A mixed-method combining both quantitative and qualitative methods were adopted. According to Robson (2017), mixed-method studies combine research approaches. In this way, it provides an extensive picture of the research subject. A mixed study makes it possible to use a certain research approach to declare the results found using another research approach. Quantitative results may exemplify qualitative data and so the research facts can be better described. By this way, it can explain how attitudes towards mathematics affect student success in problem-solving.

Sample

The study group for this research consists of 100 students selected randomly from 4th grade in an elementary school in Istanbul.

Instruments

Two different data collection tools were used in this study. The attitude scale for mathematics lesson included in The Ministry of National Education coursebook for 4th grade mathematics (Dikey publishing) was used in this research. A test which was specifically prepared by the researcher based on expert opinion and literature survey was used in order to evaluate the students' problem-solving success. The test consists of 10 questions including routine and non-routine problems. Both of the data collection tools were administrated by the researchers.

Attitude Scale for Mathematics: The attitude scale used to determine the students' attitudes towards mathematics. It consists of 12 affirmative clauses on a five-point Likert scale. The response ranges for the items are arranged as 'Strongly Disagree', 'Disagree', 'Neutral', 'Agree', 'Strongly Agree'.

Test: A test was used to evaluate the students' problem-solving success. A pilot study was carried out with a prototype of the test which contains 15 questions on a group of 40 students. The test was checked, verified and controlled by various experts. Two 4th grade teachers, two researchers, two mathematics teachers and two Turkish language teachers have eliminated the test in terms of appropriateness, scope, content and language expression. After these evaluations, the final test consisted of a total of 10 questions which routines (6) and non-routine (4) questions. The content of the test questions consists of problems on the subjects concerning operations, length, time and pattern. The final version of this worksheet is presented in the appendix. (Question numbers 1, 4, 5, 6, 7, and 8th routine; 2, 3, 9, and 10 are non-routine problems).

Data Analysis

The collected data from the attitude scale and the test were descriptively analyzed by using quantitative methods. The collected data from the attitude scale were averaged. And then, the data were scored taxonomically in three categories: students who had an attitude score's means of 5 and 4 points are shown with a positive attitude whereas students who had attitude score's means of 2 and 1 points are shown with a negative attitude. Finally, students who had attitude score's means of 3 points are shown as hesitant/neutral. The attitude' items are represented such A1, A2, A3,..., A12. The results are expressed in percentages.

The test data were analyzed qualitatively. A three-category scoring was used to analyze this data: the correct answers in which the students used the problem-solving steps or an appropriate problem-solving strategy were evaluated as "2" points, the correct answers are given only by using operations were evaluated as "1" point and situations in which the students either answered incorrectly or didn't answer at all were evaluated as "0" point. According to the scores that can be obtained from worksheets are determined between the maximum score of "20" and the minimum score of "0". The results are all expressed in frequency, cumulative frequency. The results of how the questions answered are given in percentages. And then, the students' problem-solving strategies and problem-solving steps that were applied during the problem-solving process are presented with samples from students' worksheets. The data collection are coding as S-1(Student-1), S-2, S-3,..., S-100 for each student.

The relations between the items of the attitude scale and problem-solving success scores were calculated using the Pearson product-moment correlation coefficient test.

3. Results of Research

The Attitude Scale Results

For the first question of the research, the results of the mathematics attitude scale are given in the Table 1.

Table 1. Mathematics Attitude Scale Results

Item	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
A1	3	5	8	19	65
A2	0	2	7	41	50
A3	1	2	13	34	50
A4	3	6	25	27	39
A5	9	3	21	23	44
A6	3	2	14	29	52
A7	3	3	6	24	64
A8	2	2	11	27	58
A9	4	2	9	37	48
A10	1	2	12	27	58
A11	4	1	33	21	41
A12	7	4	15	29	45

As shown in Table 1, A1- "I enjoy mathematical activities." item was "Strongly Agreed" by most of the students (65%). This result shows that the students' reaction to mathematical activities in the classroom is positive. Nevertheless, a small number of students expressed either disagreement or strong disagreement (3% and 5%, respectively). This indicates a negative attitude towards mathematics.

A2- "I enjoy studying for mathematics lesson." item was either "Strongly Agreed" (50%) and "Agreed" (41%) by a significant number of students. This suggests that most of the students are motivated and share a positive attitude to study mathematics. None of the students opted for "Strongly Disagree". This also suggests that students are not reluctant to study mathematics. There are a few students who have a negative attitude towards mathematics.

A3- "Mathematics is highly necessary for daily life." item was either "Strongly Agreed" (50%) or "Agreed" (34%) by most of the students. This shows that students are aware of the use of mathematics in daily life and they believe in the necessity of mathematics. There are a few students (12%) who have a negative attitude towards mathematics.

A4- "I do not find it difficult to learn mathematics." item was either "Strongly Agreed" (39%) or "Agreed" (27%) by most of the students. A considerable number of students opted for "Neutral" (25%). This shows that the students have a largely positive understanding of mathematics, while some of the students do not have a clear idea about the difficulty of mathematics. The remaining few students who "Strongly Disagreed" (3%) or "Disagreed" (6%) have a negative attitude towards mathematics.

A5- "I would like mathematics course hours to be increased." item was either "Strongly Agreed" (44%) or "Agreed" (23%). This shows that they have a positive attitude in general. A considerable number of students answered "Neutral" (21%). This suggests that some students do not have an opinion as to whether they need mathematics course hours to increase or not. A limited number of students (9% and 3%) have a negative attitude towards mathematics.

A6- "I enjoy studying for mathematics exams." item was either "Strongly Agreed" (52%) or "Agreed" (29%) by the majority of the students. Students who "Strongly Disagreed" (3%) or "Disagreed" (2%) have a negative attitude towards mathematics exams.

A7- "Mathematics is not a subject to be feared." item was either "Strongly Agreed" (64%) or "Agreed" (24%). This suggests that these students have a positive understanding of mathematics. Few students answered "Strongly Disagreed" or "Disagreed". This result shows that they consider mathematics as a lesson to be feared.

A8- "I find dealing with mathematics fun." item was either "Strongly Agreed" (58%) or "Agreed" (27%). This shows that these students have developed a positive understanding towards mathematics lesson. Few students answered “Strongly Disagreed” (2%) and “Disagreed” (2%), which shows their negative attitudes towards mathematics lesson.

A9- “I do my mathematics homework without getting bored.” item was either “Strongly Agreed” (48%) or “Agreed” (37%). This goes to show that the students’ understanding of mathematics is positive enough to do mathematics class homework without getting bored. Few students answered “Strongly Disagree” (4%) or “Disagree” (2%). This shows that few students have developed a negative outlook on mathematics.

A10- “We can make our work easier by using mathematics in real life.” item was either “Strongly Agreed” (58%) or “Agreed” by a significant number of students. These students have a positive attitude towards mathematics because they believe that it makes their work in daily life easier. Few students “Strongly Disagreed” (1%) or “Disagreed” (2%). Many students answered “Neutral” (12%). This is a significant result when the necessity of mathematics in daily life is concerned.

A11- “I would like to have a profession in the future which will require me to use mathematics.” item was either “Strongly Agreed” (41%) or “Agreed” (21%). A number of students are “Neutral” (33%). This shows that these students do not have any idea as to whether they would like to use mathematics in the future. Few students (5%) stated that mathematics do not hold an important weight in their future professional choices. These results show that this group of students have a negative attitude towards mathematics.

A12- “I feel comfortable solving mathematical problems.” item is either “Strongly Agreed” (45%) or “Agreed” (29%). These students feel comfortable while solving a mathematical problem, which shows that they have developed a positive attitude towards the lesson. Few students (7% and 4%) have a negative attitude towards mathematics lesson.

The total scores for the students’ attitude towards mathematics were mostly (69%) positive.

A relatively small percent (2%) of students’ attitudes, however, were negative towards mathematics. In 39% of the students, no clear attitude was observed.

The Test Results

The test results are answered for the second and third questions of the paper. Firstly, *for the second question of the research*, a general view of the scoring is given in Table 2.

Table 2. Problem-solving results

Question	Blank- Incorrect Answer (0) (%)	Correct Solution using operations only (1) (%)	Correct Solution using problem solving steps or strategies (2) (%)
S1	61	38	1
S2	34	20	46
S3	25	74	1
S4	65	24	11
S5	32	67	1
S6	60	40	-
S7	62	32	6
S8	30	46	24
S9	46	54	-
S10	24	10	66

According to the results in Table 2, 61% of the students either left the question blank or gave incorrect answers to the first question. 38% of the students solved the problem by solely using basic operations. Only 1% of the students reflected all of the problem-solving steps onto the solution and used an appropriate strategy to reach the correct solution. The first question of the test is a routine mathematical problem to measure simple operational information. The students are expected to specify the given and solicited information, formulate a suitable solution, apply the solution and check the accuracy of the result that they have obtained.

The second question of the test is a non-routine and medium-difficult mathematical problem. The students are expected to reach the correct solution by making use of appropriate arrangements. 46% of the students solved this question correctly, which is less practical compared to a routine problem and requires more mental processes, using problem-solving steps or solely doing the operations and following a strategy. 20% of the students solved the question correctly by solely using the basic operations. 34% of the students have either left the question blank or answered incorrectly.

The third question of the test is a non-routine mathematical problem of medium-difficulty. The students are expected the find out each possibility that is relevant for the solution. This question is harder than a routine problem to solve. It was answered by 74% of the students using solely the basic operations and by 1% using the problem-solving steps and an appropriate strategy. 25% of the students either left this question blank or answered incorrectly.

The fourth question of the test is a routine and medium-difficult mathematical question. The students are expected to find the correct answer by the basic knowledge operations of a geometrical shape. According to the results, 24% of the students solved the question correctly by using solely the basic operations, 11% by using the problem-solving steps and strategy. 65% of the students either left the question blank or failed to answer correctly.

The fifth question of the test is a routine and easy mathematical problem. For this question, the students are expected to reach the correct answer by using the basic operational knowledge. According to the results, 67% of the students have answered the question correctly by solely doing basic operations and 1% used the problem-solving steps and strategies. 32% of the students either left the question blank or failed to answer correctly.

The sixth question of the test is a routine and easy mathematical problem. The knowledge level required from the students for the solution of the problem is basic operations. According to the results, 40% of the students answered the question correctly by solely doing basic operations. 60% of the students either left the question blank or failed to answer correctly. For this question, none of the students neither used the problem-solving steps nor followed a tangible strategy.

The seventh question of the test is a routine and difficult mathematical problem. To be able to solve this question, the students need to have constructive knowledge of the time (calendar) and the four basic operations. According to the results, 6% of the students reached the correct answer by using problem-solving steps and following an appropriate strategy. 32% of the students answered correctly by solely doing the basic operations. 62% of the students either left the question blank or answered incorrectly.

The eight question of the test is a routine and easy mathematical problem. The students have to perform parenthesized operations and have to have basic operations knowledge to answer this question. According to the results, 24% of the students reached the correct answer by using the problem solving steps and following an appropriate strategy. 46% of the students answered the question correctly solely by using basic operations. 30% of the students either left the question blank or answered incorrectly.

The ninth question of the test is a non-routine and difficult mathematical problem. For this question, the students are required to calculate and reveal all potential possibilities to answer the question. According to the results, 54% of the students answered correctly by solely doing the basic operations. 46% of the students either left the question blank or failed to answer correctly. In this question, similar to the sixth question, none of the students neither used the problem-solving steps nor followed an appropriate strategy.

The final question of the test is a non-routine mathematical question of medium difficulty. The students are expected to reach the correct answer by using an appropriate strategy. According to the results, 66% of the students reached the correct answer by using the problem-solving steps or following an appropriate strategy. 10% of the students answered this question correctly solely by doing basic operations. 24% of the students either left the question blank or answered incorrectly.

For the second question of the research, as a result of the scoring, the total scores of the students are given in table 3.

Table 3. Total Scores for The Test

Scores (max. 20)	2	3	4	5	6	7	8	9	10	11	12	13	14
f	3	5	11	15	13	9	12	9	10	4	5	1	3
Cumulative f	3	8	19	34	47	56	68	77	87	91	96	97	100

As can be seen in Table 3, the calculation of the results reveal that 3% of the students scored 2, 5% scored 3, 11% scored 4, 15% scored 5, 13% scored 6, 9% scored 7, 12% scored 8, 9% scored 9, 10% scored 10, 4% scored 11, 5% scored 12, 1% scored 13, and 3% scored 14. Accordingly, 84% of the students are in the 10-0 score interval and 13% are between 20 and 10. None of the students scored 0,1, 15, 16, 17, 18, 19 or 20. It is significant to note that according to these results, the students who showed a positive attitude towards mathematics failed to show great achievement in solving a problem.

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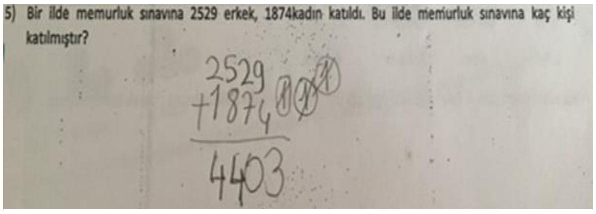
For the third question of the research, the results can be seen in table-2. This table shows that during the process of problem-solving, the students are not able to properly use the necessary problem-solving steps. Questions number 1, 3, 4, 5, 6, 7, 8 and 9 are solved only by the solution steps of a problem. The problem-solving steps are observed entirely only in questions 2 and 10. sub-steps such as rendering, explication or translation-generalization expressing that the student comprehended the problem was not observed in the majority of the questions throughout the test. Accordingly, it has been observed that the students are reluctant to apply the four operations to the numbers they see without comprehending the question. So no written plan was observed in the majority of students' answers. Finally, verifying (proof) step of the results was not observed in any of the students' answer. An example for the application step of problem-solving in the tests are given in Figure 2, an example for the use of the problem-solving steps are given in Figure 3 with a students answer.



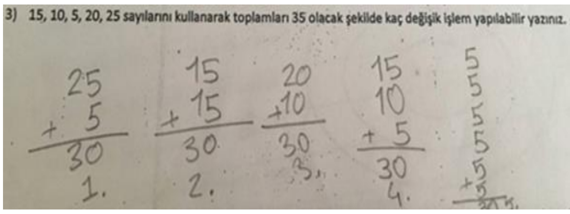


Figure 2. "S-5"- "S-35"

Figure 3. "S-19"

Another significant finding of this test is that the students rarely use certain strategies to make the solving of the problem easier during a problem-solving process. Questions number 10, 2 and 8 are the ones where a concrete strategy was used most frequently. A very few strategies were observed in questions 4, 7, 1, 3 and 5. no strategy was observed for questions number 6 and 9. some examples for the questions in which a certain strategy was used are given in figure 4, 5 and 6.

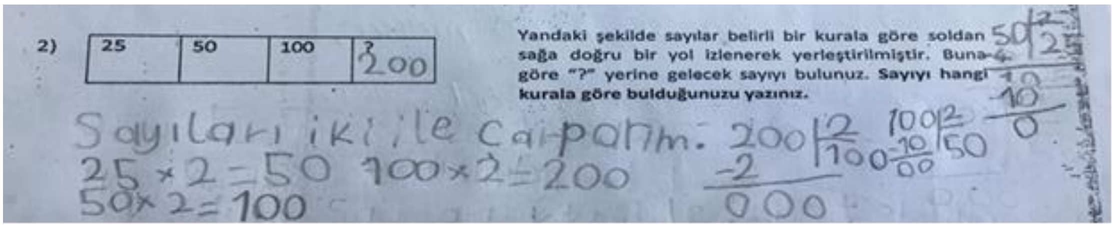
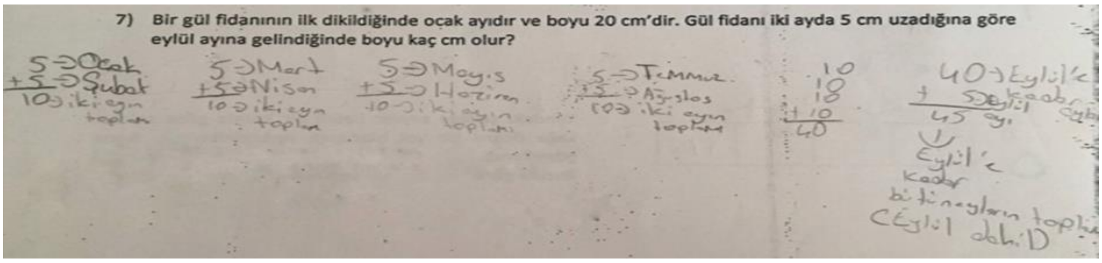


Figure 4. "S-57" Writing an equation



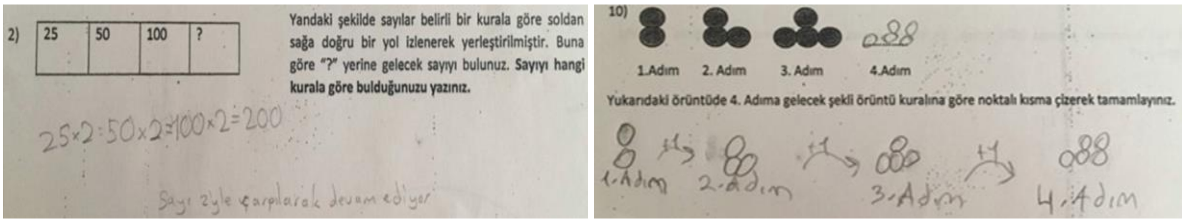


Figure 5. "S-72" Looking for Pattern

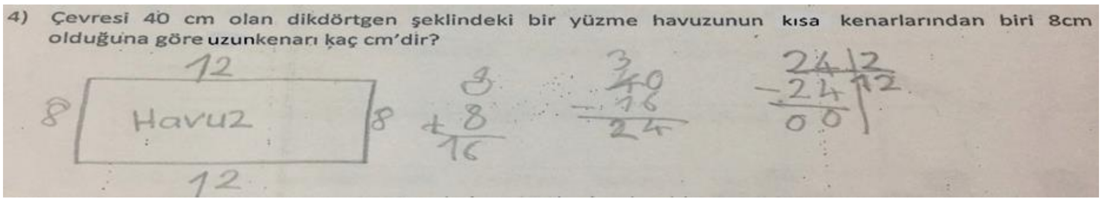


Figure 6. "S-28" Drawing a Picture Strategy

Results of the Relation between Attitude towards Mathematics and Problem Solving

For the fourth question of the research, the results of the data revealing the relation between the students' attitudes towards mathematics lesson and its effect on problem-solving are given in Table 4.

Table 4. Results on Attitudes Towards Mathematics And Its Effect On Problem Solving

Item	Problem Solving Score	Strongly Disagree (f)	Disagree (f)	Neutral (f)	Agree (f)	Strongly Agree (f)	Pearson's R (sig.)
A1	0	1	2	3	4	9	,204 (,042)
	1	2	3	5	15	56	
A2	0	0	0	1	10	8	,015 (,884)
	1	0	2	6	31	42	
A3	0	1	0	3	6	9	,082 (,419)
	1	0	2	10	28	41	
A4	0	0	0	8	5	6	,016 (,875)
	1	3	6	17	22	33	
A5	0	2	1	4	5	7	,063 (,533)
	1	7	2	17	18	37	
A6	0	1	1	5	5	7	,203 (,043)
	1	2	1	9	24	45	
A7	0	1	2	1	8	7	,246 (,014)
	1	2	1	5	16	57	
A8	0	0	1	3	5	10	,057 (,571)
	1	2	1	8	22	48	
A9	0	0	1	3	7	8	,036 (,724)
	1	4	1	6	30	40	
A10	0	0	0	5	4	10	,073 (,473)
	1	1	2	7	23	48	
A11	0	0	1	9	3	6	,092 (,361)
	1	4	0	24	18	35	
A12	0	1	1	3	7	7	,026 (,799)
	1	6	3	12	22	38	

The relation between the students' answers to all of the items in the attitude scale and their average problem solving success was examined through the use of the Pearson product-moment correlation coefficient. Accordingly:

There is a low level, positive and meaningful correlation (r=,204, n=100, p< ,05) between the students' problem solving success and their answers to the item "A1-I enjoy mathematical activities." According to these results, the increase of the students' level of enjoyment of mathematical activities has a positive effect on the increase in their problem-solving success. As the students' enjoyment of the mathematical activities increases, their problem-solving success increases with it.

There is not any significantly meaningful correlation (r=,015, n=100, p>,05) between the students' answers to the item "A2-I enjoy studying for mathematics lessons." and their problem-solving success. According to this result, there is no correlation between the increase in the level of enjoyment of the students and their problem-solving success. This shows that the students' enjoyment of studying mathematics does not affect their problem-solving success.

There is not any significantly meaningful correlation (r=,082, n=100, p>,05) between the students' answers to the item "A3-Mathematics is highly necessary in daily life." and their problem-solving success. It means that an increase in students' beliefs in the necessity of mathematics in their daily lives does not affect problem-solving success.

There is not any significantly meaningful correlation (r=,016, n=100, p>,05) between the students' answers to the item "A4-I do not find it difficult to learn mathematics." and their problem-solving success. This result shows that the attitudes towards the level of how easy the students find learning mathematics is not related to the increase of their problem-solving success.

There is not any significantly meaningful correlation (r=,063, n=100, p>,05) between the students' answers to the item "A5-I would like mathematics course hours to be increased." and their problem-solving success. These results show that the attitude towards increasing spending times in mathematics does not affect problem-solving success.

There is a low level, positive and statistically meaningful correlation (r=,203, n=100, p<,05) between the students' answers to the item "A6-I enjoy studying for mathematics exams." and their problem-solving success. This result shows that there is a correlation between the degree of students' enjoyment of studying for mathematics and their problem-solving success. It means that an increase in enjoy studying to mathematics exams, their problem-solving success increase.

There is a positive and statistically meaningful correlation (r=,246, n=100, p<,05) in between the students' answers to the item "A7-Mathematics is not a subject to be feared." and their problem-solving success. These results show that the student's attitudes towards not considering mathematics as a subject to be feared is related to their problem-solving success. This means that the more the students see mathematics as a subject not to be feared, the more their problem-solving success increases.

There is not any statistically significant correlation (r=,057, n=100, p>,05) between the students' answers to the item "A8-I find dealing with mathematics fun." and their problem-solving success. This means that even if the students have fun dealing with mathematics, this attitude does not affect their problem-solving success.

There is not any statistically significant correlation (r=,036, n=100, p>,05) between the students' answers to the item "A9-I do my mathematics homework without getting bored." and their problem-solving success. This means that the students' attitudes about enjoyment for doing their mathematics homework does not affect their problem-solving success.

There is not any statistically significant correlation (r=,073, n=100, p>,05) between the students' answers to the item "A10-We can make our work easier by using mathematics in real life." and their problem-solving success. According to this, even if students increase the level of using, this increasing does not affect their problem solving success.

There is not any statistically significant correlation (r=,092, n=100, p>,05) between the students' answers to the item "A11-I would like to have a profession in the future which will require me to use mathematics." and their problem-solving success. This means that the student's attitudes towards choosing a profession which will require them to use mathematics do not increase their problem-solving success.

There is not any statistically significant correlation (r=,026, n=100, p>,05) between the students' answers to the item "A12-I feel comfortable solving mathematical problems." and their problem-solving success. This means that even when the students feel comfortable solving mathematical problems, this does not affect their problem-solving success.

The results of this research show that some of the students' attitude towards mathematics affects problem-solving positively. This means that when the students' attitude towards mathematics increase on these areas they have positive effects on problem-solving. But the relation between the students' attitudes and their problem-solving success is not a high level meaningful relationship. A low-degree meaningful relation was observed only in scale items A1, A6 and A7. The coefficient of determination for scale items A1, A6, A7 expressing how the two variables explain each other (r^2) were examined. These estimations make up 4.1% of the total variance in items A1 and A6, as well as 6% of the total variance in item A7. This shows that problem-solving success is explained through attitudes with 4.1% according to the items A1 and A6. It is also explained through attitudes with 6% for the item A7.

4. Discussion

This paper aims to determine how students' attitudes towards mathematics course affect problem-solving processes during a real mathematical problem-solving activity. For the purpose of the research, the following questions were answered: "How do 4th grade students' attitudes towards mathematics?", "How do 4th grade students' success in mathematics tests?", "Do the students have knowledge of problem-solving strategies and problem-solving steps?", "Is there a relation between mathematics attitudes and problem-solving success?". According to the results of this study, there are one significant conclusions for the research's first question. The conclusion is that the students' attitudes towards mathematics is positive (69%). A few (2%) students opted for negative items. According to these result, a great amount of students has a positive attitude towards mathematics. In other words, most of the students are not worried about the mathematics courses. Similar studies also found positive attitudes towards mathematics course (Çaycı & Kılıç, 2017; Ismail & Awang, 2008; Mason, 2003; Özgen, et al., 2017; Piht & Eisenschmidt, 2008; Uysal, 2007; Yücel & Koç, 2011).

This study has further significant conclusions according to the results of the test. These results answer the second and third questions of the research. *The first conclusion* is that even though the students have usually a positive attitude towards mathematics, their problem-solving success is low. The questions' difficulty level on the test were considered appropriate, the number of the questions left blank or answered incorrectly are unexpectedly high. Questions numbers 4, 7 and 1 were most frequently left blank or answered incorrectly. Number 10, on the other hand, is the question that was mostly answered. The students' mathematical and reading-comprehension abilities can affect success for this paper. These results show similarities with a study by Ekici & Demir (2018) also conducted with fourth-grade students. They found that the students have difficulties in the multiplying process, and they have difficulties in understanding what they read. Besides, There may be many reasons for students' failure. These can be listed as a lack of knowledge about mathematical concepts and symbols including semantic (language), or lack of mental process which is necessary to solve problems.

The second conclusion is that using all problem solving steps are not observed in the student's worksheets. The test results of this study show similarities with the results of Gökkurt, Örnek, Hayat & Soylu's study (2015). In their study conducted with eighth grade students, it was observed that the students were inadequate in applying the problem solving steps that Polya put forth during the problem solving process. According to the results and conclusions of their study, it is understood that the problems were not solved correctly not only because of the students' lack of knowledge but also because of their inability to follow problem-solving steps. The students' effort to arrive at a solution without using problem-solving steps might be stemming from the fact that most of them see these operations as a waste of time. Some teacher behaviours such as forcing the students to solve problems quickly and regarding this as a success may foster this situation. Similarly, trying to solve more problems in a short amount of time in mathematics classrooms might also be another factor. These results also show that the students are not efficiently educated on how to use problem-solving steps and why this usage is significant. Similarly, students' use of limited problem-solving strategies shows that they do not have holistic background knowledge. As this is the case, students find it difficult to find a solution. Random solutions often cause them to make mistakes, which directly affects the success of problem-solving. As students become more aware, problem-solving success can increase as long as they need to use one or more strategies to solve problems. In addition, if students are aware of these strategies, they will use it to obtain the correct solutions that Yazgan (2007) has proven to solve non-routine problems.

Finally, for the fourth question of the study, according to the results of the attitude towards mathematics scale and its effects on problem-solving, it can be said that there is a positive correlation between variables. This is why the increase in positive attitudes will also affect problem-solving positively. This result is similar to Ismail & Awang's study (2008). When the significance level of the variables is considered, it is seen that on certain items (A1, A6, and A7) there is a low level of positive correlations. There seems to be no meaningful correlation between other attitude scale items and problem-solving success. This is why attitude towards mathematics affects problem-solving at a low degree for some items when for other items it does not affect problem-solving at a meaningful degree. This finding concurs with the researches conducted by Fraser and Butts (1982) and Papanastasiou (2000) which showed little correlation between achievement and attitudes. Also, these shows similarities with a study by Duran et. al. (2008) and the results of the PISA 2003 study (Turkish results) on the relation between attitudes and mathematics problem-solving. This might be because of some students' negative attitude towards mathematics and experiencing doubt but with others, failure in problem-solving despite having a positive attitude. Therefore, other variables are affecting the students' problem-solving success than their attitude, which leads to the conclusion that the students' attitude towards mathematics does not seem to have a significant effect on problem-solving.

5. Conclusions

In our era, problem-solving is necessary for every citizen. Previous researches show that gaining problem-solving skills is became substantial around the world. Problem-solving and related processes are basic topics in mathematics. According to the PISA and the TIMSS scores, Turkey increased gradually in problem-solving achievement. Despite the increasing success of Turkey's problem solving, students are not yet achieving the expected success. Turkey students generally believe that mathematics is difficult. It is thought that attitudes towards mathematics effects this situation. Hence, this paper aims to determine how students' attitudes towards mathematics course affect problem-solving processes during a real mathematical problem-solving activity. Additionally, the students' ability to use problem-solving steps and strategies are also revealed in this study.

Based on the discussion of research results, The first conclusion is that the students' attitudes towards mathematics is positive. The second conclusion is that students' problem-solving success is low. The third result of the research is that having a positive attitude does not affect problem-solving success. The final result of the research is that most of the students do not use problem-solving strategies and problem-solving steps except for the application of the plan.

According to the results of this study, there might be other variables than the attitude towards mathematics that effect problem-solving success. The same study can be conducted in different grade levels and the results can be presented to the scientific world after the variables that are thought to directly or indirectly affect problem-solving are stabilized. Also, this study is limited to elementary school students in a public school in Istanbul, the attitude items and worksheet' questions about the subjects concerning operations, length, time and pattern. Therefore, it is advisable to conduct studies that are wider in scale. The mathematics attitudes, problem-solving processes and the ability to use strategies of students in different regions might be researched in new studies.

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