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Research Article

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A Study on Sustainable Living Awareness of Gifted Secondary School Students

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Abstract

Problems such as global warming, epidemics, social inequalities, poverty, drought, forest fires and food inadequacy in the world today have led to an increase in people's concerns about the future. The way to eliminate the worries of human beings about the future is through a sustainable living. The aim of this study is to improve the awareness of gifted students about sustainable living through environmental education carried out in out-of-school learning environments. Mixed method was used in the research. The participants of the research are 25 gifted students selected by criterion sampling method. The " Sustainable Living Awareness Scale" developed by Akgül & Aydoğdu (2020) and the questionnaire developed by the researchers were used as data collection tools. Wilcoxon Signed Rank Test was used in the analysis of quantitative data and content analysis method was used in the analysis of qualitative data. The research findings indicate that, it was determined that environmental education positively improved students' awareness of sustainable living. It is thought that environmental education will contribute to the development of various behaviors in order to support sustainable living.

Key Words

Environmental education • Nature education • Sustainable living

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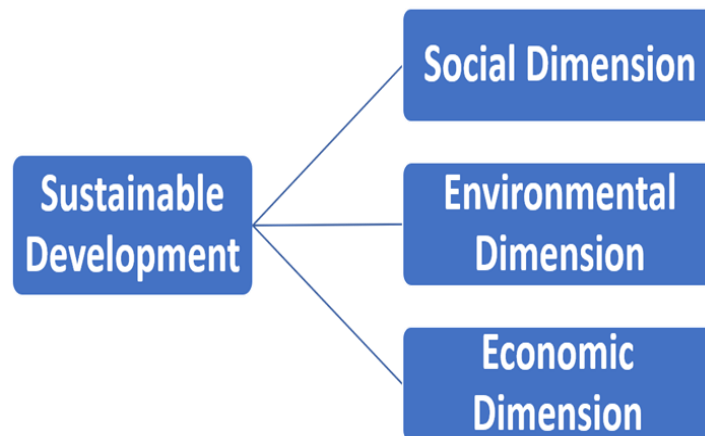
Introduction

Global warming, pandemics, social inequalities, forest fires, food shortage and other issues that affect the entire world have led people to think about and worry about the present and the future. This situation has increased the importance given to sustainability, as defined for the first time in the Report of the World Commission on Environment and Development (United Nations, 1987) as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs (p.24)," and has led countries around the world to take measures related to sustainability. Within the United Nations (UN), numerous studies have been conducted on sustainability and various decisions have been made since 1987. The most important of these decisions is the "Transforming our world: The 2030 Sustainable Development Agenda with 17 Sustainable Development Goals" adopted at the United Nations Sustainable Development Summit held in New York in September 2015. In the context of this agenda, goals have been defined as follows (1)Ending poverty (2) Ending hunger (3) Human health and well-being (4) Quality education for all (5) Social gender equality (6) Availability and sustainability of water and sanitation services for all (7) Accessible and clean energy (8) Decent human dignity jobs and economic development (9) Industry, innovation and infrastructure (10) Reducing inequalities (11) Sustainable cities and societies (12) Sustainable consumption and production (13) Climate change (14) Protection of underwater life (15) Protection of terrestrial ecosystems (16) Ensuring peace and justice and building institutions that cover these situations (17) Expressed targets have been determined as cooperation to achieve the targets, and progress in this direction is followed every year with various reports.

In schools, the concept of sustainability is often emphasized over the concept of sustainable development (Walshe, 2008). For this reason, the research was carried out on the concept of sustainability. The concept of sustainability consists of environmental, social and economic sustainability dimensions that interact with each other (Berglund & Gericke, 2016; Giddings et al., 2002; Holmberg & Sandbrook, 1992). The three dimensions are presented as a diagram in Figure 1.

Figure 1.

Sustainability Dimensions



These dimensions are described as follows (Barbier, 1987; Harris, 2000; Holmberg & Sandbrook, 1992)

- **Social Dimension:** A socially sustainable system supports social justice, gender equality, cultural diversity, ensures the adequate provision of social services, including health and education, and encourages participation in policy and decision-making processes.
- **Environmental Dimension:** An environmentally sustainable system ensures the careful and conscious use of natural resources, the conservation of biodiversity and balance in the ecosystem, and the use of renewable energy sources.
- **Economical Dimension:** An economically sustainable system consistently produce goods and services, ensures that basic needs are met or poverty is alleviated, avoid extreme imbalances that harm production, be in harmony with nature and the environment, and support the development of the regional and local market.

Considering these three dimensions, the role of education in ensuring sustainability is recognized on international platforms. At the 1972 United Nations Conference on the Human Environment held in Stockholm, the importance of environmental education was emphasized and the importance of education for sustainability was emphasized in all subsequent conferences and meetings including topics such as the environment and sustainability (Dyment et al., 2015). In order for human beings to lead sustainable lives, they need to design their lifestyles, technologies, and social institutions in harmony with the potential of nature (Capra, 2007). Individuals also require education on sustainability issues to embrace a sustainable lifestyle (Walshe, 2017). It's emphasized that education is a fundamental element in achieving sustainability goals (Bulut & Çakmak, 2018). In this context, attention has been drawn to the relationship between environmental education and sustainability education (Johnson, 2011; Summers et al., 2004; Kagawa, 2007; Wesselink & Wals 2011). Environmental education has been demonstrated to provide a future perspective on sustainability (Tilbury, 1995) and to play a key role in its attainment (McKeown, 2002; Green & Somerville, 2015). However, it has been emphasized that environmental education has become one of the important goals of sustainability education (Ärlemalm-Hagsér & Sandberg 2011; Eilam & Trop 2010). When addressing sustainability issues in educational settings, it is also emphasized that it is important to consider the environmental, economic and social dimensions of sustainability as a whole (Summers & Childs 2007; Warburton 2003). In addition, the realization of sustainability education not only in formal and formal education environments but also in informal and non-formal education environments together with various activities increases the quality of education (Tanrıverdi, 2009). It has been determined that trainings carried out in informal learning (out-of-school) environments are important for sustainability education (Clarke & Mcphie, 2014), contribute to the sustainable protection of nature and the environment (Sellmann, 2014) and , in addition to the experiences provided by out-of-school education practices contribute to the addressing of social, economic and environmental sustainability issues (Hill, 2012). Out-of-school learning environments can play an effective role in education through the use of different teaching strategies for students and the creation of interdisciplinary learning opportunities (Asfeldt et. al., 2021).

Sustainability education enables individuals to change their consumption habits for a sustainable future in a world where resources are rapidly depleting. It also instills positive attitudes and values towards solving global problems (Bulut & Çakmak, 2018). Therefore, providing sustainability education in schools and critically addressing the concept of sustainability through questioning, reflection, discussion, and criticism is crucial (Walshe, 2017). It has

been observed that sustainability education enhances students' understanding of sustainability and encourages them to examine the relationship between sustainability and their own lives (Walshe, 2013; Mahat & Idrus, 2016). Moreover, sustainability education not only enhances students' roles in terms of their consumption preferences regarding sustainability but also increases their awareness of sustainability. It encourages students to make individual behavior changes like energy and water conservation, sustainable purchasing, and transportation options (Lewis et al., 2019). Environmental education conducted with students about the sustainable living of organisms (such as frogs) has been found to contribute to students' understanding of the concept of sustainable living and the impact of human intervention on the habitats of living organisms (Hudson, 2007). Furthermore, in sustainability education, it has been observed that students make inferences about the social, economic, and environmental dimensions of sustainability (Walshe, 2008). In a study conducted by Walshe (2017), students were found to emphasize the social and economic dimensions of sustainability, although their primary focus was on the environmental dimension. Similarly, in a study conducted by Demir & Atasoy (2021), students were found to focus on the environmental dimensions of sustainability but also demonstrated a positive attitude towards its social and economic dimensions. Consistent with these findings, research by Fiedler et al. (2023) and Kagawa (2007) indicated that students often associate sustainability more with the environment and environmental issues.

Sustainability topics have been found to be closely related to the specific objectives, achievements, skills, and values of the social studies curriculum (Kaya & Tomal, 2011; Oğuz Hacet & Demir, 2019; Yalçın, 2022). It has been noted that the social studies curriculum includes objective statements related to the environmental, social, and economic dimensions of sustainability (Kardaş İşler, 2023). Furthermore, it has been emphasized that the Social Studies course is a very important subject for imparting the social, environmental, and economic dimensions of sustainability to students (Azrak, 2022). In addition to the Social Studies curriculum, it has been determined that the Science Curriculum is also related to sustainability (Ateş, 2019). Both the Social Studies Curriculum and Science Curriculum include the common concepts of "nature, natural resources, and sustainability" (Demirezen & Kaya, 2022). Moreover, when examining studies related to sustainability, it has been found that the subject of sustainability is particularly investigated in connection with science and social studies education (Aktaş et al., 2020; Aytaç & Özsevgeç, 2019; Bulut & Çakmak, 2018; Yıldırım, 2020).

The importance of this research is providing an environmental education in out of school environments to gifted students with the aim of raising awareness about sustainable living. Obtaining detailed inferences about the changes that gifted students will show towards the social, environmental and economic dimensions of sustainability with this education will be insightful in arranging the environments where sustainability education will be given. The ultimate goal is to demonstrate the necessity of organizing and conducting environmental education in out-of-school environments for the purpose of instilling sustainable living awareness in students. This study, by employing various educational approaches and designing environmental education in the context of subjects covered in social studies and science courses, investigates the impact of this education on the sustainable living awareness of gifted students. In line with this objective, the following research questions were addressed:

- Is there a significant difference in the pre-test and post-test scores of the Sustainable Living Awareness Scale and its dimensions among gifted students who participated in environmental education?
- How do the sustainable living awareness levels of gifted students change throughout the course of the education?

Method

Study Design

In order to determine and thoroughly examine the awareness of gifted students participating in environmental education towards sustainable living, this study was conducted as a mixed-methods research. Within the framework of the convergent parallel design of mixed methods, both qualitative research designs such as phenomenology and quantitative research designs like a single-group pretest-posttest quasi-experimental design were employed. The convergent parallel design involves giving equal priority to both qualitative and quantitative data to comprehensively investigate the research problem, with the data being separately analyzed and then integrated during interpretation (Plano Clark & Creswell, 2015). In this study, data collection instruments were administered to students before and after the experimental procedure, and the data were analyzed separately and then interpreted together.

Study Group

A total of 25 gifted students attending middle schools in Istanbul province were participated in the study. The decision to have a study group of 25 individuals was made due to the experimental nature of the study and the need for effective implementation of activities in small groups. The criterion sampling method was used in the selection of students. Criteria considered for selection included being identified as gifted, gender, high interest in the environment, voluntary participation, and completion of the sixth grade. Gifted individuals have higher levels of environmental perception compared to typically developing individuals; they tend to be curious, observant, problem-finders, and solution developers (Johnsen, 2011; Meador, 2003). Therefore, the most fundamental criterion in determining the study group is being gifted individuals. The reason for selecting 6th grade students is that they have a basic level of knowledge about the environment and environmental issues in the curricula of life sciences, social studies, and natural sciences. To ensure gender equality, efforts were made to maintain balance between female and male students. Out of 125 students, 25 were selected for the study, consisting of 14 female and 11 male students..

Data Collection Tools

Quantitative Data Collection Tool

To determine the awareness of gifted students participating in environmental education regarding sustainable living, the "Sustainable Living Awareness Scale" developed by Akgül and Aydoğdu (2020) was used as the quantitative data collection tool. Akgül and Aydoğdu (2020) developed this scale by reviewing the literature in the field and obtaining expert opinions during item writing. They collected data from 319 students for reliability analyses. After factor analysis, the final version of scale was prepared, which consists of 20 items in total, with 10 positive and 10 negative statements, using a three-point Likert scale. The structure of scale consists of 7 items in the environmental dimension, 5 items in the economic dimension, and 8 items in the social dimension. The internal

consistency reliability coefficient of the scale, calculated using Cronbach's alpha, is .77. Table 1 presents the dimensions of the scale and the Cronbach's alpha internal consistency reliability coefficients.

Table 1.

Scale Dimensions and Internal Consistency Reliability Coefficient

Dimension	Items	Cronbach's alpha
Social	20, 21, 22, 23, 24, 28, 32, 36	.76
Environmental	5, 7, 10, 11, 12, 13, 19	.73
Economic	38, 41, 43, 46, 48	.69

The "Sustainable Living Awareness Scale" was administered to the participants both before and after the environmental education program.

Qualitative Data Collection Tools

To explore the reasons for the changes in the awareness of gifted students regarding sustainable living as part of the qualitative aspect of the study, a data collection tool consisting of three questions was used in the form of a questionnaire. The participants' written responses were collected to examine these reasons. The questionnaire, developed by the researchers taking into account the "Sustainable Living Awareness Scale" items, was presented to three faculty members for their opinions and suggestions. Subsequently, it was applied to five middle school students to finalize its form. The questionnaire includes the following three questions:

1. "In your opinion, what is sustainable living?"
2. "What can be done to support sustainable living?"
3. "What support and behaviors do you think you have regarding sustainable living? (before training) / What support and behaviors do you think you will have regarding sustainable living after the education? (after training)"

These questions were administered to the participants before and after environmental education.

Data Analysis

Quantitative Data Analysis

The positive items on the "Sustainable Living Awareness Scale" were scored as "Agree (3)", "Undecided (2)", and "Disagree (1)". For the negative items, their scores were reverse-coded. By reversing the negative items, scores ranging from a minimum of 20 to a maximum of 60 were obtained from the scale. IBM SPSS 21.0 software was utilized for the analysis of the data collected through the scale. Prior to selecting the statistical methods for the analysis of quantitative data, it was essential to assess whether the data followed a normal distribution. To check for normality, histogram graphs and skewness coefficients for each measurement were examined. To check whether the assumption of normality was met, the researchers examined the histogram graphs and skewness coefficients for each measurement. Additionally, since the sample size was less than 50 ($n < 50$), the Shapiro-Wilk test, which is more

powerful in such cases (Mayers, 2013), was used to assess the normality of the scores. Since the analysis revealed that the data did not adhere to a normal distribution, non-parametric tests, specifically the Wilcoxon Signed-Rank Test, were employed to compare the pre-test and post-test scores.

Qualitative Data Analysis

In the analysis of the qualitative data obtained from the questionnaire used in the study, content analysis was employed. The data obtained were categorized according to the dimensions of the “Sustainable Living Awareness Scale”, which are social, environmental, and economic dimensions. Three researchers independently coded all the data, created categories, compared codes and categories, and discussed them to reach consensus on codes and categories (Ültay et al., 2021). Codes were presented in the form of frequency and percentage tables. The quantification of qualitative data involves converting written data obtained through interviews, observations or document analysis into numbers and figures. The purpose of quantifying qualitative data includes increasing the reliability and reducing bias. Quantifying qualitative data is considered a form of data analysis and allows for fairer interpretations of results (Yıldırım & Şimşek, 2013). The reliability calculation between the researchers was determined using Miles and Huberman's (2015) formula. The reliability coefficient is calculated using the formula: $\text{Agreement} / (\text{Agreement} + \text{Disagreement}) \times 100$. The reliability coefficient between the researchers was calculated as 84% for the pre-application questionnaire and 94% for the post-application questionnaire. These values indicate that the research data analysis is reliable (Miles & Huberman, 2015).

Application Process

The students participating in the study engaged in various activities during the 6-day sustainable-focused environmental education program, which covered environmental issues, proposed solutions to these problems, and interdisciplinary perspectives on sustainable living. The integration of disciplines such as physics, chemistry, biology, geography, linguistics, painting, music, philosophy, history, engineering and mathematics in the context of environmental issues has been achieved through activities based on STEM, experiments, field research, creative drama and educational games. These activities specifically targeted the three dimensions of sustainability: social, environmental and economic. Topics covered during the activities included water resources, renewable energy sources, biodiversity, maintaining balance in ecosystems, recycling and recovery, population growth, deforestation, and the importance of forests. In total, 19 activities related to sustainable living were conducted. Each activity was conducted in learning groups with varying numbers of participants, based on the applied instructional approach.

The activities were specifically designed, taking into consideration the three dimensions of sustainable living: social, environmental, and economic dimensions. The aim was for students to make observations and draw conclusions through experiments in education, to conduct in-depth examinations of events causing environmental pollution through practical activities, to gain insights into concepts such as biodiversity, ecosystems, and material cycles through field trips, and to use mobile applications to gain an understanding of various ecological footprints and determine their own ecological footprint. These activities aimed to not only raise students' environmental awareness (dimension) but also promote social awareness (dimension). They helped students understand the importance of natural resources for society, connect the concept of sustainability with different disciplines, make

inferences about issues affecting society, express the significance of sustainability for society through various professions, and blend sustainability with art to unleash their creativity. These activities also aimed to instill economic awareness (dimension) in students. They drew attention to the necessity of conserving resources while using them, proposed economic solutions to environmental issues, provided ideas for different designs, and emphasized the importance of leaving a more livable environment for future generations through mathematical calculations.

Findings

Quantitative Findings

To investigate whether there is a significant difference between the pre-test and post-test “Sustainable Living Awareness Scale” scores and dimension scores of gifted students participating in environmental education, the scale was administered both before and after the education. Table 2 presents the descriptive statistics results for the entire scale and its dimensions.

Table 2.

Descriptive Statistics for Sustainable Living Awareness Scale and Its Dimensions

Dimension	Test	N	Mean	SD	Min	Max
Social	Pre-Test	25	21.04	3.00	10	24
	Post-Test	25	21.96	2.76	14	24
Environmental	Pre-Test	25	18.24	2.86	9	21
	Post-Test	25	19.12	1.76	15	21
Economic	Pre-Test	25	12.68	2.15	6	15
	Post-Test	25	13.88	1.48	10	15
Total	Pre-Test	25	51.96	6.43	25	58
	Post-Test	25	54.96	4.29	41	60

As shown in Table 2, there has been an increase in the average scores for the social, environmental, economic dimensions and the total score of the scale in favor of the post-tests. It is also noted that there has been an increase in the minimum scores obtained in all categories for the post-tests.

In order to determine whether the data obtained from scale exhibit a normal distribution, the Shapiro-Wilk Test was applied and the results are presented in Table 3.

Table 3.

Results of the Shapiro-Wilk Test for Scale Pre-Test and Post-Test Scores

Test	N	Mean	SD	p
Pre-Test	25	51.96	6.43	.000
Post-Test	25	54.96	4.26	.001

The results of the Shapiro-Wilk test, as presented in Table 3, indicate that the pre-test and post-test data are not normally distributed ($p < 0.05$). Therefore, for data analysis, the non-parametric test, the Wilcoxon Signed-Rank Test, was employed (Table 4).

Table 4.

Wilcoxon Signed Rank Test Results for the Comparison of Scale Pre-Test - Post-Test Scores

Dimension	Pre-test- Post-test	N	Mean Rank	Sum of Ranks	z	p
Social	Negative rank	4	11.25	45.00	-2.041	.041
	Positive rank	15	9.67	145.00		
	Equal	6				
Environmental	Negative rank	7	9.79	68.50	-1.077	.282
	Positive rank	12	10.13	121.50		
	Equal	6				
Economic	Negative rank	3	10.00	30.00	-2.899	.004
	Positive rank	17	10.59	180.00		
	Equal	5				
Total	Negative rank	4	12.25	49.00	-2.716	.007
	Positive rank	19	11.95	227.00		
	Equal	2				

As seen in Table 4, a statistically significant difference ($p < 0.05$) was identified between the pre and post-test average scale scores of the students participating in environmental education. It was determined that this observed difference was in favor of the positive rank, that is, the post-test application. The results indicate that there was a statistically significant difference in the social and economic dimensions of the scale in favor of post-test ($p < 0.05$). In the environmental dimension, no statistically significant difference was found ($p > 0.05$). However, when

comparing the students' pre-test mean score for the environmental dimension (18.24) with their post-test mean score (19.12), it is apparent that the education had a positive effect.

Qualitative Findings

In order to examine the change in the awareness of gifted students participating in environmental education regarding sustainable living during the education, a questionnaire consisting of three questions was applied to the students before and after the application. The data obtained were categorized according to the social, environmental and economic dimensions of the Sustainable Living Awareness Scale.

In the research, students were asked "In your opinion, what is sustainable living?". The findings obtained from the answers given to the question before and after the training are presented in Table 5.

Table 5.

Findings Regarding Students' Definitions of Sustainable Living

Before Training					
Category	Code	f	%	Total (f)	Total (%)
Social	Livable Environment	3	12	9	36
	Living without injustice	3	12		
	Current life	2	8		
	Healthy life	1	4		
Environmental	Recyclable lifestyle	5	20	9	36
	Life in which natural balance is maintained	2	8		
	Life formed with biodiversity	1	4		
	Life that sustains the life of animals, plants, and humans	1	4		
Economic	Using natural resources economically	5	20	5	20
Other	Don't know	2	8	2	8
After Training					
Category	Code	F	%	Total F	Total %
Social	A life that requires thinking about the future and can continue for generations	7	28	13	52
	Clean, healthy, livable world	6	24		
Environmental	Living with environmental continuity	6	24	20	80
	Living in harmony with nature	6	25		
	Living that supports reuse	5	20		
	Living organisms in their own ecosystems	3	12		
Economic	Renewal and continuity of resources	9	36	9	36

When the findings in Table 5 are evaluated, expressions regarding how the students participating in environmental education define sustainable living are seen before and after the education.

As can be seen from the table, there was an increase in the answers related to the three dimensions in the sustainable living awareness scale in the definition of sustainability before and after the training. It is seen that in addition to the increase in the rate of answers after the training, the answers given afterwards also differ. Before the training, students used the expressions “livable environment”, “living without injustice”, “current life” and “healthy life” in the definition of sustainability. These statements are associated with the social dimension of sustainability. The expressions of “A life that requires thinking about the future and can continue for generations” and “a clean, healthy, livable world” are also given under this heading after training. In the definition of sustainability used before training, the expressions “recyclable lifestyle”, “life in which natural balance is maintained”, “life formed with biodiversity” and “life that sustains the life of animals, plants, and humans” are associated with the environmental dimension of sustainability. After training “living with environmental continuity”, “living in harmony with nature”, “living that supports reuse” and “living organisms living in their own ecosystems” are the responses of students indicate different definitions. The expression of “using natural resources economically” given to the question before the training and the expression of “renewal and continuity of resources” given after the training are associated with the economic dimension of sustainability.

Although there is not much variation in the responses of this question, the response rate has been increased. Students who stated that they did not know the definition of sustainability before the training also gave acceptable answers to the question after the training. Before the training, Student 13 answered the question as, *“In my opinion, sustainable living means that people can live more comfortably and healthily and meet their needs naturally. (This is the first time I've heard of the concept.)”* and after the training, *“Sustainable life is a way of life where people use resources without wasting them, recycle them, and are conscious.”* Student 2 answered before the training as *“People should live their lives in a healthy way.”* and after the training, *“All resources are sufficient for the living things in that region and the living things live in that area.”*

In the research, students were asked “What can be done to support sustainable living?”. The findings obtained from the answers given before and after the training to the question are presented in Table 6.

Table 6.

Findings Regarding What Students do to Support Sustainable Living

Before Training					
Category	Code	f	%	Total (f)	Total(%)
Social	Awareness activities	3	12	3	12
Environmental	Contributing to recycling	5	20	18	72
	Protecting natural resources	5	20		
	Protecting nature	5	20		
	Turning to renewable energies	3	12		
	Using resources economically	4	16		
Economic	Using resources economically	4	16	4	16
After Training					
Category	Code	f	%	Total f	Total %
Social	Awareness activities	6	24	6	24
Environmental	Protecting nature	5	20	24	96
	Contributing to recycling	5	20		
	Protecting natural resources	4	16		
	Turning to renewable energies	3	12		
	Creating green cities	3	12		
	Providing the best environment for living things	2	8		
	Protecting living things	1	8		
	Trying to reduce global warming	1	4		
Economic	Using resources economically	7	28	8	32
	Making different designs for the purification of resources	1	4		

Table 6 includes statements about what students do to support sustainable living. As can be seen from the table, there has been an increase in the answers related to the three dimensions in the sustainable living awareness scale regarding what to do to support sustainable living before and after the application. They stated that they carry out

“awareness activities” about what students do to support sustainable living before and after the training. This statement is associated with the social dimension of sustainability. It is seen that the rate of use of this expression increased after the training. Before the training, the students' activities to support sustainable living include “contributing to recycling”, “protecting natural resources”, “protecting nature” and “turning to renewable energies”, and after the training, the expressions “protecting nature”, “contributing to recycling”, “protecting natural resources”, “turning to renewable energies”, “creating green cities”, “providing the best environment for living things”, “protecting living things” and “trying to reduce global warming” are associated with the environmental dimension of sustainability. This finding shows that students' response rates increased after the training, as well as their answers diversified. Before and after the training the statement of “using resources economically” and the statement of “making different designs for the purification of resources” after the training question are associated with the economic dimension of sustainability.

Although there is not much variation in the responses of this question, the response rate has increased. Student 3 answered as, *"Information about recycling can be given"* before the training. After the training, the same student responded as *"Not to waste natural resources, not to pollute nature, to recycle waste, to carry out awareness-raising activities."* Student 7 replied as *"Conscious use of energy resources can be taught"* before the training. After the training the student replied as *"Resources should be consumed without being polluted and/or wasted, recycling should be supported, and waste collection points should be increased. In addition, different designs should be made for the purification (cleaning) of resources."*

In the research, students were asked " What support and behaviors do you think you have regarding sustainable living? (before training) / What support and behaviors do you think you will have regarding sustainable living after the education? (after training)". The findings obtained from the answers to the questions before and after the training are presented in Table 7.

Table 7.

Findings Regarding the Support and Behaviors Students have/will have to Support Sustainable Living

Before Training						
Category	Code	f	%	Total (f)	Total (%)	
Social	I attended the seminar	5	20	5	20	
	I collect garbage	6	24	14	56	
Environmental	I contribute to recycling	5	20			
	I protect living things	3	12			
Economic	I don't waste resources	6	24	6	24	
Others	I do not engage in any behavior	3	12	3	12	
After Training						
Category	Code	f	%	Total f	Total %	
Social	I will work to raise awareness of my environment.	7	28	10	40	
	I will give seminars	3	12			
Environmental	I will protect nature and the environment	7	24	24	96	
	I will contribute to recycling	4	16			
	I will protect natural resources	4	16			
	I will protect the trees	2	8			
	I will pay attention to tree species	2	8			
	I will contribute to the formation of green cities	2	8			
	I will take part in renewable energy projects	2	8			
	I will respect nature	1	4			
	Economic	I will use natural resources economically	10	40	10	40

As seen in Table 7; after the training, students stated with more expressions that they would support sustainable living. This finding shows that the education received positively affects the students. As seen in the table, there has been an increase in the answers to the questions related to the three dimensions in the sustainable living awareness

scale. It is seen that students who stated that they did not engage in any behavior that supports sustainable living before training also answered the question after the application. It is seen that in addition to the increase in the rate of answers after the training, the answers given afterwards also differ. Among the answers in which the students expressed their support and behavior towards sustainable living before the training, the statement of "I attended the seminar" and among the answers in which they expressed their support and behavior towards sustainable living after the training, the statement that "I will work to raise awareness of my environment" and "I will give seminars" are associated with the social dimension. The statements given before the training "I collect garbage, I contribute to recycling, I protect living things" and after the training, the statements given "I will protect nature and the environment", "I will contribute to recycling", "I will protect natural resources", "I will protect trees", "I will contribute to the formation of green cities", "I will take part in renewable energy projects" and "I will respect nature" are associated with the environmental dimension. The statements given to the question before and after the training: "I don't waste natural resources" and "I will use natural resources economically" are also associated with the economic dimension of sustainability.

There are variations in the responses of this question and the response rate has increased. Students who stated that they did not provide support or behavior regarding sustainable living before the training also gave acceptable answers to the question after the training. Student 3 replied the question as *"I attended some recycling programs and seminars"* before the training. The same student replied as *"I will be more careful not to pollute nature. I will share what I have learned with everyone, attend conferences, go to the forest more often, and pay attention to tree species. I will try to raise everyone's awareness. I will take my family to the Arboretum. I will recommend this event to everyone. It was a highly enjoyable event. I will pay attention to blue, green and gray water footprints and conserve water. I will give more importance to writing poetry. I will get more information on these subjects."* after the training. Student 13 answered the question before the training as *"I do not throw any of my garbage in the streets. I throw it in the garbage on the street or at home. I especially try to use water and electricity consciously."* After the training the student answered as *"I will continue to do the same things as I wrote in the previous form, that is, I cannot express it with words at the moment, but over time, I will look at the events I encounter in more detail."*

Conclusion, Discussion & Suggestions

The findings obtained from the study, which was carried out as a mixed-method research to determine and thoroughly examine the awareness of gifted students who participated in environmental education conducted in an out-of-school setting with an interdisciplinary approach using various learning methods towards sustainable living, reveal that the participants' awareness of sustainable living has developed positively.

Within the scope of the research, it is obvious that students' awareness and approaches towards sustainability were improved through environmental education in nature (out-of-school settings). This shows that sustainability education through environmental education (in out-of-school settings) is effective. This result obtained in the study is supported by [Hudson \(2007\)](#), who found that environmental education contributed to students' understanding of the concept of sustainable living in a study on the sustainable living of living things (frogs). Likewise, it has been determined that education in informal learning (out-of-school) settings is crucial for sustainability education ([Clarke](#)

& Mcphie, 2014), contributing to the sustainable preservation of nature and the environment (Sellmann, 2014) and addressing environmental sustainability issues (Hill, 2012). Tanrıverdi (2009), on the other hand, emphasizes that the realization of sustainability education with various activities in informal and non-formal education settings increases the quality of education. When evaluated in this direction, it can be said that the environmental education was effective in developing students' awareness and approaches to sustainability.

According to the results of the pre-test and post-test applied for sustainable living before and after the training sessions, students' scores in the social and economic dimensions of sustainability showed a significant improvement in favor of the post-test. However, no significant difference was found for the environmental dimension. In the interviews conducted with the students before and after the trainings within the scope of the research, it was determined that the students' perceptions and approaches towards all dimensions of the concept of sustainability differed, but their emphasis on the environmental dimension was at a higher level both before and after the trainings. In this case, the reason for the lack of a significant difference in the pre-test and post-test applied within the scope of the research on the environmental dimension of sustainability can be explained by the fact that the students have more experience in environmental sustainability and the education they have previously received on environmental issues. As a result, it is seen that the trainings conducted within the scope of the research contributed to the development of students in the social, economic, and environmental dimensions of sustainability; however, students associated sustainability more with environmental issues. This result is similar to the results of the studies that sustainability trainings contribute to students' perceptions about the social, economic and environmental dimensions of sustainability (Walshe, 2008), students emphasize the social and economic dimensions of sustainability, but their main focus is on the environmental dimension (Walse, 2017), students focus on the environmental dimensions of sustainability (Demir & Atasoy, 2021), and students associate sustainability more with the environment and environmental problems (Fiedler et al., 2023; Kagawa, 2007). This shows how important it is to include all dimensions of sustainability in sustainability education.

As a result of the analysis of the written responses received from the students before and after the trainings, it was determined that the students' perspectives on the concept of sustainability differed and their perceptions of the concept of sustainability changed positively. These results obtained in the study support the results of Walshe (2013) and Mahat and Idrus (2016) that sustainability trainings improve students' understanding of sustainability. Likewise Lewis, et al. (2019) found that sustainability education increased students' roles related to sustainability in terms of consumption preferences and their awareness of sustainability, which supports the results of the research. This shows how important it is to implement trainings planned within the scope of sustainability in developing students' awareness of sustainable living. As a result of the analysis of the written responses received from the students, it was concluded that the students emphasized the social, economic, and environmental dimensions of the concept of sustainability in order to support sustainable living and supported sustainable living with their behaviors. Students' behaviors to support sustainable living differed before and after the trainings. These results are similar to the study conducted by Lewis et al. (2019), in which sustainability trainings led to behavioral changes such as energy and water saving, sustainable purchasing, and transportation options. In this direction, Arısoy (2021) determined the positive effect of STEM activities on students' acquisition of sustainable living habits in his study and Küleğel

(2020) concluded that STEM activities help students better understand the importance of recycling, sustainable environment and alternative energy sources, and develop creative solutions to solve environmental problems, both of which support the results of the research. Despite the fact that it was determined that students performed behaviors towards all dimensions of the concept of sustainability before and after the trainings, it was concluded that their behaviors towards the environmental dimension were at a higher level after the application. Nevertheless, the realization of sustainability education through environmental education may have led students to emphasize more on the environment. As a result, it is seen that sustainability education has led to a positive change and increase in students' behaviors towards supporting sustainable living. For this reason, sustainability education should be expanded in order for students to develop behaviors to support sustainable living.

The target group of the study consists of gifted students. In this context, it was determined that sustainability-oriented environmental education positively changed the awareness of gifted students about sustainability and their perspectives on the environment. These results are similar to the result of [Ayaydın et al. \(2023\)](#) that out-of-school activities improve the awareness of gifted students towards environmental problems. Similarly, in this direction, in the study conducted by [Ayaydın et al. \(2018\)](#), the increase in the awareness, sensitivity, and consciousness of students with gifted towards the environment through nature education activities is similar to the results of the research. In the study conducted by [Mutlu et al. \(2019\)](#), it was determined that the awareness scores of students with gifted regarding environmental education concepts were higher than their peers with normal development. The results obtained in the study and the results obtained in other studies show that although the sensitivity and awareness of children with gifted towards the environment are high, environmental education for students with gifted is effective. In this case, in order to raise the awareness and sensitivity of gifted students to a higher level, it is beneficial to expand the environmental education carried out with these student groups.

As a result of the research, it was determined that environmental education planned in out-of-school environments within the scope of social studies and science courses was effective in students' learning about sustainability issues. This supports the fact that sustainability issues are addressed within the scope of social studies and science courses in the studies ([Aktaş et al., 2020](#); [Aytar & Özsevgeç, 2019](#); [Bulut & Çakmak, 2018](#); [Demirezen & Kaya, 2022](#); [Yıldırım, 2020](#)). Taking into consideration the contributions of environmental education planned in out-of-school environments within the scope of social studies and science courses to students' learning about sustainability issues, it is thought that it is useful to plan various environmental education programs.

Ethic

Ethical committee approval was received from the Tokat Gaziosmanpaşa University-Social Sciences and Humanities ethics committee (Date: 10.07.2020, No: 01-14).

Author Contributions

This article was written with the joint contributions of three authors.

Conflict of Interest

The authors declare that they have no conflict of interest.

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