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THE EFFECT OF VISUAL MEDIA-SUPPORTED CLASSROOM DISCUSSION ON 8TH GRADE STUDENTS' ATTITUDES TOWARDS SOCIO-SCIENTIFIC ISSUES, TOWARDS RESEARCH AND INQUIRY AND ON THEIR DECISION MAKING

(Research article)

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Abstract

The current study aimed to investigate the effect of visual media-supported classroom discussions on 8th grade students' attitudes towards socio-scientific issues, towards research and inquiry and on their decision making. The study was conducted in a secondary school located in a city in the western part of Turkey in the fall term of the 2021-2022 school year. The study group is comprised of a total of 51 eighth grade students; 25 in the experimental group and 26 in the control group. The study employed the quasi-experimental pretest-posttest control group design, one of the quantitative research methods. The study lasted for 9 weeks. As the data collection tools, the adolescent decision-making scale, the scale of attitudes towards socio-scientific issues and the scale of attitudes towards research and inquiry were used in the study. Classroom activities defined in the science curriculum were conducted with the control group students while visual media-supported classroom discussions in addition to the activities defined in the curriculum were conducted with the experimental group students. At the end of the study, a statistically significant difference was found between the pretest and posttest mean scores of the experimental and control group students taken from the scales of attitudes towards socio-scientific issues and research and inquiry in favour of the experimental group students. While no significant difference was observed between the pretest and posttest mean scores of the control group students taken from the adolescent decision-making scale, a statistically significant difference was observed between the pretest and posttest mean scores of the experimental group students taken from the adolescent decision-making scale's sub-scales of self-esteem, vigilance and cope out whereas no significant difference was observed between the pretest and posttest mean scores taken from the sub-scales of complacency and panic.

Keywords: Socio-scientific issues, visual media, decision-making, research and inquiry, attitude

1. Introduction

1.1. Socio-scientific Issues (SSI) and Importance in the Curriculum

The science curriculum, whose vision is to train scientifically literate individuals, expects students to develop skills, attitudes, values and understandings about science while they are thinking, questioning, researching and interpreting the information they have acquired, instead of memorizing scientific information while learning (MEB, 2013). Socio-scientific issues form an important context in this sense and play a critical role (Yenilmez Türkoğlu, 2021, p.21). Socio-scientific issues refer to issues which are at the intersection of science,

technology and society, lead individuals to a debate environment through mutual dialogues, discussions and arguments (Zeidler & Nichols, 2009), are not easy to solve (Sadler & Zeidler, 2005) and are open to different solutions as they may contain positive or negative approaches (Sadler, 2009; Zohar and Nemet, 2002). In order for a subject to be a socio-scientific issue, it must have a scientific basis and be a social problem that concerns society (Easwood et al., 2012). Socio-scientific issues are certainly defined as science-related social dilemmas (Sadler and Zeidler, 2005).

The effect of the rapid development of science and technology is felt in daily life, and at the same time, it increases the debates and dilemmas in daily life (Topçu, 2017). Many issues such as nuclear power plants, stem cells, flu vaccine, cloning, sugar test for pregnant women, genetically modified foods, cosmetic surgery, global warming, cholesterol drugs and organ transplantation affect science and social life in daily life (Genç, 2020, p.2). For example, there are many different views on the applications of biotechnology in agriculture. The advantages and disadvantages of these applications can be discussed, and while listening to opposing views, it can be seen that both sides present different arguments on which they are right from their own perspectives. Such issues are ambiguous issues that do not have a definite solution (Karışan, 2021).

The gains to be obtained by students in the process of learning about socio-scientific issues and their contribution to scientific literacy have been recognized by international education platforms and socio-scientific issues have begun to be included in primary and secondary curricula in many countries (American Association for the Advancement of Science [AAAS], 1989; Talim Terbiye Kurulu Başkanlığı [TTK], 2017). While socio-scientific issues, which are the reflections of science and technology on society, have been included in the science curriculum as a reform movement, especially in the United States of America, since the 1990s, in Turkey, following the emphasis put on Science-Technology-Environmental education included in the Science and Technology Curriculum in 2005, socio-scientific issues were included in the Science Curriculum for the first time in 2013 as a sub-learning area under the Science-Technology-Environment learning area (Yenilmez Türkoğlu, 2021).

One of the main goals of the Science Curriculum, which aims to educate all individuals as scientifically literate, is expressed as "to develop reasoning skill, scientific thinking habits and decision-making skills by using socio-scientific issues" (MEB, 2018). Learning environments prepared using socio-scientific issues contribute to the development of students' analytical thinking, scientific discussion, questioning, analysis, critical thinking, evaluation, explanation, interpretation, ethical and moral reasoning skills and behaviours (Evren and Kaptan, 2014; Facione, 2011). In this context, it is necessary to carefully develop all factors that will help individuals to think scientifically and to make decisions (Genç, 2020). What is aimed in a socio-scientific issue-based teaching process is to support students to be aware of the sources in scientific interactions in their own lives, to support them to develop an understanding of science contents and to participate in argumentation, opinion development and discussion environments (Klosterman et al., 2012).

1.2. Visual Media in the Teaching of Socio-scientific Issues as a Tool of Instruction

Although there are many sources in bringing socio-scientific issues to the agenda, the most important and effective tool is the popular media (Öztürk et al., 2017). With the developing technology, new information sources are constantly added to our lives and the possibilities of accessing information are increasing (Öztürk, 2021). While newspapers and radios were at

the forefront as news and entertainment sources for individuals in the 19th century, in the 21st century internet-based technologies such as Facebook and Twitter are at the forefront and are on the public agenda (Klosterman, Sadler and Brown, 2012).

Today, children are introduced to visual and auditory media such as television, computer, internet and radio as soon as they are born. The biggest source of entertainment for the new generation is to spend time with such tools (Seçkin Kapucu, 2014). Digital resources, which have replaced printed resources, have been preferred in learning environments as teaching materials in recent years (Öztürk, 2021). Teachers and students, in particular, and societies in general, can be aware of the existence, importance and discussion areas of socio-scientific issues through the media (Klosterman et al., 2012). The media is a structure that has an important power that can affect the thoughts and decisions of individuals and societies through the socio-scientific content it publishes (Jarman and McClune, 2003). For example, the consumption of chicken meat is a frequently discussed topic in the media. Some individuals affected by these discussions in the media may have a negative attitude towards chicken meat consumption, while others may ignore what they hear in the media and continue to consume chicken meat. Some people may be undecided about the consumption of chicken meat and may research the issue from different sources. For this reason, media tools such as television, magazines, digital media, and social media serve as a bridge between science and society by enabling information to meet with society (Öztürk, 2021). The relationship of socio-scientific issues with science, society and media is presented in Figure 1.

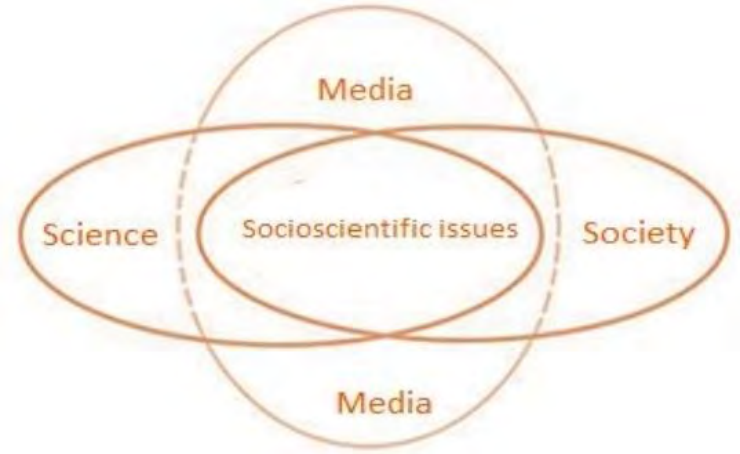

Figure 1. Relationship of socio-scientific issues with science, society and media (Öztürk et al., 2017).

When Figure 1 is examined, it is seen that there is a strong relationship between science, society and media. On the other hand, given the power of influence it has and the size of the audience it affects, how important media is can be clearly understood. Using media tools, which have been in every moment of our lives from past to present and whose importance is increasing with each day, in the teaching of socio-scientific issues will be effective and important in terms of introducing students to daily life problems and motivating them to take responsibility with citizenship awareness (Öztürk, 2021).

1.3. Significance of the Study

The needs of the society are changing and increasing day by day. Science and technology are developing at the same rate to meet these changing needs (Topçu, 2017). Scientific studies conducted in compliance with the development of technology have provided benefits to societies in many ways, but also caused some risks to emerge (Deliktaş et al., 2020, p.261). These risks gave rise to socio-scientific issues that are controversial issues that create dilemmas in the society, the correctness and falsity of which vary from person to person and that concern both society and science.

Considering the speed of developments in the world and the size of the masses that need to be reached, it is thought that the media acts as a bridge between science and society (Deliktaş et al., 2020, p.269). With the development of television, radio, newspapers, magazines, and the internet, and with their computers and applications on their smart phones, people can instantly be cognizant of many events in the world and in the country they live in. The influence of the media is great in recognizing socio-scientific issues and keeping them on the public agenda (Öztürk and Erabdan, 2018). In a study conducted on pre-service teachers, when the participants were asked about the sources of information about nuclear power plants, which is a socio-scientific issue, it was revealed that the pre-service teachers saw the media as the primary source of information (Ayas, Eş and Mercan, 2016). In addition, many studies have revealed that students spend a significant part of their time with media tools (Deliktaş et al., 2020, p.282). It has been observed that the majority of the studies were carried out at the graduate level and on pre-service teachers (Sönmez Eryaşar, 2021). Moreover, when the literature is reviewed, it is seen that there are studies on the use of media as a teaching tool. However, in these studies, it is seen that social media and newspaper news are generally used as teaching tools. Sevgi (2016) used socio-scientific issues in newspaper news and examined their effects on students' critical thinking, decision making and argumentation skills. Öztürk and Türköz (2019) developed an activity for the teaching of socio-scientific issues. First, the students were made to watch videos reflecting two different views on socio-scientific issues, then their thoughts on the issues were taken with the opinion development technique and a discussion was held in the class about the issues. As a result of the study, it was seen that the discussion and decision-making skills of the students improved during the activity process.

Socio-scientific issues addressed in the science curriculum are frequently encountered in visual media. However, studies are limited. In the current study, visual media videos containing dilemmas on socio-scientific issues were brought to the science class and the students were made to watch them and then to discuss them for seven weeks. In this study, visual media was used as an educational tool in classroom discussions of socio-scientific issues. It is thought that this study will make an important contribution to the literature and that it will provide guidance for the teachers who will use visual media in the teaching of socio-scientific issues and in the creation of classroom discussions. In this connection, the purpose of the current study is to examine the effects of visual media-supported classroom discussions on socio-scientific issues on 8th grade students' attitudes towards socio-scientific issues, attitudes towards research and inquiry and on their decision making.

1.4. Problem Statement

What is the effect of visual media-supported classroom discussions on 8th grade students' attitudes towards socio-scientific issues, towards research and inquiry and on their decision making?

1.5. Sub-Problems

In line with the main problem of the study, answers to the following sub-problems will be sought.

1. Is there a significant difference between the decision-making pretest and posttest mean scores of the experimental and control group students?

2. Is there a significant difference between the decision-making pretest and posttest mean scores of the control and experimental group students?

3. Is there a significant difference between the socio-scientific issues attitude pretest and posttest mean scores of the experimental and control group students?

4. Is there a significant difference between the socio-scientific issues attitude pretest and posttest mean scores of the control and experimental group students?

5. Is there a significant difference between the research and inquiry attitude pretest and posttest mean scores of the experimental and control group students?

6. Is there a significant difference between the research and inquiry attitude pretest and posttest mean scores of the control and experimental group students?

2. Method

2.1. Research Method

The current study employed the quasi-experimental design, one of the quantitative research methods. The quasi-experimental design is frequently used in educational research and can be used in cases where the real experimental method cannot be applied. In the current study, the pre-test post-test non-equivalent control group design, which is one of the quasi-experimental designs, was used. In this model, where there are both experimental and control groups, groups are determined by random assignment. A pre-test is administered to each group, while an experimental intervention is applied to the experimental group, no special intervention is made to the control group, and then a post-test is administered to both groups (Özmen, 2014). The schematic display of the design is given in Table 2.1.

Table 2.1. *Schematic Display of the Pretest-Postest Experimental Design with Control Group*

Groups	Pretest	Application	Posttest
Control Group	SASSI		SASSI
Experimental Group	ADMS	Visual media-supported	ADMS
	SARI	classroom discussions	SARI

The Scale of Attitudes towards Socio-scientific Issues: (SASSI)
The Adolescent Decision-Making Scale: (ADMS)
The Scale of Attitudes towards Research and Inquiry: (SARI)

2.2. Study Group

The study group of the current research is comprised of 51 (25 girls, 26 boys) 8th grade students attending a public school in a city located in the western part of Turkey in the fall term of the 2021-2022 school year. This school was chosen because it was convenient and

the researcher was working in this school. From among the five 8th grade classes in the school where the study was carried out, one of the two classes, whose grade point averages were thought to be close to each other was assigned as the experimental group and the other as the control group. The experimental group of the study consists of 26 (13 girls, 13 boys) and the control group consists of 25 (12 girls, 13 boys) students.

2.3. Data Collection Tools

In the current study, as the data collection tools, the "Adolescent Decision-Making Scale", the "Scale of Attitudes towards Socio-scientific Issues" and the "Scale of Attitudes towards Research and Inquiry" were used.

2.3.1. Adolescent Decision-Making Scale (ADMS)

In the study, the "Adolescent Decision-Making Scale" developed by Mann, Harmoni and Power (1989) and adapted into Turkish by Çolakkadıoğlu and Güçray (2007) was used to evaluate secondary school students' self-esteem and coping styles in decision making. The scale consists of two parts. While the first part is to measure "self-esteem" in decision making, the second measures "coping styles" in decision making. The first part, which aims to determine an individual's self-esteem in decision making, consists of six items. The second part of the scale consists of 4 subscales that measure individuals' coping styles in decision making. These subscales are vigilance, panic, complacency and cope out. The scale is a 4-point Likert scale, and a total score cannot be taken from the whole scale. The Cronbach alpha coefficients calculated for the ADMS's sub-scales of self-esteem, vigilance, panic, complacency and cope out are .79, .78, .77, .65 and .73, respectively; and test-retest reliability coefficients on the other hand were calculated to be .80, .81, .82, .80 and .86, respectively.

2.3.2. Scale of Attitudes towards Socio-scientific Issues

In the current study, the "Scale of Attitudes towards Socio-scientific Issues" developed by Topçu (2010) was used to measure the students' attitudes towards socio-scientific issues. The scale is a five-point Likert scale. As a result of the exploratory and confirmatory factor analyses, Topçu (2010) found that the Cronbach alpha coefficients vary between .70 and .90 and the scale consists of 3 subscales. The Cronbach alpha internal reliability coefficients of the subscales were found to be as follows: .81 for the subscale of "Liking socio-scientific issues", .90 for the subscale of "Importance of socio-scientific issues" and .70 for the subscale of "Anxiety about socio-scientific issues". The expert who developed the scale was contacted and he stated that the scale would be suitable for using in the current study.

2.3.3. Scale of Attitudes towards Research and Inquiry (SARI)

In the current study, the "Scale of Attitudes towards Research and Inquiry" developed by Korkmaz, Ebren Ozan and Karamustafaoğlu (2016) was used. It was developed to determine secondary school students' attitudes towards research and inquiry. The scale is a five-point Likert scale and consists of 3 sub-dimensions according to the exploratory factor analysis. The first of this sub-dimension is "Feeling Curious", which consists of 4 items. The factor

loadings of these items were found to be between 0.603 and 0.703. The second sub-dimension is "Avoidance", which consists of 5 items, and the factor loading of these items were found to be varying between 0.562 and 0.671. The third sub-dimension is "Valuing", which consists of 4 items, and the factor loadings of the items were found to be varying between 0.564 and 0.654. The Cronbach alpha reliability coefficient of the scale was found to be 0.756 by Korkmaz, Ebren Ozan and Karamustafaoğlu (2016).

2.4. Data Collection Process

Throughout the study, the lessons in the experimental and control groups were carried out by a teacher with 18 years of experience in science teaching, assuming the role of researcher. A year before starting her research, the science teacher in the role of researcher received 14-week training on socio-scientific issues and their teaching, teacher roles in socio-scientific issues, communicative approach, teacher discourses and discourse patterns within the scope of a non-thesis master's program at Pamukkale University. Within the context of this training, she carried out in-class practices on different socio-scientific issues and the lessons she conducted were constantly analyzed by her colleagues and university professor giving the training in terms of discourse and discourse patterns. At the end of the training, the researcher decided to work on visual media-supported classroom discussions on socio-scientific issues and determined the objectives related to socio-scientific issues in the first and second units "Seasons and Climate (Earth and Universe)" and "DNA and Genetic Code (Living Things and Life)" in the 8th grade science curriculum to be studied in the next term. She then determined the videos that she thought she would use from the visual media tools in the handling of the issues she had determined. The videos are suitable for supporting classroom discussions on the issues such as Global warming and climate change, GMOs and biotechnology.

The study lasted for 9 weeks in total; pre-test and post-tests were administered in the first and last weeks. In both groups, teaching lasted for a total of seven weeks (28 class hours). The scale of attitudes towards socio-scientific issues, the adolescent decision-making scale and the scale of attitudes towards research and inquiry were administered to the students in the control and experimental groups as pre-test and post-test. Classroom activities defined in the science curriculum were conducted with the control group students while visual media-supported classroom discussions in addition to the activities defined in the curriculum were conducted with the experimental group students. The videos were selected from secure websites about socio-scientific issues and the content was constructed by taking sections from the videos in a way that would create a dilemma. The internet addresses from which the visual media videos used in the discussions were taken are given in Appendix 1.

A lesson (first lesson) is given in Appendix 2 to show how the videos were used in the discussions by the teacher in the classroom environment, over which questions and dilemmas the discussions were carried out and the opinions expressed by students on interesting and striking responses given by their peers on socio-scientific issues. The application process of the activities in the study is given in Table 2.2.

Table 2.2. *Activity Application Process*

Week	Class Hour	Activity
1	2	Administration of the pretest to the experimental and control groups
2	4	Global warming
3	4	Global warming
4	4	Genetic diseases
5	4	GMO
6	4	Genetic engineering and biotechnology applications
7	4	Genetic engineering and biotechnology applications
8	4	Genetic engineering and biotechnology applications
9	2	Administration of the posttest to the experimental and control groups

2.5. Data Analysis

All data obtained through the scales were analyzed using the SPSS 20 program package. First, Shapiro-Wilk test was performed to see whether the data were normally distributed, and it was observed that the data were not normally distributed. Moreover, since the size of the sample is smaller than 30, non-parametric Mann-Whitney U and Wilcoxon Signed Rank tests were used. In the Mann-Whitney U test, which is the non-parametric equivalent of the independent samples t-test, and the Wilcoxon Signed Rank test, which is the non-parametric equivalent of the dependent samples t-test, there is no need for the equality of variances and normal distribution (Baştürk, 2010).

3. Findings and Interpretations

In this section, quantitative findings obtained from the analysis of the data collected from the adolescent decision-making scale, the scale of attitudes towards socio-scientific issues and the scale of attitudes towards research and inquiry are presented

3.1. Findings Obtained from the Adolescent Decision-Making Scale

3.1.1. Experimental and Control Group Students' Adolescent Decision-Making Pretest Results

The results of the Mann-Whitney U test conducted to determine whether there is a significant difference between the adolescent decision-making pretest scores of the experimental and control groups are presented in Table 3.1.

Table 3.1. *Results of the Mann-Whitney U Test Conducted to Determine Whether There is a Significant Difference between the Adolescent Decision-Making Pretest Scores of the Experimental and Control Groups*

Subscales	Groups	*N*	Mean Rank	Sum of Ranks	*U*	*Z*	*P*
Self-esteem	Experimental	25	26.26	656.50	318.500	-.123	.902
	Control	26	25.75	669.50			
Vigilance	Experimental	25	26.60	665.00	310.000	-.284	.776
	Control	26	25.42	661.00			
Cope out	Experimental	25	25.04	626.00	301.000	-.455	.649
	Control	26	26.92	700.00			
Panic	Experimental	25	24.98	624.50	299.500	-.482	.629
	Control	26	26.98	701.50			
Complacency	Experimental	25	27.18	679.50	295.500	-.559	.576
	Control	26	24.87	646.50			

When the results presented in Table 3.1 are examined, it is seen that there is no statistically significant difference between the pretest mean scores of the experimental and control groups taken from the adolescent decision-making scale's subscales of self-esteem (*U*=318.500; *p*=.902>.05), vigilance (*U*=310.000; *p*=.776>.05), cope out (*U*=301.000; *p*=.649>.05), panic (*U*=299.500; *p*=.629>,05) and complacency (*U*=295.500; *p*=.576>.05).

3.1.2. Experimental and Control Group Students' Adolescent Decision-Making Posttest Results

The results of the Mann-Whitney U test conducted to determine whether there is a significant difference between the adolescent decision-making posttest scores of the experimental and control groups are presented in Table 3.2.

Table 3.2. *Results of the Mann-Whitney U Test Conducted to Determine Whether There is a Significant Difference between the Adolescent Decision-Making Posttest Scores of the Experimental and Control Groups*

Subscales	Groups	*N*	Mean Rank	Sum of Ranks	*U*	*Z*	*P*
Self-esteem	Experimental	25	29.00	725.00	250.000	-1.420	.155
	Control	26	23.12	601.00			
Vigilance	Experimental	25	31.38	784.50	190.500	-2.550	.011*
	Control	26	20.83	541.50			
Cope out	Experimental	25	22.64	566.50	241.000	-1.596	.111
	Control	26	29.23	760.00			
Panic	Experimental	25	23.78	594.50	269.500	-1.051	.293
	Control	26	28.13	731.50			
Complacency	Experimental	25	22.38	559.50	234.500	-1.716	.086
	Control	26	29.48	766.50			

When the results presented in Table 3.2 are examined, it is seen that while there is no statistically significant difference between posttest mean scores of the experimental and control group students taken from the adolescent decision-making scale's subscales of self-esteem (*U*=250.000; *p*=.155>.05), cope out (*U*=241.000; *p*=.111>.05), panic (*U*=269.500; *p*=.293>.05), complacency (*U*=234.500; *p*=.086>.05), there is a statistically significant difference between the posttest mean scores taken from the subscale of vigilance (*U*=190.500; *p*=.011<.05)

3.1.3. Control Group Students' Decision-Making Pretest and Posttest Results

The results of the Wilcoxon Signed Rank test conducted to determine whether there is a statistically significant difference between the control group students' decision-making pretest and posttest mean scores are presented in Table 3.3.

Table 3.3. *Control Group Students' Decision-Making Pretest and Posttest Wilcoxon Signed Rank Test Results*

Subscales	Pretest-Posttest	*N*	Mean Rank	Sum of Ranks	*Z*	*P*
Self-esteem	Negative rank	11	11.68	128.50	-.291	.771
	Positive rank	12	12.29	147.50		
	Equal	3				
Vigilance	Negative rank	11	13.27	146.00	-.447	.655
	Positive rank	14	12.79	179.00		
	Equal	1				
Cope out	Negative rank	13	11.88	154.50	-.129	.898
	Positive rank	11	13.23	145.50		
	Equal	2				
Panic	Negative rank	13	12.38	161.00	-.315	.753
	Positive rank	11	12.64	139.00		
	Equal	2				
Complacency	Negative rank	11	13.86	152.50	-.586	.558
	Positive rank	15	13.23	198.50		
	Equal	0				

When the results in Table 3.3 are examined, it is seen that there is no statistically significant difference between the pretest and posttest mean scores of the control group students taken from the adolescent decision-making scale's subscales of self-esteem (z=-.291; p=.771>.05), vigilance (z=-.447; p=.655>.05), cope out (z=-.129; p=.898>.05), panic (z=-.315; p=.753>.05), complacency (z=-.586; p=.558>.05).

3.1.4. Experimental Group Students' Decision-Making Pretest and Posttest Results

The results of the Wilcoxon Signed Rank test conducted to determine whether there is a statistically significant difference between the experimental group students' decision-making pretest and posttest mean scores are presented in Table 3.4.

Table 3.4. *Experimental Group Students' Decision-Making Pretest and Posttest Wilcoxon Signed Rank Test Results*

Subscales	Pretest-Posttest	*N*	Mean Rank	Sum of Ranks	*Z*	*P*
Self-esteem	Negative rank	7	8.71	61.00	-2.357	.018
	Positive rank	16	13.44	215.00		
	Equal	2				
Vigilance	Negative rank	8	9.63	77.00	-2.090	.037*
	Positive rank	16	13.94	223.00		
	Equal	1				
Cope out	Negative rank	16	12.63	202.00	-1.489	.136
	Positive rank	8	12.25	98.00		
	Equal	1				
Panic	Negative rank	13	11.62	151.00	-.797	.425
	Positive rank	9	11.33	102.00		
	Equal	3				
Complacency	Negative rank	16	13.97	223.50	-2.105	.035*
	Positive rank	8	9.56	76.50		
	Equal	1				

When the results in Table 3.4 are examined, it is seen that there is a statistically significant difference between the pretest and posttest mean scores of the experimental group students taken from the adolescent decision-making scale's subscales of self-esteem (z=-2.357; p=.018<.05), vigilance (z=-2.090; p=.037<.05), complacency (z=-2.105; p=.035<.05) while there is no statistically significant difference between the pretest and posttest mean scores taken from the subscales of cope out (z=-1.489; p=.136>.05) and panic (z=-.797; p=.425>.05).

3.2. Findings from the Scale of Attitudes towards Socio-scientific Issues

3.2.1. Experimental and Control Group Students' Socio-scientific Issues Attitude Pretest Results

The results of the Mann-Whitney U test conducted to determine whether there is a significant difference between the experimental and control group students' socio-scientific issues attitude pretest mean scores are presented in Table 3.5.

Table 3.5. *Results of the Mann-Whitney Test Conducted to Determine whether There is a Significant Difference between the Socio-scientific Issues Attitude Pretest Scores of the Experimental and Control Groups*

Sub-dimensions	Groups	*N*	Mean Rank	Sum of Ranks	*U*	*Z*	*P*
Importance	Experimental	25	26.10	652.50	322.500	-.047	.962
	Control	26	25.90	673.50			
Liking	Experimental	25	30.42	760.50	214.500	-2.088	.037
	Control	26	21.75	565.50			
Anxiety	Experimental	25	22.84	571.00	246.000	-1.493	.135
	Control	26	29.04	755.00			
Total	Experimental	25	26.80	670.00	305.000	-.377	.706
	Control	26	25.23	656.00			

When the results in Table 3.5 are examined, it is seen that there is no statistically significant difference between the experimental and control group students' socio-scientific issues peretest mean scores (U=305.000; p=.706>.05). When the pretest mean scores taken from the sub-dimensions are examined, it is seen that there is no significant difference between the pretest mean scores taken from the sub-dimensions of importance (U=322.500; p=.962>.05) and anxiety (U=246.000; p=.135>.05) while there is significant difference between the pretest mean scores taken from the sub-dimension of liking in favour of the experimental group (U=214.500; p=.037 <.05).

3.2.2. Experimental and Control Group Students' Socio-scientific Issues Attitude Posttest Results

The results of the Mann-Whitney U test conducted to determine whether there is a significant difference between the experimental and control group students' socio-scientific issues attitude posttest mean scores are presented in Table 3.6.

Table 3.6. *Results of the Mann-Whitney Test Conducted to Determine whether There is a Significant Difference between the Socio-scientific Issues Attitude Posttest Scores of the Experimental and Control Groups*

Sub-dimensions	Groups	*N*	Mean Rank	Sum of Ranks	*U*	*Z*	*P*
Importance	Experimental	25	35.46	886.50	88.500	-4.462	.000
	Control	26	16.90	439.50			
Liking	Experimental	25	36.68	917.00	58.000	-5.043	.000
	Control	26	15.73	409.00			
Anxiety	Experimental	25	28.38	709.50	265.500	-1.125	.261
	Control	26	23.71	616.50			
Total	Experimental	25	35.42	885.50	89.500	-4.439	.000
	Control	26	16.94	440.50			

When the results in Table 3.6 are examined, it is seen that there is a statistically significant difference between the experimental and control group students' socio-scientific issues posttest mean scores (U=89.500; p=.000<.05). When the posttest mean scores taken from the sub-dimensions are examined, it is seen that there is a significant difference between the posttest mean scores taken from the sub-dimensions of importance (U=88.500; p=.000<.05) and liking (U=58.000; p=.000<.05) in favour of the experimental group, while there is no significant difference between the posttest mean scores taken from the sub-dimension of anxiety (U=265.500; p=.261>.05).

3.2.3. Control Group Students' Socio-scientific Issues Attitude Pretest and Posttest Results

The results of the Wilcoxon Signed Rank test conducted to determine whether there is a significant difference between the control group students' socio-scientific issues attitude pretest and posttest mean scores are presented in Table 3.7.

Table 3.7. *Results of the Wilcoxon Signed Ranked Test Conducted to Determine whether There is a Significant Difference between the Socio-scientific Issues Attitude Pretest and Posttest Mean Scores of the Control Group*

Sub-dimensions	Pretest-Posttest	*N*	Mean Rank	Sum of Ranks	*Z*	*P*
Importance	Negative rank	10	14.25	142.50	-.839	.402
	Positive rank	16	13.03	208.50		
	Equal	0				
Liking	Negative rank	6	12.29	86.00	-1.585	.113
	Positive rank	16	11.88	190.00		
	Equal	3				
Anxiety	Negative rank	11	11.59	127.50	-.644	.520
	Positive rank	13	13.27	172.50		
	Equal	2				
Total	Negative rank	8	16.38	131.00	-1.130	.258
	Positive rank	18	12.22	220.00		
	Equal	0				

When the results of the Wilcoxon Signed Rank test given in Table 3.7 are examined, it is seen that there is no statistically significant difference between the control group students' socio-scientific issues attitude pretest and posttest mean scores (z=-1.130; p=.258>.05). When the mean scores taken from the sub-dimensions are examined, no significant difference is observed between pretest and posttest mean scores of the control group students taken from the sub-dimensions of importance (z=-.839; p=.402>.05), liking (z=-1.585; p=.113>.05) and anxiety (z=-.644; p=.520>.05).

3.2.4. Experimental Group Students' Socio-scientific Issues Attitude Pretest and Posttest Results

The results of the Wilcoxon Signed Rank test conducted to determine whether there is a significant difference between the experimental group students' socio-scientific issues attitude pretest and posttest mean scores are presented in Table 3.8.

Table 3.8. *Results of the Wilcoxon Signed Ranked Test Conducted to Determine whether There is a Significant Difference between the Socio-scientific Issues Attitude Pretest and Posttest Mean Scores of the Experimental Group*

Sub-dimensions	Pretest-Posttest	*N*	Mean Rank	Sum of Ranks	*Z*	*P*
Importance	Negative rank	3	5.50	16.50	-3.697	.000
	Positive rank	20	12.98	259.50		
	Equal	2				
Liking	Negative rank	3	3.00	9.00	-3.927	.000
	Positive rank	20	13.35	267.00		
	Equal	2				
Anxiety	Negative rank	7	9.86	69.00	-2.101	.036
	Positive rank	16	12.94	207.00		
	Equal	2				
Total	Negative rank	3	5.00	15.00	-3.743	.000
	Positive rank	20	13.05	261.00		
	Equal	2				

When the results presented in Table 3.8 are examined, it is seen that there is a statistically significant difference between the experimental group students' pretest and posttest mean scores (z=-3.743; p=.000<.05). When the mean scores taken from the sub-dimensions are examined, it is seen that there are significant differences between the pretest and posttest mean scores taken from the sub-dimensions of importance (z=-3.697; p=.000<.05), liking (z=-3.927; p=.000<.05) and anxiety (z=-2.101; p=.036<.05).

3.3. Findings from the Scale of Attitudes towards Research and Inquiry

3.3.1. Experimental and Control Group Students' Research and Inquiry Attitude Pretest Results

The results of the Mann-Whitney U test conducted to determine whether there is a significant difference between the experimental and control group students' research and inquiry attitude pretest mean scores are presented in Table 3.9.

Table 3.9. *Results of the Mann-Whitney Test Conducted to Determine whether There is a Significant Difference between the Research and Inquiry Attitude Pretest Scores of the Experimental and Control Groups*

Sub-dimensions	Groups	*N*	Mean Rank	Sum of Ranks	*U*	*Z*	*P*
Feeling Curious	Experimental	25	29.64	741.00	234.000	-	.084
	Control	26	22.50	585.00		1.728	
Avoidance	Experimental	25	27.38	684.50	290.500	-.654	.513
	Control	26	24.67	641.50			
Valuing	Experimental	25	24.28	607.00	282.000	-.817	.414
	Control	26	27.65	719.00			
Total	Experimental	25	27.66	691.50	283.500	-.783	.433
	Control	26	24.40	634.50			

When the results in Table 3.9 are examined, it is seen that there is no statistically significant difference between the experimental and control group students' research and inquiry attitude pretest mean scores (U=283.500; p=.433>.05). When the scores taken from the sub-dimensions of the scale are examined, it is seen that there is no significant difference between the pretest mean scores taken from the sub-dimensions of feeling curious (U=234.000; p=.084>.05), avoidance (U=290.500; p=.513>.05) and valuing (U=282.000; p=.414>.05).

3.3.2. Experimental and Control Group Students' Research and Inquiry Attitude Posttest Results

The results of the Mann-Whitney U test conducted to determine whether there is a significant difference between the experimental and control group students' research and inquiry attitude posttest mean scores are presented in Table 3.10.

Tablo 3.10. *Results of the Mann-Whitney Test Conducted to Determine whether There is a Significant Difference between the Research and Inquiry Attitude Posttest Scores of the Experimental and Control Groups*

Sub-dimensions	Groups	*N*	Mean Rank	Sum of Ranks	*U*	*Z*	*P*
Feeling Curious	Experimental	25	31.80	795.00	180.000	-2780	.005
	Control	26	20.42	531.00			
Avoidance	Experimental	25	33.88	847.00	128.000	-3.738	.000
	Control	26	18.42	479.00			

Valuing	Experimental	25	31.46	786.50	188.500	-2.594	.009
	Control	26	20.75	539.50			
Total	Experimental	25	33.26	831.50	143.500	-3.425	.001
	Control	26	19.02	494.50			

When the results in Table 3.10 are examined, it is seen that there is a significant difference between the experimental and control group students' research and inquiry attitude posttest mean scores in favour of the experimental group (U=143.500; p=.001<.05). When the scores taken from the sub-dimensions of the scale are examined, it is seen that there is a significant difference between the posttest mean scores taken from the sub-dimensions of feeling curious (U=180.000; p=.005<.05), avoidance (U=128.000; p=.000<.05) and valuing (U=188.500; p=.009<.05).

3.3.3. Control Group Students' Research and Inquiry Attitude Pretest-Posttest Results

The results of the Wilcoxon Signed Rank test conducted to determine whether there is a significant difference between the control group students' research and inquiry attitude pretest and posttest mean scores are presented in Table 3.11.

Table 3.11. *Results of the Wilcoxon Signed Ranked Test Conducted to Determine whether There is a Significant Difference between the Research and Inquiry Attitude Pretest and Posttest Mean Scores of the Control Group*

Sub-dimensions	Pretest-Posttest	*N*	Mean Rank	Sum of Ranks	*Z*	*P*
Feeling Curious	Negative rank	10	12.65	126.50	-.351	.725
	Positive rank	13	11.50	149.50		
	Equal	3				
Avoidance	Negative rank	13	12.42	161.50	-.027	.978
	Positive rank	12	13.63	163.50		
	Equal	1				
Valuing	Negative rank	11	14.32	157.50	-.217	.828
	Positive rank	13	10.96	142.50		
	Equal	2				
Total	Negative rank	12	11.25	135.00	-.091	.927
	Positive rank	11	12.82	141.00		
	Equal	3				

When the results of the Wilcoxon Signed Rank test given in Table 3.11 are examined, it is seen that there is no statistically significant difference between the control group students' research and inquiry attitude pretest and posttest mean scores (z=-.091; p=.927>.05). Moreover, there is no statistically significant difference between the pretest and posttest mean scores taken from the sub-dimensions of feeling curious (z=-,351; p=.725>.05), avoidance (z=-,027; p=.978>.05) and valuing (z=-217; p=.828>.05).

3.3.4. Experimental Group Students' Research and Inquiry Attitude Pretest-Posttest Results

The results of the Wilcoxon Signed Rank test conducted to determine whether there is a significant difference between the experimental group students' research and inquiry attitude pretest and posttest mean scores are presented in Table 3.12.

Table 3.12. *Results of the Wilcoxon Signed Ranked Test Conducted to Determine whether There is a Significant Difference between the Research and Inquiry Attitude Pretest and Posttest Mean Scores of the Experimental Group*

Sub-dimensions	Pretest-Posttest	*N*	Mean Rank	Sum of Ranks	*Z*	*P*
Feeling Curious	Negative rank	7	9.00	63.00	-2.082	.037
	Positive rank	15	12.67	190.00		
	Equal	3				
Avoidance	Negative rank	7	6.71	47.00	-2.172	.030
	Positive rank	13	12.54	163.00		
	Equal	5				
	Negative rank	5	9.80	49.00	-2.716	.007
Valuing	Positive rank	18	12.61	227.00		
	Equal	2				
	Negative rank	6	10.42	62.50	-2.692	.007
Total	Positive rank	19	13.82	262.50		
	Equal	0				

When the results in Table 3.12 are examined, it is seen that there is a statistically significant difference between the experimental group students' research and inquiry attitude pretest and posttest mean scores (z=-2.692; p=.007<.05). Moreover, there are significant differences between the experimental group students' pretest and posttest mean scores taken from the sub-dimensions of feeling curious (z=-2.082; p=.037<.05), avoidance (z=-2.172; p=.030<.05) and valuing (z=-2.716; p=.007<.05).

4. Discussion, Results and Suggestions

Results and suggestions derived from the findings of the study are presented under three headings.

4.1. Results and Discussion related to the Adolescent Decision-Making Scale

When the pretest and posttest mean scores of the control group students taken from the adolescent decision-making scale' sub-scales of self-esteem, vigilance, cope out, panic and complacency were examined, no statistically significant difference was found.

In light of the results of the current study, it can be argued that positive attributes of adolescent decision-making such as self-esteem and vigilance were positively affected by the use of visual media-supported classroom discussions. Moreover, these discussions led to a decrease in negative attributes of adolescent decision-making such as cope out. While the pretest mean score taken from the sub-dimension of cope out by the experimental student students was 27.18, the posttest mean score dropped to 22.38. When the scores taken from the sub-dimensions of cope out and panic are examined, it is seen that while the pretest mean score taken from the sub-dimension of cope out by the experimental group was 25.04, the posttest mean score dropped to 22.66. Similarly, while the pretest mean score taken from the sub-dimension of panic by the experimental group was 24.98, the posttest mean score dropped to 23.78. These drops observed in the scores taken from the negative sub-dimensions of the adolescent decision-making scale supported the positive sub-dimensions in the scale, yet not having led to a statistically significant difference. Thus, the visual media-supported classroom discussions can be said to have supported the development of positive attributes involved in the process of adolescent decision-making. The decrease observed in the negative

attributes involved in decision-making processes such as panic, cope out and complacency is also a finding showing the effectiveness of the program. The method used may have led the adolescents to perceive themselves as more competent in decision-making processes. When the attributes such as panic, complacency and cope out are considered to be related to the level of anxiety of the individual, it can be said that the competences gained by adolescents during the education process have an important role in the adolescents' perception of themselves as competent and therefore in the reduction of anxiety-related processes (panic, cope out and complacency).

Studies in the literature support that discussing socio-scientific issues in the classroom environment contributes positively to the development of students' decision-making skills. Matkins and Bell (2007) examined the decision-making processes of pre-service teachers in terms of the nature of science and socio-scientific issues. After the study, it was observed that the decision-making skills of the pre-service teachers improved positively. Patronis, Potari, and Spiliotopoulou (1999) aimed to have students make their own decisions by creating argumentations on socio-scientific issues. At the end of the study, they observed that the students were able to make their own decisions by creating arguments against the problem they encountered in daily life. Zengin, Keçeci, and Kırılmazkaya (2011) concluded that using the argumentation method in science lessons made students active in the decision-making process. Goloğlu (2009) conducted a study with the participation of 5th grade primary school students on socio-scientific issues and observed that nutrition education supported by activities involving socio-scientific issues positively affected the students' decision-making skills. In the study conducted by Molinatti et al. (2010), it was aimed to analyze the decision-making and discussions of high school students during a discussion on the use of embryonic stem cells, which is a socioscientific issue, in research and treatment. As a result of the study, it was seen that they were motivated, produced arguments more carefully and their decision-making skills improved. In the study conducted by Gülhan (2012), it was seen that the use of discussion on socio-scientific issues contributed positively to the decision-making skills of eighth grade students. Unlike the current study, in the study done by Gülcü (2019) on secondary school 7th grade students, the effect of six-hat thinking technique was investigated on students' academic achievement, critical thinking and decision making skills. Although there was a significant increase in the academic achievement of the students as a result of the activities, there was no significant difference in their critical thinking and decision-making skills.

4.2. Results and Discussion related to the Scale of Attitudes towards Socio-scientific Issues

When the pretest and posttest mean scores of the control group students taken from the scale of attitudes towards socio-scientific issues were examined, no statistically significant difference was found. However, a statistically significant difference was found between the pretest and posttest mean scores taken from the scale of attitudes towards socio-scientific issues by the experimental group students in favour of the posttest.

It is thought that the visual media-supported activities carried out in this study may have made students enjoy researching and discussing these issues, and therefore may have improved their interests in and attitudes towards socio-scientific issues. Evren and Kaptan (2014) stated that science education based on socio-scientific issues improved students' attitudes and motivation towards science. Discussing socio-scientific issues in the classroom environment motivates students to the lesson and increases their interest in the lesson (Albe, 2008). According to the results of the research on the attitudes and epistemological beliefs of students on controversial/socio-scientific issues, the awareness of the students taught on

socio-scientific issues increased and their knowledge of the subject was positively affected by this situation (Şahintürk, 2014; Taşpınar, 2011). In their study on 6th grade students, Karışan and Türksever (2017) concluded that the inclusion of socio-scientific issues in science classes increased students' sensitivity towards socio-scientific issues in a positive way. Durmaz and Karaca (2020), in their study with 7th grade students, concluded that the use of socio-scientific issues in science lessons positively affected students' perspectives on socio-scientific issues. The study conducted by Gülhan (2012) with 8th grade students on socio-scientific issues concluded that students' sensitivity towards science-society problems increased. Yakar (2017) examined the effects of the Socratic questioning technique on secondary school 5th grade students' attitudes towards socio-scientific issues and their level of motivation towards learning science and concluded that the students in the experimental group had more positive attitudes than the students in the control group.

4.3. Results and Discussion related to the Scale of Attitudes towards Research and Inquiry

When the pretest and posttest mean scores of the control group students taken from the scale of attitudes towards research and inquiry were examined, no statistically significant difference was found. Classroom discussions supported by visual media were found to have created a significant difference in the pretest and posttest mean scores taken from the sub-dimensions of feeling curious, avoidance and valuing by the experimental group students in favour of the posttest. Sadler, Barab, and Scott (2007) gave students problem situations involving socio-scientific environmental issues in their study. The students were expected to propose solutions and create evidence, synthesize findings and use multidimensional thinking skills for the solution of these issues. In the study, a rubric was used to evaluate socio-scientific inquiry. As a result of the study, the students' levels of scientific inquiry were observed to have increased. Özsoy and Kılınç (2017) observed that Feskök activities, which are based on science teaching built on socio-scientific issues, have positive aspects such as making students question and fostering them to think.

Socio-scientific issues are constantly changing due to their nature. The situations, conditions and different potential information that form the basis of socio-scientific issues cannot always be known and predicted. For this reason, individuals need to make continuous research and inquiry in the process of making a decision on a socio-scientific issue (Öztürk, Bozkurt Altan, 2021). When individuals make a decision about a socio-scientific issue, only the prior knowledge they have is not sufficient. For this reason, it is necessary to search for new information on the subject in question (Kolsto,2001). One of the most important criteria necessary for an individual to do research on a subject is his/her feeling curious about that subject. Çalık and Coll (2012) see that the most important feature of curiosity is the desire it arouses for exploration/research. Therefore, if curiosity develops in an individual, research, exploration and questioning skills become sustainable (Çalık 2021). When individuals want to know about a subject, they act in a motivated way to learn (Keller, 1987). Combs (1982) emphasized that student' emotions, attitudes and feelings are important in the learning process. Gaining awareness about an issue helps an individual understand what his/her needs and wants are and how they function (Duman and Yakar, 2017). It is seen that classroom activities supported by visual media on socio-scientific issues improved the positive characteristics of students, such as curiosity and valuing, and positively weakened their negative characteristics such as avoidance. Through socio-scientific issues, students do not accept events as they are, but research and question the relevant issue (Ekinci and Aybek, 2010).

4.4. Suggestions

- Individuals both affect and are affected by the environment in which they live. Different geographies can affect individuals' perspectives on events. Similar studies can be done on individuals from different geographies.
- This study conducted on socio-scientific issues with the support of visual media was carried out with the participation of 8th graders. The same study can be conducted at different grade levels.
- Since socio-scientific issues contain dilemmas, the events depicted in visual media videos should be presented in such a way as to include different perspectives equally.
- The current study was conducted on the socio-scientific issues of climate change, GMO, genetic diseases, genetic engineering and biotechnology. Similar research can be conducted on different socio-scientific issues.
- In the current study, the adolescent decision-making scale was used. By using different decision-making scales, it can be investigated whether different results will be obtained in terms of decision-making skill.

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APPENDICES

APPENDIX 1. Internet Addresses of the Visual Media Used

- Two discussion events were held on global warming and climate change.

1st Discussion - Factors affecting global warming and climate change (human-nature).

2nd Discussion - The impact of industry 4.0 and 5.0 on global climate change.

- A discussion was held on genetic diseases in pregnancy.
- A discussion was held on the benefits and harms of GMO.
- Three discussions were held to raise their awareness of genetic engineering and biotechnology applications by improving their knowledge and skills and to discuss their positive/negative effects.

1st Discussion - Design Dolls.

2nd Discussion - Gene transfer and Gene doping

3rd Discussion – Artificial meat

WEEK	Socio-scientific issue	INTERNET ADDRESSES OF THE VISUAL MEDIA USED
1ST	Global climate change	https://youtu.be/DOg8hdv3fWM https://www.trthaber.com/m/?news=yerkure-isiniyor-iklim-degisiyor-dunya-felakete-mi kosuyor&news_id=614898&category_id=8 https://youtu.be/RXFWDo18w4E
2ND	Global climate change	https://youtu.be/I-_Sx4x3YXw
3RD	Genetic diseases	https://www.youtube.com/watch?v=eUjkzfc3qNA&t=17s https://www.dailymotion.com/video/x5yn4t6 https://www.youtube.com/watch?v=hRl4XoA8CEQ https://www.facebook.com/watch/?v=276694882972840 The videos taken from the internet addresses were edited in order to create a balanced dilemma and to adjust their length and were recorded at the following internet address. https://drive.google.com/file/d/1sRGj5F0nT0MWZ5HZsv1iX_-xIwITbXMK/view?usp=sharing

4TH	GMO	https://www.youtube.com/watch?v=A4uHSEf78Mk https://youtu.be/ui_PcXQm3LU https://www.youtube.com/watch?v=FUg5_0MpRyE The videos taken from the internet addresses were edited in order to create a balanced dilemma and to adjust their length and were recorded at the following internet address. https://drive.google.com/file/d/1rmfe0tB3R3s4rOEuZJx9f9S0uIXuuQPe/view?usp=sharing
5TH 6TH	Genetic engineering and biotechnological applications	https://www.youtube.com/watch?v=A4uHSEf78Mk https://www.youtube.com/watch?v=qfzNQAgfsZA&t=265s
7TH	Genetic engineering and biotechnological applications	https://www.youtube.com/watch?v=7ikdqNgC-jM

APPENDIX 2. A Section of the Classroom Environment during the First Week Application

GLOBAL WARMING AND CLIMATE CHANGE

At the beginning of the lesson, the students were made to watch a video consisted of visual media images to inform them about what global warming and climate change are and their possible effects. Then, the students were made to watch a video consisted of visual media images about the views that argue that global warming and climate change are caused by humans, and a video consisted of visual media images that argue that global warming and climate change are the results of the natural cycle of the Earth. After the students watched the videos, they were asked the following questions: ""Do you think global warming and climate change are caused by humans? Or are they the results of the natural cycle of the Earth?"

The students were given enough time to think about this question. A total of 23 students participated in the study. While 10 of the students argued that global warming and climate change are the results of the natural cycle of the Earth, 13 students argued that global warming and climate change are caused by human-induced causes.

The students who argued that global warming and climate change are the results of the natural cycle of the Earth were influenced by the videos they watched and stated that this change had occurred in the past and even repeated many times. They said that both ice age and drought had been experienced in the past, and that there was a lot of evidence about this. They even mentioned that global warming and climate change had been turned into a global crisis and that there were circles that wanted to profit from it.

The students who argued that global warming and climate change are caused by human beings drew attention to the industrial revolutions and said that the number of factories hugely increased after these revolutions, and that the use of fossil fuels as an energy source also increased carbon emissions. They mentioned that the recent rise in sea level due to the increase in the rate of melting of glaciers would flood many places. They said that living things that are used to living in cold climate would be adversely affected by global warming and climate change, and biodiversity would decrease. They also argued that drought would affect agriculture, would cause an increase in the population of some insects and that food shortages would be inevitable.

At the end of the discussion, two students changed their minds and said that they were for the idea that global warming and climate change are the results of the natural cycle of the Earth, while 5 students stated that global warming and climate change are caused by both human beings and natural cycle of the Earth.