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## **An Analysis of the Relationship between Problem Solving Skills and Scientific Attitudes of Secondary School Students**

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### **Abstract**

This study was carried out to examine the relationship between secondary school students' problem-solving skills and scientific attitudes in terms of gender, class level and education level of the parents. In the study, correlational research model, which is among the general survey models, was employed. The sample of the study consisted of 560 students selected from the secondary schools in Afyonkarahisar Province, Turkey by using convenience sampling method. In the study, Problem Solving Inventory for Children (PSIC) and Scientific Attitude Scale (SAC) were applied to collect the data. In the analysis of the data, Pearson correlation analysis, one-way variance analysis and two-way variance analysis were performed. As a result of the analyses, a negative and low-level relationship was found between secondary school students' problem-solving skills and scientific attitudes. While there was a negative and low-level relationship in terms of female students, it was found that this relationship was not significant for male students. When analyzed in terms of class level and maternal education level, it was concluded that this relationship was not significant. It was concluded that problem solving skills and gender did not have a significant and common effect on students' scientific attitudes. Similarly, it was concluded that problem solving skills and class level did not have a significant and common effect on students' scientific attitudes. There was no significant difference between middle school students' scientific attitudes in terms of problem-solving skill levels. In addition, it was determined that students' problem-solving skills were not a significant predictor of their scientific attitude.

**Key words:** Problem-solving skills, Scientific attitude, Secondary school students

### **Introduction**

In the 21st century, students have to get an education at a level that can keep up with changes and developments. Students face numerous and varied problems in the different social environments they are in, as well as in their own private area. Students need to use problem solving skills to cope with these problems. Moreover, human beings encounter some problems not only in their childhood but also in every period of their lives. To continue life in a healthy and orderly manner, individuals must eliminate the problem situations they encounter. According to Erden (1998: 52), people need to have problem solving skills to adapt to social life and change, to be successful and independent. People develop an attitude towards the situation, person, or objects because of the learning that takes place according to their knowledge and interests in the process of producing solutions to the problems they encounter. Among the objectives of the Science Curriculum in Turkey, it is stated that students should develop curiosity, attitude and interest in the events that occur in nature (Ministry of National Education [MoNE], 2018:4). Therefore, it can be understood clearly that scientific attitude is important in education.

The complex situations that individuals experience can be considered as a problem (Polat & Tmkaya, 2010: 348). Moreover, any difficulties felt and desired to be eliminated can be a problem (Karasar, 2016: 81). Problem solving can be defined as the process of eliminating the difficulties encountered. According to another definition, it is a complex process in which cognitive, affective, and behavioral skills are used, and the people go through from feeling the problem to finding a solution to the problem. (DemirtaÇ & Dnmez, 2008: 183). Ocak and EÇmir (2014: 29) stated that problem solving is a skill that provides personal development and effective

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learning. In this case, problem solving skill can be described as one of the most important skills that a person must achieve to produce solutions in problem situations.

It is seen that the concept of attitude is handled in different ways. Attitude is expressed as a fact gained through learning, guiding the behavior of the individual and causing bias in decision making process. Thurstone (1931), on the other hand, defined the attitude as “a positive or negative density ranking and grading towards a psychological object” (Tavçançıl, 2010). Scientific attitude has been defined by Jayasree and Rao (1999) as investigative considerations and behaviors that facilitate to find a solution for problems, come up with information, and transfer the research competences into experience. According to Rani and Rao (2000), scientific attitude is the disposition look for the truth, think rationally and behave sensibly (Çakır, 2012: 23). Therefore, it can be said that we need to have those attitudes and behaviors to continue both our education life and our daily routine. According to BaÇaın (1988: 300), a person with a scientific attitude is willing to recognize and solve the situation or problem he/she faces; designs several ways to solve the problem and starts to question one of these ways; evaluates the outcome of the actions. In this context, Bingham (1976: 11) stated that problem solving skill is related to attitude. The scientific attitude adopted by the individual in the problem-solving process enables the problem to reach rational solutions. Students who have a scientific attitude in solving a problem can recognize the problem and try different solutions. For this reason, students with strong scientific attitude are expected to have problem solving skills. Similarly, students with high level problem-solving skills are expected to have strong scientific attitudes. In this aspect, it can be thought that there may be a relationship between problem solving skill and scientific attitude.

When the literature is examined, many studies with respect to problem-solving skills and scientific attitude have been found (Korkut, 2002; Osborne, Simon & Collins, 2003; Terzi, 2003; Saygılı, 2010; Totan, 2011; Özden, 2012; Gömleksiz & Bozpolat, 2012; Canpolat, Kazak Çetinkalp & ÖzkaÇer 2013; Koç, 2014; Yu, Fan & Lin, 2015; Mahulae, Sirait & Sirait, 2017; Karahan, 2018; Puspita, 2018). However, there is no study investigating the relationship between problem-solving skills and scientific attitude of the secondary school students. In this respect, it can be said that the research is an original study. For this reason, literature review is handled separately in terms of topics.

Numerous studies were found in the literature review related to problem-solving skills. While some of them studied the problem-solving skills of students, teachers, or prospective teachers in terms of various variables, some of them examined the relationship between problem-solving skills and another variable. For example, Canpolat, Kazak Çetinkalp and ÖzkaÇer(2013) investigated problem-solving skills of 2<sup>nd</sup> class primary school students and classroom climate in a physical education class. While Terzi (2003) conducted a study on the 6<sup>th</sup> class students' interpersonal problem-solving skills perceptions, Karahan (2018) studied high-school students' problem-solving skills and life satisfaction. On the other hand, Gömleksiz and Bozpolat (2012) evaluated the opinions of the 4<sup>th</sup> and 5<sup>th</sup> class students on problem-solving skills; Korkut (2002) examined the problem-solving skills of high school students. Saygılı (2010) examined the effect of effective use of instructional technologies in science and technology lessons on problem solving skills of primary school students and some other variables. Also, Totan (2011) examined the effect of the problem-solving skills training program on the 6<sup>th</sup> class primary school students' social-emotional learning skills. Similarly, relational studies on problem-solving skills are also included in the literature. Uysal (2007) conducted a study on the relationship between secondary school students' problem-solving skills, anxieties, and attitudes towards mathematics lesson. On the other hand, Öner (2019) investigated the relationship between secondary school students' attitude towards STEM, perception, problem-solving and questioning learning skills in his master's thesis; Gözcü Reyhan (2018) examined the relationship between the creative thinking tendencies, perceptions of problem-solving and academic achievement of the 8<sup>th</sup> class students of primary education; Gülen (2017) carried out a study on the relationship between adolescents' problem-solving skills and cyberbullying coping behavior. Also, Derin (2006) surveyed the relationship between problem-solving skills, locus of control, and academic achievement of elementary school 8<sup>th</sup> class students. In addition, while DemirtaÇand Dönmez (2008) preferred to work with teachers in secondary education, Ocak and EÇmir (2014) carried out their study with prospective teachers; Polat and Tümkaya (2010) investigated their research with students studying at classroom teaching program; Akyol (2019) conducted his study with students of education faculty.

Besides that, various quantitative and qualitative studies have been conducted to determine the scientific attitude such as scientific attitudes of primary school students (e.g. Afacan, 2008; Mıhladıız & Duran, 2010), of gifted girl students (e.g. Camcı Erdoğan 2013), of secondary school students (e.g. Kılıç, 2011; Sekar & Mani, 2013; Kalaivani & Pugalenth, 2015; Ocak, Ocak & Olur, 2021) and of prospective teachers studying in Abu Dhabi (e.g. Önen Öztürk, 2016). While Çakır (2012) investigated the relationship between classroom teachers' opinion on the nature of science, scientific attitude and science self-efficacy levels, Çelik and Onay (2014) conducted

their study on the 6<sup>th</sup> class students' scientific attitudes and self-confidence; Ergin and Özgürol (2011) surveyed the relationship between scientific attitude and emotional intelligence. On the other hand, Özden (2012) researched on the views and scientific attitudes of secondary school students towards scientific knowledge in terms of various variables; Uzun (2011) examined the views of the 5<sup>th</sup> class students towards scientific knowledge and their attitudes towards Science. Demirbağ and Yağbasan (2011) conducted a study on the effect of 2005 Science and Technology Curriculum in the development of scientific attitudes of primary school students. It is seen that both scientific attitude and problem-solving skills are examined separately in terms of different variables.

### **Problem Statement and Importance of the Study**

Rapid changes and developments in science and technology caused by the millennium age cause people to face different situations and problems in a wide range of environments. Individuals with problem-solving skill can solve their problem situations and create a balanced situation again. Individuals with a high level of problem-solving skills can easily cope with the problems they come upon. In addition, to keep up with the rapid changes and developments in science and technology, the scientific attitude levels of individuals should be high since scientific attitude help individuals to keep up with the changes and benefit from the advantages provided by technology. Based on the understanding that school is life itself, it is among the general aims of education to develop the ability of individuals to find solutions to the problems they will encounter throughout their lives and a positive attitude towards science. Scientific attitudes of students are thought to improve their problem-solving skills, knowledge production skills and research tendencies. For this reason, knowing the relationship between students' problem-solving skills and their scientific attitudes, and the factors affecting this relationship may be a source for the studies of organizing and developing the educational environment and curriculum content.

In this study, it is aimed to examine the relationship between problem solving skills and scientific attitudes of secondary school students in terms of gender, class level and parental education level variables.

### **Following sub-questions guided throughout the study:**

#### *Sub questions:*

- 1) What is secondary school students' problem-solving skills level?
- 2) What is secondary school students' scientific attitudes level?
- 3) Is there a significant relationship between problem-solving skills and scientific attitudes of secondary school students?
- 4) Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of gender?
- 5) Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of class level?
- 6) Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of their mothers' education level?
- 7) Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of their fathers' education level?
- 8) Do the problem-solving skills and gender variable have a significant and common effect on the scientific attitudes of secondary school students?
- 9) Do the problem-solving skills and class level variables have a significant and common effect on the scientific attitudes of secondary school students?
- 10) Is there a significant difference between the scientific attitudes of secondary school students in terms of their problem-solving skills levels?
- 11) Are secondary school students' problem-solving skills a predictor of their scientific attitudes?

## **Method**

### **Research Design**

This study, which is conducted to investigate the relationship between students' problem-solving skills and scientific attitudes in terms of various variables, employed a correlational research model. Correlational research models purpose to specify the existence or degree of variance between two or more variables (Karasar, 2016: 114).

## Population and Sampling

This research was studied with 653 students from 5<sup>th</sup>, 6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup> class studying at four different secondary schools in Afyonkarahisar Province, Turkey in the 2016-2017 academic year. For the sample to represent the population, the study was carried out with 560 secondary school students who were appropriate at the 95% confidence level (Büyüköztürk et al., 2016: 85). The population of study is the secondary school students in Afyonkarahisar Province, Turkey. In the study, convenience sampling method, one of the simple random sampling methods, was used in order to reach a large number of students in a short time, in the most accessible way, and to select an unbiased study group.

Table 1: Sample Distribution

Variable	Type	N
Gender	Female	311
	Male	249
	Total	560
Class	5	103
	6	125
	7	167
	8	165
	Total	560

## Data Collection Tools

In the study, the data were gathered by the Problem-Solving Inventory for Children (PSIC) improved by Serin, Bulut Serin and Saygılı (2010) to determine the problem-solving skills of secondary school students and the Scientific Attitude Scale (SAS) developed by Moore and Foy (1997) and Demirbağ and Yağbasan (2006) adapted it to Turkish by to identify their scientific attitudes. PSIC comprise of 24 items and 3 sub-dimensions. These 3 sub-dimensions are trust to problem-solving skill (12 items), self-control (7 items), and avoidance (5 items). The validity and reliability test of the inventory was conducted, and the Cronbach Alpha reliability coefficient was 0.86, and it was stated that all the sub-dimensions of the scale were reliable (Serin, Bulut Serin & Saygılı 2010: 455). The items in the inventory were prepared in a 5-point Likert type and the tendency of the individuals to show the behaviours stated in the items; 1: I never behave like this, 2: I rarely behave like this, 3: I behave like this once in a while, 4: I behave like this frequently, 5: I always behave like this.

Scientific Attitude Scale was translated into Turkish and then presented to the expert for its proficiency in terms of language, content, and scope. The scale consists of 6 sub-dimensions. These 6 sub-dimensions are scientific laws and structure of theories, having scientific behaviour, the structure of science and its approach to the cases, the structure and objective of science, the place, and importance of science in society, and eagerness to exercise scientific studies. The items were prepared in a 5-point Likert type and the degree of people's participation in the items was classified as "I strongly agree", "I agree", "I am neutral", "I disagree" and "I strongly disagree". 20 of the items in the scale were determined as positive and 20 as negative. Negative items were reversed during analyses. As a result of the reliability analysis of the scale, the Cronbach Alpha reliability coefficient was 0.76, and Spearman-Brown two-half correlation was found as 0.84.

## Data Analysis

The scales and personal information form were applied to 653 secondary school students. However, it was seen that some of the forms were incomplete. Therefore, the analyses were conducted on 560 scale forms. The valid response rate was 85 %. The data obtained from the scales were analysed in a computer environment by means of a statistical program. The lowest average score that can be obtained from the scales is 1. The highest score is 5. In the analysis conducted in the study, the level of significance was accepted as .05.

## Findings and Interpretation

### Sub problem 1: What is the secondary school students' problem-solving skills level?

The scores obtained from the problem-solving skills scale are shown in Table 2.

Table 2: Secondary School Students' Problem Solving Skills Level

Scale and Sub-Dimensions	x	sd
Trust to Problem-Solving Skills	3.76	.75
Self-Control	3.47	.83
Avoidance	4.05	.73
Total	3.74	.62

In Table 2, the mean value of secondary school students' problem-solving skills level related to the sub-dimensions is at the medium level ( $x = 3.76$ ,  $x = 3.47$ ,  $x = 4.05$ ). With the examining the general score that the students had, it was clear that the students had a high level of skill as the other sub-dimensions.

### Sub problem 2: What is secondary school students' scientific attitudes level?

The scores obtained from the scientific attitude scale are shown in Table 2.

Table 3: Secondary School Students' Scientific Attitude Level

Scale and Sub-Dimensions	x	sd
Scientific Laws and Structure of Theories	2.69	.55
The Structure of Science and Its Approach to Cases	2.84	.52
Having Scientific Behaviour	2.80	.59
The Structure and Objective of Science	2.10	.64
The Place and Importance of Science in Society	3.87	.84
Eagerness to Exercise Scientific Studies	2.66	.43
Total	2.71	.37

In Table 3, the mean value of secondary school students' scientific attitude level related to the sub-dimensions is at the medium level ( $x = 2.69$ ,  $x = 2.84$ ,  $x = 2.80$ ,  $x = 2.10$ ,  $x = 3.87$ ,  $x = 2.66$ ). With the examining the general score that the students had, it was clear that the students had a medium level of skill as the other sub-dimensions.

### Sub problem 3: Is there a significant relationship between problem-solving skills and scientific attitudes of secondary school students?

Pearson correlation test was used to investigate the relationship between problem-solving skills and scientific attitude.

Table 4: Correlation Analysis Result

	N	Pearson Correlation	p
Problem Solving Skills	560	-.09	.02
Scientific Attitude	560		

As can be seen in table 4, there is a significant relationship between secondary school students' problem-solving skills and scientific attitude ( $p = .02$ ;  $p < .05$ ). It was found that this relationship was negative and low ( $r = -.09$ ;  $r < .30$ ).

### Sub problem 4: Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of gender?

A partial correlation test was used to examine the relationship between problem solving skills and scientific attitudes in terms of gender variable.

Table 5: Partial Correlation Test Result in Terms of Gender

		Pearson Correlation	p	N
Female	Problem Solving Skills Scientific Attitude	-.11	.04	311
Male	Problem Solving Skills Scientific Attitude	-.07	.23	249

As a result of the analysis, there was a significant relationship between the problem-solving skills and scientific attitudes of female students ( $p = .04$ ;  $p < .05$ ). This relationship is negative and low ( $r = -.11$ ;  $r < .30$ ). However, the relationship between male students' problem-solving skills and scientific attitudes was not significant ( $p = .23$ ;  $p > .05$ ).

**Sub problem 5: Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of class level?**

A partial correlation test was used to analyse the relationship between problem solving skills and scientific attitudes in the sense of class-level variable.

Table 6: Partial Correlation Test Result in Terms of Class Level

		Pearson Correlation	p	N	
Class Level	5	<u>Problem Solving Skills</u> Scientific Attitude	.00	.97	103
	6	<u>Problem Solving Skills</u> Scientific Attitude	-.08	.35	125
	7	<u>Problem Solving Skills</u> Scientific Attitude	.03	.67	167
	8	<u>Problem Solving Skills</u> Scientific Attitude	-.09	.22	165

In respect of the analysis results obtained in table 6, there was no significant relationship between secondary school students' problem-solving skills and scientific attitudes in the sense of class level variable ( $p > .05$ ).

**Sub problem 6: Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of their mothers' education level?**

Partial correlation test was used to analyse the relationship between problem-solving skills and scientific attitudes in terms of mothers' educational level variable.

Table 7: Partial Correlation Test Results in Terms of Mothers' Education Level.

		Pearson Correlation	p	N	
Mother Education Level	Primary School	<u>Problem Solving Skills</u> Scientific Attitude	-.13	.14	121
	Secondary School	<u>Problem Solving Skills</u> Scientific Attitude	-.05	.40	204
	High School	<u>Problem Solving Skills</u> Scientific Attitude	-.13	.11	135
	University	<u>Problem Solving Skills</u> Scientific Attitude	-.06	.55	100

As a result of the analysis, it was obtained that the relationship between secondary school students' problem-solving skills and scientific attitudes was not significant in terms of their mothers' education level ( $p > .05$ ).

**Sub-problem 7: Is there a significant relationship between secondary school students' problem-solving skills and scientific attitudes in terms of their fathers' education level?**

A partial correlation test was used to analyse the relationship between problem-solving skills and scientific attitudes in the sense of fathers' education level variable.

Table 8: Partial Correlation Test Results in the Sense of Fathers' Education Level.

		Pearson Correlation	p	N	
Father Education	Primary School	<u>Problem Solving Skills</u> Scientific Attitude	-.25	.06	63

Level		Problem Solving Skills			
Secondary School		_____	-.13	.19	100
		_____			
High School		_____	-.06	.39	201
		_____			
University		_____	-.06	.37	196
		_____			

As a consequence of analysis, the relationship between secondary school students' problem-solving skills and scientific attitudes was not significant in the sense of their fathers' education level ( $p > .05$ ).

**Sub problem 8: Do the problem-solving skills and gender variable have a significant and common effect on the scientific attitudes of secondary school students?**

To analyse the common effect of the problem-solving skill variable and gender variable on scientific attitude, two-way analysis of variance was performed.

Table 9: Two-Way Analysis of Variance (ANOVA) Results

Source of Variance	Sum of Squares	df	Mean of Squares	F	p	$\eta^2$
Problem Solving Skills	376.89	2	188.44	.82	.44	.00
Gender	243.19	1	243.19	1.05	.30	.00
Problem Solving Skills *Gender	225.17	2	112.58	.49	.61	.00
Error	127208.36	554	229.61			
Total	6741997.00	560				

According to table 7, problem solving skills variable and gender variables do not have a significant and common effect on the scientific attitudes of secondary school students ( $p > .05$ ).

**Sub problem 9: Do the problem-solving skills and class-level variables have a significant and common effect on the scientific attitudes of secondary school students?**

To analyse the common effect of the problem-solving skill variable and class level variable on scientific attitude, two-way analysis of variance was performed.

Table 10: Two-Way Analysis of Variance (ANOVA) Results

Source of Variance	Sum of Squares	df	Mean of Squares	F	p	$\eta^2$
Problem Solving Skills	20.79	2	10.39	.04	.95	.00
Class Level	5073.02	3	1691.00	7.65	.00	.04
Problem Solving Skills *Class Level	489.52	4	122.38	.55	.69	.00
Error	121558.78	550	221.01			
Total	6741997.00	560				

According to Table 8, problem-solving skills variable and class level variable do not have a significant and common effect on the scientific attitudes of secondary school students ( $p > .05$ ).

### Sub problem 10: Do the scientific attitudes of secondary school students differ in terms of problem-solving skills?

Independent samples t test was conducted to examine the effect of students' problem-solving skills on their scientific attitudes.

Table 11: Independent Samples t Test Results

		N	x	S.D.	t	df	p
Problem Solving Skills	Low	252	2.73	0.40	1.19	558	.23
	High	308	2.69	0.35			

As a consequence of the analysis, no significant difference was found between the scientific attitudes of secondary school students according to their problem-solving skill levels ( $p > .05$ ).

### Sub problem 11: Are secondary school students' problem-solving skills a predictor of their scientific attitudes?

Regression analysis was done to test if problem-solving skill is a significant predictor of scientific attitude.

Table 12: Simple Linear Regression Analysis Results

	$\beta$	Standard Error $\beta$	R	R <sup>2</sup>	Standardized $\beta$	t	F	p
Problem Solving Skills	-1.56	1.21	.05	.0025	-.05	-1.28	1.66	.19

As a consequence of the analysis, it was determined that the problem-solving skills of secondary school students were not a significant predictor of their scientific attitudes ( $p = .19$ ;  $p > .05$ ).

## Conclusion-Discussion and Suggestions

This study was conducted to determine the relationship between secondary school students' problem-solving skills and scientific attitudes in the sense of various variables. According to the findings obtained in the study, there was a negative and low-level relationship between problem solving skills and scientific attitudes of secondary school students. Although the students' scientific attitude level is high, it can be said that they avoid finding solutions to problems. There are studies supporting the findings of this finding in the literature. Similarly, Derin (2006) stated that there was a negative relationship between problem solving skills, locus of control and academic achievements of the 8<sup>th</sup> class students in primary education. In a study conducted by Gülen (2017), it was found that there was a negative and low-level relationship between adolescents' problem-solving skills and coping behaviour with cyberbullying. In the study investigated by Gözcü Reyhan (2018), it was appeared that there was a negative and significant relationship between the 8<sup>th</sup> class students' creative thinking tendencies and their perceptions of problem solving. According to a study conducted by Öner (2019), there was a negative and significant relationship between secondary school students' problem-solving skills and STEM perceptions. Karahan (2018), found a negative relationship between problem solving skills and life satisfaction of high school students in his study. Apart from these, a significant relationship was found in other correlational studies conducted with the scientific attitudes of the students, but this relationship was found to be positive, unlike the current study. In the study conducted by Afacan (2008: 174) there was a significant relationship between the level of perception of the primary school students about their STCE relationship and their scientific attitudes. Çelik and Onay (2014: 48) examined the relationship between the scientific attitudes and self-confidence of the 6<sup>th</sup> class students. In this study, a positive relationship was found between students' self-esteem and scientific attitude levels. He stated that students with high self-confidence levels had high scientific attitudes. In the study investigated by Özden (2012) it was appeared that there was a positive and significant relationship between the views of primary school students towards scientific knowledge and their scientific attitudes. In the study conducted by Ergin and Özgürol (2011), it was obtained that there was a positive and significant relationship between students' emotional intelligence and scientific attitudes. In the study conducted by Kılıç (2011), it was determined that the relationship between scientific creativity and scientific attitude was

not significant. In the study conducted by Gözcü Reyhan (2018), it was clear that there was no significant relationship between students' perceptions of problem solving and their academic success.

According to the results of this study, it was concluded that the scientific attitudes of female students with the high problem-solving skills were low. It was found that the relationship between male students' problem-solving skills and scientific attitudes was not significant. Ergin and Özgürol (2011: 1772) found that scientific attitude did not differ by students' age, gender and class level. Mıhladıız and Duran (2010), Demirbağ and Yağbasan (2011: 338), Özden (2012: 95) and Özden and Yenice (2014) also found in their studies that there was no significant relationship between students' scientific attitudes and gender. In the study carried out by Terzi (2003: 10) on 6<sup>th</sup> class students' interpersonal problem-solving skill perceptions and the study conducted by Taylan (1990: 50), it was found that there was no significant difference in terms of gender variable.

According to the findings of the study, no significant relationship was found between the problem-solving skills and scientific attitudes of secondary school students in terms of the class level variable. According to this result, the relationship between students' problem-solving skills and scientific attitudes does not change as to the class level. Similarly, in the studies investigated by Afacan (2008) and Özden (2012), it was determined that the scientific attitudes of the students did not differ by the class level. In the study conducted by Gömleksiz and Bozpolat (2012), it was resulted that there was no significant difference between the 4<sup>th</sup> and 5<sup>th</sup> class students in terms of problem-solving skill levels. Akyol (2019) found in his study with students of education faculty that there was no significant difference between problem-solving skills and class level.

As a result of the analysis, as to the education level of the mother and father, there was no significant relationship between secondary school students' problem-solving skills and scientific attitudes. However, a negative and low-level relationship was found in terms of students whose father was a primary school graduate. Similar results were found in the literature review. Mıhladıız and Duran (2010) concluded that there was no significant correlation between the attitudes of primary students towards science and the educational level of their parents. In the study investigated by Derin (2006), it was concluded that there was no significant relationship between the problem-solving skills of the 8<sup>th</sup> class students and the education level of their parents.

According to the results of this study, the common effect of problem-solving skills and gender on the scientific attitudes of secondary school students was not significant. Hence, it can be said that students' problem-solving skill levels or the difference in gender do not influence their scientific attitude level. These findings are similar to the results of the study conducted by Fadli (2019) on scientific attitudes and problem-solving skills.

The common effect of problem-solving skills and class level on the scientific attitudes of secondary school students was investigated. It was concluded that the common effect was not significant. As to the analysis, when the scientific attitudes of the secondary school students were examined according to their problem-solving skill levels, no significant difference was obtained. It was determined that students' problem-solving skills were not a significant predictor of their scientific attitudes. In another saying, problem solving skills do not have an impact on the explanation of students' scientific attitudes.

This study was conducted with secondary school students. A similar study can be carried out at primary school, high school, and university level. The study was designed with quantitative research method. It can be performed by patterning with qualitative research methods to obtain more detailed information. The scope of the research can be expanded by measuring attitudes towards disciplines such as mathematics. To have more detailed information in determining problem solving skills, a measurement tool can be developed and examined in terms of different variables. The results can be compared by conducting a study in terms of scientific attitude on a group trained in problem solving skills. The variables subject to the research can be considered together in an experimental study. By conducting a meta-analysis study within the scope of the variables subject to the study, the results obtained with a holistic perspective can be reinterpreted.

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