

Investigation of the Effect of Environmental Education Course Supported by Educational Technology Tools on the Environmental Achievement and Affective Dispositions of Prospective Science Teachers

Büşra Şafak KILIÇ¹

Nurcan ÖZKAN²

¹Dr., Yıldız Technical University, Education Faculty, Mathematics and Science Education Department, busrasafak1995@gmail.com, ORCID: 0000- 0001-5294-9478

²Prof. Dr., Trakya University, Education Faculty, Mathematics and Science Education Department, nurcanozkan@hotmail.com, ORCID: 0000-0001-5045-6186

Abstract: The aim of this study is to determine the effect of environmental education supported by educational technology tools on the environmental literacy of pre-service science teachers. The study group consists of 56 pre-service teachers studying in their third year at Trakya University Faculty of Education, Department of Science Education, during the 2018–2019 academic year. A single-group pre-test/post-test design was employed in the study. The educational process lasted for 14 weeks. In the quantitative component of the study, environmental achievement test and a scale for environmental affective dispositions were used as data collection instruments. The quantitative data from the study were analyzed using the SPSS 20.00 (Statistical Package for the Social Sciences) software. The study found that environmental education supported by educational technology tools significantly increased the environmental literacy of prospective science teachers in terms of both knowledge and affective dispositions.

Key Words: Prospective Science Teachers, Environmental Education, Educational Technology Tools, Environmental Achievement Test, Scale of Affective Dispositions Towards the Environment

Eğitim Teknolojisi Araçlarıyla Desteklenen Çevre Eğitimi Dersinin Fen Bilimleri Öğretmen Adaylarının Çevreye Yönelik Başarıları İle Duyuşsal Eğilimlerine Etkisinin Araştırılması

Özet: Bu çalışmanın amacı eğitim teknolojisi araçları tarafından desteklenen çevre eğitiminin fen bilimleri öğretmen adaylarının çevre okuryazarlığına etkisini ortaya koymaktır. Çalışma grubunu 2018-2019 öğretim yılında Trakya Üniversitesi Eğitim Fakültesi Fen Bilimleri Öğretmenliği Bölümü 3. sınıfta öğrenim gören 56 öğretmen adayı oluşturmaktadır. Araştırmada tek gruplu ön test-son test desen kullanılmıştır. Eğitim süreci 14 hafta devam etmiştir. Araştırmanın nicel boyutunda veri toplama aracı olarak çevreye yönelik başarı testi ile çevreye yönelik duyuşsal eğilimler ölçeği kullanılmıştır. Araştırmanın nicel verileri SPSS 20.00 (Statistical Package for the Social Science) programı ile çözümlenmiştir. Araştırma sonucunda eğitim teknolojisi araçlarıyla desteklenen çevre eğitiminin fen bilimleri öğretmen adaylarının çevre okuryazarlığını bilgi ve duyuşsal eğilimler yönünden anlamlı ölçüde artırdığı tespit edilmiştir.

Anahtar Kelimeler: Fen Bilimleri Öğretmen Adayları, Çevre Eğitimi, Eğitim Teknolojisi Araçları, Çevreye Yönelik Başarı Testi, Çevreye Yönelik Duyuşsal Eğilimler Ölçeği

1. INTRODUCTION

Environmental literacy is a core set formed by the combination of understanding, skills, attitudes, and mindsets that enables individuals to take steps toward sustainable actions. At its core, it is a process of questioning the human relationship with the world, seeking answers, and applying the answers obtained to life (Roth, 2002). An individual's environmental literacy emerges from a holistic consideration of their environmental knowledge, environmental attitudes, and environmentally oriented behavior (Murphy and Olson, 2008).

Environmental education aims to cultivate environmentally literate individuals who understand the importance of environment-related systems and take appropriate measures to ensure they function as they should (Roth, 1992). Science teachers play a crucial role in achieving this goal by guiding their students through the perspectives they adopt and by touching their lives. For effective environmental education, prospective teachers are expected to internalize the dimensions of environmental literacy and possess the qualities of environmentally friendly individuals, thereby serving as role models for their future students. It is known that the selection of methods, techniques, and tools to be used in the learning process plays a role in the quality of environmental education. Effective and lasting learning is achieved through the use of appropriate technologies that allow students to experience knowledge firsthand and provide visual support for abstract concepts. Multimedia environments, simulations, projection systems, and computers are examples of

educational technology tools. It is believed that integrating these tools into learning environments will enhance students' understanding of problems, clarify the interconnections within environments and ecosystems, and provide the opportunity to observe the potential scale a problem might reach in later stages.

The perspectives on environmental education held by prospective teachers—who will guide students through the environmental education process—are considered significant. Research evaluating the effectiveness of environmental education reveals that not only students but even teachers in subject areas involving environmental topics do not feel sufficiently competent in this regard.

1.1. Purpose of the Research

The aim of this study is to examine the effect of environmental education supported by educational technology tools on the environmental literacy of prospective science teachers. The aim of this process is to train pre-service teachers who possess the qualities of environmentally literate individuals: those who adopt a sustainable lifestyle, are aware of their knowledge and emotions, engage in restorative environmental behaviors, and are capable of generating solutions to environmental problems.

1.2. Significance of the Research

An examination of studies focusing on environmental education reveals that the samples studied are concentrated on primary and secondary school students. High school students and pre-service teachers have been identified as the sample groups least represented in these studies (Bahar and Kiras, 2017). A significant portion of the studies conducted has addressed the impact of environmental education on environmental attitudes. Subsequently, it has been observed that variables such as environmental knowledge and the level of environmental behavior have been examined. However, it has been determined that there has been relatively less focus on the variable of environmental literacy, which holistically encompasses the dimensions of knowledge, attitudes, behaviors, and problem-solving skills (Bahar and Kiras, 2017). In research on environmental education, quantitative research methods—particularly the survey model—are frequently employed, whereas mixed methods combining quantitative and qualitative approaches are encountered less often (Çakırlar Altuntaş and Turan, 2016).

When evaluated in terms of the techniques employed in environmental education, studies examining the impact of cooperative learning, project-based learning, problem-based learning, and field trips stand out (Özbuğutu, Karahan and Tan, 2014). Conversely, it has been determined that insufficient research has been conducted on the impact of educational technology tools in environmental education. For effective and efficient environmental education, the methods employed during the educational process and the qualifications of the educator are of significant importance. In this regard, there is considered to be a need for alternative environmental education practices. The perspectives on environmental education held by prospective teachers—who will guide students through the environmental education process—are considered significant. Research evaluating the effectiveness of environmental education reveals that not only students but even teachers in subject areas involving environmental topics do not feel sufficiently competent in this regard.

1.3. Problem Cümlesi

Does environmental education supported by educational technology tools have an impact on the environmental literacy of prospective science teachers?

1.3.1. Alt Problemler

The sub-problems formulated in line with the purpose of the study are as follows:

1. Does an environmental education course supported by educational technology tools have a significant effect on the environmental knowledge levels—a sub-dimension of environmental literacy—of pre-service science teachers?
2. Does an environmental education course supported by educational technology tools have a significant effect on the levels of affective dispositions towards the environment—a sub-dimension of environmental literacy—among prospective science teachers?

2. MATERIAL AND METHODS

This study is an example of experimental research, specifically employing the single-group pre-test/post-test design, which is classified as a weak experimental design. Measurements of the research group regarding the dependent variable were obtained using the same group and the same data collection instruments, with a pre-test administered prior to the intervention and a post-test administered afterwards.

2.1. Working Group

When forming the study group, the convenience sampling method—a non-random sampling technique—was selected. The study group for this research consists of third-year pre-service teachers from the Science Education Department of the Trakya University Faculty of Education, located in the city center of Edirne. A total of 56 pre-service teachers are included in the study group.

In this study, a personal information form was used—initially to get to know the participants—to collect data on the development of environmental literacy among third-year pre-service science teachers. The aim was to better characterize the study group using a personal information form, one of the quantitative data collection tools. The personal information form was created by readapting the model developed by Erdoğan (2009)—a task undertaken by Fettahlioğlu (2012). The form consists of 10 items regarding grade level, gender, parents' education and occupation, curiosity about the environment and nature, time spent in natural settings, and concern for the environment. An environmental science achievement test and a scale of affective dispositions towards the environment were used as quantitative data collection instruments in the study. It was administered to prospective teachers by the researcher during the spring semester of the 2018–2019 academic year.

2.2. Environmental Science Achievement Test

In this study, the environmental science achievement test developed by Fettahoğlu for his 2012 doctoral dissertation was used—within the framework of ethical guidelines—to measure the environmental knowledge levels of prospective science teachers. The “Environmental Achievement Test” is a test consisting of five multiple-choice items and containing a total of 44 questions. This test was administered to third-year students in the Science Education Department of the Trakya University Faculty of Education during the spring semester of the 2018–2019 academic year, and item and reliability analyses were conducted based on the obtained findings. As a result of the analysis, four items with an item discrimination index lower than 0.20 were removed from the test. Following the item analysis, the scale was revised to consist of 40 items. As a result of the reliability analysis, the KR-20 reliability coefficient was found to be 0.71. Since the reliability coefficient of the environmental achievement test exceeds 0.70, the scale is considered reliable (Büyüköztürk, 2007). The topics covered by the scale include: concepts of ecology and the environment; ecological relationships and communities; factors affecting living organisms; energy flow; material cycles; environmental pollution (air, water, noise, soil, radioactive, and light pollution); biodiversity; and the definition and scope of sustainable development. The maximum score attainable on the environmental achievement test is set at 40.

2.3. Scale of Affective Tendencies Towards the Environment

In this study, the “Scale of Affective Tendencies towards the Environment,” developed by Yavetz, Goldman, and Pe'er (2009), was used to reveal the affective tendencies of prospective science teachers towards the environment. The scale was prepared using a 5-point Likert-type format. Consisting of 23 items, the scale comprises 5 negatively worded items (items 2, 6, 10, 15, and 23) and 18 positively worded items. Scoring was conducted by applying reverse coding to negatively worded items. If all questions are answered, the maximum score obtainable on the scale is 95, and the minimum score is 23. A reliability analysis was conducted for the environmental attitude scale, and the Cronbach's alpha reliability coefficient was calculated as 0.81. A reliability coefficient above 0.70 indicates that the scale is reliable (Büyüköztürk, 2007).

2.4. Analysis of the Data

In this study, quantitative analyses were performed using the “SPSS 20.00 (Statistical Package for the Social Sciences)” computer program. A dependent samples t-test was conducted to determine the differences between the pre-test and post-test scores of prospective teachers regarding their environmental achievement and environmental affective dispositions.

3. FINDINGS

The results of the descriptive statistics regarding the profiles of the prospective science teachers participating in the study group are presented in Table 4.1.

Table 4.1: Information Regarding the Profiles of Prospective Teachers

Teacher Candidate Characteristics	Responses	Frequency (f)	Percentage (%)
Gender	Female	48	85,7
	Male	8	14,2
Mother's occupation	Housewife	49	87,5
	Worker	4	7,1
	Civil servant	1	1,7
	Self-employed	1	1,7
	Retired	1	1,7
	Other	-	-
Mother's education level	Illiterate	3	5,3
	Primary school	24	42,8
	Middle school	16	28,57
	High school	12	21,42
	Associate degree	-	-
	Bachelor's degree	1	1,7
	Postgraduate	-	-
	I don't know	-	-
Father's occupation	Worker	14	25
	Civil servant	18	32,1
	Farmer	1	1,7
	Self-employed	25	44,64
	Retired	8	14,28
Father's education level	Illiterate	-	-
	Primary school	15	26,78
	Middle school	19	33,9
	High school	16	28,57
	Associate degree	1	1,7
	Bachelor's degree	5	8,9
	Postgraduate	-	-
	I don't know	-	-
How curious are you about information regarding the environment and nature?	I am not curious at all	-	-
	I am slightly curious	7	12,5
	I am moderately curious	38	67,8
	I am very curious	11	19,64
How often have you visited natural areas during your free time in the last year?	I have never gone	-	-
	I rarely went	15	26,78
	I sometimes went	24	42,85
	I went very often	17	30,35
Is there anyone in your family who is concerned about environmental pollution?	Yes	46	82,14
	No	10	17,85
If there is one, could you specify who it is?	My mother	39	69,64
	My father	28	50
	My sibling(s)	21	37,5
	Other	4	7,14

An examination of Table 4.1 reveals that the study group consisted of 48 female and 8 male teacher candidates. Regarding the occupations of the teacher candidates' parents, the categories were "housewife" for mothers and "self-employed" for fathers. When the educational backgrounds of the parents are examined, it is observed that mothers are concentrated at the primary and middle school levels, while fathers are concentrated at the primary, middle, and high school levels. Prospective teachers show a moderate level of interest in information regarding the environment and nature. When asked about the frequency with which they spend their leisure time in nature, they indicated that they occasionally visit such settings.

The sub-problem of the study was formulated as follows: "Does an environmental education course supported by educational technology tools have a significant effect on the environmental knowledge levels—a sub-dimension of environmental literacy—of pre-service science teachers?" To address this problem, the "Environmental Science Achievement Test" was administered to the prospective teachers before and after the implementation. A normality test was conducted to examine whether the scores obtained by the prospective teachers on the test followed a normal distribution. The relevant results are presented in Table 4.2.

Table 4.2: Information Regarding Kolmogorov-Smirnov and Shapiro-Wilk Test Results for Students' Environmental Science Achievement Scores Before and After the Implementation

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistics	df	p.	Statistics	df	p.
Pre-test	0,081	56	0,200*	0,977	56	0,359
Son-test	0,102	56	0,200*	0,958	56	0,051

A review of the literature indicates that the Kolmogorov-Smirnov test is appropriate when the sample size is 50 or greater, whereas the Shapiro-Wilk test is suitable when the sample size is less than 50 (Büyüköztürk, 2007). In this study, considering that the sample group consisted of 56 pre-service teachers, the Kolmogorov-Smirnov test results presented in Table 4.2 were taken into account. Based on the Kolmogorov-Smirnov test results ($p_{\text{pre-test}} = 0.2 > 0.05$ and $p_{\text{post-test}} = 0.2 > 0.05$), it can be stated that the data exhibit a normal distribution. In other words, there is no significant difference between the distributions of the pre-test and post-test score series and the theoretical normal distribution. Consequently, it appears that the data obtained from the administration of the environmental science achievement test can be analyzed using parametric tests.

A difference was observed between the scores obtained by prospective science teachers on the environmental science achievement test administered before and after the implementation (Table 4.3 and Figure 4.1). A paired-samples t-test was conducted to determine whether this difference was significant. The test results are presented in Table 4.4.

Table 4.3: Students' Mean Achievement Scores Related to the Environment

	Mean	N	Standard Deviation	Standard Error of the Mean
Pre-test	23,2500	56	3,62441	0,48433
Post-test	32,0714	56	4,38534	0,58602

Figure 4.1: Students' Average Achievement Scores Related to the Environment

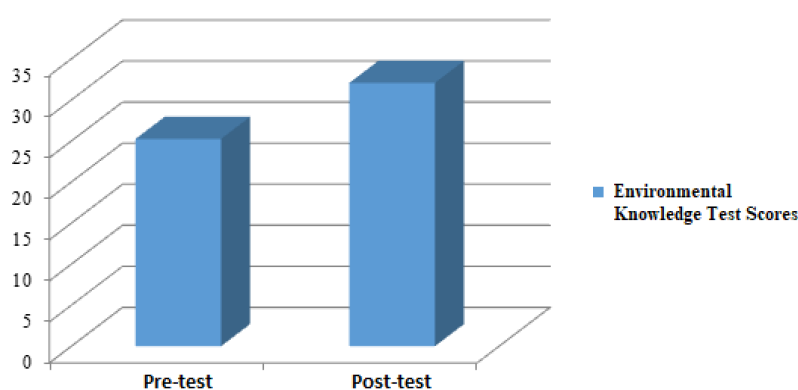


Table 4.4: Paired-Samples t-Test Results for the Pre-test and Post-test Mean Scores of the Environmental Achievement Test Scale

	Paired Differences					t	df	p.
	Mean	Std. Deviation	Std. Error of the Mean	95% Confidence Interval for the Difference				
				Bottom	Top			
Pre test – post test	-8,82143	4,10812	0,54897	-9,92159	-7,72127	-16,069	55	0,000

The environmental science achievement test consists of a total of 40 items. Each correctly answered question is worth 1 point. The maximum score attainable on the test is 40. It was determined that the arithmetic mean of the pre-test scores obtained by the prospective teachers was 23.25, while the arithmetic mean of their post-test scores was 32.07. According to the paired-samples t-test applied to the data, a statistically significant difference was found between the scores in favor of the post-test scores [$t(55) = -16.069$, $p < 0.001$]. This finding indicates that environmental education supported by educational technology tools is effective in increasing the environmental knowledge levels of pre-service science teachers.

The second sub-problem of the study was formulated as follows: "Does an environmental education course supported by educational technology tools have a significant effect on the levels of affective dispositions towards the environment—a sub-dimension of environmental literacy—among pre-service science teachers?" To address this problem, the "Affective Tendency Scale towards the Environment" was administered to prospective teachers before and after the implementation. A normality test was conducted to examine whether the scores obtained by the prospective teachers followed a normal distribution. The relevant results are presented in Table 4.5.

Table 4.5: Information Regarding Kolmogorov-Smirnov and Shapiro-Wilk Test Results for Students' Affective Disposition Scores Towards the Environment Before and After the Implementation

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistics	df	p.	Statistics	df	p.
Pre-test – Post-test score difference	0,113	56	0,073	0,976	56	0,333

Based on the Kolmogorov-Smirnov test results presented in Table 4.5, it can be stated that the data exhibit a normal distribution ($p = 0.07 > 0.05$). Consequently, it is evident that the data obtained using the environmental affective disposition scale can be analyzed using parametric tests. The scores obtained by prospective science teachers regarding their affective dispositions towards the environment—measured both before and after the implementation—are presented in Table 4.6 and Figure 4.2. A paired-samples t-test was conducted to determine whether the difference between these scores was statistically significant. The test results are presented in Table 4.7.

Table 4.6: Students' Mean Scores for Affective Tendencies towards the Environment

	Mean	N	Standard Deviation	Standard Error of the Mean
Pre-test	90,4643	56	9,90127	1,32311
Post-test	95,1607	56	8,84570	1,18206

Figure 4.2: Mean Scores of Students' Affective Tendencies Towards the Environment

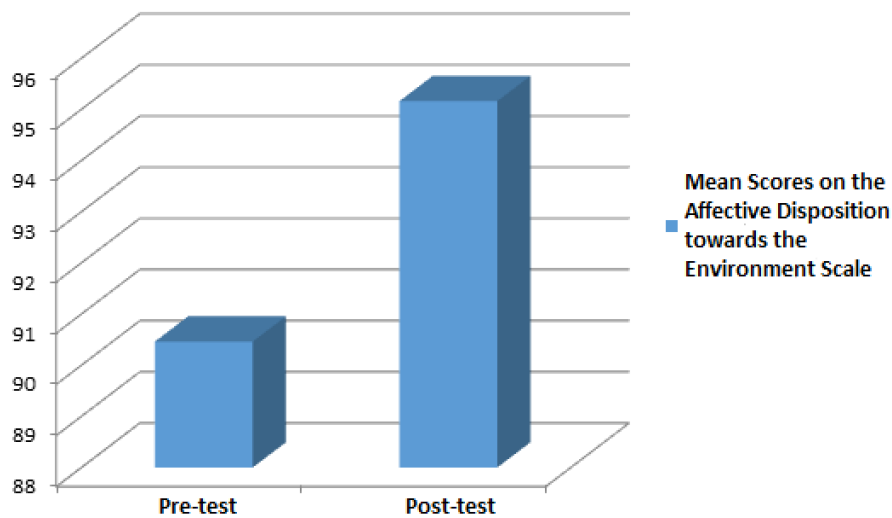


Table 4.7: Paired-Samples t-Test Results for Pre-test and Post-test Mean Scores on the Affective Tendency Towards the Environment Scale

	Paired Differences					t	df	p.
	Mean	Std. Deviation	Std. Error of the Mean	95% Confidence Interval for the Difference				
				Bottom	Top			
Pre test – post test	-4,69643	9,40777	1,25717	-7,21585	-2,17701	-3,736	55	0,000

It was determined that the arithmetic mean of the scores obtained by prospective teachers on the pre-test was 90.46, while the arithmetic mean of the scores obtained on the post-test was 95.16. When the averages are compared, it is observed that affective disposition scores increased following the interventions conducted with pre-service teachers. According to the paired-samples t-test applied to the data, a statistically significant difference was found between the scores in favor of the post-test scores [$t(55) = -3.736$, $p < 0.001$]. This finding indicates that environmental education supported by educational technology tools is effective in increasing the levels of affective dispositions toward the environment among pre-service science teachers.

4. RESULTS AND DISCUSSION

This study was designed to examine the effect of environmental education supported by educational technology tools on the environmental literacy of prospective science teachers. In line with this general objective, the sub-objectives of the study are organized into two sections: The assessment of environmental knowledge and the assessment of affective dispositions towards the environment.

4.1. Results and Discussion Regarding the First Sub-problem

At the beginning of the implementation process, it was determined that the pre-service teachers' mean scores on the environmental science achievement test were 22.64, indicating a moderate level of performance. Based on this, it can be said that the pre-service teachers possessed some knowledge regarding the environment prior to the implementation. However, it is evident that this score level is insufficient for prospective science teachers who will guide future generations. It was determined that, following a post-test administered at the conclusion of a 14-week environmental education program supported by educational technology tools, the score level rose by 9.43 points to reach a value of 32.07. It was determined that the difference between the scores obtained by prospective science teachers on the environmental achievement test prior to the intervention and those obtained on the same test after the intervention was significant and favored the post-test scores [$t(55) = -16.069$, $p < 0.001$]. In other words, the study found that environmental education

supported by educational technology tools was effective in increasing the academic achievement levels of prospective science teachers.

The findings obtained from the study are consistent with relevant research in the literature (Güven and Sülün, 2012; Okur, 2009; Şimşek, 2017). It is considered effective for capturing the attention of pre-service teachers and sustaining their interest that the materials used in the environmental education process—conducted with the support of educational technology tools—address 21st-century skills. The integration of the technological tools they use in every aspect of their lives into the learning process boosts their motivation and supports them in taking an active role in that process. The statement by Uzunoğlu (1997)—“Environmental education materials produced using interactive multimedia technologies, in particular, have enriched environmental education conducted via textbooks and the chalkboard, thereby deepening learning and understanding”—supports the view that environmental education bolstered by educational technology tools enhances performance in the subject.

A review of the literature reveals considerable evidence indicating that the use of educational technology tools in learning environments is more effective than traditional teaching methods in enhancing academic achievement across various grade levels and learning domains (Gökmen and Solak, 2015; Güven and Sülün, 2012; Keskin, 2006). Multimedia elements, particularly animations and simulations, were incorporated into the training process conducted as part of the research. The use of these elements influenced students' creativity by encouraging them to utilize their imaginations. These elements have provided the opportunity to witness events that are difficult to observe in terms of time and space. Furthermore, they are considered effective in facilitating a better understanding of complex ecological relationships and environmental issues. Thus, an increase in academic achievement was achieved. It appears that numerous studies examining the impact of multimedia elements—such as animations and simulations—from the realm of educational technology tools on students' academic achievement support this finding (Daşdemir and Doymuş, 2012; Efendioğlu, 2012; Sırakaya, 2015).

In this context, the improvement in prospective teachers' achievement in environmental science can be attributed to their curiosity about the materials used—which fostered a willingness to learn—their ability to engage with the activities due to the appeal to various senses, and their active participation resulting from finding the process enjoyable. Furthermore, individualized learning may have been achieved because the activities involved in the process appeal to multiple types of intelligence—particularly visual, auditory, and kinesthetic intelligence. It is considered that researcher-participant and participant-participant interactions, along with the fact that the means of accessing information are independent of time and space, facilitate the process of acquiring knowledge. Based on the results of this study and related research in the literature, it can be concluded that methods and techniques which enrich the learning environment, facilitate active student participation in the lesson, and provide settings where students can structure their own learning will have a positive impact on student achievement.

4.2. Results and Discussion Regarding the Second Sub-problem

At the beginning of the implementation process, the scale of affective dispositions towards the environment—the second sub-dimension of the environmental literacy scale—was administered to the prospective teachers as a pre-test. It was determined that the prospective teachers' mean scores for affective dispositions towards the environment were high, at 90.46. This situation indicates that prospective teachers possess affective dispositions towards the environment that can be considered positive prior to receiving environmental education. It was determined that, following a 14-week environmental education program supported by educational technology tools, the score level rose to 95.16—an increase of 4.70 points—based on the post-test administered at the end of the process. It was determined that the difference in scores observed between the pre-intervention and post-intervention scores obtained from the scale measuring affective dispositions towards the environment among prospective science teachers was significant and favored the post-test scores [$t(55) = -3.736$, $p < .001$]. This situation demonstrates that environmental education supported by educational technology tools is effective in increasing the levels of environmental affective dispositions among prospective science teachers.

The primary reason for the result obtained can be attributed to the fact that the technological tools and applications used in the educational process were interactive with the prospective teachers and supported their active participation in the learning process. The use of technological elements has enriched the teaching-learning process and proven effective in sustaining the interest of prospective teachers and increasing their

motivation for the course. Affective disposition towards the environment refers to individuals' sensitivity to the environment and the extent to which societal ethical values are taken into account in environment-related decisions and responsible environmental behaviors (Fettahlioğlu, 2012). At this point, it can be said that materials used in environmental education—such as animations, simulations, educational films, mobile applications, and environmental documentaries supported by educational technology tools—are effective in altering and developing individuals' existing emotions and thoughts, primarily by fostering awareness, thanks to their ability to appeal to multiple senses and their visually and auditorily impressive nature.

The results obtained from the study are consistent with relevant research in the literature (Arıkan, 2006; Kırılmazkaya, 2014; Sonekinci, 2019; Yorğun, 2019). In a study by Büyükkaynak (2018), it was found that pre-service teachers' attitudes toward the environment and their curiosity about the environment increased in parallel. Based on this result, fostering an individual's curiosity about the environment facilitates the development of a positive attitude toward the environment. The inclusion of technological elements that sustain students' interest and curiosity within the learning environment fosters the development of positive attitudes. Research conducted by Aslan (2014) determined that computer-assisted instruction positively influenced the attitudes of prospective science teachers toward the course. In their study, Aslan Efe, Yücel and Efe (2020) concluded that the activity of making a documentary could reduce the pre-service science teachers' existing negative attitudes toward the environment. It was determined that, as a result of the educational process, the pre-service teachers' ecocentric attitudes toward the environment shifted in a positive direction.

Thanks to the animations, simulations, and documentary films used during the implementation process, prospective teachers were able to witness global environmental issues that they had not observed in their immediate surroundings. Although they indirectly experienced the effects of these problems, it was found that many of them were optimistic in visualizing the magnitude of the danger at the beginning of the educational process. However, they stated that upon witnessing these problems, they realized the magnitude of the danger and the necessity of taking immediate action, and felt concern and anxiety regarding the situation. Consequently, animation, simulation, and environmental documentaries have proven effective in making abstract concepts concrete, enabling viewers to visualize them more appropriately and to witness the living conditions of creatures in other regions as well as the depletion of our planet. Prospective teachers were able to observe environmental problems in distant regions they could not have visited in person. This experience influenced their affective dispositions toward the environment, particularly their capacity for empathy.

In her/his study, Öner (2017) examined the effect of instruction supported by simulations and animations on the science achievement and motivation of pre-service teachers studying in the Department of Classroom Teaching. The research findings indicate that instructional practices supported by animation and simulation have a positive impact on students' achievement and motivation. In her/his study examining the effect of using animations on pre-service teachers' attitudes toward the course, Bayram (2012) concluded that the use of animations as instructional material did not create a significant difference in their attitudes. The reason for this situation is that the implementation process was insufficient to influence the individual's attitudes. Research conducted by Buldur and Ömeroğlu (2018) concluded that environmental education supported by multimedia created a positive difference in students' attitudes toward the environment. In her/his study, Efendioğlu (2012) found that the use of multimedia simulations in the Science and Technology Laboratory Applications course had a positive effect on pre-service teachers' attitudes toward the course. Karasaç's (2019) study found that environmental education supported by mobile applications positively influenced students' attitudes toward both the environment and technology.

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