

The Effect on Environmental Attitude of the Active Learning Method Applied in Teaching the Biology Topic "Current Environmental Issues and Human" for 10th Grade Students

Lütfiye Özalemdar

¹Asst. Prof. Dr., Giresun University, Giresun-TURKEY, lozalemdar1981@hotmail.com, ORCID ID: 0000-0002-6809-2904

ABSTRACT

The aim of this study is to find out the effect on environmental attitude of the active learning method applied in teaching the biology topic "Current Environmental Issues and Human" for 10th grade students. The study was carried out through one group pretest-posttest design as an experimental model. The research sample consists of 50 students who are attended at 10th grade. The research data was collected by using the "Environmental Attitude Scale". The data analysis was performed through the dependent groups t-test. The findings revealed a significant difference in favor of the latest tests at the level of students' environmental behavior and attitude. However, no change was observed at the level of environmental thinking. According to these findings, it was found that the active learning method, which is applied in teaching the related topic, had a positive effect on the students' environmental attitude and environmental behavior, while not changing the environmental thinking.

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Introduction

The environment is a place that creates an ecological system and which is based on long-term and orderly interaction of the living and non-living beings in a certain area (İncekara & Tuna, 2010). There is a relation between human and environment which depends on mutual interaction and continues for a lifetime. This relation needs to be harmonious in order to maintain the life (Köksal Akyol, Körükçü, Salı & Sarıaslan, 2019). With the influence of various factors, humanity has started to take over and consume nature in time. This has disrupted the balance between humankind and nature and resulted in destruction of natural life sources, thus not being able to meet the needs (Candan & Maltaş Erol, 2016; Erdoğan & Özsoy, 2007; Meşe & Alıncak, 2016).

The environmental issues, which have become an important problem in today's world, are caused by human behavior both in general and individually (Doğan & Puruçcuoğlu, 2017). This requires training which positively affects these behaviors (Akıllı & Yurtcan, 2009). An environmental training, which aims to raise individuals with environmental consciousness, awareness and positive attitude, is highly important in preventing environmental issues and protecting the environment (Gök & Afyon, 2015; Kahyaoğlu, 2013; Özdemir & Çobanoğlu, 2008).

A successful education depends on the harmonization of the learning and teaching methods to be applied in this process (Aydemir, 2010). Information growth and technological advances; brings an understanding to learning and teaching environments in which the individual is active and responsible for his own learning (Ormancı & Çepni, 2020). In environmental education, application of methods,

which requires active student participation and responsibility taking, allows them to achieve the specified goals at the desired level (Aydemir, 2010). Active learning method is a learning and teaching method which puts responsibility on students by fully involving them in the learning process with all its aspects and includes several learning techniques to ensure variety in learning (Kardaş & Uca, 2016). Enhancing the conceptual learning of students, providing students with different perspectives towards inquiry and research and helping them to gain creativity and ensure the stability of knowledge are among the basic aims of active learning methods (Şahin, 2007).

Active learning is a type of learning in which student takes an active role in listening to the class and participation in the class, can use high thinking and decision-making skills, co-operates with other students and can ask for help from teacher as much as necessary (Aksu, 2005). Active learning, which means students learn by doing, can be considered as lifelong learning (Wolfe, 2006). Active Learning Technique (ALT) is an instructional technique with focus on learner who interacts with subject matter content of a course through active participation that generates ideas, rather than being a passive listener and a receiver of knowledge (Salman, 2009). Some techniques commonly used in active learning are snowball, hourglass, card showing, card matching, sandwich, information paper bag, writing poetry, mind mapping, fast tour, butter-bread, case study, brainstorming, is it correct-is that wrong, educational play, learning by discovering, teaching by presenting (Ün Açıkgöz, 2011, pp.127-169), and six thinking hats technique (Bilgiç, 2011). Some of the instructional studies and tactics that can be used in active learning are slogan creation, writing poetry/stories, speaking/writing about the picture, find mistakes and causes, finding a title, puzzle, course logging, concept map, did you hear, worksheet and preparing Venn diagram (Ün Açıkgöz, 2011, pp.85-125) and fishbone (Ural, 2011). The body of literature includes several studies in which various methods and techniques for active learning are used together (Aytañ, 2017; Bölükbaşı & Özdemir, 2009; Suna, 2019; Thaman, Dhillon, Saggar, Gupta & Kaur, 2013; Ural, 2011).

Environmental education allowing an individual to gain a positive attitude towards environment and positive standards of judgment is a necessary factor for changing the individual's behaviors which cause environmental problems (Erten, 2004; Köğce, Ünal & Şahin, 2009). Attitudes, which are a type of behavior that appears in certain manners in any situation, are gained through learning and can change and develop (Gezer, Çokadar, Köse & Bilen, 2006).

Kardaş and Uca (2016) has analyzed 75 studies consisting of a PhD dissertation, master's thesis, and papers in which students' attitudes towards the course involving active learning practices were studied and it was found in the majority of these studies that students' attitudes towards courses where active learning techniques were used changed in a positive manner. The studies in the literature conducted by Akkurt (2010), Arık (2017), Bilgi (2008), Keleş, Uzun & Varnacı Uzun (2010), Tezel & Karademir (2015) related to the effect on environmental attitude of active learning method show that these studies include boundedness in terms of the area of learning, sample group, used techniques and ways of implementation. Thus, the effect on the students' environmental attitude of active learning method applied in teaching the biology topic "Current Environmental Issues and Human" for 10th grade students were selected as the problem situation of this study.

The aim of this study is to present the effect on the students' environmental attitude of teaching the biology topic "Current Environmental Issues and Human" for the 10th grade students by using active learning methods and techniques such as "have you heard?", "concept map", "speaking/writing about the picture", "fishbone", "six thinking hats", "finding the mistakes in the story", "puzzle" and "card matching". This research in which active learning methods and techniques are applied, it is important in terms of raising generations that can produce active solutions for ongoing environmental problems, helping teachers in lessons and providing resources for researchers in applying the method to different disciplines.

Methods

Research Design

"One-group pretest-posttest design" was used as an experimental method in this study. In this design, with no randomness and matching, the effect of the experimental treatment is tested through a study on a single group. The assessment instrument is given to the group as a pretest before the implementation and as a posttest after the implementation, and the significance of the difference between the pretest and posttest assessments of the subjects related to the dependent variable is tested (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel, 2010, p.198). The experimental pattern of the research can be shown as in Figure 1.

Figure 1

One Group Pretest-Posttest Pattern

Group Experimental Group	Pretest	Operation	Posttest
	O1	X	O2

Note. (URL-1) O1: Pretest scores O2: Posttest scores, X: Experimental (Independent) variable

In this research, the following path was followed in accordance with this model:

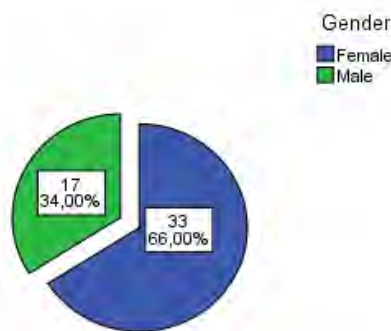
As there is no randomness in the research design, the samples were selected among 10th grade students at a determined school. "Environmental Attitude Scale" was administered to the students as a pretest before the experimental treatment. The topic of "Current Environmental Issues and Human" was taught to the students using active learning methods and techniques. The "Environmental Attitude Scale" was administered again to the students as a posttest after the experimental treatment.

Sampling

This research was carried out with 50 students studying at 10th grade. Since there was no random assignment in the research design, the sample was selected from 10th grade students studying at a designated school by purposeful sampling method. 17 (%34) students are male and 33 (%66) students are female. The distribution of students according to their gender is given in Graph 1.

Graph 1

Distribution of Students by Gender



Data Collection Tool

In order to measure the change in the students' environmental attitude as a result of active learning method-based teaching, "Environmental Attitude Scale" was used, which was developed by Uzun & Sağlam (2006) and consisted of the environmental thinking and environmental behavior subscales.

The topic of "Current Environmental Issues and Human" was taught to the students by using active learning methods and techniques such as "have you heard?", "concept map", "speaking/writing about the picture", "fishbone", "six thinking hats", "finding the mistakes in the story", "puzzle" and "card matching". This teaching was carried out for three weeks, two hours a week (Appendix 1). In order to decide which active learning methods and techniques to use, the subject "Current Environmental Problems and Human" is divided into sub-headings. In determining the subtitles; the objectives on the subject in the 2018 biology curriculum were taken into account. Active learning methods and techniques applied within the scope of the subject are given in Table 1.

Table 1

Active Learning Methods and Techniques Applied within the Scope of the Subject

Current environment and human subtitles	Active learning methods and techniques
Current environmental problems	Have you heard?
Environmentally harmful human activities	
Air pollution	Concept map
Water pollution	
Types of air pollution	Speaking/Writing about the Picture
Diseases that emerge as a result of environmental issues	
Causes of forest fires	Fishbone
Causes that can reduce biological diversity	
Results of Environmental Problems	Six thinking hats
Environmental facts and disciplines that can be utilized	
Ecological footprint	Finding the mistakes in the story
Carbon footprint	
Water footprint	
Air-pollutant gases	Puzzle
Gases that increase the greenhouse effect	
General information about current environmental problems and human issue	
Preventing environmental issues	Card matching

Environmental Attitude Scale

"Environmental Attitude Scale" developed by Uzun & Sağlam (2006) is a five-point Likert scale prepared as Always=5, Mostly=4, Sometimes=3, Rarely=2, Never=1. The scale consists of 27 items in total, including 13 items in "Environmental Behavior Subscale" and 14 items in "Environmental Thinking Subscale". Minimum 27 and maximum 135 points can be scored in the scale, including 13 to 65 points for the "Environmental Behavior Subscale" and 14 to 70 points for the "Environmental Thinking Subscale". The scope and face validity of the scale was ensured with an expert opinion, and the construct validity by means of factor analysis. It was found as a result of the analysis that the scale had three factors. These factors were respectively listed as "environmental concern, environmental consciousness, and environmental awareness" in the Environmental Behavior Subscale and "environmental opinion, environmental pollution, and environmental issues" in the Environmental

Thinking Subscale. Reliability analysis of the scale was performed by calculating the item-total correlation, Cronbach's alpha internal consistency coefficient and Spearman-Brown split half test correlation. Cronbach's alpha internal consistency coefficient for the scale in general was found as 0.80, while Spearman-Brown split half test correlation was 0.76 (Uzun & Sağlam, 2006). In this study, test-retest analysis was performed to calculate the reliability of the Environmental Attitude Scale, which was applied to the participants twice with a certain time interval. The Pearson correlation coefficient obtained for the overall scale after test-retest analysis was calculated as 0.83.

Data Analysis

The responses provided for the Environmental Attitude Scale were assessed between 5 and 1, and an environmental attitude environmental behavior and environmental thinking scores was obtained for each student. The data collected from the scale were analyzed using the dependent groups t-test. One-sample Kolmogorov Smirnov test was applied to determine whether the difference between pretest-posttest scores of environmental attitude, environmental behavior and environmental thought showed normal distribution or not. As a result of the obtained K-S(z) analysis; it was determined that the difference between environmental attitude ($K-S(z)=0,307$; $p>0.05$), environmental behavior ($K-S(z)=0,399$; $p>0.05$) and environmental thought ($K-S(z)=0,06$; $p>0.05$) pretest-posttest scores showed normal distribution. For this reason, the data obtained from the scale were analyzed using dependent groups t-test from parametric tests. Test-retest analysis (Pearson correlation) was conducted to examine the reliability of the Environmental Attitude Scale in this study. Tables and graphs were used to show the analysis results of the data.

Findings

In this chapter of the study, the findings obtained through the analysis of the data collected by "Environmental Attitude Scale" were presented in tables and graphs.

The data related to the students' pretest-posttest scores for the Environmental Attitude Scale were given in Table 2.

Table 2

Dependent Groups T-Test Results Related to The Students' Pretest-Posttest Scores for The Environmental Attitude Scale

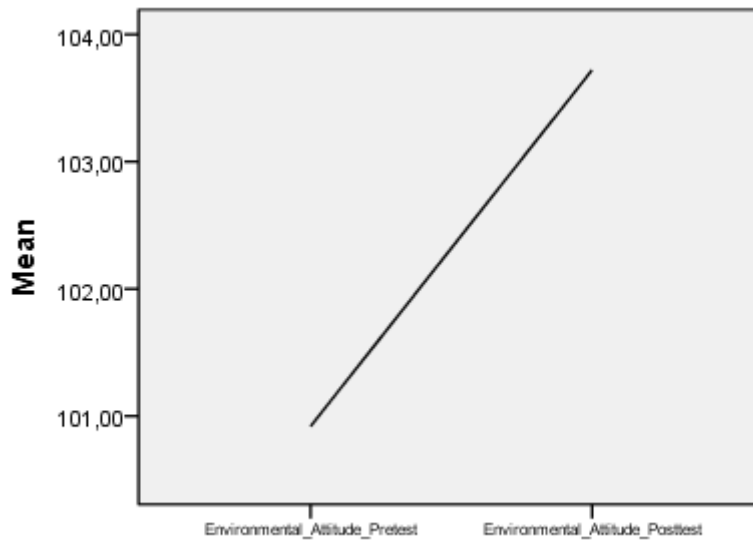
Tests	N	\bar{X}	Sd	df	t	p
Pretest	50	100.92	9.25	49	-2.838	.007
Posttest		103.72	12.43			

According to the findings in Table 2, there is a significant difference ($t_{49} = -2.838$, $p < .05$) in favor of posttests between the students' environmental attitude scale pretest-posttest scores.

The change in students' environmental attitude scale pre-test and post-test mean scores is given in Graph 2.

Graph 2

Change of Students' Environmental Attitude Pretest-Posttest Mean Scores



The data related to the students' pretest-posttest scores for environmental behavior and environmental thinking, which are subscales of the Environmental Attitude Scale, were given in Table 3.

Table 3

Dependent Groups T-Test Results Related to The Students' Pretest-Posttest Scores for Environmental Thinking and Environmental Behavior Subscales

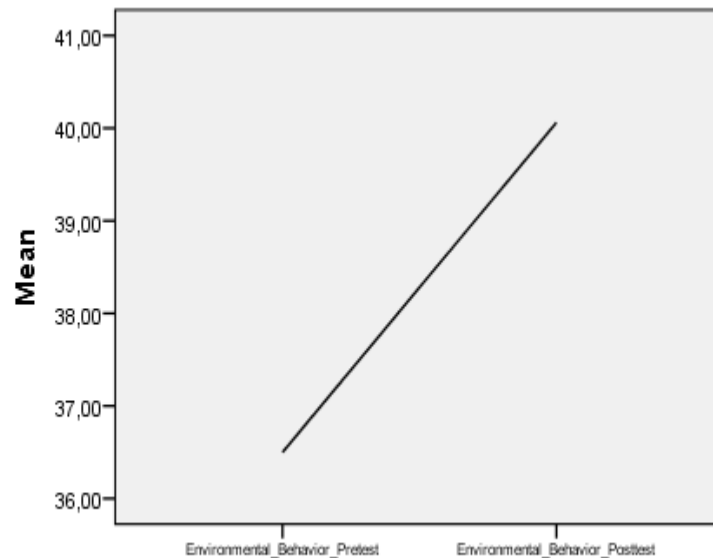
Environmental Attitude Subscales	Tests	N	\bar{X}	Sd	df	t	p
Environmental behavior	Pretest	50	36.50	7.66	49	-3.884	.00
	Posttest		40.06	10.82			
Environmental thinking	Pretest	50	64.42	4.10	49	.849	.40
	Posttest		63.66	7.32			

According to the findings in Table 3, there is a significant difference between the students' pretest-posttest scores ($t_{49} = -3.884, p < .05$) for the environmental behavior in favor of the posttests, while there is no significant difference between the pretest-posttest scores ($t_{49} = .849, p > .05$) for the environmental thinking subscale.

The change in the students' environmental behavior scale pretest and posttest mean scores is given in Graph 3.

Graph 3

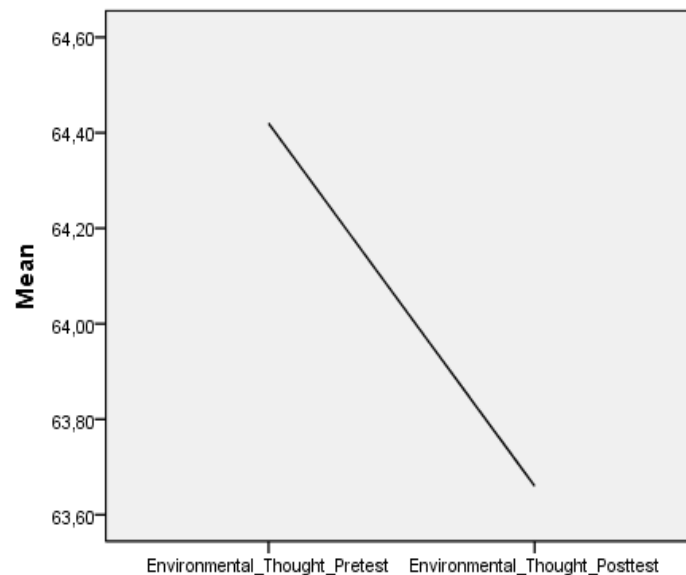
Change of Students' Environmental Behavior Pretest-Posttest Mean Scores



The change in the environmental behavior scale pretest and posttest mean scores of the students is given in Graph 4.

Graph 4

Change in Students' Environmental Thought Pretest-Posttest Mean Scores



Discussion

In this study, the effect on environmental attitude of active learning method applied in teaching the biology topic "Current Environmental Issues and Human" for 10th Grade Students was analyzed. The topic of "Current Environmental Issues and Human" was taught to the students using active learning methods and techniques such as "have you heard?", "concept map", "speaking/writing about the picture", "fishbone", "six thinking hats", "finding the mistakes in the story", "puzzle" and "card

matching". The analysis of the assessments made before and after teaching the students about the environmental attitude revealed a significant increase in the level of students' environmental attitudes.

The research samples in the body of literature that show similarity to this finding of the research are as follows: Within the scope of the study carried out by Bilgi (2008) the effect on the students' level of environmental attitude and environmental knowledge of the active learning methods applied in teaching the environmental issues in High School Grade 1 geography program compared to teacher-centered methods was analyzed. In this study, it was reached to the result that active teaching applied in environmental education was more effective and positive for the students in terms of environmental knowledge and environmental attitude compared to teacher-centered teaching. In the same study, teachers were asked which active teaching methods they preferred in teaching environmental issues within the scope of geography lesson. 10% of the teachers stated that concept maps are among the most suitable techniques and methods. In the study carried out by Akkurt (2010) the effect on the students' success and environmental attitudes of active learning approach applied in teaching High School Grade 1 students the biology topic "ecology and environmental pollution" compared to traditional form of teaching was analyzed. In this study, it was found that active learning method applied in teaching the related topic was more effective in improving students' success and making them develop a positive attitude towards the environment compared to traditional methods. In the study carried out by Keleş et al. (2010) the effect on the teacher candidates' environmental consciousness, attitude towards the environment, thought and behaviors of the nature education project in which active learning methods were applied was analyzed. In this study, it was found that the natural education program had a positive effect on the participants' environmental consciousness, attitudes and behaviors and had a lasting effect, but did not have any effect on their environmental thoughts. Within the scope of the study carried out by Şenel (2010) the effect on the science teacher candidates' environmental consciousness of problem-based active learning method compared to direct instruction was analyzed. In this study, it was found that both methods increased environmental consciousness, while problem-based learning method was more effective in increasing environmental consciousness than direct instruction method. Within the scope of the study carried out by Arık (2017) the effect on the environmental education of constructive learning approach and/or active learning was analyzed. In this study, it was found that constructive learning approach and/or active learning-based environmental education was more effective compared to traditional learning and had a large effect on the students' environmental academic success and their attitudes towards the environment.

In addition, the results of the studies carried out by Akdal (2010), Armbruster, Patel, Johnson & Weiss (2009), Aydın (2011), Bilgi (2008), Çalışkan (2005), Çizmeçi (2006), Duman & Şahiner (2008), Gao (2019), Güçlü (2007), Güney (2011), Kaya & Ersoy (2011), Klepaker, Almendingen & Tveita (2007), Mathias (2014), Protus, Martin & Shikuku (2020), Saygı (2009), Türksoy & Taşlıdere (2016), Wilke (2020), Yıldırım (2009) and which analyzed the effect of active learning method applied in teaching courses of different topics on the students' attitudes towards the course were in parallel with the findings of the research. It is seen that one or more of the active learning methods and techniques used in this study are also used in these studies. These studies also included different active learning methods and techniques.

In this study, the analysis of the assessments made before and after the teaching process regarding the students' levels of environmental behavior and environmental thinking, which are the subscales of environmental attitude, revealed a significant increase in the students' levels of environmental behavior. However, no significant difference was found in their levels of environmental thinking. It is thought that the students' high levels (\bar{X} =64.42) of environmental thoughts before the education have an effect on their levels of environmental thoughts remaining the same after the education.

The research samples in the body of literature that show similarity to this finding of the research are as follows: In the experimental study carried out by Keleş et al. (2010) in order to analyze effect on the teacher candidates' environmental consciousness, their attitudes towards the environment, thinking and behaviors of the natural education project where active learning methods were applied, it was

found that this project improved environmental consciousness, had a positive effect on their environmental attitudes and behaviors, but did not lead to any significant change in the environmental thought. Within the scope of the study carried out by Tezel & Karademir (2015) the effect on the middle school students' attitudes towards the environment, behaviours, and thoughts of the project "I Understand the Inquiring Nature of Science" in which active learning methods were applied was analyzed. In this study, it was found that the project was not effective on the students' attitudes towards the environment, behaviors, and thoughts. The experimental results of this study related to the environmental attitudes, behaviors and thoughts outside from active learning are in parallel with the results of the study conducted by Arı (2019), Cevher Kalburan (2009), Hamalosmanoğlu & Güven, (2014), Leeming, Porter, Dwyer, Cobern, & Oliver (1997), Shay Margalit & Rubin (2017), Uçar & Karakuş (2017).

Conclusion and Suggestions

In this study, it was aimed to present the effect on environmental attitude of the active learning method applied in teaching the biology topic "Current Environmental Issues and Human" for 10th grade students. In this study, it was found that active learning method applied in teaching the biology topic "Current Environmental Issues and Human" for 10th grade students improved the levels of students' environmental attitudes and thus had a positive effect on the environmental attitude. When the study is analyzed in terms of environmental behavior and environmental thought, which are the subscales of the environmental attitude, it is found that the students' levels of environmental behavior improved after the education, but their levels of environmental thought remained the same. Therefore, it can be said that active learning method has a positive effect on environmental behavior, but it is not effective on environmental thoughts. It is thought that the students' high levels of environmental thoughts before the education have an effect on their levels of environmental thoughts remaining the same after the education.

Suggestions

Based on the results of this study,

- Different active learning methods and techniques can be included in the course's teaching process in order to improve environmental thoughts in which no significant increase was observed.
- Quantitative data collected in this regard can be supported by qualitative data.

In the future,

- Experimental studies can be conducted related to the effect on environmental attitude of different variables.
- The effect of active learning on attitudes towards various topics in biology subject can be studied.
- The effect on environmental attitudes of active learning method to be applied in various disciplines in terms of the environment can also be studied.

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Appendix 1: Lesson Plan Example

Lesson: Biology
Class: 10 th grade
Unit: The ecology of ecosystem and Current environmental problems
Subject: Current environmental problems and human
Time: Three week (Six hour)
Learning Gains: 1. The causes and consequences of current environmental issues are evaluated. a. The current environmental issues (decrease in biological diversity, air pollution, water pollution, soil pollution, radioactive pollution, noise pollution, acid rains, global climate change, erosion, destruction of natural habitats and forest fires) are summarized and the negative effects of these issues on living beings are specified. b. Emphasis is placed on diseases caused by environmental issues. 2. Their role as an individual in the emergence of current environmental issues is questioned. a. Practices are done related to ecological footprint, water footprint and carbon footprint. b. It is ensured that solutions are developed to reduce the ecological footprint, water footprint and carbon footprint. 3. Solutions are offered to prevent environmental pollution in local and global contexts. a. Examples of the work done to prevent environmental pollution locally and globally are provided. b. It is ensured that human activities that harm the environment at local and global scale are discussed. c. Examples are given as to how biology is associated with other disciplines in the prevention of environmental pollution.
Teaching-Learning Methods and Techniques: Have you heard?, concept map, speaking / writing about the picture, fishbone, six thinking hats, finding the mistakes in the story, puzzle, card matching
References/Tools and Equipment: Secondary education curriculum for the biology lesson [Ministry of National Education (MoNE), 2018], activity papers, internet
Activities: <u>Have You Heard?</u> Subject: Current environmental problems Implementation: Say a sentence about the topic starting with "Have you heard?" (After receiving the opinions of the students, current environmental issues are written on the board). <u>Puzzle</u> Subject: General information about current environmental problems and human issue Implementation: Complete the puzzle provided on the topic (After the students complete the puzzle, the answers are reflected on the board and necessary explanations are made). <u>Concept Map</u> Subject: Air pollution

Implementation: Examine the concept map given on the topic (The concept map reflected on the board is interpreted together with the students)

Puzzle

Subject: Air-pollutant gases and gases that increase the greenhouse effect

Implementation: Complete the puzzle provided on the topic (After the students complete the puzzle, the answers are reflected on the board and necessary explanations are made).

Speaking / Writing About the Picture

Subject: Types of air pollution

Implementation: Look at the pictures prepared on the topic. Share your ideas about the sources in pictures that create air pollution. In your opinion, which of these sources are natural and which are formed by human effect? (Correct answers are written on the board).

Concept Map

Subject: Water pollution

Implementation: Examine the concept map given on the topic (The concept map reflected on the board is interpreted together with the students)

Speaking / Writing About the Picture

Subject: Diseases that emerge as a result of environmental issues

Implementation: Look at the pictures prepared on the topic. Consider what could be the health problems in the pictures. Let's discuss which of these health problems can occur as a result of the environmental problems indicated in the picture (Correct answers are written on the board).

Fishbone

Subject: Causes of forest fires, causes that can reduce biological diversity

Implementation: Let's fill in the relevant parts of the fishbone diagrams with the ideas you will share on the topic (Correct answers are written on the board).

Six Thinking Hats

Subject: Results of Environmental Problems

Implementation: (Black hat: pessimistic, judgmental, negative thinking) Share your ideas on the topic to represent the black hat. (Correct answers are written on the board).

Finding the Mistakes in The Story

Subject: Ecological footprint, Carbon footprint, Water footprint

Implementation: Read the story given on the topic. Identify the wrong behaviors in this story (After the students complete the story, the answers are reflected on the board and interpreted).

Card Matching

Subject: Preventing environmental issues

Implementation: Look at the cards prepared on the topic. Some cards contain environmental issues and some cards contain the ways to prevent these environmental issues. There is a number on each card. Write down which environmental issue can be avoided by which way to match the card numbers. (After the students have completed the matching, the correct answers are written on the board and interpreted).

Have You Heard?

Subject: Environmentally-harmful human activities

Implementation: Say a sentence about the topic starting with "Have you heard?". (Correct answers are written on the board).

Six Thinking Hats

Subject: Environmental facts and disciplines that can be utilized

Implementation: (Green hat: progressive, innovative, creative thinking, productive) Share your ideas on the topic to represent the green hat (Correct answers are written on the board).