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WATCH-THINK OVER-DISCUSS: AN ACTIVITY SAMPLE REGARDING THE TEACHING OF SOCIO-SCIENTIFIC ISSUES[1]

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ABSTRACT

The purpose of this study is to elaborate on a sample activity in socio-scientific issues. For this purpose, an activity that lasted for 80 minutes (2 periods) was developed. The implementation process is reported in this paper. The first dimension of the implementation process begins with the tracking of videos that will reflect two different views on the subject of socio-scientific issues (Watch). Then by using opinion development technique, the students are encouraged to think about these issues (Think Over). Finally, the students are involved in the classroom discussion process (Discuss). At the end of this study, nearly all of the students reported positive opinions about the activity and they gained knowledge about the subject. Students also reported that their argumentation and decision making skills are the most developed skills during the process. This activity will be an example teaching module for teachers and pre-service science teachers.
Keywords: socio-scientific issues, opinion development technique, middle school students.

İZLE –DÜŞÜN- TARTIŞ: SOSYO-BİLİMSEL KONULARIN ÖĞRETİMİNE İLİŞKİN BİR ETKİNLİK ÖRNEĞİ

ÖZ

Bu çalışmanın amacı sosyo-bilimsel konuların öğretimine ilişkin örnek bir etkinliğin ayrıntılı biçimde ele alınmasıdır. Bu amaç doğrultusunda araştırma kapsamında 80 dakika (2 ders saati) süren bir etkinlik geliştirilmiş ve etkinliğin uygulama süreci ile örneklerine yer verilmiştir. Uygulama sürecinin ilk boyutu sosyo-bilimsel konu ile ilgili iki farklı görüşü yansıtacak videoların izlenmesi ile başlamaktadır (İzle). Sonra öğrencilerin görüş geliştirme tekniği kullanılarak sosyo-bilimsel konuya ilişkin düşünmeleri sağlanır (Düşün). Son olarak öğrenciler konu ile ilgili sınıf içi tartışma sürecine dâhil olurlar (Tartış). Araştırma sonunda öğrencilerin tamamına yakınının etkinlikle ilgili olumlu görüş bildirdikleri ve konu ile ilgili bilgi sahibi oldukları tespit edilmiştir. Öğrenciler süreçte en çok tartışma ve karar verme becerilerinin geliştiğini belirtmişlerdir. Etkinliğin öğretmenlere ve öğretmen adaylarına örnek bir öğretim modülü olacağı düşünülmektedir.
Anahtar kelimeler: sosyo-bilimsel konular, görüş geliştirme tekniği, ortaokul öğrencileri.

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INTRODUCTION

In a world that is rapidly developing and changing day by day, it is important for the individuals to participate in the discussion processes on complex issues within the society and take part as individuals in the societal decisions (Byhring, 2014). As a matter of fact, individuals evaluate various scientific subjects on a regional and global level while making decisions. Such issues in society are defined as socio-scientific issues [SSIs] (Sadler, 2004). SSIs are complex, scientifically controversial, open-ended issues without clear-cut solutions (Kolstø, 2001; Sadler, 2004) and they are up to date in the context of real life (Ratcliffe & Grace, 2003). Today, SSIs are mostly the biotechnical issues such as cloning, stem cells, and genetically modified foods, as well as the environmental issues such as global climate change, land use areas and the introduction of foreign substances (both biotic and abiotic) (Sadler & Zeidler, 2005). It is considered important for the individuals who go through the process of evaluation and decision making regarding a socio-scientific issue by considering many dimensions show the characteristics of scientific literate individuals during the process; and it is thought that the SSIs makes important contributions to the development of scientific literacy levels of individuals (Presley et al., 2013). In fact, scientific literacy requires the active participation of the individual in the societal decisions to be taken regarding the scientific issues in the society as well as the concepts of scientific knowledge and the nature of science (Dawson, 2011; Dawson & Carson, 2017; Dawson & Venville, 2009).

Many studies in the related literature indicate that the SSIs are efficient and important issues in raising scientific literate individuals in science education (Zeidler & Sadler, 2011). Additionally, many researchers emphasizing on the importance of SSI stated that it is important that these subjects take part in science courses (Driver, Newton, & Osborne, 2000; Kolstø, 2001; Topçu, Muğaloğlu, & Güven, 2014). In this respect, it has been emphasized that SSI constitute a meaningful context in raising scientific literate individuals in the science education studies (see Özdem, Demirdöğen, Yeşiloğlu, & Kurt, 2010; Öztürk & Yenilmez Türkoğlu, 2018; Yerdelen, Cansiz, Cansiz, & Akcay, 2018). The changes and innovations made in the science programs are aligned with the findings of the studies. SSI, as a concept, primarily took place in the learning area of Science Education-Technology-Society-Environment within the scope of Science Course Education Program; and continued its emphasis on the learning area of Science-Engineering-Technology-Society-Environment within the 2017 Science Teaching Program. Among the general objectives of the 2018 science program, the importance of SSI on developing reasoning, scientific thinking practices, and decision-making skills by using socio-scientific subjects was emphasized (Ministry of National Education [MoNE], 2013; 2017; 2018).

In the literature, a limited number of studies proposing various activities related to in-class applications of the SSI were found (Chang Rundgren, 2011; Tekin, Aslan, & Yılmaz, 2018). In her study, Rundgren (2011) proposed the post-it activity in order to enable the students to think with the multidimensional structure of SSI (environment, economy, etc.). In the post-it activity, the students were asked to write the yes/no decisions regarding the genetically modified organisms on the left and right sides of a cardboard. Then, the students were asked to write the reasons for their decisions on post-its and paste them to the related sections. In this way, the strongest reasons, as well as the other reasons, were identified and which dimensions that the students took into consideration in decision making was specified. Tekin et al. (2018) developed an activity aimed at the teaching of SSIs in their study. In this case, primarily, students' attention was drawn to the science-society relation. The teachers were asked to state concepts regarding science-society; then such concepts were written on papers and put in a bag. They were asked to place the concepts randomly drawn from the groups in the Science-Technology-Society-Environment cardboards given to them. Afterwards, the groups were asked to choose and save a word from their own cards, then choose three more words and to put the concepts in different places.

In the studies mentioned above, the students' attention was tried to be drawn to the controversial scientific issues in society with

the in-class applications of SSIs. In the current study, on the basis of similar aims, it is intended that the students will be aware of SSIs, think about the subject, discuss and determine their views during the final decision-making process regarding the subject. Media, which is one of the most effective means of bringing SSIs to the public agenda, is preferred in this study. As a matter of fact, the teachers and students can easily be aware of these issues through the display of different views and discussion platforms regarding SSIs by the media (Klosterman, Sadler, & Brown, 2012), which has an important function between science and the society (Öztürk, Eş, & Turgut, 2017). In this respect, through the use of YouTube, which is a tool of social media, it is intended to enable the display of different views concerning SSIs, students having an idea on both views and going through a course of discussion regarding the issue. It is considered important that the students engaging in such a discussion platform see different views, evaluate their own views, and go through a course of decision making. In this respect, it is projected that this study is different from the studies that have been conducted and it will be an important teaching module for both prospective and inservice teachers.

In the application process of the study, opinion development technique is preferred. Opinion development technique is a discussion technique used to develop different opinions in students in the teaching of controversial and contradictory subjects. In opinion development, students can adopt an opinion on the subject and make arguments to support their opinions. However, in the course of time, after hearing different views, they can develop or change their opinions.

ACTIVITY IMPLEMENTATION

The study aims to evaluate in detail a sample activity module related to the teaching of socio-scientific issues. In accordance with this aim, this study was carried out with 25 sixth grade and seventh grade middle-school students who applied, on a voluntary basis and parent permission, to the project named ”I am Preparing for the Future: I'm Looking for a Solution to the Problems" which is executed as a part of Sinop Children's University and supported within the scope of TÜBİTAK 4004 Nature Education and Science Schools. Necessary permissions were obtained from the parents of the students for the photographs taken in the course of the project to be shared in various platforms such as the media and the studies to be conducted.

The name of the activity is "Observe-Think Over-Discuss." The name of the activity was determined by the researchers considering the stages of the application process. With regard to the use of social media tool, YouTube as the audio and visual source was used in the study. In order to enable the students to listen to two different opinions concerning SSIs, the *Watch* dimension is given place in the activity module at the first stage. Through the videos, the individuals are given the opportunity to understand the message intended to be delivered by the picture or image and to recreate their own visual experiences (Demirel, 2005). In the *Think Over* dimension of the module, the students think about what they have seen and heard in the videos and go through a process of decision making. They test their thoughts regarding SSIs before watching the videos and after watching them. In the *Discussion* dimension, the students try to persuade the opposite opinion while trying to support their opinions/decisions concerning SSIs with the elements of argumentation. Thus, the groups of students who adopt the same opinion actively participate both in the internal and external discussion process. In such a process, the students are expected to gain many skills and achievements such as working with a team, respecting different ideas, communication, problem-solving, discussion, and decision-making. The socio-scientific issue in the current activity was "Nuclear Power Plant."

Tools and Materials

The tools and materials used in the activity are as follows:

- Activity sheet (Appendix 1)
- Colored Cardboards
- Computer
- Activity Journal (Appendix 2)

The application stages of the Watch-Think Over-Discuss activity are shown in Figure 1. The stages of the activity's application process are detailed below.

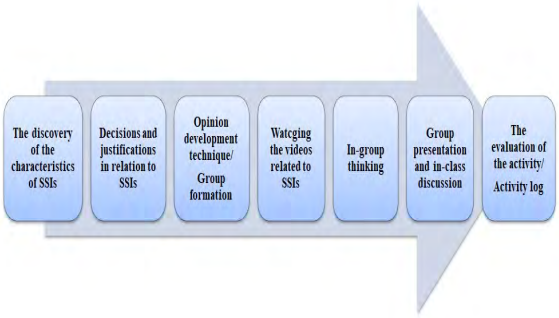

Figure 1. The Application Stages of the Watch-Think Over-Discuss Activity Module

First Application Stage (Exploring the Characteristics of the Socio-scientific Issues)

At this stage, primarily, the researcher examines the students' preliminary knowledge about the scientific subjects that are on the agenda of society. In this step, without going into the definition of the SSIs, the students are expected to be aware of the issues that are controversial and create a dilemma in the individual and to explore the characteristics of the SSIs. The issue examples given by the students are written on the board. The issue examples given by the students in the study in question are as the following: Sinop nuclear power plant, the use of phones, artificial intelligence, Akkuyu nuclear power plant. Then, the students are asked of the common characteristics of the issues, and thus their exploration of the characteristics of the SSIs is enabled, and their awareness of the issues is raised. The recommended time for this stage is 10 minutes.

Second Application Stage (Decisions and Justifications in Relation to Socio-scientific Issues)

In order to determine the general profiles of the students regarding the socio-scientific issue of the nuclear power plant, a questionnaire, in which their decisions and justifications are asked, is given to them (Appendix 1) and the students are asked to answer the questions individually. The recommended time for this stage is 10 minutes. In this form, students explain how they can make decisions about the establishment of a nuclear power plant, their justifications, and how they might persuade other students in accordance with their own opinion. Photograph 1 offers a scene from this stage.

Photograph 1. Decisions and Justifications of Students

Third Application Stage (Opinion Development Technique / Formation of the Groups)

Five minutes is considered sufficient for this stage. Firstly, "Nuclear Power Plant Should be Constructed" is written on the board. As the stages of the opinion development technique, *Strongly Agree*, *Agree*, *Neutral*, *Disagree* and *Strongly Disagree* (Figure 2) options are written on five different cardboards and hung/pasted on the classroom walls. The students are asked what they think about "Nuclear Power Plant." The aim here is to identify what the students think about the nuclear power plant and to ensure that the ones who agree with each other form groups.

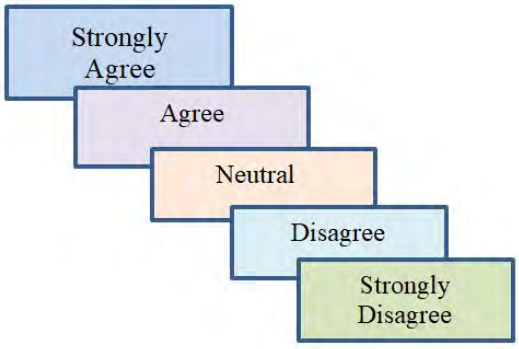

Figure 2. Stages of the Opinion Development Technique

Here are some examples of the students' opinions in the current research:

S7: I really do not want the nuclear energy plant to be constructed in Sinop.

S13: Of course I do not want the nuclear energy plant to be constructed in Sinop. Our green Sinop is much more beautiful.

S17: I am in favor of its construction. For energy.

S3: Ma'am, everyone is saying something, but I could not decide.

As can be understood from the examples, students have expressed different opinions regarding the issue. The students are asked to go where the cardboard, which is suitable for their decision regarding the nuclear energy plant, is placed in. Thus, those who support the same opinion come together and form a group.

Photograph 2. Group Formation

Fouth Application Stage (Watching Videos)

At this stage, in order to enable the students realize there are multiple viewpoints in relation to the Nuclear Power Plant, four videos (lasting for maximum 3-5 minutes) with the highest rate of click, two of which having news content of the positive view and the other two having news content of the negative view) are respectively displayed to the students. The recommended time for this step is 15 minutes.

Fifth Application Stage (In-Group Thinking)

Photograph 3. In-group Thinking

The teacher asks the students to think about the videos they have watched and to discuss among themselves on the basis of the opinion they are situated within (Photograph 3). Here, the students are expected to establish a healthy communication within the group, to use different elements of argumentation to support the opinions of the groups, to share their ideas and to reach a decision. The recommended time for this step is 5 minutes.

Sixth Application Stage (Group Presentation and In-class Discussion)

Groups watching videos from YouTube social media channel (Akkuyu Nükleer A.Ş., 2015; Filozof Mustafa, 2011; Işıtmak, 2016; Mühendis Beyinler, 2015) think about videos and write down the decisions they have made on the issue, then explain them in turn. They explain their decisions and justifications in the form of "I strongly disagree with the construction of Nuclear Plant because...", for instance. In this way, each group submits various arguments, such as assertions and data justifications to the other groupmates in order to support their views, and the class discussion process begins following the completion of all group presentations (Photographs 4 and 5). The recommended time for this step is 25 minutes.

Photograph 4. Sample Group Presentation 1

Photograph 5. Sample Group Presentation 2

When the group presentations and discussion process are completed, the teacher says that the students who have changed their opinions regarding the construction of the nuclear power plant can participate in the group in front of the related cardboard. Thereafter, some of the

students that are in groups may change their opinions and join another group. Here, the teacher plays a key role. The reasons why the student changes his opinion and how he is convinced are tried to be identified through asking questions to the student. The students made a decision due to the arguments they expressed during the in-class discussion process and the videos they watched and then explained their opinions (Photographs 6-8). At the end of the application process, for example, an *undecided* student joined the group *strongly disagrees* with the idea of constructing the nuclear power plant. When the teacher first asked why he was undecided, the student stated "...I mean, it seems that there are both positive and negative sides to it. Thus, I am undecided." After the discussion, when the student was asked why he changed his group and his decision, he answered: "This group has answered my question on why it should not be constructed. My friends talked about the effects of nuclear on health and the environment. I guess I am convinced." He asserted justifications as such and changed his opinion.

Photograph 6. In-class Discussion 1

Photograph 7. In-class Discussion 2

At the end of this stage, the students are not given any information about the accuracy or inaccuracy of their opinions. This activity aims to provide the students with various skills such as to listen to the opposite view, to respect, to see the different points of view regarding the same subject, to change their own opinions, to assert arguments and justifications while making decisions.

Photograph 8. In-class Discussion 3

Seventh Application Stage (The Evaluation of the Activity / Activity Journal)

In the final stage, the activity journal (Appendix 2), in which the opinions on the activity are asked, is given to the students. In the activity journal, the students are asked (i) whether they liked/disliked the activity and the reasons why they did so and (ii) the development of which skills the activity contributed to. Here, it is aimed to identify the strengths and weaknesses of the activity and to take into account the suggestions of the students. The recommended time for this step is 10 minutes.

CONCLUSION and SUGGESTIONS

At the end of the study, it was determined that almost all of the students who completed the activity journal (f = 24) liked the activity and 1 student did not like it. The students who expressed that they liked the activity asserted justifications such as the activity providing a discussion environment (f = 12), the activity being fun (f = 12) and learning new information about the nuclear power plant (f = 11); whereas the student who did not like the activity expressed that he did not like it because he was still undecided regarding the issue. For instance, one student expressed his opinion as "Everyone freely expressed what they thought," another student said "...I like how my reasoning ability has improved," and another one said "It was fun to discuss the issue. Plus, I learned lots of new information." Among the skills of the students that they think the activity has improved, discussion (f=18) and decision making (f=12) are the ones that are mostly emphasized. The examples of the

activity journals with the written opinions of the students are presented below. Figures 3, 5, and 8 show student comments indicating that the discussion aspect of the activity was favored and that the students' discussion skills have improved; Figure 4 contains a comment about learning new information on the subject; and the comment given in Figure 7 expresses that the activity was thought provoking. The opinion of the student commenting that he did not like the activity because he was left undecided is given in Figure 6.

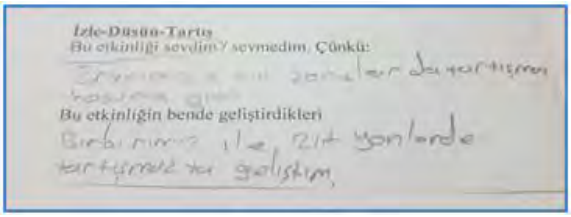

Figure 3. The Activity Log of Student 3

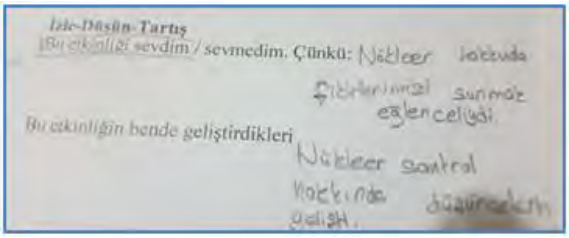

Figure 4. The Activity Log of Student 8

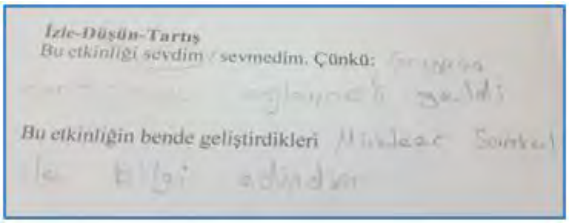

Figure 5. The Activity Log of Student 9

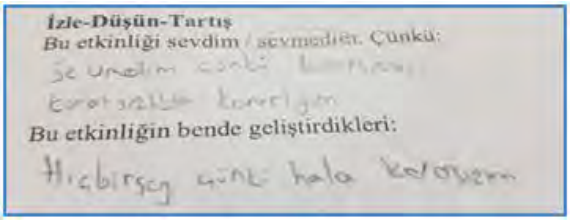

Figure 6. The Activity Log of Student 16

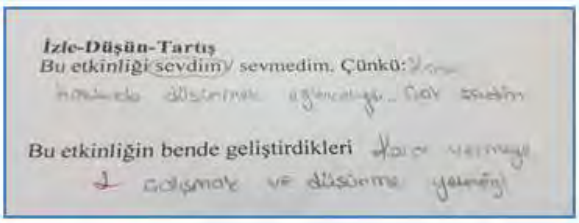

Figure 7. The Activity Log of Student 18

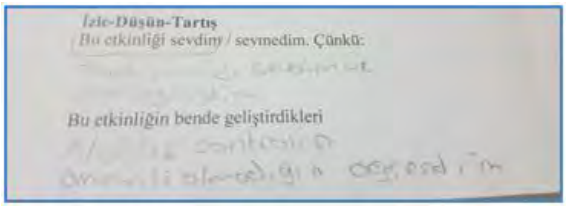

Figure 8. The Activity Log of Student 13

In light of the findings obtained from the journals of the students, it is seen that the students had the opportunity to express themselves regarding the SSIs in the application process of the Watch-Think Over-Discuss activity, to express their opinions comfortably and to support their decisions with various elements of argumentation. The findings revealed that they exchanged ideas within the teamwork during the application process based on the opinion development technique and attempted to persuade different opinions after discussing the issue among themselves. In the meantime, the activity supported many characteristics and skills of students such as sharing ideas with each other in a respectful manner, healthy communication with each other, discussion, using various arguments to defend their decisions, and decision making.

In the implementation process of the activity, the researchers did not encounter any negative situation regarding classroom management possibly due to the fact that the number of participants was 25. However, since it is thought that it would be difficult to ensure the control over the class in the crowded classrooms, group representatives can be identified, and only the representatives can be given the right to speak. In each group talk, the representative can be changed, and each student can be given the opportunity to express his/her opinion. In this way, the group representatives can communicate decisions and justifications to the other groups on behalf of the group. Another important point is that students' opinions about the nuclear power plant were taken individually and in written form at the beginning of the activity, and their opinions were taken orally after the in-group discussion. There have been students who have changed their decisions in line with the purpose of the opinion development technique, and similar situations are likely to be encountered in future studies. However, the individual opinions of the students who change

their decision or who want to adapt to the group although they think differently may be overlooked. Due to the small number of participants in the present study, the students were asked to express their opinions and justifications on the issue individually at first. However, this may not be possible in different classroom applications; for this reason, taking opinions in relation to SSIs in written form can help the teacher to see the decision on the issue and what justifications are asserted. The activity, which is thought to be aligned with the current science curriculum, can be used at different grade levels supported by the opinion development technique during the application process and in the teaching of different SSIs. It is projected that this activity will serve as an example for teachers who are the practitioners of the science class teaching curriculum and for the prospective teachers who will step into the teaching profession.

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Appendix 1

Nuclear Power Plant Information Form

***** My decision on the construction of the nuclear power plant:
……
……
……..

*My Justification/Justifications:
-
-
-
-
-
-
…

*How can I persuade my friends who do not agree with me?
*I can refute the opinion of my friends who do not agree with me by this means:
……
……..
……
……..
……
……..

Appendix 2

Activity Log