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Examination of Secondary School Students' Attitudes towards Socioscientific Issues*

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Abstract
The interplay between culture and technology is dynamic. Since ancient times, science has had a major impact on people, and people have determined the general direction of science progress. In this way, there is mutual influence between society and science. Socioscientific issues have emerged as a result of the interaction process between science and society. In this context, it was aimed to examine eighth grade students' attitudes towards socioscientific issues. The study was conducted with 136 eighth grade students studying in a city in the Central Anatolia region of Turkey in the 2018-2019 academic year. Quantitative data collection and analysis methods were used in this study, which aimed to examine the secondary school students' attitudes towards socioscientific issues. "The Attitudes towards Socioscientific Issues Scale (ATSIS) " was used as data collection tool in the study. According to the findings of the factorial ANOVA test; it was determined that eighth grade students' showed positive attitude on socioscientific issues. While students had positive attitudes related to interest and usefulness of SSI, they also had neither positive nor negative attitudes related to interest and usefulness of SSI. In addition, it was observed that the general attitude levels about socioscientific issues and the mean scores of interest and usefulness, liking and anxiety sub-dimensions did not differentiate according to gender. Based on the findings, the importance of socioscientific issues was emphasized and recommendations were made to program makers, researchers and practitioners on teaching.

Keywords: Socioscientific Issues, Attitude, Secondary School Students

* This study has been prepared from the second author's master's thesis prepared under the consultancy of the first author.

1. Introduction

1.1 Introduce the Problem

Since ancient times, science has had a major impact on people, and people have determined the general direction of science progress. In this way, there is mutual influence between society and science. Scientific developments are driven by the needs of society. Scientific progress has a major effect on people's sense of values, so dilemmas and controversies are increasing (Sadler and Zeidler, 2004).

Knowledge accumulation is increasing day by day. Therefore, what is expected from today's students is to know which of their knowledge is supported by evidence and which is based on theory. In addition, another important point is that students are aware that knowledge is dynamic and changes over time (Çepni, 2005). Thus, today's individuals will be more active in both accessing and using information, solving the problems, reaching conclusions about the possible risks, benefits and possibilities of the problems related to science, and creating new information.

In recent years, due to scientific and technological studies and the possible risks of these studies it is necessary to use socioscientific issues in education. Socio-scientific issues are current issues that include scientific and social issues together, contain many social dilemmas, do not have a definite answer, are open to discussion, cannot be easily concluded, including moral and ethical issues, and concern the society (Fowler, Zeidler and Sadler, 2009; Sadler; 2004; Ratcliffe and Grace, 2003; Zeidler, Sadler, Applebaum and Callahan, 2009).

For a subject to be expressed socio-scientific, it must contain two criteria at least:

- These; the issue is related to the field of science and
- This issue has a social context (Eastwood, Sadler, Zeidler, Lewis, Amiri and Applebaum, 2012).

It is inevitable that science develops rapidly, individuals try to keep up with the changing world, they follow the media, information is spreading rapidly, and also they are affected by scientific and non-scientific information. In addition, socioscientific issues that we encounter frequently in the media, on websites and in many other places are frequently discussed by people with their positive and negative aspects. For example, nuclear power plants planned to be built in Sinop and Mersin region in Turkey are constantly discussed by many scientists in television programs. While some people argue that the opening of a nuclear power plant will contribute to the country's economy and will have many similar benefits, some people focus on the possible risks.

The National Research Council (NRC 1996, Queensland School Curriculum Council, 2001) emphasized that individuals should be able to discuss socioscientific issues, moreover they need to improve their skills in making analyzes and decisions on this subject.

The ability to make informed decisions on science-related social issues is considered an important attribute of scientific literacy which is one of the ultimate goals of science education. Therefore, the decision-making stages of students on socioscientific issues have been examined by many researchers and are still being studied. In addition, according to most studies, it has been observed that students understand science concepts better in learning environments where socioscientific issues are core elements (Topçu, Muğaloğlu and Güven, 2014).

Since the sub-topics of socioscientific issues are problems which individuals may encounter in their daily lives, science education aims to explain these topics and teach them to students (Albe, 2008; Kolsto, 2006; Nielsen, 2012; Walker and Zeidler, 2007). For example, when considered in terms of socioscientific issues, social concerns and ethical dilemmas should not be socio-scientific issues should not be considered separately from science education (Sadler, 2011; Sadler, Amirshokoohi, Kazempour and Allspaw, 2006). Therefore, socioscientific issues have been included in the Science curriculum in many countries and it is aimed to improve students' thoughts on this issue (Oulton, Dillon and Grace, 2004). Students' understanding on socioscientific issues enables them to make more informed decisions on real-life problems and social dilemmas and it is important that they realize

processes and actions they used to make those decisions (Albe, 2008; Kolsto, 2006; Van der Zande, Warloo, Brekelmans, Akkerman and Vermunt, 2011). Individuals who know about SSI are aware of ethical, legal and scientific issues. In addition, they take an active role in decision-making processes regarding these issues (Van der Zande, 2009). This awareness of students also enables them to be active members of the society (Dawson, 2011). For this reason, it is necessary that individuals raise their awareness about ethical dilemmas and their understanding of different perspectives, and they gain the skills necessary to solve these dilemmas (Dawson, 2011).

When the related literature was examined, it was seen that there are many studies on socioscientific issues at the undergraduate level (İşbilir, Ertepınar and Çakıroğlu, 2012; Özdemir and Çobanoğlu, 2008; Soysal, 2012; Turan, 2012) and some studies focus on a topic selected from socioscientific issues (Demir and Düzleyen, 2012; Kırbağ Zengin, Keçeci, Kırılmazkaya and Şener, 2012; Özdemir and Çobanoğlu, 2008; Uzunkol, 2012). Genç and Genç (2017) conducted on a content analysis on socioscientific issues studies carried out in Turkey. in this content analysis, Genç and Genç (2017) observed that mainly global warming (30.56%), biotechnology (19.44%), nuclear energy (13.89%), GMO (13.89%), organ transplantation (13.89%), cloning (%) 5.56) and HEPP (2.78%) issues were studied. It is noteworthy that most of the studies are quantitative (77.78%). In addition, according to the results of the study, questionnaire (50.94%) was the most preferred data collection tool, besides achievement test (18.87%), attitude scale (13.21%) and interview forms (16.98%) were also included. Moreover, most of the studies were conducted with undergraduate students (61.11%), respectively high school students (19.44%), secondary school students (11.11%), educators (5.56%) and parents (2%, 78).

In this study, socioscientific issues such as stem cells, cloning, GMOs, nuclear power plants, biotechnology, global warming, HEPP and organ transplantation were determined by field studies and opinions of field experts. These selected topics are included in the secondary school science curriculum. As it is seen, multiple socioscientific issues will be examined together in this study.

The ability to talk and discuss about socioscientific issues is important for the individual to make the right decisions on behalf of herself/himself, her environment and our country. socioscientific issue (SSI)-based education draws the attention and increases young people's interests and knowledge in these issues. All individuals should be informed about socioscientific issues that cover many subjects, so it is essential to help the students to become aware of socioscientific issues in the classroom. The number of study on socioscientific issues is increasing every year in Turkey. For this reason, it should be investigated in education levels. When the relevant literature was examined, it was observed that studies have been conducted on socioscientific issues at different educational levels: at higher education (Al, 2015; Arslan and Atabey, 2018; Çakırlar Altuntaş, Yılmaz and Turan, 2017; Demiral and Çepni, 2018; Demircioğlu and Uçar, 2014; Eş, Işık Mercan and Ayas, 2016; Gürbüzoğlu Yalmancı and Gözüm, 2016; Harman and Çökelez, 2017; İşbilir, 2010; Karakaya, 2015; Kaya, 2013; Kurt and Ekici, 2013; Sönmez and Kılınç, 2012; Ural Keleş, 2018; Yalvaç Hastürk, 2013), at secondary education (Ayvacı and Şenel Çoruhlu, 2009; Çetin and Harman, 2012) and at primary education (Çavuş, 2013; Demirci and Yüce, 2018; Gülhan, 2012; Kırbağ Zengin, Keçeci, Kırılmazkaya, 2012; Özsoy and Kılınç, 2017; Öztürk, 2013; Topçu and Atabey, 2017; Yavuz Topaloğlu and Balkan Kıyıcı, 2017). It is striking that most of the researches is at the undergraduate level while the studies conducted with secondary school students is less. This study will also increase the number of studies for middle school students. Considering that eighth grade science curriculum includes more SBK-related acquisitions than other grade levels and SBK has two aspects, social and scientific, it is important to study the SSI for the eighth graders because it directly concerns the science course.

In this study, based on the explanations above, it is focused on examining the attitudes of eighth grade students towards socioscientific issues.

For this purpose, answers to the following questions will be sought:

- What is the attitude level of eighth grade students towards socioscientific issues?
- Do the attitudes of eighth grade students towards socioscientific issues differentiate according to gender?
- Do the attitudes of eighth grade students towards socioscientific issues differentiate according to mother's education level?

- Do the attitudes of eighth grade students towards socioscientific issues differentiate according to father's education level?

2. Method

2.1 Research Model

Quantitative data collection and analysis methods were used in this study, which aimed to examine the attitudes of secondary school student towards socioscientific issues. A research was carried out using the general survey model in the study. Survey research aims to define a situation as it exists and collect data to identify certain characteristics of a group (Karasar; 2006, Büyüköztürk, Çakmak, Akgün, Karadeniz and Demirel, 2010). A general survey is an overall review to make a general judgment about a universe made up of many members, the whole universe or within a sample (Karasar, 2006).

2.2 Study Group

The study was conducted with 136 eighth grade students studying in eight different state secondary schools located in a city of the Central Anatolia region of Turkey. In this study, convenience sampling, which is one of the purposeful sampling methods, was selected. This sampling method provides the researcher speed and practicality because in this method, the researcher chooses a situation that is close and easy to access (Yıldırım and Şimşek, 2016).

To describe the demographic characteristics of the students in the study, demographic variables thought to affect their attitudes about socioscientific issues, and their frequency and percentage values group are given below.

Table 1: Frequency Table for the Variable Gender

Gender	Frequency	Percent (%)
Female	73	53,7
Male	63	46,3
Total	136	100,0

As seen in Table 1, It was observed that the numbers of male and female participants are close to each other.

Table 2: Frequency Table for Mother's Education Level Variable

Mother's Education Level	Frequency	Percent (%)
Primary School	71	52,2
Middle School	45	33,1
High School	17	12,5
University	3	2,2
Total	136	100,0

According to the findings in Table 2, it was seen that the mothers of the students participating in the study were mainly primary school (52.2%) graduates, and a very small portion of them was university graduates (2.2%)

Table 3: Frequency Table for Father’s Education Level Variable

Father’s Education Level	Frequency	Percent (%)
Primary School	37	27,2
Middle School	43	31,6
High School	43	31,6
University	13	9,6
Total	136	100,0

According to the findings in Table 3 when the fathers' education status of the students participating in the study were examined, it was found that most of them were secondary school (36.6%) and high school (36.6%) graduates, and the fathers who were university graduates (9.6%) were still less.

2.2 Data collection tools

Information about the use of data collection tool used in the research process was presented below.

2.2.1 Attitudes towards Socioscientific Issues Scale

The "Attitude Scale towards Socioscientific Issues" developed by Topçu (2010) was used to measure eighth grade students' attitudes towards socioscientific issues. this scale consisted of 30 items with 3 sub-dimensions as (1) Liking (2) Anxiety; (3) interest and usefulness. It was a five-point Likert type scale and its response format was ranging from (1) strongly disagree to (5) strongly agree. Item-26 and item-28 in the liking sub-dimension were reverse coded because they contain negative attitude expressions. Item-3, item-5, item-12, item-16, item-17, item-19 and item-29 in the anxiety sub-dimension were reverse coded when calculating the attitude score. However, while calculating the scores in the anxiety sub-dimension, the answers given to the items were not subjected to reverse coding. As a result, the mean scores of the participants' attitude and for the sub-dimensions of the scale were formed by taking the arithmetic mean of their responses to the relevant items. Topçu (2010) found that a confirmatory factor analysis supported the three-dimensional structure of ATSIS and the Cronbach α coefficient ranged from 0.70 to 0.90. Cronbach α coefficients for each dimension were computed and "Liking socioscientific issues" was found as .8, "The interest and usefulness of socioscientific issues" .90, "Anxiety towards socioscientific issues" .70.

Before the study, a pilot study was conducted with 150 students for the reliability studies of the scale and the reliability coefficient of the scale was found to be .72, so it was decided that the scale could be applied to secondary school students. Essentially, internal consistency reliability test of 0.7 or higher indicates an acceptable level of reliability (Büyüköztürk, 2012; Şimşek, 2017). In this study, the Cronbach alpha coefficient was calculated as .89 for the whole attitude scale about socioscientific issues, .84 for the Interest and Usefulness of socioscientific issues sub-dimension, .87 for the Liking sub-dimension, and .72 for the Anxiety sub-dimension.

2.3 Analysis of data

In the study, the scales given to the students were examined one by one in the analysis of the data. In addition, the data was checked for inaccuracies, and then they were entered into the SPSS program by the researcher. While analyzing the data, the answers given to the scale were scored as "1 = Strongly Disagree", "2 = Disagree", "3 = Undecided", "4 = Agree" and "5 = Strongly Agree". Items 26 and 28 in the liking sub-dimension are reverse coded because they contain negative attitude statements. Likewise, all seven items in the Anxiety sub-dimension (Item 3, Item 5, Item 12, Item 16, Item 17, Item 19 and Item 29) were scored by reverse coding while calculating the students' general attitude score. However, while calculating the Anxiety subscale score, the answers given to the items were scored without any reverse coding process. In this context, students' attitude and sub-dimension mean scores about socioscientific issues were formed by taking the arithmetic mean of their answers to the relevant items. The distribution of the number of students participating in the study according to their demographic characteristics was determined by calculating the frequency and percentage values. Likewise, the attitude levels of the students about socioscientific issues were evaluated using descriptive statistics.

The factorial ANOVA model was used to determine whether the students' attitude levels about socioscientific issues differentiate according to demographic variables. The factorial ANOVA should be used when the research question asks for the influence of two or more independent variables on one dependent variable. The results of the factorial ANOVA model provide more detailed and generalizable findings than the one-way ANOVA model (Howell, 2008). While the effect of only one factor on the dependent variable is shown in the one-way ANOVA model, in the factorial ANOVA model, the effect of two factors (independent variable) and their interactions on the dependent variable can also be examined (Akbulut, 2010; Howell, 2008). There are many types of factorial

models and such designs are classified by the number of levels of each factor and the number of factors. So a 2x2 factorial will have two levels or two factors and a 2x3 factorial will have three factors each at two levels. A "main effect" is called the effect of one of your independent variables on the dependent variable, ignoring the effects of all other independent variables while interaction effects may occur between two or more categorical independent variables as in factorial analysis of variance designs.If the interaction effect is significant among these effects, it means that a more important result is obtained than the main effects (Akbulut, 2010) the 2 x 4 x 4 factorial ANOVA model was used in the study because the gender variable, which was considered as a demographic variable in the study, consisted of two categories, the mother's education level four categories, and the father's education level four categories.

3. Findings

3.1 Findings Related to Testing Normality of Data

Whether the average scores obtained from the attitude scale on socioscientific issues and its sub-dimensions show normal distribution according to the subcategories of the variables of gender, mother's education level and father's education level was evaluated by taking into account the skewness and kurtosis values of the data and some descriptive statistical values. The obtained findings were presented in Table 4, Table 5, and Table 6.

According to the limits stated below, the attitude score of a group can be evaluated according to the 5-point Likert type average score. While determining the width between class intervals, Class Width = Array Width / Number of Groups equality was checked. Class Width was expressed as 4/5 = 0.80. Accordingly, mean scores between 1.00-1.79 are very negative, mean scores between 1.80-2.59 are negative, scores between 2.60-3.39 are neither positive nor negative, scores between 3.40-4.19 are positive, and mean scores between 4.20-5.00 are interpreted as very positive attitude (Tekin, 1987).

Table 4: Descriptive Statistics Regarding Sub-Dimensions and Attitudes towards Socioscientific Issues According to Gender Variable

Dimension	Gender	N	Mean	Ss.	Skewness	Kurtosis	Minimum	Maximum
General attitude	Female	73	3.40	0.55	-0.476	0.021	1.90	4.50
	Male	63	3.43	0.73	-0.720	1.084	1.13	4.77
The interest and usefulness	Female	73	3.58	0.66	-0.699	0.253	1.77	4.69
	Male	63	3.59	0.90	-1.094	1.262	1.00	5.00
Linking	Female	73	3.27	0.80	-0.649	0.061	1.20	4.80
	Male	63	3.40	0.96	-0.634	0.292	1.00	5.00
Anxiety	Female	73	2.76	0.74	0.446	-0.207	1.29	4.57
	Male	63	2.81	0.85	0.375	-0.069	1.00	5.00

Table 5: Descriptive Statistics Regarding Sub-Dimensions and Attitudes towards Socioscientific Issues According to Mother's Education Level Variable

Dimension	Level of Education	N	Mean	ss.	Skewness	Kurtosis	Minimum	Maximum
General attitude	Primary	71	3.36	0.71	-0.742	0.611	1.13	4.57
	Secondary	45	3.47	0.54	-0.232	1.341	1.97	4.77
	High School	17	3.51	0.59	0.206	-1.132	2.73	4.53
	University	3	3.42	0.41	1.719	-1.121	3.17	3.90

The interest and usefulness	Primary	71	3.46	0.88	-0.985	0.511	1.00	4.65
	Secondary	45	3.69	0.62	-0.858	2.116	1.69	5.00
	High School	17	3.75	0.61	0.306	-0.754	2.92	5.00
	University	3	3.90	0.99	1.176	-1.258	3.08	5.00
Linking	Primary	71	3.23	0.97	-0.554	-0.334	1.00	4.80
	Secondary	45	3.43	0.79	-0.401	0.983	1.40	5.00
	High School	17	3.52	0.70	-0.413	-0.041	2.00	4.60
	University	3	3.43	0.68	1.361	-2.221	2.90	4.20
Anxiety	Primary	71	2.65	0.73	0.667	0.824	1.00	5.00
	Secondary	45	2.88	0.78	0.028	-0.348	1.29	4.57
	High School	17	2.94	0.95	0.244	-0.994	1.53	4.57
	University	3	3.48	0.97	1.361	1.768	2.71	4.57

Table 6: Descriptive Statistics on Sub-Dimensions and Attitudes towards Socioscientific Issues According to Father's Education Level Variable

Dimension	Level of Education	N	mean	ss.	Skewness	Kurtosis	Minimum	Maximum
General attitude	Primary	71	3.46	0.63	-0.509	0.479	1.67	4.50
	Secondary	45	3.29	0.68	-0.581	1.947	1.13	4.77
	High School	17	3.40	0.63	-0.778	0.530	1.67	4.40
	University	13	3.73	0.52	-0.126	-1.262	2.87	4.53
The interest and usefulness	Primary	71	3.58	0.75	-1.203	2.709	1.00	4.69
	Secondary	45	3.49	0.78	-0.561	0.436	1.31	5.00
	High School	17	3.59	0.85	-1.268	1.464	1.15	5.00
	University	13	3.86	0.59	-0.004	-0.260	2.92	5.00
Linking	Primary	71	3.22	0.83	-0.654	0.078	1.00	4.60
	Secondary	45	3.23	0.93	-0.298	0.408	1.00	5.00
	High School	17	3.43	0.88	-0.924	0.525	1.20	4.80
	University	13	3.69	0.76	-0.655	0.632	2.00	4.70
Anxiety	Primary	71	2.41	0.55	0.546	0.780	1.29	3.86

Secondary	45	3.01	0.80	0.316	0.016	1.43	5.00
High School	17	2.98	0.88	-0.101	-0.565	1.00	4.57
University	13	2.45	0.52	-0.112	0.599	1.53	3.43

According to the findings in Table 4, it was seen that all the skewness values of the overall mean scores of male and female students' attitudes, the interest and usefulness, liking and anxiety are within the ± 2 range, and the kurtosis values were all within the ± 3 range. Findings in Table 6 and Table 7 were similar. The skewness coefficients of the students' average general attitude, the interest and usefulness, liking and anxiety scores were in the range of ± 2 according to the education level of both the mother and the father, while the kurtosis coefficients were in the range of ± 3. According to these findings, it can be said that the overall scores of the students' attitude and sub-dimension towards socioscientific issues did not violate the normal distribution assumption.

Findings Regarding Students' Attitudes and Sub-Dimensions on Socioscientific Issues

Whether the mean scores of the students' general attitude towards socioscientific issues and sub-dimension showed a significant difference according to the gender of the students, their mother's educational level and their father's educational level were examined with the factorial ANOVA model.

Table 7: Factorial ANOVA Test Results on General Attitude Scores towards Socioscientific Issues

Source of Variation	Sums of Square	Df	Mean Square	f	p
Gender	0.017	1	0.017	0.040	.841
Mother's education	0.074	3	0.025	0.058	.981
Father's education	0.808	3	0.269	0.639	.592
Gender*Mother's education	0.236	3	0.079	0.186	.905
Gender*Father's education	1.175	3	0.392	0.929	.429
Mother's education*Father's education	2.493	7	0.356	0.844	.553
Gender*Mother's education*Father's education	1.499	4	0.375	0.889	.473

**p>.05*

According to the findings in Table 7, it can be said that the general attitude levels of the students towards socioscientific issues did not significantly differentiate according to the gender of the students, their mother's educational level and their father's educational level(*p>.05*). The situation was similar when considering the interactions between independent variables. It was seen that both the interactions of the variables in pairs and the interaction of all three did not make a significant difference in the general attitude levels of the students about socioscientific issues (*p>.05*).

Table 8: Factorial ANOVA Test Results Related to the Interest and Usefulness Sub-Dimension Scores

Source of Variation	Sums Of Square	Df	Mean Square	f	p
Gender	0.163	1	0.163	0.260	.611
Mother's Education	0.369	3	0.123	0.197	.898
Father's Education	1.484	3	0.495	0.791	.501
Gender*Mother's Education	0.489	3	0.163	0.260	.854
Gender*Father's Education	0.811	3	0.270	0.432	.730
Mother's Education*Father's Education	5.762	7	0.823	1.316	.249
Gender*Mother's Education*Father's Education	1.015	4	0.254	0.406	.804

**p>.05*

In line with the results in Table 8, it can be said that students' the interest and usefulness sub-dimension average scores did not significantly differentiate according to the gender of the students, their mother's educational level and their father's educational level(p>.05). It was observed that the interaction between gender and mother's education level, the interaction between gender and father education level variables, and the interaction between the variables of mother's education level and father's education level did not cause a significant difference in the students' mean scores in the interest and usefulness sub-dimension (p>.05). Likewise, the joint effect of all three independent variables did not lead to a significant difference in the students' mean scores in sub dimensions (p>.05).

Tablo 9: Factorial ANOVA Test Results Related to Liking Sub-Dimension Scores

Source of Variation	Sums Of Square	Df	Mean Square	f	p
Gender	0.158	1	0.158	0.198	.657
Mother's Education	0.269	3	0.090	0.113	.952
Father's Education	1.994	3	0.665	0.836	.477
Gender*Mother's Education	0.702	3	0.234	0.294	.830
Gender*Father's Education	2.871	3	0.957	1.204	.312
Mother's Education*Father's Education	5.416	7	0.774	0.973	.455
Gender*Mother's Education*Father's Education	2.451	4	0.613	0.771	.547

**P>.05*

According to the findings in Table 9, the liking sub-dimension mean scores of the students did not show a significant difference according to the gender of the students, their mother's educational level and their father's educational level (p> .05). In addition, as in the interest and usefulness sub-dimension, the interactions of three independent variables with two and the mutual interaction of all three did not lead a significant difference on the students' liking sub-dimension mean scores (p> .05).

Table 10: Factorial ANOVA Test Results Related to Anxiety Sub-Dimension Scores

Source of Variation	Sums of Square	Df	Mean Square	f	p
Gender	0.143	1	0.143	0.246	.621
Mother's Education	2.830	3	0.943	1.625	.188
Father's Education	5.831	3	1.944	3.348	.022
Gender*Mother's Education	0.326	3	0.109	0.187	.905
Gender*Father's Education	3.239	3	1.080	1.860	.141
Mother's Education*Father's Education	1.394	7	0.199	0.343	.932
Gender*Mother's Education*Father's Education	2.704	4	0.676	1.165	.330

**P>.05*

According to the results in Table 10, while the students' anxiety sub-dimension mean scores did not show a significant difference according to the gender of the students and their mother's educational level(p> .05), they showed a significant difference according to their father's educational level(p<.05). As a result of the Tukey multiple comparison test conducted according to the education level of the father, it was determined that the anxiety levels of the students whose fathers were secondary and high school graduates were significantly higher than those whose fathers were primary school graduates.

Again, according to the results in Table 10, considering the common effects between independent variables, it was observed that the interaction between the gender and mother's education level variables, the interaction between the gender and father education level variables and the interaction between the education level of the mother and the education level of the father did not showed a significant difference in the anxiety sub-dimension mean scores

of the students. The interaction of all three independent variables also did not cause a significant difference in students' anxiety sub-dimension mean scores ($p>.05$).

4. Results and Discussion

When the findings of this study, in which eighth grade students' attitudes towards socioscientific issues were examined, it was determined that the general attitudes of the participants towards socioscientific issues and their attitudes in the interest and usefulness sub-dimension were positive while the participants developed neither positive nor negative attitudes in the liking and anxiety sub-dimension. In addition, it was observed that levels of the general attitude towards socioscientific issues and the mean scores of the interest and usefulness, liking and anxiety sub-dimensions did not differentiate according to gender variable. Keefer (2003) concluded that decision-making about socioscientific issues does not affect gender. Tekin and Aslan (2019) examined the gender variable in their study conducted with prospective teachers and concluded that gender attitude towards socioscientific issues did not differentiate statistically. Again in Yolagiden (2017), in a similar study conducted with prospective teachers, they stated that the participants' attitudes towards socioscientific issues did not differentiate in terms of gender. Similarly, Cebesoy and Dönmez-Şahin (2013) stated in their study that gender variable did not affect prospective teachers' attitudes towards socioscientific issues. These studies were mostly conducted with university students and it overlaps with our study in terms of not differentiating the attitude according to gender. This study, on the other hand, was conducted with secondary school students, and the absence of a study on attitude at the secondary school level reveals the difference of the study. Unlike this study Qin and Brown (2007), in their study on GMO, which is an example of socioscientific issues, found that gender variable differentiates attitudes and this differentiation is in favor of women. One of the reasons why the gender variable affects attitude in this study may be that GMO, which is a socioscientific issue, expresses a narrower area within socioscientific issues. Considering the aforementioned studies, it can be concluded that gender did not make a significant difference regarding socioscientific issues. Regardless of gender, it can be said that socioscientific issues address all members of the society (Tekin and Aslan, 2019).

Genç (2019), in a study conducted with secondary school students, found that the scores of participants scientific attitude towards socioscientific issues did not show a significant difference in terms of maternal education level variable. This result is in line with the result of the study. Tekinarslan Şahiner (2018) conducted a study for secondary school students in order to determine the students' level of knowledge about hydroelectric energy, solar energy, wind energy, thermal energy, nuclear energy and geothermal energy, which are among the energy resources taught under the topic of energy within the scope of social studies course. 1350 eighth grade students participated in the study. In the study, it was concluded that students whose mothers graduated from undergraduate and graduate achieved high achievement scores, while those who had doctorate education and who were illiterate had low achievement scores.

According to another finding of the study, it was determined that the general attitude levels about socioscientific issues and the interest and usefulness and liking sub-dimension mean scores did not differintiate significantly according to the educational status of the father. However, the anxiety sub-dimension score differentiated according to the father's occupation. Çepni and Geçit (2020), in their study conducted with prospective social studies teachers, concluded that there was no significant difference between the educational status of the father and the attitude towards socioscientific issues. In addition, Doğru (2010) aimed to determine the levels of the 8th grade students' knowledge about biotechnology, which is a socioscientific issue, in a study. In the study, a significant difference was not found in terms of father education level, which is one of the variables. This study overlaps with our study, the lack of a significant difference both in terms of grade level and educational status of the father. Unlike our study this study does not cover all socioscientific issues.

5. Suggestions

The following recommendations are presented in this study conducted on socioscientific issues

- Teaching socioscientific issues can be given effectively starting from primary school.

- While organizing programs, gains can be discussed and solutions can be offered.
- Starting from primary education, socioscientific issues-based acquisitions and activities can be applied in social studies and science lessons.
- Although there are many studies on socioscientific issues at the university level, the number of studies can be increased by including these studies at the primary education level.
- The study can be conducted in different disciplines and developed in larger samples.

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