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Environmental Literacy: Comparison between Chemistry Teacher Candidates, Chemistry Teachers, and Individuals in Environmentally Related Professions[1]

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An essential component of preventing environmental issues is environmental education. Environmental education's primary goal is to raise people's environmental literacy—their understanding and sensitivity to the environment. The purpose of this study is to compare the environmental literacy of chemistry teacher candidates, chemistry teachers, and environmentally related professions in terms of their awareness of environmental issues, knowledge, attitude, and use. It also seeks to find out how gender and experience affect environmental literacy. A total of 793 people from three groups participated in the study. Participants completed an environmental literacy scale that included components for environmental knowledge, environmental attitude, environmental concern, and environmental use. According to the results of the research, it was determined that the three participant groups were sufficient in the components of environmental attitude, environmental use, and environmental concern, but their level of knowledge about environmental issues was not sufficient. Considering the total environmental literacy scores of the study groups, a statistically significant difference was determined in favor of chemistry teachers compared to the other groups. In addition, it was determined that the level of environmental literacy differed according to the o gender and professional experience of teachers.

Keywords: Environmental literacy, teacher candidates, teachers, environmentally related profession.

INTRODUCTION

The term "environment" refers to all biotic and abiotic (social, cultural, historical, climatic, and physical) elements that impact a living being or a living community over the course of their existence. These elements can be visible or unseen and are influenced by one another (Yücel & Morgil, 1998). Another definition of environment states that it is the term used to describe the living environment in which living things are linked by vital connections, influence one another, and are affected by one another (Atasoy, 2006; Güler, 2010). Since the beginning of time, mankind has profited from the environment and lived a life that is connected with it. However, industrialization and rising population density in some areas, particularly since the 17th century, have led to several environmental issues. To ensure a healthy future, people must take responsibility for and exercise the appropriate care in protecting the environment, which interacts with living things.

Education is the most significant strategy for raising environmental sensitivity among people. Environmental education is educating people on environmental concerns, so they know the biological environment and its problems and take action to jointly solve them (Stapp et al. 1969). It can be defined as ensuring the active participation of all segments of society in solving problems and protecting natural, historical, cultural, and socio-aesthetic values (Alım, 2006). This is accomplished by increasing environmental awareness among individuals and society. The 1977 International Conference on Environmental Education was a significant turning point in environmental education.

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Environmental problems' causes have been studied, and the significance of increasing public knowledge of them has been underlined (Fensham, 1978; Yalçınkaya, 2012). The definition of environmental education that was emphasized at the Tbilisi Conference is currently the definition that is most frequently recognized. Environmental education is defined as "a learning process that increases individuals' knowledge and awareness about environmental problems, develops the skills necessary to evaluate problems, and encourages attitudes, motivation, and responsibility to take responsible actions and make informed decisions," as emphasized in the Tbilisi Conference (Kışoglu, 2009).

The main objective of environmental education is to increase the environmental literacy levels of citizens. Environmental literacy is shown as the most effective way to cope with environmental problems (Akıllı & Genç, 2015; Kıyıcı, Yiğit & Darçın, 2014). According to Roth (1992), who first defined the concept of environmental literacy, environmental literacy is the ability of an individual to express what he knows about the environment in which he lives as behavior. According to another definition, environmental literacy is defined as the whole process of making decisions about the environment in which a person lives and transforming these decisions into behavior (Şahin, Ünlü, & Ünlü, 2016; Roth, 1992). In several studies, various aspects of environmental literacy are highlighted.

In a study conducted by Atılgan, Coşkan, Saltuk and Erkan (2007) on the use of chemical and organic fertilizers in greenhouses by farmers in the Antalya region, it was found that 48% of the 123 farmers participating in the study were only primary school graduates and most of these farmers used chemical and organic fertilizers without having soil analysis. It was also found that the higher the level of education, the less chemical pesticides and fertilizers were used. It was also found that producers are typically concerned only with production volume when fertilizing, and do not care about the efficiency of fertilization and therefore do not consider environmental issues.

In order for environmental education, which is provided to improve the environmental literacy levels of individuals, to achieve its goal, the dimensions that make up environmental literacy should be clearly determined. In order for an individual to be labeled as environmentally literate, he/she must have all the components of environmental literacy. According to Roth (1992), environmental literacy consists of four components: (i) knowledge, (ii) attitude, (iii) value and (iv) behavior.

Turkey's secondary and higher education systems do not offer enough environmental education courses. The environmental education course is offered as an elective and has a set number, of course, hours in educational institutions that offer it (Uzun & Sağlam, 2007). The only way to raise environmentally conscientious people and environmental literates who apply what they learn about the environment to their conduct is to provide them with a high-quality environmental education. The fact that individuals who receive environmental education are environmentally literate by improving their knowledge, attitudes, and behaviors towards the environment; thus, coping with environmental problems effectively reveals the importance of raising environmental literacy. Studies on environmental education in Turkey have increased since 2008, and investigations are mostly carried out with teachers and teacher candidates (Kahyaoğlu, 2016; Timur, Yılmaz & Timur, 2014; Sönmez, Hastürk & Ballıel-Ünal, 2022). Studies with adult individuals are seriously scarce (Sönmez, Hastürk & Ballıel-Ünal, 2022).

However, environmental education does not only concern teachers and teacher candidates. Environmental education is necessary for everyone to live harmoniously with society and nature. Because every individual has a responsibility toward the environment. For this reason, the importance of environmental education is increasing, especially for professions related to the environment and architecture. These occupational groups are professions that are directly related to the environment, such as environmental engineering, agricultural engineering, architecture, and civil engineering (Plant Magazine, 2015). However, there is no study in the literature that identifies the environmental literacy levels of environmental professions.

The purpose of this study is to compare the environmental literacy of chemistry teacher candidates, chemistry teachers, and individuals in environmental-related professions in terms of knowledge, attitude, use, and concern. It also seeks to understand the impact of gender and

professional experience on teachers and participants in environmental-related professions' environmental literacy. The results of this study can be used to design education programs for those who will teach others about environmental issues, and those who will make environmental decisions since the majority of research utilized to evaluate the levels of environmental literacy among K–12 students, teachers, and teacher candidates. Studies that determine the environmental literacy levels of adults have not been encountered frequently (Morrone, Mancl, & Carr, 2001). A scale to measure environmental literacy levels in adults was established in Turkey by Atabek-Yiğit, Köklükaya, Yavuz, and Demirhan (2014); nevertheless, the scale was also applied to university students in other research. It is believed that this study, which evaluated the degree of environmental literacy among individuals in the environmental-related professions, would contribute to the field. For this reason, it is thought that this study, which determines the environmental literacy levels of individuals in environmental-related professions, will contribute to the field.

METHOD

In this study, survey design, one of the types of quantitative research, was used. Survey research is the research in which participants' opinions about a subject or event are taken, or their characteristics such as interests, skills, abilities, and attitudes are determined. They are generally carried out on relatively larger samples compared to other studies (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2009, p.231).

Study Group

The study's sample included (i) chemistry teacher candidates enrolled in education programs (n = 91), (ii) chemistry teachers (n = 390), and (iii) environmentally related professions (n = 312). In total, 793 individuals participated. Employees in the following professions are included in the group: city planners (n=70), environmental engineers (n=66), architects (n=54), civil engineers (n=34), geological engineers (n=22), surveyors (n=18), agricultural engineers (n=14), chemical engineers (n=12), petroleum engineers (n=4), mining engineers (n=3), forest engineers (n=1), biologists (n=10), and geophysical engineers (n=4).

81% of pre-service teachers, 75% of teachers and 59% of professional groups are women. In total, 553 women took part in the study. 16.5% of the teacher candidates were in the first grade, 22.0% were in the second grade, 33% were 3rd-grade students, and 28.5% were 4th-grade students. The teachers participating in the research and the participants in the occupational group were grouped according to their professional experience. According to their professional experience, the participants were divided into three groups those with a maximum of 4 years of experience, those with 4-8 years of experience, and those with at least eight years of experience. 58.5% of chemistry teachers and 85.6% of participants working in occupational groups related to the environment have at least nine years of experience.

Data Collection Tool

This study was used the Environmental Literacy Scale at Michigan State University (MSU-WATER, 2001-2006) and was adapted into Turkish by Teksöz, Şahin, and Ertepınar (2010). For the use of the Turkish version of the scale, the scale was obtained from the authors with the mission. The scale consists of four components: environmental knowledge, environmental attitude, environmental use, and environmental concern. The environmental knowledge component of the scale is aimed to determine the environmental knowledge levels of the participants. There are 11 multiple-choice questions in this component. One point was given for correct answers and 0 points for incorrect answers. In the environmental attitude component, there are nine questions in a 5-point Likert type from "strongly agree" to "strongly disagree" This component is aimed to determine the perceptions of the participants toward the environment. There are 19 questions in the environmental use component. This component, it aimed to reveal the environmental awareness and behaviors of the participants. As in the attitude component, there are 5-point Likert-type questions from "strongly agree" to "strongly disagree" in the use component. Nine questions were included in the environmental concern

component in the final component of environmental literacy. This component is aimed to determine the sensitivities of the participants toward environmental issues and problems. The interest component is a Likert-type scale consisting of "I am very interested", "I am interested", "I am somewhat interested", "I am not interested", and "I am not at all interested". During the evaluation of Likert-type questions, the highest 5 points for positive statements and the lowest 1 point for negative statements were evaluated.

This scale is aimed to determine the environmental literacy levels of chemistry teacher candidates, chemistry teachers, and occupational groups related to the environment under four main headings: environmental knowledge, environmental uses, attitude, and concern towards the environment. After the scale was applied to the participant group, the internal consistency coefficient was calculated, and 0.78 for environmental knowledge; 0.65 for environmental attitude, 0.76 for environmental use, and 0.73 for environmental concern were found. It was decided that the internal consistency coefficients obtained were at an acceptable level for the continuation of the research.

Data Analysis

Since the scale used consists of Likert- type questions (ordinal data), non-parametric statistical tests should be used even if the data show normal distribution during the analysis. In addition, it is more appropriate to use median and mode instead of mean in data analysis during descriptive statistics (Turan, Şimşek, & Aslan, 2015). For this purpose, in the statistical evaluation of the data, the median values were given in addition to the mean, and non-parametric statistical analyzes were used during the analyses. IBM SPSS 26.0 (Statistical Package for Social Science for Personal Computers) program was used for statistical analysis. Kruskal Wallis H-Test and Mann Whitney U-tests were used to determining the significant differences between environmental literacy components and the factors affecting environmental literacy. Assumptions were checked for analysis.

FINDINGS

The findings of the study are presented under two headings: (i) environmental literacy of the participants (considering its sub-components and total score), and (ii) determining the variables that may affect the environmental literacy of the participants.

Determination of Environmental Literacy Level of Participants

To determine whether there is a difference between the environmental literacy of chemistry teacher candidates, chemistry teachers, and environmental-related professions, the mean scores of the four components of the environmental literacy scale and the groups were statistically compared. Table 1 provides the descriptive statistics values for the participants' total score and the component of the environmental literacy scale.

Table 1. Descriptive Statistics Test Results for the Environmental Literacy Scale

Component	Participants	N	Mean	Median	Standard Deviation	Min.	Max.	Kolmg. Smirnov
Environmental knowledge	Teacher candidates	91	6.297	6.0	1.623	2.0	9.0	.000
	Teachers	390	7.318	7.0	1.696	2.0	11.0	.000
	Environmental-related professions	312	7.821	8.0	1.594	2.0	11.0	.000
Environmental attitude	Teacher candidates	91	36.220	36.0	3.105	28.0	41.0	.006
	Teachers	390	35.803	37.0	5.226	19.0	45.0	.000
	Environmental-related professions	312	35.520	36.0	4.340	17.0	45.0	.000
Environmental use	Teacher candidates	91	77.363	77.0	6.288	61.0	91.0	.200
	Teachers	390	76.782	79.0	11.001	34.0	95.0	.000
	Environmental-related professions	312	77.795	77.0	6.563	54.0	94.0	.018
Environmental concern	Teacher candidates	91	35.8132	36.0	4.5312	26.0	45.0	.000
	Teachers	390	37.2846	39.0	7.3403	9.0	45.0	.000
	Environmental-related professions	312	36.9551	38.0	6.9095	9.0	45.0	.000
Environmental literacy total score	Teacher candidates	91	155.692	156.00	10.443	135.0	183.0	.200
	Teachers	390	157.187	161.00	19.323	75.0	190.0	.000
	Environmental-related professions	312	158.090	158.00	12.660	118.0	184.0	.009

In Table 1, participants' environmental knowledge mean scores were below 8. According to NEETF/Roper's (2005) grading scale, participants have an inadequate level of environmental knowledge since the means were less than 8. The lowest score of the environmental attitude component could be 9 and the highest score could be 45. According to the results, the mean scores of groups were above 35 points, indicating that all groups have a positive attitude toward the environment. The lowest score of the environmental use component could be 19, and the highest score could be 95. The mean scores of groups were higher than 76, indicating groups are aware of their responsibilities to the environment. The concern component consists of 9 items. The lowest score could be 9, and the highest score could be 45. The mean scores of groups were higher than 35 concerned about environmental problems and issues. Finally, the environmental literacy scale's lowest score could be 37, and the highest score could be 196. According to Table 1, participants' environmental literacy total mean scores were higher than 155, indicating groups have adequate environmental literacy. Environmental literacy total mean scores of environmental-related profession participants were the highest.

Table 2. Kruskal Wallis H-Test Results of Environmental Literacy Test Scores

Component	Participants	N	Mean Rank	df	X^2	p	Significance (Mann-Whitney U Test)
Environmental knowledge	Teacher candidates	91	256.81	2	57.97	.000	Environmental-related professions >Teacher candidates Environmental-related professions >Teachers Teachers> Teacher Candidates
	Teachers	390	382.69				
	Environmentally related professions	312	455.77				
Environmental attitude	Teacher candidates	91	409.50	2	5.339	.069	
	Teachers	390	412.67				
	Environmental-related professions	312	373.77				
Environmental use	Teacher candidates	91	371.57	2	2.413	.299	
	Teachers	390	408.56				
	Environmental-related professions	312	389.97				
Environmental concern	Teacher candidates	91	314.55	2	15.562	.000	Environmental-related professions >Teacher candidates Teachers> Teacher Candidates
	Teachers	390	418.90				
	Environmental-related professions	312	393.67				
Environmental literacy total score	Teacher candidates	91	334.95	2	9.572	.008	Teachers> Teacher Candidates
	Teachers	390	416.04				
	Environmental-related professions	312	391.30				

According to Table 2, for participants' environmental knowledge component ([$X^2(2)=57.97$; $p< .05$]), environmental concern component ([$X^2(2)=15.562$; $p< .05$]), and environmental literacy total score ([$X^2(2)=9.572$; $p< .05$]), a statistically significant difference was determined between the participant groups. Mann Whitney U test was used to determine which group favored the significant difference between the groups. The pairwise combinations of the groups were used to assess the difference. According to the Mann-Whitney U Test results of the environmental knowledge component scores, it was determined that the environmental knowledge level of the environment-related professional groups was higher than the chemistry teacher candidates, and chemistry teachers, and the knowledge level of chemistry teachers was higher than the chemistry teacher candidates, and the differences were statistically significant. In addition, it was determined that the level of concern for environmental problems of chemistry teachers and environment-related professional groups was higher than that of chemistry teacher candidates and the difference was statistically significant. When the total scores on the environmental literacy scale were compared, it was found that chemistry teachers had higher levels of environmental literacy than chemistry teacher candidates and that this difference was statistically significant in their favor.

Identification of variables that may affect environmental literacy

Another aim of the research is to determine the effect of gender and professional experience on environmental literacy scores. For this purpose, without considering the groups, the descriptive

statistical data of the environmental literacy sub-components and the total score of the participants according to gender are given in Table 3.

Table 3. Descriptive Statistics of Participants' Environmental Literacy Component Scores by Gender

Component/	Gender	N	Mean	Median	SD	Min.	Max.	Kolmg. Smirnov
Environmental knowledge	Men	240	7.333	8.00	1.635	3.0	11.0	.000
	Women	53	7.427	7.00	1.741	2.0	11.0	.000
Environmental attitude	Men	240	35.017	35.00	5.244	17.0	45.0	.000
	Women	553	36.052	37.00	4.389	19.0	45.0	.000
Environmental use	Men	240	76.642	77.00	8.471	35.0	95.0	.000
	Women	553	77.510	78.00	9.221	34.0	94.0	.000
Environmental concern	Men	240	36.796	37.00	7.128	9.0	45.0	.000
	Women	553	37.069	38.00	6.818	9.0	45.0	.000
Environmental literacy total score	Men	240	155.788	157.0	15.569	106.0	190.0	.000
	Women	553	158.058	160.0	16.293	75.0	189.0	.000

Table 3 shows that the participant's environmental literacy total scores vary depending on the participant's gender. The Mann-Whitney U Test, a nonparametric analysis technique, was used to compare the mean scores of environmental literacy components, and the test results are shown in Table 4.

Table 4. Kruskal Wallis H-Test Results of Environmental Literacy Components Test Scores by Gender

Component	Gender	N	Mean Rank	Sum of Rank	U	p
Environmental knowledge	Men	240	389.26	93423.50	64503.50	.524
	Women	553	400.36	221397.50		
Environmental attitude	Men	240	360.27	86465.50	57545.50	.003
	Women	553	412.94	228355.50		
Environmental use	Men	240	373.14	89553.00	60633.00	.053
	Women	553	407.36	225268.00		
Environmental concern	Men	240	390.69	93766.50	64846.50	.608
	Women	553	399.74	221054.50		
Environmental literacy total score	Men	240	365.98	87835.00	58915.00	.012
	Women	553	410.46	226986.00		

Table 4 shows the outcomes of the U-Test, which was conducted to see whether there was a gender difference in the participants' scores for environmental literacy and its sub-components. According to Table 4, there were significant differences between the scores for the environmental attitude component (U=57545.50; p.05) test and their total scores (U=58915.00; p.05]) according to gender. When the mean rank is examined, it is seen that this significant difference is in favor of women in both score types. However, environmental knowledge component U=64503.50; p> .05]), use component ([U=60633; p> .05]) and interest component (U=.64846.50; p> .05]) do not differ significantly according to gender.

Professional experience is another factor in which the study examined the impact of environmental literacy. The participants' professional experience is divided into 0-4 years, 5-8 years, and nine years. But because there were only five participants in the 0–4 year category of the

environmental-related professions, the analysis was conducted by combining that category with the 5-8 year category. The descriptive statistics data of the participants' environmental literacy and sub-component scores are given in Table 5.

Table 5. Descriptive Statistics of Participants' Environmental Literacy Component Scores by Professional Experience

Component		Experience	N	Mean	Median	SD	Min.	Max.	Kolm. Smirn.
Teachers	Environmental knowledge	0-4 years	71	6.74	7.00	1.60	2.0	10.0	.005
		5-8 years	91	7.64	8.00	1.66	3.0	11.0	.000
		9 and more	228	7.36	7.00	1.70	3.0	11.0	.000
	Environmental attitude	0-4 years	71	35.79	36.00	3.93	21.0	41.0	.023
		5-8 years	91	35.23	36.00	5.44	19.0	45.0	.000
		9 and more	228	36.04	37.00	5.49	19.0	45.0	.000
	Environmental use	0-4 years	71	76.42	77.00	8.83	37.0	91.0	.001
		5-8 years	91	75.33	78.00	11.52	34.0	91.0	.000
		9 and more	228	77.47	80.00	11.37	35.0	95.0	.000
	Environmental concern	0-4 years	71	36.34	38.00	7.17	17.0	45.0	.000
		5-8 years	91	35.27	36.00	7.46	13.0	45.0	.000
		9 and more	228	38.38	40.00	7.16	9.0	45.0	.000
	Environmental literacy total score	0-4 years	71	155.30	240.33	15.50	81.0	179.0	.001
		5-8 years	91	153.48	158.00	19.18	77.0	182.0	.000
		9 and more	228	159.25	163.00	20.23	75.0	190.0	.000
Environmental-related professions	Environmental knowledge	0-8 years	45	7.78	8.00	2.27	4.0	11.0	.002
		9 and more	267	7.83	8.00	1.61	2.0	11.0	.000
	Environmental attitude	0-8 years	45	36.18	36.00	3.84	22.0	43.0	.185
		9 and more	267	35.41	35.00	4.14	17.0	45.0	.000
	Environmental use	0-8 years	45	78.15	77.00	6.53	61.0	91.0	.200
		9 and more	267	77.74	77.00	6.58	54.0	94.0	.200
	Environmental concern	0-8 years	45	35.47	37.00	7.17	12.0	45.0	.027
		9 and more	267	37.21	38.00	6.85	9.0	45.0	.000
	Environmental literacy total score	0-8 years	45	157.53	157.00	12.71	120.0	180.0	.200
		9 and more	667	158.18	159.00	12.67	118.0	184.0	.030

The Kruskal Wallis H-Test and Mann-Whitney U test, which are nonparametric analysis methods, were used to determine the impact of professional experience on environmental literacy scores and sub-components of chemistry teachers and occupational groups related to the environment. The analysis results are shown in Table 6.

Table 6. Environmental Literacy Components Test Scores of Participants by Professional Experience

Component		Experience	N	Mean Rank	df	X^2	p	Significance (Mann-Whitney U Test)
Teachers	Environmental knowledge	0-4 years	71	158.54	2	11.189	.004	9 and more > 0-4 years; 5-8 years > 0-4 years
		5-8 years	91	216.03				
		9 and more	228	198.82				
	Environmental attitude	0-4 years	71	186.50	2	2.635	.268	
		5-8 years	91	183.14				
		9 and more	228	203.23				
	Environmental use	0-4 years	71	179.14	2	6.372	.041	9 and more > 5-8 years
		5-8 years	91	177.87				
		9 and more	228	207.63				
	Environmental concern	0-4 years	71	177.32	2	20.610	.000	9 and more > 5-8 years; 9 and more > 0-4 years
		5-8 years	91	156.99				
		9 and more	228	216.53				
	Environmental literacy total score	0-4 years	71	169.51	2	16.162	.000	9 and more > 5-8 years; 9 and more > 0-4 years
		5-8 years	91	167.35				
		9 and more	228	214.83				
Environmental-related professions	Environmental knowledge	0-8 years	45	152.63	1	.101	.750	-
		9 and more	267	157.15				
	Environmental attitude	0-8 years	45	172.76	1	1.719	.190	-
		9 and more	267	153.76				
	Environmental use	0-8 years	45	160.61	1	.109	.741	-
		9 and more	267	155.81				
	Environmental concern	0-8 years	45	135.93	1	2.759	.097	-
		9 and more	267	159.97				
	Environmental literacy total score	0-8 years	45	152.04	1	.128	.720	-
		9 and more	267	157.25				

The Kruskal Wallis and U-Test results, which were conducted to determine whether the scores of the participants' environmental literacy and its sub-components differ according to professional experience, are given in Table 6. According to Table 6, it was determined that environmental literacy components and total scores of environmental-related professions did not differ significantly according to professional experience. However, it was determined that there was a statistically significant difference between the environmental knowledge component scores of chemistry teachers ([$X^2(2)=11.189$; $p< .05$]). According to the results of the Mann-Whitney, which was conducted to determine which group this difference favors, it is seen that the group with 9 years or more and 5-8 years of professional experience differs from the group with 0-4 years of experience. Similar to this, participants with 9 or more years of experience perform statistically considerably better on the environmental use component test than those with 5-8 years of experience ([$X^2(2)=6.372$; $p< .05$]). Finally, the environmental concern component and environmental literacy total test scores also differ statistically significantly in favor of those with 9 or more years of professional experience from those with 5-8 years and 0-4 years of experience (respectively, [$X^2(2))=20.610$; $p< .05$]; [$X^2(2) =16.162$; $p< .05$]).

CONCLUSION

This study aims to determine the environmental literacy levels of pre-service chemistry teachers, chemistry teachers, and environmental professionals, and the effects of gender and professional experience factors on environmental literacy.

The study's conclusions demonstrated that although the three participant groups' environmental knowledge was lacking, their environmental attitudes, use, and concern were all-sufficient. These findings are consistent with the results of studies conducted with teachers and teacher candidates (Derman & Hacıeminoğlu, 2017; Kışoğlu, 2009; Fettahlıoğlu, 2018). For instance, in the study conducted by Derman and Hacıeminoğlu (2017) with elementary teachers, it was determined that the teachers were good in the environmental concern and environmental use components, at a medium level in the environmental attitude component, and a low level in the environmental knowledge component. In the study of pre-service science teachers, Fettahlıoğlu (2018) found that while their environmental knowledge was lacking, their attitudes toward the environment were moderate. It is crucial for people to be adequately informed about the environment. Because the level of knowledge of individuals about environmental issues and environmental problems positively affects their attitudes, interest, and use levels toward the environment (Dillon & Gayford, 1997; Fettahlıoğlu, 2018; Teksöz et al. 2010). Attitude towards the environment is the whole of the beliefs and thoughts of individuals against the situations and problems related to the environment (Bogner & Wiseman, 2006). There is a positive relationship between environmental knowledge and attitude towards the environment (Koç & Karatekin, 2013).

The mean scores of the environmental literacy components of the participant groups are different from each other. According to the findings of the analysis performed to determine whether the difference between the groups is statistically significant, it was found that the test scores of the environmental-related professions in terms of the environmental knowledge component differed from the chemistry teachers and chemistry teacher candidates in a statistically significant way in favor of the professionals. It is thought that the differentiation of environmental literacy knowledge levels of environmental-related professions from other groups is an important factor, as well as having professional experience in this field, in addition to graduating from an environmental-related undergraduate department. It can be thought that they differ from other groups because they learned information about environmental issues by doing and living in their professional life as well as the education given during their undergraduate education. Koç, Çorapçıgil, and Doğru (2018) found that undergraduate courses affect environmental literacy in their study with pre-service teachers. Similarly, Liu, Teng, and Han (2020) state that action-oriented education can be more effective than traditional environmental education in schools. In addition, chemistry teachers' knowledge test scores are also statistically significantly higher than teacher candidates. It is believed that because chemistry teachers teach environmental subjects or give lectures on them, their degree of environmental knowledge is higher than that of teacher candidates.

It is seen that the scores of the chemistry teacher candidates, chemistry teachers and environmental-related professions related to the environment do not differ in the scores of the sub-components of environmental literacy, attitude, and use. It is interesting that the environmental knowledge component of the professionals with the highest mean scores did not show any significant differences in the professionals' attitudes toward the environment, despite the fact that there was no significant difference between the research groups. Even if participants in environmental-related professions have different degrees of environmental knowledge than the rest of the group, it is essential to emphasize that environmental attitudes and environmental use components are the same for all participants. This result means that individuals in professional groups related to the environment have knowledge about environmental issues, but unlike other participants, they do not have a positive attitude and behavior towards the environment. These professionals are expected to have favorable attitudes and behaviors towards the environment. Liu et al. (2020)'s study with 2824 adults revealed that environmental information has a statistically significant and positive effect on

attitude towards the environment, attitude towards the environment, and behavior towards the environment. This result can be supported by other studies in the literature (e.g., Casaló, Escario & Rodriguez Sanchez, 2019) but contradicts the result of our research. The mean score of the chemistry teachers is greater than that of the other research groups when the total environmental literacy scores are included. According to the results of the analysis, it was understood that the difference between the environmental literacy levels of chemistry teachers and chemistry teacher candidates was significant and this difference was in favor of chemistry teachers. However, the environmental literacy total scores of the environment-related professions do not differ from other groups. When all of the research's findings are considered, the following interesting finding becomes apparent: Considering the components of the environmental literacy scale and the total score, it was determined that while the participants of the environment-related profession group were expected to be more successful than the other groups, they showed a significant difference only in terms of the knowledge component. It is expected that environmental literacy components and total scores will be very high in terms of the undergraduate education they have received in terms of their professions and their professional qualifications. In the study conducted by Teksöz et al., (2010), it was emphasized that the components of environmental literacy could not be considered independently of each other. According to the study, it has been emphasized that the relationship between environmental knowledge and attitude towards the environment is positive, the level of knowledge will increase with the increase in the importance given to environmental education in higher education, and the levels of the components of attitude, use, and interest in environmental problems will also increase. However, the results obtained from this study do not agree with the results of the mentioned study. This situation can be interpreted as the environmental-related professions having environmental knowledge. Still, they do not use this knowledge in a way that creates a meaningful difference in the recognition and solution of environmental problems compared to other groups. In addition, the knowledge component score average of the occupational group related to the environment is not at a sufficient level according to NEETF/Roper (2005). For this reason, the mean scores of the other components did not differ statistically significantly compared to the other groups.

When all research participants, regardless of the study group, are examined, the levels of the environmental attitude component and the environmental literacy total score differ significantly in favor of women according to gender, in contrast to the levels of the knowledge, use, and interest sub-components, which do not differ. The study determined that the significant differences according to gender were in favor of women. There are numerous studies in the literature that claim that women have more positive attitudes regarding the environment (Arık & Yılmaz, 2017; Atasoy & Ertürk, 2008; Bozkurt, 2011; Büyükkaynak & Aslan, 2019; Çimen & Benzer, 2019; Gökmen, 2008; Küçükbaş- Duman & Yurtseven, 2022; Mercan, 2013). In the study conducted by Atasoy and Ertürk (2008), it was found that students' environmental knowledge and environmental attitude scores differed significantly in favor of women. The study conducted by Arık and Yılmaz (2017) with pre-service science teachers determined that female teachers had higher attitudes towards the environment. According to the results of the study conducted by Büyükkaynak and Aslan (2019) with 190 teacher candidates, women's attitudes towards the environment are higher. It is thought that the reason why women's attitudes towards the environment are higher is due to the affective characteristics of women. Büyükkaynak and Aslan (2019) and Çimen and Benzer (2019) also stated that this difference might be due to the fact that women are more sensitive. Gökçe & Sarıyar (2019, in their studies investigating the reason for the differentiation of the attitude towards the environment in favor of women, explain the difference in gender roles, women's having more sensory characteristics, and the physiological characteristics and hormones of women and men.

Professional experience was another factor whose impact on environmental literacy was examined in the study. The study's findings show no difference between the occupational groups despite the fact that teachers' environmental literacy levels rise with their professional experience. In a study by Uyar & Temiz, (2019) in which environmental literacy levels of elementary teachers were determined, it was found that teachers with 16 years and more service years had higher

environmental literacy levels than teachers with 0-5 years, 6-10 years and 11-15 years of service. Similarly, Erkol and Erbasan (2018) determined that teachers with 21 years or more of professional experience have significantly higher environmental self-efficacy than those with 0-5 years of professional experience. It is thought that the fact that senior teachers attend more classes on environmental issues over time, and read or hear something about environmental issues through various media organs affects their environmental literacy levels.

The fact that there is no significant difference in the environment-related professions according to professional experience is a situation that needs to be investigated. A high level of environmental literacy means individuals are aware of environmental problems. Carrying out environmental training at all levels of education and in every occupational group is an important step toward solving environmental problems.

According to the research results, it is thought-provoking that the environmental literacy levels of the participants who have received training and are in the profession, who can be considered experts in environmental issues, do not differ from other groups. As researchers, we think that the reason for this is the fact that the participants of this group are from different sub-professional groups (such as engineers, architects, and city planners ...), the differences in the education received at the undergraduate level and the areas of specialization in the profession affect the average scores of the group. For this reason, we think that studies involving different sub-professional groups and comparing these groups among themselves will yield more meaningful and explanatory results, and researchers are recommended to conduct such studies.

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