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The Effect of Out-of-School Learning Activities on 5th Grade Students' Science, Technology, Society and Environment Views

[1] Arzu Küçük*, [2] Nagihan Yıldırım

[1] National Ministry of Education, Rize, Turkey
[2] Recep Tayyip Erdoğan University, Faculty of Education, Rize, Turkey

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Abstract

This study aimed to examine the effects of out-of-school learning activities carried out within the 5th grade human and environmental unit of science teaching program on students' views of science, technology, society, and the environment. In the research, the "mixed research method", which emerged as a research paradigm that acts as a bridge between quantitative and qualitative research, was used. In this study, a group of 22 students, consisting of 5th-grade students, taught all of their courses outside the school in the human and environmental unit. To measure the impact of these practices on students' understanding of Science, Technology, Society, and Environment, quantitative data were applied three times, in the beginning, in the end, and at the end of the following six months, with the Science, Technology, Society and Environment survey, while qualitative data were processed throughout the applications via worksheets, structured diaries and semi-structured interviews with students after the intervention. Quantitative data analysis was done by calculating the item scores of each question in the questionnaire, and the analysis of qualitative data was done through content analysis. Based on the quantitative and qualitative data that greatly support each other in this research, it has been revealed that the out-of-school learning activities implemented within the scope of the human and environmental unit have improved the science, technology, and environmental views of the study group, and also its permanence can be achieved in a long time.

Correspondence to Arzu KÜÇÜK, National Ministry of Education, Rize, Turkey, Email: arzukucuk@gmail.com

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Introduction

One of the external conditions of the concept of learning is known as the learning environment. These environments are areas where teaching materials and tasks are structured and the desired teaching process is realized in this way (Taşçı & Soran, 2008). In this context, school and in-class learning environments, which were previously the primary learning environments, have been extended to include out-of-school environments. The use of out-of-school learning environments in education and training processes enables children to get rich experiences first hand, to perceive the events and elements in their usual place, in their usual environment, in this process, to perceive them easily by using many sensory organs, to be able to experience the abstract and complex events concretely, to increase their attention and motivation, disciplines. It is known that he/she can establish inter-relationship and develop his personal and social skills (Atmaca, 2012; Balkan Kıyıcı & Atabek Yiğit, 2010; Soysal, 2019).

It is stated that the out-of-school learning environments to be designed for this purpose can increase the desire to learn in children, contribute positively to both their motivation for learning and their attitudes towards the lesson, and thereby increase their interest in science and academic achievements in science lessons (Ayotte-Beaudet, Potvin, & Lapierre, 2017; Dori & Tal, 2000; Ramey-Gassert, 1997). It is known that outdoor education is a combination of environmental education, outdoor activities, and personal and social development (Higgins, Loynes, & Crowther, 1997). In this respect, out-of-school learning environments can provide learning opportunities in different ways that are not included in classroom learning environments, provide opportunities for children to learn in different learning styles, help each student gain earnings at their own pace of learning, and also help children spend enough time and configure their senses in the best way (Melber & Abraham, 1999). Apart from these, other benefits of directing children to out-of-school learning environments are; enriching science, increasing exploring nature, providing social experiences and entertainment, and providing concrete experiences about abstract and complex phenomena (Griffin, 2004; Tal & Morag, 2009). The literature reveals that education in out-of-school learning environments also has an enriching, supportive and complementary potential in school education (Şen, 2019). Such training, besides mental comprehension, encourages students to establish empathetic connections, to wonder, to look critically, and to gain practical skills (Ertaş- Kılıç & Şen, 2014). Undoubtedly, compared to classical classroom teaching when children visit new places they study science subjects differently, and interestingly, they are more excited and have a stronger desire to learn (Braund & Reiss, 2006).

Research from the Ministry of Education on Educational Vision 2023 document to take place in conjunction with the non-school learning environment in Turkey, is one of the topics of interest in recent years (Armağan, 2015; Balkan Kıyıcı & Atabek Yiğit, 2010; Bakioğlu & Karamustafaoğlu, 2014; Bodur, 2015; Bozdoğan, 2007; Ertaş, Şen, & Parmaksızoğlu, 2011; Küçük & Küçük, 2019; Yorulmaz, 2016). These learning environments, on the one hand, provide students with rich learning environments, on the other hand, facilitate students to easily structure information with concrete examples (Balkan Kıyıcı & Atabek Yiğit, 2010). Similarly, there is the potential to strengthen the social relationships of students and contribute to the development of science skills (Panizzon & Gordon, 2003). However, to date, out-of-school learning environments have often been perceived by students and teachers as places for entertainment and sightseeing (Laçin Şimşek, 2011). However, teachers who want to teach in out-of-school settings should know well and what should be done before going out, after, and even back to school to perform these tasks functionally. In this way, it is possible to raise the science-literate individuals targeted by the program.

Science literacy has seven dimensions: the nature of science, key science concepts, scientific process skills, Science-Technology-Society-Environment interactions, scientific and

technical psychomotor skills, the core values of science, science interests, and attitudes. An individual who is a science-literate understands the nature of science and scientific developments; comprehend basic science concepts, principles, laws, and theories and use them appropriately; uses scientific processes to solve problems and make decisions; understand the relationship between science and technology, science and environment and their interaction with society; it also has the interests that lead to a richer and more fulfilling life (Köseoğlu et al. 2003). The individual who is a science-literate can use scientific principles, participate in discussions on scientific issues with socio-cultural aspects affecting the society and make effective decisions. (National Research Council, 1996). This literacy is seen as a civic competence that requires rational thinking about personal, social, political, and economic problems that we may encounter throughout life (Hurd, 1998). Undoubtedly, one of the most important science literacy is "Science-Technology-Society-Environment" interactions and Science-Technology-Society-Environment Education that will reveal this interaction. The main purpose of this education is to increase the scientific and technological literacy of all members of a society (Yager, 1996).

With Science-Technology-Society-Environment education, it is aimed that the students get to know their social, technological, and natural environment and understand the relationships between them instead of just content with the science content provided with textbooks (Yalaki, 2014). In this way, students are expected to comprehend how the subjects they learn about science and technology at school affect both their own lives and society. The main purpose here is that students realize that science is not just a cluster of different types of scientific knowledge, it is a process, and therefore there are social, economic, ethical, and political aspects of science and technology. When these outcomes can be achieved, students can make informed decisions as responsible members of society in the face of scientific and technological developments that affect their lives.

During science education based on the Science-Technology-Society-Environment students are expected to be active in the education and training process and encouraged to research and solve problems. Similarly, students can use various resources to collect information, use the information they have obtained, cooperate with other students, interpret the research results, discuss among themselves, and most importantly, make a decision about the subject they are researching and attempt to implement this decision (Yalaki, 2014). The Science-Technology-Society-Environment approach can be applied in different ways depending on the opportunities and conditions in science education programs (Solomon & Aikenhead, 1994). One of these applications is known as motivation with it. In this application, students' interests are drawn with Science-Technology-Society-Environment subjects (how science and technology affect society) and it is aimed to make the lesson more interesting.

Science-Technology-Society-Environment education starts with teaching a subject related to science and technology (Solomon & Aikenhead, 1994). In this context, the human and environmental unit included in the science education curriculum is a very appropriate subject in terms of conducting training based on this approach and achieving its outcomes. This subject is also an ideal situation for students to experience potential problems in themselves using multiple sources. In this process, informal education practices, as well as formal education, should increase the spread. The problems in this subject that concern society (eg biodiversity, environmental pollution) are more closely related to technology. Society and therefore students are not affected by the scientific world, but by the technological world around them (Yalaki, 2014). Therefore, when students encounter a problem that concerns society, it is an important opportunity for them to learn the technology related to the problem and the science behind this technology to understand the problem and produce solutions. In this process, students are expected to research the technological and scientific aspects of the subject first, and then to make and present small-scale scientific research using the data they collect.

In addition to formal education, informal science education has an important role in the development of individuals' literacy. In this way, students can use a wide variety of resources to access information, including nonformal learning environments. For example, media, the internet, libraries, experts in the field, universities, and private or public institutions can create resources to access the desired information. The next step is for students to experience a research process under the guidance of a teacher; collecting data and organizing and discussing the information and data they collect, developing hypotheses and solutions, and reaching a conclusion. At this stage, if possible, students can consult their hypotheses or conclusions by contacting specialists. According to the conclusion reached in this way, students can initiate a process of action by making a decision and, if appropriate, with representatives of individuals and institutions who are responsible members of the community. In this process, articles and short notes written for the relevant people and institutions can be put to work.

It turns out that the recruitment of these types of out-of-school learning environments is important for students to be educated as science-literate individuals as well as cognitive learning. In this context, examining the possible effects of these environments on science, technology, society, and environment views only by removing the places listed above and becoming ordinary places in out-of-school studies, adding other innovative environments (eg exhibitions, panels, theaters, computer labs, etc.). can provide new information to the subject area.

This study aims to examine the effects of out-of-school learning activities designed within the scope of the human and environment unit on students' views on science, technology, society, and the environment.

Method

In this research, the "mixed research method" that emerged as a research paradigm that acts as a bridge between quantitative and qualitative research was used (Onwuegbuzie & Leech, 2004). Mixed method researches are defined as “the researcher's combining qualitative and quantitative methods, approaches and concepts within a study or successive studies” (Cresswell, 2003; Tashakkori & Teddlie, 1998. In mixed-method research, the researcher chooses the pattern that best meets the research question and the rationale of the research, taking into account the interaction, priority, timing, and way of combining the quantitative and qualitative stages in his work. Many research designs in the literature will facilitate researchers' model selection (Cresswell, 2003; Cressweel & Plano-Clark, 2011; Leech & Onwuegbuzie, 2009; Morse & Niehaus, 2009; Johnson & Christensen, 2017; Teddlie & Tashakkori, 2009). In this research, the sequential pattern created by Creswell's studies in the field of education was preferred (Cresswell, 2003). In the first stage of this design, the quantitative data that responds to the research question primarily is collected and analyzed. Qualitative data is collected and analyzed in the second stage. The researcher uses qualitative results to explain the quantitative results in the first stage. It is especially useful to use this pattern in explaining unexpected research results.

In this study, short and long-term effects of out-of-school learning environments on the study group's views on science, technology, society, and environment were investigated. For this purpose, Science-Technology-Society-Environment Questionnaire was applied three times, in the beginning, at the end of the application, and in the sixth month following. However, qualitative data collected through worksheets, structured diaries, and semi-structured interviews used by students during activities conducted in out-of-school learning environments were used to explain quantitative results.

Working group

The study group of this research consists of 22 students studying in the 5th grade of a middle school in Çayeli District of Rize. 7 of these students are boys and 15 are girls. Official permissions were obtained from the Rize Provincial Directorate of National Education after obtaining written consent from the parents of the students to carry out this study in the specified secondary school.

Design and Implementation of Human and Environmental Unit Out-of-School Learning Activities

In this study, firstly, the unit where lessons can be carried out in out-of-school learning environments is included in the range and scope of out-of-school learning as considering the open-air activities, environmental education, personal and social development components, it was determined as the 5th grade Human and Environmental Unit in the 2018 Science Education Curriculum (Higgins, Loynes, & Crowther, 1997). The Human and Environmental Unit is included in the 4th and 5th-grade curriculum in the 2018 Science Course Curriculum. While this unit is expressed with two achievements in the 4th-grade science course, it consists of eight achievements in the 5th-grade science course. The 5th grade Human and Environmental Unit; It is aimed to question the causes and consequences of environmental problems, biodiversity, endangered and endangered creatures and the things to be done to protect these species, sensitivity to environmental problems caused by human activities, and to gain knowledge and skills to solve these problems. (MEB, 2018). In this unit, there are 3 sub-titles: Biodiversity, Human and Environment Relationship, and Destructive Nature Events.

Effective learning environments should be designed to provide students with the opportunity to apply in environments that are similar to real environments where they can use the knowledge they acquire by offering rich contexts that reflect the real world and everyday life (Kılıç, 2004). In this respect, the state learning theory is based on the assumptions of the constructivist approach that "learning is structured with real tasks and social experiences in the context of real-life" and is a theory that keeps students at the center of the learning process (Higgins & Nicol, 2002). In this structuring process, there is an open-minded exchange of views between the teacher and the student, and the student creates his views about the world by running his personal experiences. In another dimension, in reconstruction, the student may want to change their personal experience by referring to the theoretical structures they encounter. In the last reflection process, sometimes their personal and social structures need to be disrupted to gain new insights. In short, this learning process starts with personal experience and leads to deep questioning (Higgins & Nicol, 2002).

In this research, visits to out-of-school learning environments consist of three phases: (i) things to do before going to the out-of-school learning environment, (ii) things to do in out-of-school learning environments, and (iii) things to do after returning from out-of-school learning environments. In these three stages, the "structuring", "restructuring" and "reflecting" components of the constructivist theory are properly reflected.

(i) Before going to out-of-school learning environments

The actions to be taken before moving to out-of-school learning environments for the Human and Environment Unit include preparations for the out-of-school environment in which the application will be carried out. These preparations consist of obtaining administrative permissions, setting the tools, making appointments from the institution or institution to be visited, and distributing the question papers prepared for out-of-school learning environments

to students. In other studies related to the subject area, although brochures with the introduction of the place to visit, what we will learn, what to do before the trip? what to do during the trip? what to do after the trip? were provided for students (Bakioğlu, 2017), no such study was required in this study. In this study, the first two sections of the out-of-school learning worksheets were distributed to the students at least one day before going out of school learning environments, and they were provided with preparations at home. On the first page of this material, there is brief information about the out-of-school learning environment and a few images. After the preparations made by the students before the visit were checked in the classroom and/or schoolyard, the purpose, duration, content, what to pay attention to during the visit, and what to do next were shared orally by the teacher. The students are prepared both mentally and effectively in the learning environment and the subject to be covered via these activities. During the preparation of this preparation, it is important that the teacher creates a discussion environment and has an inquiry, initiates the thinking process (Önder, Abacı, & Kamaraj, 2009). In this way, it has been tried to create preliminary knowledge and perception about students that a systematic study will be carried out for outcomes of the lesson in out-of-school learning environments. After this sharing, the last two pages of out-of-school learning worksheets were given to the students along with the secretary file that would make writing easier.

(ii) During Out-of-School Learning Environments

What to do in out-of-school learning environments includes what to do in out-of-school settings. For this purpose, out-of-school learning environment worksheets and some catalogs were used. The students used the third page of the worksheets given to them before the visit to take notes and record their data and observations. The purpose of their preparation is to ensure that students are planned and alert during implementation. These materials were corrected by taking the feedback of the second researcher, as well as another faculty member. By the nature of the activity (for example, I am reviewing the IUCN Red List and Measuring the Amount of Light and Sound), there are also data collection forms in the relevant section of some worksheets. These papers were delivered to the first researcher with the fourth part of the worksheet after the extra activities in the classroom and/or at home after the event.

The students received the answers to the questions they prepared before, in line with their interests and curiosity about the subject of the course and the subject or person who made the presentation. They were constantly warned by the teacher that they should never leave the place of visit without completing this task and before. During the application, the students with hardcover files were given by the teacher to answer the questions in the out-of-school learning environment papers, and they were asked to keep their school bags with them at all times.

(iii) After Returning Out of School Learning Environment

Completing the process after returning from the out-of-school learning environment contributes to both the strengthening of learning and the emergence of new ideas. In this way, false learning can be corrected and students' communication skills can be supported (Sözer & Oral, 2016). Within the scope of the Human and Environment unit, to reinforce the knowledge and skills prepared to develop the knowledge and skills learned in out-of-school learning environments, after the visit in the school environment or the classroom after the visit; a summary has been made by the teacher, referring to what they know about the subject-acquisition and the place of visit and what they want to learn. In this process, some students were asked to share the records of the answers they received to the questions they asked. In the end, students can write short articles, prepare posters, design posters, etc. they were asked to

complete extra work at home with individual or group work. After these procedures, the students delivered the next day with extra studies, by writing what I learned on the last part of the worksheet. These materials were also presented in the classroom. Extra tools have been used to reinforce the knowledge learned in out-of-school settings and also to estimate how effective learning is. After these presentations, the teacher made a final topic summary concerning the extra work done.

The outcomes of each department of the Human and Environmental Unit and out-of-school learning environments covering these achievements are explained in the attached tables:

Table 1. Human and Environment Unit achievements and out-of-school environments and teaching methods covering these achievements

Topics	Topic / Concepts	Time (min)	achievements	Out-of-School Environments Covering Gains	Teaching Methods
Biodiversity	Biodiversity, natural life, extinct creatures, habitat, ecosystem	80	F.5.6.1.1.Questions the importance of biodiversity for natural life. *It gives examples of plants and animals that are extinct or in danger of extinction in our country and the world.*	Natural habitat	Field Work + + Game
		40		Faculty of Education Garden	Orienting
		40	F.5.6.1.2. Discusses the factors threatening biodiversity based on research data.	Computer Lab	Research and investigation
		80		Auditorium	Panel
Human and Environment Relationship	Environmental pollution, environmental protection, and beautification, human-environment interaction (human impact on the environment), local and global environmental problems	40	F.5.6.2.1. Express the importance of the interaction between humans and the environment. *The negative effects of environmental pollution on people's health are mentioned.* F.5.6.2.2. It offers suggestions for the solution of an environmental problem in its immediate environment or our country. F.5.6.2.3. It makes inferences about environmental problems that may occur in the future as a result of human activities. F.5.6.2.4. Discusses the examples of benefits and harms in human-environment interaction on examples.	Theater Hall	Theater
		60		Hydroelectric power plant	Field Work + Seminar
		60		Airport Construction Area	Field Work + Seminar
		40		University Physics Department	Seminar
		40		Environment and Urbanization Rize Provincial Directorate	Seminar
		40		Çayeli District Health Directorate	Seminar
		80		Çayeli District Center	Research and investigation
Destructive Natural Phenomena	Destructive natural phenomena and ways of protection	160	F.5.6.3.1. Explains destructive natural events caused by natural processes. *Earthquakes, volcanic eruptions, floods, landslides, tornadoes, hurricanes are*	Showroom	Exhibition

	mentioned without going into detail. F.5.6.3.2. It expresses ways of protection from destructive natural events.	

The Human and Environment Unit out-of-school teaching activities prepared within the scope of this study were applied to the study group for 5 weeks between April 25 and May 24, 2019. Practices were made mostly by taking the other lessons or empty lessons, especially during the science class hours included in the formal program, either completely during the school period or partially overflowing the time.

Data Collection

Quantitative data of this study were collected with the Student Questionnaire on Science, Technology, Society and Environmental Issues, and the qualitative data with worksheets, structured student diaries, and student interview form.

Student Questionnaire on Science, Technology and Environment Issues

In this study, a Student's Questionnaire on Science Technology Society Environment prepared by Doğru and Şeker (2012), which contains questions on science technology, society, and environment was used. In the questionnaire, a total of 52 items which is rated as 4-point Likert type (Strongly Agree-Agree-Disagree-Strongly Disagree) and classified under the sub-topics of "science and technology", "technology", "technology's impact on society", "science and technology's effect on society", “impact on science and technology”, “impact of science and technology on the environment”, “effect of technology on the environment” and “effect of society on the environment”.

Worksheets

A tool known as “getting a written opinion” can be used in the evaluation of the performance of individuals, in which they can answer written and verbal questions in writing (Çepni & Ayvacı, 2012). With this tool, the individual has the opportunity to organize his thoughts in the writing process first, and since he has enough time to write, subjects such as why he was successful or not, why he did not exhibit one behavior and the other, can be measured from his expressions. The level of knowledge of individuals can be measured more effectively in a subject investigated in this way. The worksheets used in this research consist of four parts. On the first page, there are explanations about which places to visit within the scope of the activity and the purpose of the activity by referring to the previous out-of-school activity, what purpose the activity will be held during and after the visit. In addition to this, a few photos were placed on the page in addition to short information so that students can get to know out-of-school learning environments to be visited. In the first part of these worksheets, they can write what they expect about the acquisitions of the unit "What Do I Know?" There is a section named. This section was created to probe students' pre-learning on the subject. In the second part of these worksheets, they will be able to write what they expect to learn during the visit to the acquisitions of the unit in the form of "What do I want to learn?" There is a section named. This section was created to attract the students' interest in the subject and to ensure the sustainability of their curiosity, known to be effective in their learning processes.

The page containing the first two sections of this worksheet was given to the students at least one day before the event. Students who fill the sections related to this path individually shared what they wrote in the classroom and/or schoolyard before setting out for the visit. In this process, while the teacher briefly summarized the questions to be sought and reminded the new questions that may be asked to the experts, the students provided the opportunity to revise the questions in the second part of the worksheet. These first two stages are used as the "structuring" component of the constructivist approach.

In the third part of this worksheet, there is a page called "My Visit Notes" where students can write their observations about course acquisition during the visit and the answers given to themselves and their friends' questions. This section was requested to be completed during the visit. This stage has been used as the "restructuring" component of the constructivist approach.

In the fourth and last part of this worksheet, students will be able to write what they learned during the visit, as well as what they learned after extra activities at school and/or at home. There is a section named "What Have I Learned?". This section allows students to comfortably write at home what they have learned, including the relevant achievements. After these articles were shared with the class at the next meeting and the important points of the subject were summarized by the teacher for the last time, they were collected for analysis. This last stage was used as the "reflection" component of the constructivist approach.

Structured Student Diaries

In this study, the students in the study group were asked to write structured notes called "My Science Diary" at the end of each day of out-of-school practices and to deliver the next official working day. In this way, effective in students' learning lives; situations such as comments about the application, positive or negative reactions they give (Çepni, 2018; Elliott, 1991; Mertler, 2006; Patton, 2018). For this purpose, at the end of the applications included in the guide teaching material, diaries containing what they learned in the classroom or at home, the events and emotions they experienced for the first time were held. At this point, it is known that the learning outcomes of the activities or lessons carried out in educational environments, including out-of-school, are evaluated, and student diaries are used in qualitative or quantitative researches where the opinions of students about the education they receive are measured. (Erduran-Avcı, 2008; Göloğlu Demir & Yılmaz, 2018; İnce, 2017; Küçük, 2006).

In these writings, the students write freely, focusing on other topics beyond the purpose of the research, in many cases, their thoughts, perceptions, and experiences gained outside the school. However, in the current study, students were asked to write by focusing on the criteria presented in the context of the theoretical foundations of the research, rather than writing freely. These criteria are; the places visited for each day, their feelings, curiosities, the things they like and dislike, were determined after the lessons as I wish and, well, what they said and the information they learned.

Student Interview Form

In this research, after all, applications were completed, semi-structured interviews were made with the study group. After the interview questions were prepared by the researcher, the experts of the subject area were reviewed and finalized. The interview form, which was formed in this way and consists of three questions that can answer the research question of the current study, was used to obtain the opinions of the students about the courses carried out in out-of-school environments and also to support learning products measured by quantitative measurement tools. In this way, all the students in the study group were interviewed for at least 30 minutes in the week immediately after the applications were completed. The questions asked in these

interviews; it is aimed to understand the perceptions of out-of-school learning environment practices on students in terms of knowledge and skills, to determine whether there are places that have difficulties to learn in out-of-school learning environments, and to understand to what extent they are satisfied with the lessons in out-of-school learning environments.

Data Analysis

In this study, the questionnaire which consists of eight sub-dimensions was graded in 4-point Likert type. Descriptive statistical values of the answers given by the study group to each item in the sub-scales in this questionnaire for pre-test, post-test, and permanence-test applications were calculated. To compare the values reached in this way, charts were drawn in Excel. In this process, the items in which the difference between the pre-test / post-test / permanence-test applications for each item was 0.10 and above were also determined.

Although there are no standard ways for qualitative data analysis (Creswell, 2013; Yıldırım & Şimşek, 2011), the collected data is still analyzed in two different ways: descriptive and content analysis (Corbin & Strauss, 2007). In this research, all qualitative data were subjected to content analysis. The transactions made in this process are described below, which may reflect the content analysis process.

Editing Data

The first link in the data analysis spiral begins with the data management process (Creswell, 2013). For this purpose, researchers can convert their data to computer files or appropriate text units. In this study, the structured diary and student interview data records of the worksheets and the sections of "what I learned" are classified for analysis after they are written.

Reading and Reminder Notes

In the second row, all the data are tried to be made sense by reading them before being divided into pieces. For this process, short notes or reminder notes are written on the edges of the datasheets, and the data is started to be discovered. In this study, while the applications are still going on, after learning all the extra works that are expected to be completed in the classroom and / at home, what I have learned has been scanned. By starting to add meaning to the expressions in the data, draft codes and categories were started to be created. In this process, after reviewing the objectives of the research, the materials were carefully read at least twice. In this way, to make inquiries about the research questions, the pieces of information reflecting the effect of the science lessons conducted in non-school environments in the literature and shared in the section where theoretical information is provided - reflecting the effect of the learning products on the cognitive, affective and psychomotor - products are drawn in pencil or a box. by taking the reminder notes and writing them next to the datasheets.

Describing, Classifying, and Interpreting Data in Codes and Themes

At this stage, the data are identified, classified, and interpreted based on the reading and short reminder notes on the helix. In this study, firstly, the pieces of data created by the researcher known as lean coding have been repeatedly examined and codes have been created. Datasheets were copied immediately afterward and given to another science education specialist and asked to code. These codes were then examined together to prevent any codes from being left out. In this way, as a second step, open codes were first combined under a new code by the researcher. The grouping process of open codes is known as axis or analytical (Corbin & Strauss, 2007).

This coding descriptor is beyond the first coding; it consists of the interpretation and reflection of meaning (Richards, 2005). This main list creates a simple draft or classification system that reflects recurring regularities and patterns in the study. These patterns and regularities then become categories or themes.

Another issue is the use of existing or a priori codes to guide the coding process. Although the debate on this issue is still ongoing (Crabtree & Miller, 1992), it is stated that the use of "pre-formed" codes will facilitate analysis (Creswell, 2013). The qualitative data obtained from the structured student diaries in this study are the preliminary codes listed in the pre-determined conceptual framework such as "what is felt, what is wondered, what kinds of decisions are made, what they like, and what they can say in the activities"

Interpret Data

Interpretation is a process that begins with the development of codes, where themes are created from codes, and then themes are organized in larger units to make data logical. Categories are conceptual elements that contain many original examples, that is, the piece of data determined beforehand (Merriam, 2009). The categories should be comprehensive, semi-private, responsive, and conceptually compatible, capable of meeting the purpose of the research. In this context, the suitability of the categories produced by the researcher by combining the codes in the previous stage was first confirmed by a science educator who is specialized in qualitative data analysis and out-of-school learning, and then by the second researcher. In this way, the frequencies of the codes that constitute the source for each category are also calculated. For the themes and categories created in this process, the issues with "consensus" and "disagreement" were discussed and the partial arrangements proposed were made.

Presenting and Visualizing Data

Analysis of qualitative data primarily involves the preparation and organization of the data, then coding and combining the codes into themes, and finally presenting them in figures, tables, or in a discussion (Creswell, 2013). In this context, the researchers present what they have found in the final stage of the data analysis spiral in a package of text tables or figures. Qualitative analysis of the research conducted for this purpose is presented with the help of the code and category produced in the tables. The frequency values of the codes are also included in these presentations. The analysis of qualitative data about what I learned from the worksheets, the frequency values of the codes, the categories created, the activities and gains associated with them are given in an integrated manner.

Validity and Reliability Studies

Internal Validity / Belief

The basic strategy that can be used for this purpose is known as triangulation that works in three different ways (Merriam, 2009; Patton, 2018). These; (i) the use of multiple methods in data collection, (ii) the use of multiple data sources, (iii) the involvement of more than one researcher, or employing multiple theories to be used in comparing, controlling, and confirming the findings. The use of multiple methods in data collection simply involves checking the explanations presented during the interviews by comparing them with the observations made at

the relevant location and those collected from the relevant documents. In this way, triangulation is made by using three different data collection methods including interview, observation, and document examination. In this process, triangulation with multiple data sources ensures that the data collected in observations made at different times or locations are compared with the data collected by interviewing people with different perspectives or by making multiple interviews with the same people. In this study, to examine and compare the multidimensional reflections of the students in the working group of the out-of-school teaching practices of the human and environmental unit on the learning products, qualitative data were collected through multiple documents such as student interviews, student structured diaries, and worksheets. These data were used to query the data collected through quantitative measurement tools to confirm how these outputs were achieved.

The fact that more than one researcher participates in the same study and actively participates in data collection and analysis processes provides the researcher triangulation. Another method proposed for this purpose is known as “triangular analysts” (Patton, 2018). In this strategy, two or more people take part in the data analysis process and the data are analyzed and compared independently. Out-of-school teaching practices carried out in this study were monitored part-time by the second researcher. The qualitative data obtained in this way were analyzed simultaneously by the other researcher who followed the applications other than the researcher, and even by another academic member who was competent in the qualitative data analysis, and the researcher triangulation was provided.

Another strategy is known as member checking or member inquiry. As a participant questioning, in this strategy, feedback is received on the findings that started to emerge by reaching some of the people from whom the data were provided. In this way, the first analysis is shared with some participants, so that the data is perceived and checked whether the comments based on them are correct or not. For this purpose, after the analysis of the structured diaries and worksheets delivered after the out-of-school teaching practices on the first day, some students were constantly asked for feedback. For this process, students with different levels of interest and success for science lessons are selected; They were asked to verbally share the situations that emerged in the first findings of how teaching activities carried out outside the school were reflected in learning products. In this process, at the exit of the school, during the seizure in the corridor or garden; What was the first lesson we did out of school at the beginning of the week? What did you learn? Is the next lesson taught in the classroom or outside? etc. questions are posed.

A final strategy is known as “expert review”. In this context, the second researcher, as explained in the previous pages; has made important contributions to enrich the presentation of active participation and research findings in all work and processes related to the planning, execution, and conclusion of the current research.

Reliability / Consistency

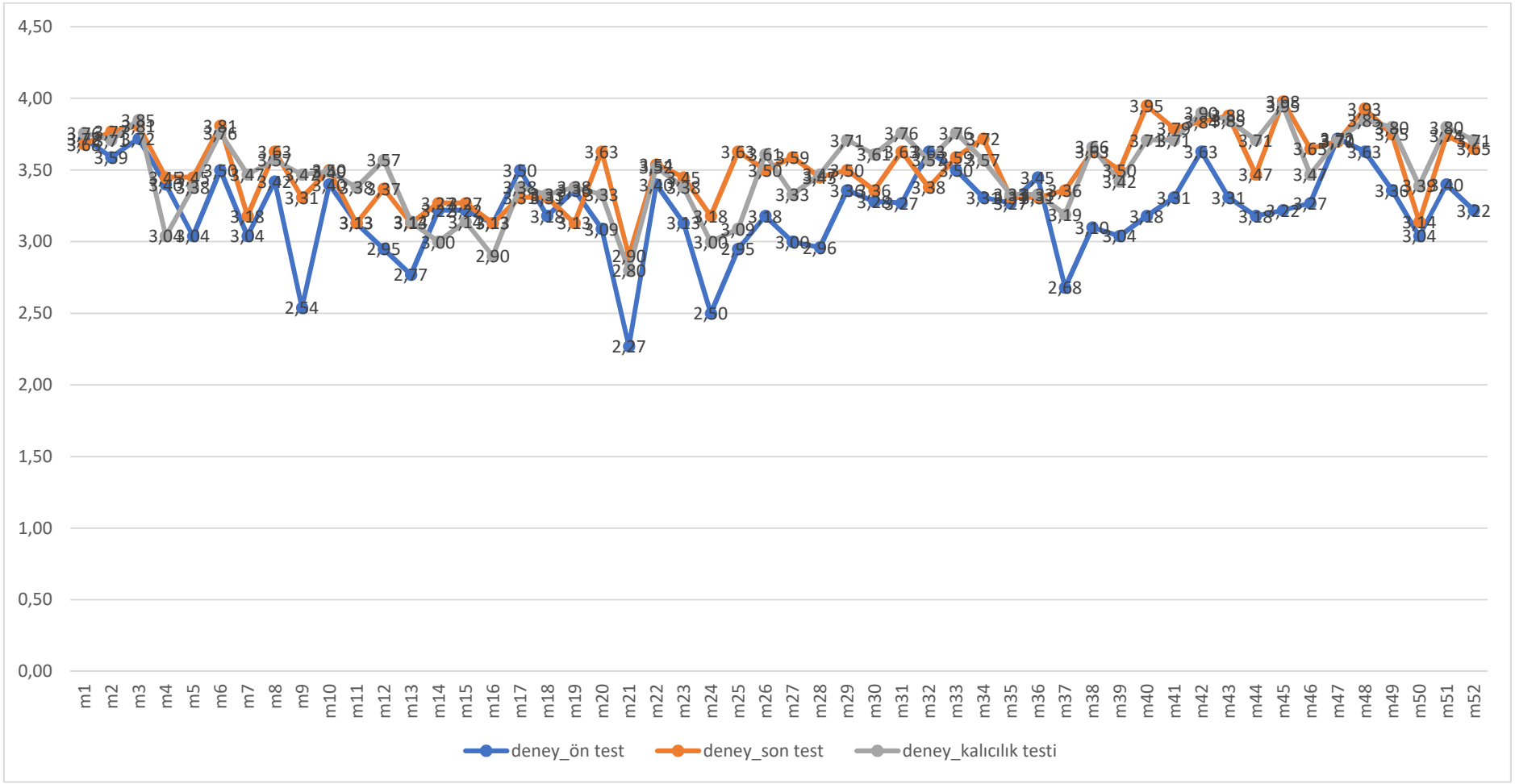
To ensure consistency or reliability, the "auditing technique" is used with the triangulation, expert examination, and the researcher's location, which are employed in the establishment of the internal validity/credibility of the research. The first three of these are described on the previous pages. On the other hand, in the last one, the supervision technique, an independent reader tries to verify the findings of the study by following the path and method used by the researcher. In this way, it is clear how qualitative data is collected and how categories are created, and how decisions are made during the review process. This topic, namely how to analyze the content of qualitative data, and how it was supervised by another person, one of the experts in the science education subject area, and a second researcher, was extensively explained in the previous section. For this purpose, in the presentation of research data; by providing direct quotations from the answers shared by parents and students in the interviews,

the reader was allowed to confirm the category. Besides, the role of the researcher in the research process and the conditions under which the data collection tools were applied, and how the data collected were analyzed were comprehensively explained in the study.

Results

Findings from the Student's Questionnaire on Science Technology Society Environment

Data obtained from the questionnaire, which was applied to the study group three times as a pretest a week before the Human and Environment Unit started to be operated outside the school, a post-test a week after the application, and a retention test approximately six months after the application, the descriptive statistical values of each question in the survey calculated and presented in the chart below.



Grafik 1. Pre, post, and permanence test results of Student's Questionnaire on Science, Technology, Society and Environment

While the scores of the study group calculated from the questionnaire mostly vary between 2.50-3.0 in the pretest, it exceeds 3.00 and even 3.50 in the posttest. Besides, average item scores to the questions about the impact of science and technology on the environment (38-41), the effect of technology on the environment (42-45), and the effect of the society on the environment (46-52) were very close to the highest score of 4.00.

In this context, the range between the pretest and posttest mean scores of some questions are;

0,53 for Item 38 (Science and Technology lesson educates individuals sensitive to environmental problems)

0.46 for Item 39 (various factors and negative factors occurring in the environment can be prevented by advances in science and technology)

0,77 for Item 40 (wastes (chemicals, plastics, metals, etc.) generated by technological systems are problems related to environmental pollution of the society),

0.48 for Item 41 (waste (household, industrial, medical, institutional, etc.) is properly recycled and rendered less harmful to the environment through science and technology education),

0,21 for Item 42 (car users need to be obliged to have their exhaust gases checked regularly)

0.57 for Item 43 (to reduce waste, use of plastic as a packaging material should be minimized)

0.29 for Item 44 (industrial organizations must be obliged to prove that they destroy hazardous waste safely)

0.76 for Item 45 (I would like to enact laws to protect living beings who are in danger of extinction)

0,38 for Item 46 (for electricity energy should be obtained from renewable sources as much as possible, even if it increases the cost),

0.38 for Item 48 (individuals are responsible for protecting the environmental life),

0,39 for Item 49 (sensitivity of societies is important in protecting wildlife (a natural environment where animals and plants live)

0.10 for Item 50 (I think that the technological devices produced by mankind negatively affect the environment),

0.34 for Item 51 (the biggest factor in pollution of the environment is society itself) and finally,

0.43 for Item 52 (artificial products against the environment have a negative effect).

Similarly, the difference between retention test and posttest mean scores were calculated as; 0,24 for Item 44 (industrial organizations must be obliged to prove that they destroy hazardous waste safely) and 0,25 for Item 50 (I think that the technological devices produced by mankind negatively affect the environment),

However,

-0.24 for Item 40 (wastes (chemicals, plastics, metals, etc.) generated by technological systems are problems related to environmental pollution of the society) and -0.18 for Item 46 (electricity should be obtained from renewable sources as much as possible, even if it increases the cost) were also calculated.

Findings from What I Learned from Worksheets

In this research, during the practices in the study group, the articles in the "what I learned" section in the last part of the worksheet applied to each out-of-school learning activity were subjected to content analysis for each activity. The data obtained as a result of this analysis are divided into code-categories and themes and presented with the help of tables with frequency values.

Table 2
Analysis of Articles in What I Learned in Worksheets

Targets	Activity No	Category	f
-Questions the importance of biodiversity for natural life.	1	Learning the basic concepts of the subject	52
		Recognizing living creatures and recognizing their importance	33
		Realizing the relationship between living things	22
-It gives examples of plants and animals that are extinct or in danger of extinction in our country and the world.	2	Extinct animals	95
		Reasons for the extinction of living things	63
		Things to do to prevent the extinction of living things	51
		The structure of scientific knowledge	40
		Effects of extinction of living things	25
-Discusses the factors threatening biodiversity based on research data.	3	Endangered animals	81
		Endangered plants	55
		Things to do to prevent the extinction of living things	53
-Discusses the factors threatening biodiversity based on research data.	4	Factors threatening biodiversity	73
		Biological diversity and importance	26
-Express the importance of the interaction between humans and the environment. -The negative effects of environmental pollution on people's health are mentioned. -Discusses the examples of benefits and harms in human-environment interaction on examples.	5	Causes of air pollution	36
		Consequences of air pollution	17
		Ways to prevent air pollution	12
-Express the importance of the interaction between humans and the environment. -The negative effects of environmental pollution on people's health are mentioned. -Discusses the examples of benefits and harms in human-environment interaction on examples.	6-7	Positive aspects of human and environmental interaction	20
		Negative aspects of human and environmental interaction	10
-Express the importance of the interaction between humans and the environment. -The negative effects of environmental pollution on people's health are mentioned. -Discusses the examples of benefits and harms in human-environment interaction on examples.	8	How scientific studies are done	41
		Scientific concepts on the subject	33
		Air pollution and its importance	19
-Express the importance of the interaction between humans and the environment. -The negative effects of environmental pollution on people's health are mentioned. -Discusses the examples of benefits and harms in human-environment interaction on examples.	9	Causes of pollution and ways to prevent pollution	32
		The importance of natural resources and conservation	30
		Pollution values of Rize	11

-Express the importance of the interaction between humans and the environment. -The negative effects of environmental pollution on people's health are mentioned. -Discusses the examples of benefits and harms in human-environment interaction on examples.	10	Causes of pollution and ways to prevent pollution	96
		The effect of environmental pollution on human health	38
		Statistical data on impurities	22
-Express the importance of the interaction between humans and the environment. -The negative effects of environmental pollution on people's health are mentioned. -Discusses the examples of benefits and harms in human-environment interaction on examples. -It makes inferences about environmental problems that may occur in the future as a result of human activities. -It offers suggestions for the solution of an environmental problem in its immediate environment or our country.	11-12	Light and sound intensity unit	12
		Light and sound pollution measurement	11
		Influence of unnecessary illumination and light and sound pollution with a population density	5
		Damages of light and sound pollution	3
		Effects of music and speech on light and sound pollution	2
		Effect of light type on light and sound pollution	2
		The effect of cars on light and sound pollution	1
		Ways to prevent light and sound pollution	1
-Explains destructive natural events caused by natural processes. -Earthquakes, volcanic eruptions, floods, landslides, hoses, hurricanes are mentioned without going into detail. -It expresses ways of protection from destructive natural events.	13	Natural disaster types and their formation	63
		Ways to protect from natural disasters	30
		Causes of natural disasters	25
		Consequences of natural disasters	17

Findings from Structured Logs

In this research, the "decisions made" section of the structured diaries that students wrote after each activity day during the practices in the study group were subjected to content analysis. The data obtained as a result of this analysis are divided into code-categories and themes and presented with the help of tables with frequency values.

Table 3
Analysis of the Articles in the Structured Decisions Section of Structured Logs

Theme	Category	f										
Decision making		Day 1.	Day 2.	Day 3.	Day 4.	Day 5.	Day 6.	Day 7.	Day 8.	Day 9.	Day 10.	Day **11.**
	Research-investigation	2	3	-	1	2	1	2	-	-	2	2
	Environmental awareness	7	7	5	4	12	3	3	8	10	6	1
	Career	2	-	-	1	-	2	3	1	-	-	-

Based on these data, it has been revealed that the decisions taken by students are categorized under three categories: research- investigation, environmental awareness, and career. Although the emphasis on environmental awareness is frequently observed in these decisions, it has been determined that this situation is repeated only once for the last day. Also, students stated that

they made decisions about research and career on some days, albeit a small number. It was also determined that no decisions regarding research and examination were mentioned for the 3rd, 8th, and 9th days. Career decisions were made on the 1st, 4th, 6th, 7th, and 8th days.

Findings from Semi-Structured Interviews

In this study, the answers to the questions asked in the interviews made after the practices in the study group and reflecting the students' views about science, technology, society, and environment were subjected to content analysis. The data obtained as a result of this analysis are divided into code-categories and themes and presented with the help of tables with frequency values.

Question 1: What did these practices provide you out of knowledge?

Table 4
Analysis of the answers about what practices gained participants out of knowledge

Theme	Category	f	Sample answers
Out-of-school learning activities provide students with	Social and personal skills (Communication, self-confidence, working with a group)	29	"I was a little closer to me before. Now I'm a little better, my shyness has decreased. " (Ö18) "I walk with my friends for a while, I like to chat. When they leave their homes, walking alone and crossing it seems to be a lot of fun now." (Ö9) "I have overcome my fear." (Ö2)
	Consciousness (Environment and disaster awareness, public awareness)	23	"For example, someone on the road threw a box of buttermilk on the ground. We took it with my brother and put it in the trash. One day I told my friend not to throw the core shells on the concrete outside. I said to my mother and father I don't want to take salep. One day, we were in the village, you can make ice cream using salep, someone said. We shouldn't use salep, so I said some plants are getting extinct." (Ö6)
	Environmental awareness (getting to know the environment and some institutions)	14	"I went to places I didn't go. For example, I did not know power plants like that. " (Ö3)
	Scientific Skill (Asking questions, observing, critical and creative thinking)	12	"For example, when I think of something, I think what can happen next. What happens if it happens? What if it happens? I thought more about its causes and consequences. Now I think more comprehensively. " (Ö8)
	Course objectives (Increased interest and curiosity, research)	6	"Now I wonder more, I do more research. I go online, I have books, I read them at home. It seems more logical to me that I did not read and understand before.." (Ö8)
	Career planning (knowing and choosing jobs)	3	"Getting to know hydroelectric power plants and airports gave me an idea of the job I would choose. I want to be someone working there. " (Ö1)

Based on this table, the achievements stated by the students with the help of the lessons taught in out-of-school learning environments are gathered in 6 categories. Students stated that they gained social and personal skills (f = 29) and consciousness (f = 23) as well as

environmental awareness (f = 14) and scientific skill (f = 12). In addition to this, students referred to the lesson-oriented outcomes such as increased interest and curiosity (f = 6) and contributions to career planning (f = 3).

Question 2: Being in out-of-school learning environments contributed to give you an idea about your future profession? How?

The answers given to this question were categorized as "had an effect" / "no effect" and then to which type of profession they were directed to.

Table 5
Analysis of the answers for professional career awareness

Theme	Category	f	Total f
The effect of out-of-school learning practices on the vocational thoughts of their choice	Had an effect	16	22
	No effect	6	

Theme	Category	f	Sample answers
Students' thoughts on professional group preferences	Science teacher	10	"I will be a teacher. I want to take a better look at the things around me, and I want to teach them to my students …… I was going to do an out-of-school activity. I decided to be a teacher teaching in class only in rainy weather." (Ö13)
	Scientist	7	"I got to know scientists at events, they contribute a lot to people." (Ö15)
	Engineering (forestry, mechanical, and electrical electronic engineering.	7	"I wanted to be a mechanical engineer, I want more now. That profession came a little closer to me. People working in the hydroelectric power plant, for example, I will work like them." (Ö18) "In the past, I would never think of such a profession, whatever I would be, I would say it was enough, but when the courses we taught outside were, I liked the science lesson more and I want to gain something about it. I want to be a science teacher or scientist like you." (Ö12)
	Environment and living things (veterinarian, software developer)	6	"I always wanted to be a software engineer. Now I think; Can I be a software engineer and do something environmentally conscious? Can I help you with something? Because we can help the environment when the technology is so advanced and why should we not do this?" (Ö8)

Moving from this table, 16 students stated that the lessons they did in out-of-school settings had an impact on the choice of profession, while 6 students stated that they did not affect. Students who say that out-of-school environments affect their future profession often answer that they decide to choose professions related to engineers, scientists, environment, and living

creatures, while 4 of them want to choose a profession related to science, and 5 of them are teachers who take their students to out-of-school environments. stated that they wanted to be.

Question 3: Do you think that lessons in out-of-school learning environments will benefit you in your daily life?

Table 6
Analysis of the answers related to the benefits of the applications to the participants in daily life

Theme	Category	f	Sample answers
Contribution of out-of-school learning activities to daily life	Environmental actions (Do not litter, raise awareness, gain awareness, protect living and environment)	27	"For example, a friend of mine wants to build a house and will install it next to power stations because he does not know that he is harmful. I can inform him. I can also inform anyone who does not know polluting the environment or protecting animals." (Ö7) "For example, exhaust gases coming out of cars, they should have exhaust gases checked. When my grandfather's car was working, he was always throwing smoke. I said to my grandfather, there is harm to the environment. It doesn't get it checked. " (Ö19)
	Environmental awareness (Getting to know the nearby environment and institutions)	7	"I didn't know where we were going before. I learned Çayeli better now. I can go to some places myself. " (Ö18)
	Social and cultural development	4	"I wasn't asking so many questions when we went somewhere. Now I can ask more of the things I was wondering." (Ö6) "For example, I was a little shy, I was less shy to speak there. " (Ö20)
	Disaster awareness	1	"To protect against natural disasters, it is necessary to plant trees. For example, I can plant trees around." (Ö18)

According to this table, it was determined that the students (f = 27) mostly mentioned the environmental contributions of the lessons taught in out-of-school settings. Also, the students referred to the fact that they know the environment and institutions they live in, which can be called environmental awareness (f = 7), and have positive effects on their social and cultural development (f = 4).

Discussion and Conclusion

"Science-Technology-Society-Environment Interactions", one of the seven dimensions of science literacy apart from key science concepts, scientific process skills, scientific and technical psychomotor skills, values that constitute the essence of science, science interests, and attitudes, are included in the scope of this research. In this context, a good contribution can be made to science literacy by providing this interaction with a good Science-Technology-Society-Environment Education (Yager, 1996). This education has taken place in the science education program of Turkey after the science education programs of many countries abroad (MEB, 2005, 2013). With this education, it is aimed that the students get to know their social, technological, and natural environment and understand the relationships between them instead of just content with the science content provided with textbooks (Yalaki, 2014). The training of individuals who understand science, technology, society, and environment interactions and can

use their knowledge in daily decision-making processes and who are science literate is among the aims of qualified science education (Bora, Arslan, & Çakıroğlu, 2006). During science education based on this understanding, students are expected to be active in the education and training process and encouraged to research and problem-solving. Similarly, students can use various resources to collect information, use the information they obtain, collaborate with other students, interpret the research results, discuss among themselves, and most importantly, make a decision about the subject they are researching and attempt to implement this decision (Yalaki, 2014). These issues are explained by the students to experience the research process under the guidance of the teacher; it has largely found its place in out-of-school learning activities prepared within the scope of human and environmental units, until they gather data and organize and discuss the information and data they collect, develop hypotheses and solution suggestions, and come to a conclusion, to communicate with experts, to create opportunities for them to consult their hypotheses or conclusions.

In this respect, in the study, the discussion of the question of how the students in the study group, who study their lessons in out-of-school learning environments, have an impact on their understanding of science, technology, society, and environment in a short and long time and what are the possible causes of this. In the discussion to be given to answer this question; In addition to the quantitative data obtained from the Science, Technology, Society, and Environment Survey, qualitative data obtained from worksheets filled in by students for each activity, diaries, and also semi-structured interviews were used as the main data source.

Moving from the chart that includes the pretest, posttest, and retention test data, the scores of the participants, which were calculated from the questions in the questionnaire, ranged mostly between 2.50-3.0, while the posttest exceeded 3.00 and even over 3.50. Similarly, in the survey; When the average item scores calculated from the answers given to the questions about the impact of science and technology on the environment (38-41), the effect of technology on the environment (42-45), and the effect of the society on the environment (46-52), it was determined that the average scores were nearly 4.00. In this context, the difference between the pretest and the posttest mean scores increased the items in the last three dimensions of the survey out of the possible outcomes of the out-of-school learning activities, with values between 0.10 and 0.67 points. Similarly, the difference between retention test and post-test mean scores increased between 01.10 and 0.29 points.

The qualitative data supporting the quantitative data shared in the previous paragraphs regarding the out-of-school teacher guidance material applied in this research and in the human and environmental unit to give the students in the study group understanding of STSE should be obtained with qualitative data. Starting from Table 2, the "What I Learned?" It turns out that it can be produced from the articles in the section. As an example, expressing the importance of the interaction between humans and the environment, addressing the negative effects of environmental pollution on people's health, discussing the benefits and harms in human-environment interaction on examples. It turns out that a large number of categories for achievements can be developed through content analysis as the output of events. Similar activities are available when student daily articles are subjected to content analysis for activities lasting 11 days in total (Table 3). The categories of research and investigation and environmental awareness under the theme of decision-making point to this output. Similarly, for the first question asked in student interviews (What did these applications gain out of knowledge?); There are 23 codes in the category of "consciousness (environmental and disaster awareness, community awareness)", 14 codes in the "environmental awareness" category, and 3 codes in "career planning" (Table 4). Again, to the second question posed, "Has being in out-

of-school learning environments contributed to give you an idea about your future profession? How?" 6 of the 16 students who responded to the question that it was effective also referred directly to environmental professions constitute an important output (Table 5). The answers to the 3rd Question (Do you think that the lessons in out-of-school learning environments will benefit you in your daily life?) are collected under 4 categories (Table 6). Within the category of "environmental actions" included among these categories, not throwing trash, raising awareness of the society, gaining awareness, protecting living things and the environment, etc. There are 27 codes containing expressions and 7 codes in environmental awareness.

Based on the quantitative and qualitative data mentioned previously and supporting each other greatly, it shows that the study group of the out-of-school teacher guidance material applied within the scope of the human and environment unit has developed the science, technology, and environmental understanding in a short time and its permanence can be achieved in a long time. Effective science-technology-society-environment education can be done with theoretical and applied interdisciplinary studies (Demirdirek, 2019; Farmer, Knapp, & Benton, 2007; McDonald & Czerniak, 1994; Özdemir, 2010; Zaragoza & Fraser, 2017). In this context, research in which formal and informal learning environments work together can contribute to students' awareness of environmental and social issues, making them eager to take part in decision-making processes, and in particular to engage in community activities related to the environment (Dori & Tal, 2000). In this respect, by choosing the scope of the out-of-school teacher guide material as a human and environmental unit, creating out-of-school teaching activities with an interdisciplinary approach could be beneficial in enriching students' related understanding. In science education, the classroom environment is a limited learning environment, and therefore the physical world outside the classroom is used as a living laboratory (National Research Council, 1996). Outside the school environment should be used within the scope of science lessons for both students to love nature and to solve the mystery of nature in this way (Türkmen, Topkaç, & Atasayar-Yamık, 2016). In the literature on the subject area, there are a limited number of studies on informal learning environments for students to understand the science-technology-society-environment relationship (Akçadağ, Çiğdem, & Omca Çobanoğlu, 2018; İnce, 2017). In one of these studies, 5th-grade students visited the recycling facility, botanical garden, science center, and zoo as an informal learning environment (İnce, 2017). After this visit, students' views on the relationship between science-technology-society-environment were collected through the VOSTS (Views on Science-Technology-Society / Views on Science-Technology-Society) survey. In this study, to be consistent with the results of the current research; informal learning environment visits have been effective in understanding students' science-technology-society-environment relationship, understanding the characteristics of scientists, and understanding the nature of scientific knowledge. In another study, teaching the "Human and Environment" unit with out-of-class teaching approach significantly affected the affective tendency of the 7th-grade students and their problem determination-solving skills (Akçadağ, Çiğdem, & Omca Çobanoğlu, 2018). In this context, it can be employed as an effective tool within the framework of sustainability of out-of-class educational environments and the development of environmental literacy of students (Demirdirek, 2019). Fallik, Rosenfeld, and Eylon (2013) argued that students do not like science as a school lesson but still want to participate in out-of-school science activities and besides, they have a high interest in scientists (Balçın & Topaloğlu, 2019; Fallik, Rosenfeld, & Eylon, 2013; Jarvis & Pell, 2002; Prokop, Tuncer, & Kvasnicak, 2007). In the current study, students did some of their activities in the university context. The fact that they had the opportunity to interact with scientists at events and even ask them questions was able to produce rich outputs.

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