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Abstract

For a sustainable environment, raising future generations as environmentally literate individuals is vital, and this responsibility falls on the shoulders of teachers. Because the construction of future generations is the duty of teachers, to carry out this responsibility, teachers and pre-service teachers, from education faculties to the schools where they work, must first be environmentally literate individuals themselves. In this case, the study aims to examine the environmental literacy of social studies pre-service teachers in a versatile way. For this purpose, the descriptive survey model was used in the study, and the collected quantitative data were analyzed. In order to investigate the environmental literacy levels of pre-service teachers, a 4-dimensional scale developed by Kaplowitz and Levine (2005) and adapted by Teksöz, Şahin, and Ertepinar (2010) according to Turkish education and Turkish conditions was used in this study. Within the scope of the research, the relevant scale was applied to a total of 376 pre-service teachers studying in the Social Studies Teaching program of Erciyes University and Süleyman Demirel University in Turkey. According to the results, a significant difference was found between the pre-service teachers' environmental knowledge and environmental literacy and their beliefs on whether environmental education in Turkey raises environmentally literate individuals. Moreover, statistically, significant differences were found between the environmental literacy and gender of the pre-service teachers in favor of female pre-service teachers. In light of the findings, suggestions were presented to experts and other researchers.

Introduction

Environmental pollution (air, water, biosphere, etc.), an ecological crisis or environmental degradation, which occurs as a result of the destruction of the environment and is frequently heard at the international level today, and it is one of the most substantial threats facing humanity. The reason is that 24% of global deaths are caused by modifiable environmental factors (World Health Organization, 2018). If these changes that occur in the environment are negative and harmful, they are defined as environmental problems (Alım, 2006). Unfortunately, overly ambitious individuals' mindless pursuit of technological and industrial progress has created multifaceted environmental problems that pose unforeseen obstacles to efforts toward the well-being of all humanity. This situation is so dire that all living organisms are now more or less exposed to the danger of water, air, and soil

pollution (Shafi, 2005). Therefore, addressing the current state of the global natural environment constitutes one of the most pressing and vital challenges in human history. This is due to population growth, associated economic activities, and consumption patterns in an increasingly industrialized and interconnected planet, coupled with increasing environmental pressures. The environmental crisis's nature is far-reaching, including habitat loss, increased pollution, loss of biodiversity, and dwindling resources (Sharp, 2002). According to Erten (2004), these problems are the bitter realities faced by humanity, which have been urgently expressed by scientists over the years but ignored by the greed for more significant financial gain and prosperity. If the insensitivity to environmental protection continues regularly, humanity will likely face many more disasters in the future. The basis of all this is the industrialization movements, the plundering of nature by humanity, and the malicious use of nature for their benefit.

When studies on environmental protection and continuous development are examined internationally, “Our Common Future,” published by the United Nations Environment and Development Commission in 1987 (known as the Brundtland Report), has had a tremendous impact in all countries in terms of the environment (UNESCO, 1987). “Our Common Future” has provided essential indications on how to ensure a healthier living environment, not to further devastate the environment shared by all humanity, by making the hope of living in a more privileged world. This situation also formed the basis of the enormous changes in the 21st century. The United Nations Conference on Environment and Development (UNCED), also known as the “Earth Summit,” held on 3-14 June 1992 in Rio de Janeiro, Brazil, has an important place in the fight against environmental problems. Before that, the first Environmental Conference, held in Stockholm, Sweden, in 1972, was a considerable effort to focus on human socio-economic impacts and evaluate economic activities on the environment (This conference brought together political leaders, scientists, diplomats, media representatives, and non-governmental organizations from 179 countries) (UNESCO, 1992).

In order to understand the leading causes and effects of environmental problems, it is necessary to know and understand the essential characteristics of the environment. This is a primary requirement to imagine the strength and limits of the ecosystem in which we live (Akyüz, 2020; Cakir et al., 2019). In this respect, environmental knowledge is vital for producing and developing ecological actions because, in this way, the individual will know what kind of behavior to take towards the environment. Therefore, environmental knowledge is an intellectual prerequisite for developing and exhibiting ecological behavior (Otto & Kaiser, 2014). On the other hand, environmental literacy, born out of environmental knowledge and awareness (Roth, 1968), is much more than a component of environmental education (Stables & Bishop, 2001). Because environmental literacy starts with framed information, it also includes understanding the underlying principles of behavior, the knowledge and skills needed to search the issue, and how to apply this information (Coyle, 2005). Knowing how the world works and learning to ensure sustainability by protecting the environment is the basis of environmental literacy (Orr, 1990). Creating an environmentally literate society is one of the primary goals of environmental education (Genc, 2015).

Cheng and So (2015) stated that teachers play a vital role in educating students as knowledgeable, environmentally conscious, and responsible green citizens. Teachers have a vital role in transforming education especially with the advent of educational technologies and online learning settings (Noroozi & Sahin, 2022a, 2022b) to better cater

education for a sustainable future. There is an increasing interest in the relationship between academic departments and the development of teacher candidates' environmental literacy (Goldman, Yavetz & Pe'er, 2014; Keskin, Akcay, & Kapici, 2020; Szóke, 2023). In this context, several key educators in the field of environmental education have sought to further clarify and refine the broad definition of environmental education in order that it can be used in goal and objective planning and in the evaluation of programs that promote environmental literacy and make them attractive (Moseley, 2000). The reason is that the architects of a successful environmental education are teachers (Lloyd-Strovas, Moseley, & Arsuffi, 2018).

Education is crucial to enable individuals to understand the environmental importance and how to create a sustainable environment. Rickinson (2001) states that environmental education should include environmental knowledge, attitudes, and behaviors. This training should be adapted to improve environmental literacy. Education cannot remain isolated from contemporary social and environmental problems. Moreover, environmental education cannot ignore critical debates whose research links these considerations to the methodological, epistemological, and ontological contents that distinguish environmental education from its unexamined use. After a careful and comprehensive review of the literature in this area, it is clear that environmental education studies are more complex and controversial than those in the past (Hart, 1996).

Environmental education resources guide educators in creating opportunities for students to learn. Environmental education has multiple dimensions: social community, sense of place, cultural symbols, psychological presence, political and economic systems, and biophysical space. In this context, including these various dimensions in environmental education programs allows the life stories of cultures to be shaped locally or socially (Ardoin, 2006). However, environmental education is not only multifaceted, but it is also constantly evolving. Newer approaches focus on the social dimension of current environmental challenges, address behavior change in an even more active form, and facilitate learning rather than directing it. Environmental education also aims to develop skills such as questioning, discovering and analyzing values, researching and solving problems, and developing personal responsibility or ownership to be a responsible environmental society (Monroe, Andrews & Biedenweg, 2008; Ozturk, 2023). Şahin, Ünlü, and Ünlü (2016) stated that raising environmentally conscious people is only possible if individuals receive a competent environmental education about environmental problems. Because environmental education in Turkey is limited only to university life, it does not have critical importance at the university level and is limited only to specific departments. According to Kızılcı, Yiğit, and Darçın (2014), in today's world, where it is essential to raise individuals to be environmentally literate, conscious, and sensitive, people should be raised in order to prevent environmental problems that have become serious problem for humanity. In light of this perspective, teacher and pre-service teachers' environmental knowledge and environmental literacy levels are vital for a sustainable environment. Regarding environmental literacy, which also takes place in social studies education, it is critical to determine the environmental literacy status of pre-service teachers who will carry out environmental education for a sustainable world and a healthy future generation. Within the framework of this general purpose, it is aimed that the data collected about the environmental literacy levels of pre-service teachers can reveal more detailed results in order to ensure a sustainable future. Therefore this study aims to examine social studies pre-service teachers' environmental literacy and environmental knowledge. In this context, answers to the following questions were sought in this study:

1. Is there a significant difference between social studies pre-service teachers' environmental knowledge scores and their genders, Grade Levels, The Degree of Finding Themselves Sufficient in Environmental Knowledge (TSFTSEK), Situations of Thinking that Environmental Education Conducted in Turkey Raise Environmentally Literate Individuals (STEECTRELI), Conditions of Receiving Environmental Education (CREE) and Participation in Environmental Behaviors (PEB)?
2. Is there a significant difference between social studies pre-service teachers' environmental literacy scores and their genders, Grade Levels, The Degree of Finding Themselves Sufficient in Environmental Knowledge (TSFTSEK), Situations of Thinking that Environmental Education Conducted in Turkey Raise Environmentally Literate Individuals (STEECTRELI), Conditions of Receiving Environmental Education (CREE) and Participation in Environmental Behaviors (PEB)?

Method

Model of the Research

In this study, which aims to examine the environmental literacy levels of social studies teacher candidates, the descriptive survey model, one of the quantitative research methods, was used. Survey researches allow the sample taken from the universe on a particular subject to be seen through numerical expressions and the behavior, attitude, etc. of individuals. It allows the collection of data on variables that cannot be measured directly (Creswell, 2017). In other words, a screening study on social studies pre-service teachers aimed to determine the environmental literacy levels and examine the results.

Participants of the Study

Social studies pre-service teachers studying at the education faculties of Erciyes University and Süleyman Demirel University in the academic year 2021-2022 in Turkey participated in the research. 256 (68.1%) of the teacher candidates are female, and 120 (31.9%) are male. In addition, 255 (67.81%) of the pre-service teachers do not think environmental education in Turkey raises environmentally literate individuals; 121 (32.18%) think environmental education in Turkey raises environmentally literate individuals. 247 (65.69%) of the pre-service teachers stated that they did not receive environmental education and 129 (34.3%) stated that they received environmental education.

Data Collection Tools and Data Processing

In the study, "Environmental Literacy Scale" and Environmental Knowledge Test developed by Kaplowitz and Levine (2005) and adapted into Turkish by Teksöz, Şahin, and Ertepinar (2010) were used in order to determine the environmental literacy of social studies teacher candidates. The environmental literacy scale consists of 38 items; items 3, 5, 7, 8, 14, 15, 17, and 24 are negative items for environmental literacy, while the others are positive items. The KMO value of the scale was found to be .88, and it was stated that the data were suitable for factor analysis. It consists of items collected in the first dimension with factor loadings ranging from .691 to .418 and belongs to the "Environmental Use" dimension. In the second dimension, the items named "Concern for

Environmental Issues" in the original scale were loaded with factor loads ranging from .678 to .481. In the last dimension, "Attitude Towards Environment," items were loaded with factor loadings varying between .584 and .391. In addition, the internal consistency coefficients of the scale were specified as .81 for "Environmental Use," .88 for "Concern for Environmental Issues," and .70 for "Attitude towards Environment" (Teksöz, Şahin & Ertepinar, 2010). The environmental knowledge test consists of 11 multiple-choice questions. A score of 1 was given for correct answers and 0 for incorrect answers. The factor loads of the "Environmental Knowledge" questions ranged from .684 to .316, and the internal consistency coefficient was stated to be .88. No missing data was found in the data collected in the study. While filling the tools, no questions were left blank by the pre-service teachers. In addition, Mahalanobis distances were calculated, and 25 observations showing one-way extreme values were removed from the dataset. After the abovementioned regulations, it was decided to include 376 tools out of 401 for teachers.

As a result of the factor analysis performed for the environmental literacy scale in this study, it was observed that the correlation coefficients calculated between the factors and their items ranged from .62 to .89. According to Büyüköztürk (2002), a correlation coefficient of .60 and above can be interpreted as a high level of correlation. In addition, as a result of the confirmatory factor analysis performed in the study, the value obtained by dividing the chi-square fit index value by the degree of freedom ($\chi^2 / df = 4.39$) was found to be below 5, which is considered an acceptable or excellent value (Marsh & Hocevar, 1988). In addition, when the RMSEA (.095), SRMR (.065), GFI (.94), CFI (.75), NFI (.91), RFI (.92) values were examined, it was determined that the model showed acceptable fit or perfect fit. (Fan, Thompson & Wang, 1999; Hu & Bentler, 1999).

In the study, the reliability coefficient of KR-20 for the environmental knowledge test was calculated as .72. In addition, the mean of Item Difficulty (p) was calculated as .64, and the mean of Item Discrimination (r) was calculated as .41. The item discrimination of the test can be considered as an acceptable situation (Turgut & Baykul, 2012).

Analysis of Data

The study examined whether there is a statistically significant difference between the social studies pre-service teachers' environmental literacy and environmental knowledge scores (continuous independent variables) and the categorical independent variables. For this purpose, it was first examined whether the data collected were normally distributed since the statistical analyses to be applied had some assumptions. In this context, skewness-kurtosis values, Kolmogorov–Smirnov/Shapiro Wilk statistics, QQ Plot, and Histogram graphs were examined. In this context, it was observed that the index obtained by dividing Environmental Knowledge scores (Skewness= 0.141 and Kurtosis= 0.272) and Environmental Literacy (Skewness= 1.273 and Kurtosis= 2.057) skewness-kurtosis statistics by their standard errors was not within the range of ± 1.96 (Tabachnick & Fidell, 2013). In addition, Kolmogorov-Smirnov and Shapiro-Wilk statistics ($p > .05$), QQ plots, and Histogram graphs were also examined. As a result, it was determined that the data did not show normal distribution. Considering the normality of the data obtained in the research, data were analyzed with their nonparametric equivalents instead of parametric analyses. In addition, the significance level was accepted as .05 in the statistical analyses used in the research.

Results

Findings Regarding the First Question of the Research

Is there a significant difference between social studies pre-service teachers' environmental knowledge scores and their genders?

When Table 1 is examined, it is seen that the mean rank of male pre-service teachers' environmental knowledge scores (198.10) is higher than that of female pre-service teachers' (184.00). The findings revealed that this difference between the environmental knowledge scores of the two groups and the gender variable was not statistically significant ($U=14207.500$; $p>0.05$). In other words, it can be said that the gender of pre-service teachers does not have a significant effect on environmental knowledge scores.

Table 1. Mann Whitney U Test between Environmental Knowledge and Gender

Gender	N	MR	SR	U	p
Female	256	184.00	47103.50	14207.500	0.235
Male	120	198.10	23772.50		

Is there a significant difference between social studies pre-service teachers' environmental knowledge scores and their grade levels?

When Table 2 is examined, according to the results of the Kruskal Wallis H test, which was conducted to determine whether the environmental knowledge scores of the pre-service teachers differ significantly according to the grade levels, it was seen that the environmental knowledge total scores of the pre-service teachers did not differ statistically significant according to the grade levels ($\chi^2(3) = 6.861$, $p> 0.05$). In other words, it can be said that social studies pre-service teachers' grade levels do not have a significant effect on their environmental knowledge scores.

Table 2. Kruskal Wallis H Test between Environmental Knowledge and Grade Level

Grade Level	N	MR	df	χ^2	p
1st Grade	98	171.84			
2nd Grade	115	180.46			
3rd Grade	71	209.96	3	6.861	0.076
4th Grade	92	199.73			

Is there a significant difference between social studies pre-service teachers' environmental knowledge scores and their TSFTSEK?

When Table 3 is examined, it is seen that the mean rank of environmental knowledge points of the pre-service teachers who find themselves sufficient in environmental knowledge (196.06) is higher than the mean rank of environmental knowledge of the pre-service teachers who do not find themselves sufficient in environmental knowledge (174.20). The findings revealed that this difference between the environmental knowledge scores of

the two groups and the variable of the situations of finding themselves sufficient in environmental knowledge was not statistically significant ($U=14131.000$; $p>0.05$). In other words, the pre-service teachers' finding themselves sufficient in environmental knowledge does not significantly affect their environmental knowledge scores.

Table 3. Mann Whitney U Test between Environmental Knowledge and TSFTSEK

TSFTSEK	N	MR	SR	U	p
Yes	246	196.06	48230.00	14131.000	0.060
No	130	174.20	22646.00		

Is there a significant difference between social studies pre-service teachers' environmental knowledge scores and their STEECTRELI?

When Table 4 is examined, it is seen that the mean rank (207.52) of the environmental knowledge scores of the pre-service teachers who do not think that the environmental education carried out in Turkey raises environmentally literate individuals is higher than the mean rank (148.42) of the pre-service teachers who think that the environmental education carried out in Turkey raises environmentally literate individuals.

Table 4. Mann Whitney U Test between Environmental Knowledge and STEECTRELI

STEECTRELI	N	MR	SR	U	p	d
Yes	121	148.42	17959.00	10578.000	0.000*	0.605
No	255	207.52	52917.00			

* $p<0.05$

The findings revealed that this difference between the environmental knowledge scores of the two groups and the variable of thinking that environmental education carried out in Turkey raises environmentally literate individuals are statistically significant ($U=10578.000$; $p<0.05$). In other words, it can be said that the pre-service teachers' thinking that environmental education in Turkey raises environmentally literate individuals statistically significantly affects their environmental knowledge scores. When the effect size was also examined ($d=0.605$), it was determined that this difference had a moderate effect size (Cohen, Manion & Morrison, 2007).

Is there a significant difference between social studies pre-service teachers' environmental knowledge scores and their CREE?

When Table 5 is examined, it is seen that the mean rank of environmental knowledge points (191.98) of the pre-service teachers who received environmental education is higher than the mean rank of environmental knowledge (186.68) of the pre-service teachers who did not receive environmental education. The findings revealed that this difference between the environmental knowledge scores of the two groups and their environmental education status was not statistically significant ($U=15483.000$; $p>0.05$). In other words, it can be said that pre-service teachers' environmental education status does not significantly affect their environmental knowledge scores.

Table 5. Mann Whitney U Test between Environmental Knowledge and CREE

CREE	N	MR	SR	U	p
Yes	129	191.98	24765.00	15483.000	0.650
No	247	186.68	46111.00		

Is there a significant difference between social studies pre-service teachers' environmental knowledge scores and their PEB?

When Table 6 is examined, it is seen that the mean rank of environmental knowledge points of pre-service teachers who do not participate in environmental behaviors (193.46) is higher than the mean rank of pre-service teachers who participate in environmental behaviors (180.05).

Table 6. Mann Whitney U Test between Environmental Knowledge and PEB

PEB	N	SO	ST	U	p
Yes	139	180.05	25027.00	15297.000	0.242
No	237	193.46	45849.00		

The findings revealed that this difference between the environmental knowledge scores of the two groups and their participation in environmental behaviors was not statistically significant ($U=15297.000$; $p>0.05$). In other words, pre-service teachers' participation in environmental behaviors does not significantly affect their environmental knowledge scores.

Findings Regarding the Second Question of the Study

Is there a significant difference between social studies pre-service teachers' environmental literacy scores and their genders?

When Table 7 is examined, it is seen that the mean rank of environmental literacy scores of female pre-service teachers' (203.23) is higher than that of male pre-service teachers' (157.07).

Table 7. Mann Whitney U Test between Environmental Literacy and Gender

Gender	N	MR	SR	U	p	d
Female	256	203.23	52027.50	11588.500	0.000*	0.378
Male	120	157.07	18848.50			

* $p<0.05$

The findings revealed that this difference between the environmental literacy scores of the two groups and the gender variable was statistically significant ($U=11588.500$; $p<0.05$). In other words, it can be said that the gender of pre-service teachers has a significant effect on environmental literacy scores. When the effect size was examined ($d=0.378$), it was determined that this difference had a small effect size.

Is there a significant difference between social studies pre-service teachers' environmental literacy scores and their grade levels?

When Table 8 is examined, according to the results of the Kruskal Wallis H test, which was conducted to determine whether the environmental literacy scores of the pre-service teachers differ significantly according to the grade levels, it was seen that the environmental literacy total scores of the pre-service teachers did not differ statistically significant according to the grade levels ($\chi^2(3) = 4.997, p > 0.05$). In other words, it can be said that social studies pre-service teachers' grade levels do not have a significant effect on their environmental literacy scores.

Table 8. Kruskal Wallis H Test between Environmental Knowledge and Grade Level

Grade Level	N	MR	df	χ^2	p
1st Grade	98	169.61			
2nd Grade	115	202.87	3	4.997	0.171
3rd Grade	71	189.43			
4th Grade	92	189.94			

Is there a significant difference between social studies pre-service teachers' environmental literacy scores and their TSFTSEK?

When Table 9 is examined, it is seen that the mean rank of environmental literacy of the pre-service teachers who do not find themselves sufficient in environmental knowledge (193.00) is higher than the mean rank of environmental literacy of the pre-service teachers who find themselves sufficient in environmental knowledge (186.12). The findings revealed that this difference between the environmental literacy scores of the two groups and the variable of the situations of finding themselves sufficient in environmental knowledge was not statistically significant ($U=15404.500; p > 0.05$). In other words, the pre-service teachers' finding themselves sufficient in environmental knowledge does not significantly affect their environmental literacy scores.

Table 9. Mann Whitney U Test between Environmental Literacy and TSFTSEK

TSFTSEK	N	MR	SR	U	p
Yes	246	186.12	45785.50	15404.500	0.559
No	130	193.00	25090.50		

Is there a significant difference between social studies pre-service teachers' environmental literacy scores and their STEECTRELI?

When Table 10 is examined, it is seen that the mean rank of environmental literacy scores of pre-service teachers who do not think that environmental education in Turkey raises environmentally literate individuals (197.23) is higher than the mean rank of environmental literacy (170.11) of pre-service teachers who think that environmental education in Turkey raises environmentally literate individuals. The findings revealed that this difference between

the environmental literacy scores of the two groups and the variable of thinking that environmental education carried out in Turkey raises environmentally literate individuals are statistically significant ($U=13202.000$; $p<0.05$). In other words, it can be said that the pre-service teachers' thinking that environmental education in Turkey raises environmentally literate individuals statistically significantly affects their environmental literacy scores. When the effect size was examined ($d=0.261$), it was determined that this difference had a small effect size.

Table 10. Mann Whitney U Test between Environmental Literacy and STEECTRELI

STEECTRELI	N	MR	SR	U	p	d
Yes	121	170.11	20583.50	13202.000	0.024*	0.261
No	255	197.23	50292.50			

* $p<0.05$

Is there a significant difference between social studies pre-service teachers' environmental literacy scores and their CREE?

When Table 11 is examined, it is seen that the mean rank of environmental literacy scores of pre-service teachers who do not receive environmental education (190.47) is higher than the mean rank of environmental literacy scores of pre-service teachers who receive environmental education (184.72). The findings revealed that this difference between the environmental literacy scores of the two groups and their environmental education status was not statistically significant ($U=15444.000$; $p>0.05$). In other words, it can be said that pre-service teachers' environmental education status does not significantly affect their environmental literacy scores.

Table 11. Mann Whitney U Test between Environmental Literacy and CREE

CREE	N	MR	SR	U	p
Yes	129	184.72	23829.00	15444.000	0.626
No	247	190.47	47047.00		

Is there a significant difference between social studies pre-service teachers' environmental literacy scores and their PEB?

When Table 12 is examined, it is seen that the mean rank of environmental literacy of pre-service teachers who participate in environmental behaviors (190.58) is higher than the mean rank of environmental literacy of pre-service teachers who do not participate in environmental behavior (187.28).

Table 12. Mann Whitney U Test between Environmental Literacy and PEB

PEB	N	MR	SR	U	p
Yes	139	190.58	26490.00	16183.000	0.777
No	237	187.28	44386.00		

The findings revealed that this difference between the environmental literacy scores of the two groups and their participation in environmental behaviors was not statistically significant ($U=161183.000$; $p>0.05$). In other words, pre-service teachers' participation in environmental behaviors does not significantly affect their environmental literacy scores.

Discussion and Conclusion

When the relevant literature on the environmental knowledge of pre-service teachers is examined, it is stated that pre-service teachers have low environmental knowledge (Al-Dajeh, 2012; Alkaher & Goldman, 2018; Goldman et al., 2006; Özyürek et al., 2019; Pe'er et al., 2007; Saribas et al., 2014; Shamuganathan & Karpudewan, 2015; Tal, 2010 Tuncer et al., 2009; Yavetz et al., 2009). On the other hand, in the research by Krnel and Naglic (2009), it was revealed that environmental knowledge does not result in more environmentally sensitive behavior and environmental awareness. Timur and Yılmaz (2011) stated that the environmental literacy of pre-service science teachers is moderate in terms of environmental knowledge. Similarly, Ünlü (2016) found a significant difference in favor of science teacher candidates between 4th grade, classroom teaching, and science teaching, and environmental knowledge in Turkish teaching and social studies teaching, similar to this result. However, in another study, Çimen and Timur (2013) stated that pre-service teachers' environmental knowledge did not differ according to their departments.

According to the findings obtained in the study, no statistically significant difference was found between the environmental knowledge scores of social studies pre-service teachers and their genders, grade levels, the situations of finding themselves sufficient in environmental knowledge (TSFTSEK), conditions of receiving environmental education (CREE) and participation in environmental behaviors (PEB). However, there was a statistically significant difference between the pre-service teachers' situations of thinking that environmental education conducted in Turkey raises environmental literacy individuals (STEECTRELI) and their environmental knowledge scores in favor of those who do not think that environmental education in Turkey raises environmentally literate individuals. When the effect size was also examined, it was determined that this difference had a moderate effect size.

This result was also obtained in studies conducted on other samples similarly. For example, in some studies conducted with pre-service science teachers, it was determined that there was no significant difference between their environmental knowledge and gender (Robinson & Crowther, 2001; Timur & Yılmaz, 2011). Akman (2017) also examined the relationship between pre-service teachers' human-environment relations and grade levels and stated that there was no significant difference. Similarly, Ünlü (2016) stated in his research that the environmental knowledge scores of the 1st and 4th-grade social studies teacher candidates do not differ according to the grade variable. Contrary to the result obtained in this study, Karatekin (2011) examined environmental knowledge scores of social studies pre-service teachers according to grade levels and stated that there was a significant difference between 1st and 2nd grades in favor of 1st grades. Ateş (2018), in his study with social studies pre-service teachers and pre-service science teachers, stated that both groups have sufficient knowledge of sustainable environmental information and that pre-service science teachers are at a better level than social studies pre-service teachers in

this regard. On the other hand, Öztürk, Tüzün, and Teksöz (2013) revealed that there is a significant difference between pre-service teachers' school enrollment years and environmental knowledge and that this difference is in favor of senior pre-service teachers between senior and first- and second-year pre-service teachers. Tuncer et al. (2009) also stated in their studies that environmental knowledge, a component of environmental literacy, is thought to differ in terms of self-efficacy among pre-service teachers, but they did not reach this result. A similar result was obtained in this study. In Echavarren's (2017) study conducted on an extensive sample based on individuals in 51 countries, it was stated that there was a negative correlation between gross domestic product per capita and environmental concerns. In other words, more affluent countries also revealed that the environmental concerns of the population are weaker than those of developing countries. He also stated that environmental concerns in these countries are also on environmental education (Echavarren, 2017). Givens and Jorgenson (2011), on the other hand, stated that in their research based on individuals in 38 countries, they also focused on environmental education and stated that people with higher education increased the rate of expressing environmental concerns. Environmental education has excellent value for a country because a good critical environment and a sustainable education create an environment for transforming individuals and societies, where individuals respect their equal-based differences in their concerns and thoughts about common environmental areas (Wildemeersch, 2018). Robelia and Murphy (2012) analyzed 15 studies. They stated that environmentally literate people are significantly more likely to engage in some pro-environmental activities compared to individuals who have not received environmental education. Similarly, in their study with university students, Zsóka, Szerényi, Széchy, and Kocsis (2019) stated that there was a strong relationship between environmental knowledge, environmentally sensitive action, and environmental commitment levels, and they stated that this was significantly related to the intensity of environmental education. On the other hand, Arbuthnott (2009) stated that environmental knowledge and attitudes are not fully reflected in daily activities regarding consistent environmental behavior in universities. DeChano (2006), in his study conducted on students aged 17-19 in England, the USA, Chile, and Switzerland, stated that students' environmental knowledge was weak and revealed no statistically significant relationship between environmental knowledge and environmental attitudes. On the other hand, Tal (2010), in his research conducted with pre-service teachers, stated that pre-service teachers' environmental knowledge needed to be improved before the practical design application. In addition, Tal (2010) stated that environmental behaviors and knowledge have increased with online discussion forums and field trips, while more environmental education practices should still be carried out. Türkoğlu (2019), on the other hand, in his study examining the environmental knowledge of preschool teachers and preschool pre-service teachers, stated that pre-service teachers have environmental knowledge more than preschool teachers. However, he stated that preschool teachers have more practical knowledge than pre-service teachers. Bögeholz (2006), on the other hand, defended the importance of nature experiences for environmental behavior, environmental knowledge, and environmental values and revealed in his research that nature experiences are at the center when it comes to environmental knowledge and environmental values.

When the environmental literacy of pre-service teachers is examined in the literature, Arnon et al. (2015) found a medium level of environmental literacy in a study with university students. Lloyd-Strovas et al. (2017) found in their research with university students that while they stated that they were not environmentally literate, their attitudes were slightly higher. However, their environmental knowledge and environmental behavior levels were

low. Nunez and Clores (2017) stated in their study that students have moderate environmental literacy and environmental knowledge and a high level of environmental sensitivity and attitude. In addition, Stevenson Carrier and Peterson (2014) stated that teachers' ecological knowledge levels are high within the scope of environmental literacy. In the research, the most prominent problem stated by teachers about environmental literacy is the need for more teaching time. Kayalı (2018) stated that the environmental literacy levels of religious culture pre-service teachers are at a medium level. Sigit et al. (2019) stated in their research that the environmental literacy of biology pre-service teachers is high. Karatekin and Aksoy (2012) reported that social studies pre-service teachers have a medium level of environmental literacy.

According to the findings obtained in the study, no statistically significant difference was found between the environmental literacy scores of social studies pre-service teachers and their grade levels, the situations of finding themselves sufficient in environmental knowledge (TSFTSEK), conditions of receiving environmental education (CREE) and participation in environmental behaviors (PEB). However, there was a statistically significant difference between the pre-service teachers' situations of thinking that environmental education conducted in Turkey raises environmentally literate individuals (STEECTRELI) and their environmental literacy scores in favor of those who do not think that environmental education in Turkey raises environmentally literate individuals. When the effect size was also examined, it was determined that this difference had a small effect size. In addition, a statistically significant difference was found between the gender of pre-service teachers and their environmental literacy scores in favor of female pre-service teachers. This difference has a small effect size.

In this study, it was determined that the result in favor of female pre-service teachers obtained in the environmental literacy variable was also seen in some studies in the literature (Erol & Gezer, 2006; Gardos & Dodd, 1995; Özsoy, Özsoy & Kuruyer, 2011; Tikka, Kuitunen & Tynys, 2000; Tuncer et al., 2009). From this point of view, it can be interpreted that the environmental literacy of female pre-service teachers is higher than that of male pre-service teachers. Kahyaoğlu and Özgen (2012) found a significant difference in the group of social studies pre-service teachers in the study, in which prospective teachers were examined according to the scores of their attitudes towards environmental problems. On the other hand, Karadağ and Acar (2020) concluded that there was no significant difference in comparing pre-service teachers' awareness of environmental problems and their grade levels. A similar result was obtained in this study as well. On the other hand, Uyanık (2021), in his study in which the environmental attitudes of pre-service science teachers and social studies pre-service teachers were also examined, found a significant difference in favor of social studies pre-service teachers in terms of environmental attitudes. Bozdemir and Faiz (2018) examined environmental ecocentric, anthropocentric, and antipathic attitudes and pre-service teachers' ecocentric and antipathic attitude scores according to the grade level variable. According to the results they obtained in their studies when the scores of the pre-service teachers at the 2nd and 4th-grade levels were in favor of the 4th-grade pre-service teachers, and when the scores of the 1st and 4th-grade and 2nd and 4th-grade pre-service teachers were compared, they found a significant difference in favor of the 1st and 2nd grade pre-service teachers, respectively. Özgen (2012) stated that there was no significant difference in pre-service teachers' environmental indifference and disinterestedness sub-dimension according to the grade variable in a study conducted with a group of pre-service social studies teachers. Yıldırım, Bacanak, and Özsoy (2012), on the other hand, examined pre-service teachers' sensitivity to environmental problems according to the class

variable and stated that there was a significant difference between the 2nd and 4th grades in favor of the 4th grades. On the other hand, Yılmaz (2021) revealed that social studies teacher candidates' environmental literacy did not show a significant difference between affective education and behavior sub-dimensions and grade level variables. In a study by Saribas, Teksos, and Ertepinar (2014), researchers examined pre-service teachers' environmental literacy and self-efficacy beliefs. They stated that there was a significant relationship between pre-service teachers' self-efficacy beliefs and their interest in the environment. Similarly, in a study conducted by Sürmeli (2013) with preschool teachers, environmental literacy and science and technology self-efficacy beliefs were examined. In his research, he stated that teachers' self-efficacy belief levels were sufficient and that there was a significant interaction between teachers' science and technology self-efficacy beliefs and environmental concerns. In the study conducted by Wong (2005), which included a large sample across the country in China, it was stated that the participants had concerns about environmental education. Wong (2005) also conducted his study with university students. He stated that the students exhibit a government-trust attitude. The students think that the responsibility for environmental policies belongs to the state, as other citizens have stated, and that the state is responsible for the steps to be taken to protect the environment. McDaniel and Alley (2005) conducted a study based on people in West Georgia, USA's rural and urban basins. They stated that the population living in rural basins had higher environmental knowledge and awareness levels than the urban population. Kahyaoglu, Daban, and Yang (2008) asked the social studies teacher candidates' attitudes towards the environment and whether they received environmental education at the high school or university level. They concluded that there is no significant difference between these two variables. A similar result was obtained in this study as well. On the other hand, Altınöz (2010) stated that there is a significant difference between pre-service teachers' attitudes toward the environment and their status of receiving environmental education. Kayalı (2010) stated that there is a significant difference between the pre-service teachers' teaching field (social studies, Turkish, and classroom teaching) and their scores on environmental problems, and this situation is in favor of social studies pre-service teachers (the highest). In the study by Karakaya, Avgın, and Yılmaz (2017), it was stated that there is a statistically significant difference between pre-service teachers' attitudes and environmental behaviors towards the environment and the status of receiving environmental education. In parallel with the findings obtained in this study, Kışoğlu, Yıldırım, Salman, and Sülün (2016) obtained a similar result between environmental literacy and participation in environmental behaviors and stated that there was no significant difference between pre-service teachers' behaviors towards environmental problems and their membership in environmental organizations. Çobanoğlu and Türer (2015) examined pre-service teachers' awareness of the environmental dimension of sustainable development. They found no significant difference between social studies pre-service teachers and pre-service science teachers. On the other hand, in their research conducted with teachers, Bloom and Fuentes (2019) stated that experiential learning opportunities (site visits, excursions, simulations, etc.) contributed significantly to the development of environmental literacy. In a study conducted by Karatekin, Kuş, and Meryem (2014), it was stated that the social participation of teacher candidates in solving environmental problems is at a deficient level, and this is due to the low level of knowledge, interest, sensitivity and awareness of pre-service teachers towards the environment. Akman and Alagöz (2017), on the other hand, in their research to determine the social literacy and environmental literacy levels of primary school pre-service teachers and to determine the effect of various determined variables on the components of environmental literacy, revealed that pre-service teachers' environmental, behavioral tendencies are higher than environmental perceptual tendencies.

Recommendations

According to the findings obtained in the study, the environmental education of pre-service teachers should be investigated in more detail by other researchers, and the relevant authorities should support the content of environmental education in a way that strengthens environmental literacy. In addition, case thinking that environmental education carried out within the scope of education programs in Turkey raises environmentally literate individuals; As a result of the statistically significant difference in favor of those who do not think, studies should be carried out by other researchers or experts to determine the factors and causes of this situation in detail.

Notes

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