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Article

A Measurement of Environmental Literacy of Nursing Students for Sustainable Environment

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Abstract: Environmental literate citizenship is a lifelong learning process that aims to develop citizens who have the knowledge, skills, and commitment to make responsible decisions that will affect the quality of the environment. The purpose of the present study was to evaluate the environmental literacy levels of nursing students in terms of sustainable environmental by considering the dimensions of environmental literacy. It was also aimed at understanding the correlation among dimensions of environmental literacy and revealing the factors affecting the dimensions of environmental literacy. This research was designed as a descriptive study in the survey model. A total of 278 nursing students participated in this research. It was revealed that students obtained a high score for use and concern from the dimensions of environmental literacy, their attitudes towards the environment were moderate; however, nursing students took the lowest points for the environmental knowledge component, which indicates that students need support in environmental knowledge. It was put forward that there were statistically significant differences based on gender and taking environmental related courses with dimensions of environmental literacy. All dimensions of environmental literacy were found to be positively correlated with each other, ranging from low to moderate relations.

Keywords: environmental literacy; sustainable environment; nursing students

1. Introduction

The concept of environmental literacy was first used by Charles E. Roth in 1968 [1]. Environmental literacy was defined as an individual's level of environmental knowledge and awareness [2] (p.13). Charles E. Roth expanded his first definition of environmental literacy in 1992 and reported that environmental literacy should also include observable behaviors [3] (p.10). At this point, Roth emphasizes the necessity of developing skills in problem solving, planning, and cooperation, apart from the knowledge, behavior, and sensitivity necessary for literacy, and the importance of education for the environment [4]. According to Orr, an environmentally literate individual knows the effect of science, technology, culture, and agricultural activities on the functioning of natural systems and takes sound environmental decisions that will provide the sustainability of the environment [5].

Environmental literate citizenship is a lifelong learning process that aims to develop citizens who have the knowledge, skills, and commitment to make responsible decisions that will affect the quality of the environment [6]. An environmental literate individual is conscious, sensitive, and morally mature and will not contribute to the deterioration of his/her environment [7].

Environmental education and the development of environmental values in higher education institutions are some of the topics that have been discussed intensively [8,9,10,11]. University students are expected to take an active role in social and professional life after graduation because one of their important roles is to carry the knowledge, skills, attitudes, and values they gained during their university education to their professional and personal lives and environments. Therefore, one of the goals of

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universities is to enable all students to become environmental literate regardless of their field. The first step to achieve this goal is to find the current environmental literacy levels of university students. The development of this phenomenon is an important step for future generations to live on a healthier and more sustainable planet [12]. Higher Education for Sustainable Development has been encouraged by UNESCO through different programs [13] and currently with Agenda 2030 [14].

Studies have been carried out to determine the level of environmental literacy in various universities around the world [15,16,17,18,19,9,20,21,10,22]. The results of these studies stated that the environmental knowledge level of university students was low. The results of the research carried out at different levels of formal education in Turkey, it was found that students' environmental knowledge levels were low [23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41].

The Environmental Literacy Project carried out in Canada produced material for all teachers, based on the fact that environmental issues are an interdisciplinary subject and students need to be environment literate regardless of their field of study [8]. Thomas and Nicita emphasized that research should be carried out with the aim of determining environmental literacy, and in this way, the effectiveness of environmental and sustainable development education in universities should be determined [42].

Universities are leaders in the development of forms of education to design solutions to problems associated with sustainable development [43]. Kirk reported that nursing students receive insufficient training to understand the links between the environment, sustainability, and health [44]. Therefore, pedagogical strategies are required to break the current education gap and include environmental sustainability for the nursing degree [43].

The concept of sustainable development is fundamental to health systems and it is necessary for nurses to know the terms of sustainability and the environment and their relationship to human health and well-being [45,46]. The nursing group is a change agent with the capacity to improve health and control the use of health resources; therefore, knowledge and skills on sustainability in the nursing profession and the effects of environmental issues will make it possible to change attitudes and forms of action in their daily work, which will improve people's health [43,47].

As it can be seen from the results of the studies above, although there are many studies on environmental literacy in various universities around the world, this research is planned to be conducted since there are very few studies on the environment in the field of nursing.

In of this information, to find the environmental literacy levels of nursing students studying at the faculty of nursing in terms of sustainable environment by considering the four main dimensions of environmental literacy (knowledge, attitude, use, and concern); the investigation of whether the environmental literacy levels change depending on selected variables (gender and having environment related courses) and determining the correlations among the dimensions of environmental literacy (EL) constitutes the problem of this research.

2. Purpose of the Study

The purpose of the present research was to evaluate the environmental literacy levels of nursing students studying at the faculty of nursing in terms of a sustainable environment by considering the four main dimensions of environmental literacy (environmental knowledge, environmental attitude, environmental use, and environmental concern). The present study also aimed to understand the correlation among the four components of environmental literacy and to reveal the factors affecting the four dimensions of environmental literacy. Responses were sought to the following questions within the scope of this purpose:

1. What is the level of four dimensions of environmental literacy among nursing students studying at the Faculty of Nursing? (environmental knowledge,

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environmental attitudes, environmental uses, concern toward environmental problems)

2. 2Is there any correlation among the four dimensions of EL of nursing students studying at the Faculty of Nursing?

(a) Is there any correlation between nursing students' EL dimensions of knowledge and attitude?

(b) Is there any correlation between nursing students' EL dimensions of knowledge and use?

(c) Is there any correlation between their EL dimensions of knowledge and concern?

(d) Is there any correlation between their EL dimensions of attitude and use?

(e) Is there any correlation between their EL dimensions of attitude and concern?

(f) Is there any correlation between their EL dimensions of use and concern?

3. Does the level of environmental literacy for four dimensions scores differ?

(a) based on their gender?

(b) based on their environment related courses taken?

3. Materials and Methods

3.1. Model of Study

This research is a descriptive study in the survey model [48,49]. Survey research is a study that aims to collect data to identify certain characteristics of a group [50,51].

3.2. Population and Sample

The population of the research comprises of nursing students studying at the Faculty of Nursing of University of Akdeniz in Antalya, Turkey in the fall term of the 2021-2022 academic year (1st Grade= 238, 2nd Grade= 232, 3rd Grade=245, 4th Grade: 285; Total = 1000 nursing students).

The sample of the study consists of a sum of 278 students who have the power to represent the universe, based on the 5% deviation amount for the 95% confidence interval [50,52]. The ratio of each class to the total in terms of the number of students was found and a sample was taken from each class at this rate. The simple random sampling method was performed to determine the sample for this research [50] (pp. 85-86). Before the questionnaire forms were distributed, the students were declared about the aim of the research, the implementation period of the questionnaire, and the questionnaire form, and then, they were asked to fill in the questionnaire forms on a voluntary basis.

The implementations were performed by the researcher between 13 October and 13 November, 2021. The process of filling out of questionnaire forms was carried out by face-to-face interview technique. A total of 278 completed questionnaire forms were returned (response rate = 100%) and analysed.

3.3. Data Collection Tool

The Environmental Literacy Questionnaire and the Personal Information Form were employed to determine the environmental literacy levels of nursing students. The personal information form performed in the current research was developed to reveal the socio-demographic characteristics of nursing students. It covers two categories: gender, and taking environmental related courses.

The Environmental Literacy Questionnaire (ELQ) was derived from part of the Michigan State University project and was originally used by Kaplowitz and Levine [9]. This questionnaire was translated and adapted into the Turkish language and applied by Tuncer et al. They found the Cronbach's alpha (internal consistency) coefficient for the knowledge, attitude, uses, and concern item sets to be 0.88, 0.64, 0.80, and 0.88, respectively [39]. Later, the Environmental Literacy Questionnaire was revised and used by Kahyaoğlu [53].

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In this study, the Environmental Literacy Questionnaire revised by Kahyaoğlu was used. The Environmental Literacy Questionnaire (ELQ) consists of four components; knowledge (11 items), attitude (12 items), uses (19 items), and concern (9 items). Kahyaoğlu found the Cronbach alpha values for the 4 components of the survey were as follows: knowledge, 0.88; attitude, 0.88; use, 0.70; and concern, 0.90 [53].

In the present study, the Cronbach's alpha coefficient was figured out for each component to examine the reliability of the measurements, which was found to be 0.702 for the component of knowledge, 0.706 for the component of attitude, 0.833 for the component of use, and 0.933 for the component of concern. Nunally stated that the coefficient for the reliability measurement needs to be ≥0.70 [54].

In the knowledge component of the Environmental Literacy Questionnaire was used multiple-choice questions. Each of the respond choice sets was designed to have one right respond.

The attitude dimension of the questionnaire is presented to participants who answer them using five point Likert–type scale ranging from 1 "strongly disagree" to 5 "strongly agree" (1= Strongly disagree, 2= disagree, 3= undecided, 4= agree, 5= Strongly agree).

Environmental use items measured participants' intentions to take part in pro-environmental behaviors [39]. The Use dimension of the questionnaire is presented to participants who answer them using five point Likert–type scale ranging from 1 "strongly disagree" to 5 "strongly agree".

Concern dimension is five point Likert-type scale ranging from "very concerned" to "not cocerned". Therefore, the maximum point of concern component was 45, and the minimum point was 9 [9]. The higher point means the higher the concern toward environmental problems.

3.4. Analysis of the Data

Data analysis was conducted using "Statistical Package for Social Sciences 21.0" (SPSS Inc., Chicago, IL, USA). Descriptive statistics such as frequencies and percentages were measured for the dimensions of environmental literacy, and for the items on demographic information. Moreover, means, medians, the minimum and maximum scores, and standard deviations were also evaluated for the components of environmental literacy. Shapiro-Wilk and Kolmogorov-Smirnov Tests were performed on the data in order to find out whether they were normally distributed. Since the groups were not normally distributed ($p<.05$) [55,56]. It was looked at the values of skewness and kurtosis. In a normal distribution, the values of the skewness and kurtosis are 0 [57]. In this study, the Skewness test value was -7.04, while the kurtosis test value was +2,19. Because the groups were not distributed normally, the non-parametric the Kruskal Wallis H test and Mann Whitney U test were performed to compare groups, correlation analysis (Spearman's rho correlation) was also performed.

3.5. Research ethics

In order to carry out the research, "Institution Permission" from the Faculty of Nursing of the University of Akdeniz, "Ethics Committee Permission" from the Clinical Research Ethics Committee of the Faculty of Medicine of the University of Akdeniz and both written and verbal consent were obtained from the nursing students who will participate in the research with the "Volunteer Informed Consent Form" on the basis of voluntariness. Permission was obtained from the author via e-mail for the Environmental Literacy Scale, which will be used in the collection of research data.

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4. Results

Table 1. Descriptive characteristics of the sample.

Variable	Group	n	%
Sex	Male	106	38.3
	Female	171	61.7
	Total	277	100.0
Taking an environmental education/environmental issues course during nursing students' education	Yes	35	12.6
	No	243	87.4
	Total	278	100.0

In Table 1, 61.7 % of the respondents in this research were female, while 38.30% were male. It is seen that 87.4% of the nursing students who participated in the research did not take environment related courses during their education, while 12.6% of them took environment related courses during their education.

The aggregate number of right answers for each nursing student was scored as either acceptable or unacceptable regarding the respondents' overall level of environmental knowledge, as has been done in previous studies [9,58]. NEETF/Roper calculated letter grades (e.g., A, B, C, and F) based on the percentage of participants' right responses finding that aggregate points of greater than 70% were passing or acceptable levels of environmental knowledge [58].

In Table 2, it can be said that only 7.2% of the nursing students have an acceptable level of environmental knowledge according to this classification. Another remarkable point is that 92.8% of the nursing students participating in this study did not get adequate scores from the knowledge component of the survey.

Table 2. Environmental knowledge levels of the nursing students.

Number of questions responded correctly	Point percentage range	Percent of participants per point	Grade	Adequacy of points
10 or more	90-100%	0.4	A	Adequate
9	89-80%	1.4	B	Adequate
8	79-70%	5.4	C	Adequate
7	69-60%	12.9	D	Inadequate
6 or fewer	59% or less	79.9	F	Inadequate

In Table 3, it is seen that the majority (74.5%) of nursing students answered correctly to question about biodiversity of environmental knowledge items. Moreover, more than half (58.6%) of the participants answered correctly to the question related to major sources of river and sea pollution and trees as renewable resource (56.5 %). Furthermore, less than half of the participants correct responded the questions concerning the extinction of animal species (48.2%), batteries as hazardous household waste (46.8%) and, Official institution in Turkey that takes decisions to conserve the environment is the Ministry of Environment, Urbanism and Climate Change (46.03%). A great majority of respondents gave false responds for items 5 (89.6 %) and 6 (79.1%) and 14 (79.1). The environmental knowledge items with the least correct responses (20.9%) were concerned about method for storing nuclear waste and electricity generation in Turkey. Nursing students' responses indicate that their level of environmental knowledge was low, given that all questions participants responded correctly to the question.

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Table 3. Nursing students' answers on environmental knowledge items about environmental matter.

Item Number	Item topic	Correct response	
		n	%
4	Biodiversity	261	75.0
5	Motor vehicles are the most important source of carbon monoxide	41	11.8
6	Electricity generation in Turkey - hydro power plants	75	21.6
7	As the main cause of river and sea pollution in Turkey untreated domestic, industrial and agricultural wastewater	208	59.8
8	Trees as a renewable resource	202	58.0
9	The protective effect of the ozone layer	104	29.9
10	Garbage in Turkey	119	34.2
11	The official institution in Turkey that takes decisions to protect the environment is the Ministry of Environment, Urbanism and Climate Change	161	46.3
12	Batteries as hazardous waste	165	47.4
13	Extinction of animal species	170	48.9
14	A method for storing nuclear waste	73	21.0

In Table 4, the "agree" and "strongly agree" options in this section were assessed together. A large majority of respondents (75.9%) agreed that mankind is seriously destroying nature, and 73.7% believe that humanity must live in harmony with nature in order to survive; 66.5% of nursing students agreed that there are growth limits beyond which industrialized society cannot expand; 63.7% of students agreed that we must develop a steady-state economy in which industrial growth is controlled in order to maintain a healthy economy. 56.1% of participants believe that the balance of nature is very delicate and easily disturbed, while 27.7% of them disagree have an opinion about the matter. 55.1% of them support that when people use nature, it often produces disastrous consequences, while 25.2% of them are undecided about the matter; while 48.6% of the nursing students agree that we are approaching the limit of the number of humans the earth can support, 22.7% of them are undecided about the matter.

While the expressions expressing negative opinions are taken into account, 60.7% of the nursing students didn't endorse the idea that human beings have the right to change the natural environment according to their needs. Moreover, 52.9% of them disagreed with the statement that the main purpose of man is to dominate nature; 55.4% of respondents disagreed that people need not conform to nature, because they can arrange nature according to their own needs "people were meant to rule over the rest of nature" and about 22.4% disagreed that plants and animals exist for the benefit of humans (Table 4).

Finally, nursing students expressed positive attitudes about the importance of the attitude dimension for environmental literacy. It seems that nursing students have a pro-ecology worldview.

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Table 4. Nursing students' answers on environmental attitude items about environmental matter.

Item Nb	Items	Strongly Disagree %	Disagree %	Undecided %	Agree %	Strongly Agree %	Means	SD
15	We are approaching the limit of the number of human the earth can support.	19.4	9.4	22.7	18.7	29.9	3.30	1.47
16	The balance of nature is very delicate and easily disturbed.	12.2	15.5	16.2	19.4	36.7	3.53	1.43
17	People have the right to modify the natural environment according to their needs.	40.6	20.1	18.0	12.2	9.0	2.29	1.34
18	The main purpose of mankid is to dominate nature.	39.6	13.3	21.2	13.7	12.2	2.46	1.43
19	When humans use nature, it often produces disastrous consequences.	6.8	12.9	25.2	25.2	29.9	3.58	1.23
20	Plants and animals exist for the benefit of humans.	11.2	11.2	25.2	24.5	28.1	3.47	1.31
21	To maintain a healthy economy we will need to develop a steady state economy in which industrial growth is controlled.	4.0	7.6	24.8	24.5	39.2	3.87	1.13
22	Mankid must live in harmony with nature in order to survive.	4.0	7.2	15.1	18.3	55.4	4.14	1.16
23	Earth has limited space and resources like a spaceship.	7.2	11.2	30.2	22.3	29.1	3.55	1.22
24	Humans need not conform to nature, because they can arrange nature according to their own needs.	37.8	17.6	21.6	9.4	13.7	2.44	1.42
25	There are limits to growth beyond which our industrialized society cannot expand.	4.3	7.9	21.2	23.7	42.8	3.93	1.16
26	Mankind is seriously destroying nature.	5.8	2.9	15.5	18.0	57.9	4.19	1.15

∗ negative-phrased items (17, 18, 20, 24)

In Table 5, this dimension measures nursing students' intention to participate in environmental use. The "Agree and strongly agree" and "strongly disagree and disagree" options in this section were evaluated together. Nursing students were asked to answer questions evaluating the use dimension of EL.

A great majority of nursing students agreed on the items related to the effect of changes in living habits (such as consumption) in solving environmental problems (76.2%); effect of public participation in solving environmental problems (71.9%); requirement of setting special fields for endangered species (71.6%); harms and benefits impact of technological changes for the environment (69.4%); all plants and animals play a significant role in nature (69.1%); requirement of laws on water quality should be stricter (68%); requirement of legislation to make recycling mandatory (67.7%); and awareness of responsibilities in resolving environmental problems (66.9%); importance of being aware of environmental problems (65.9%); role of science and technology in resolving environmental problems (65.5%); role of changes human value in resolving environmental problems (65.5%); and significance of feeling accountable for any harm human cause to the environment (64.7%); the government's role in arrangement the use of private areas for conservation of wildlife (64.0%) (Table 5).

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In Table 5, when negative items were examined, it was seemed that most of the respondents showed a concious and considerate approach to nature**.** Nursing students disagree and strongly disagree with 50.7 % that, poisonous snakes and insects should be killed as they pose a threat to people, while 25.9 % of them undecided have view about the issue; Moreover, less than half of the nusing students (45.7%) disagree and strongly disagree that laws on air pollution are strict enough, while 29.9% of the respondents undecided for this item. 41.9% of nursing students agree and strongly agree wich wild animals that ensure meat for humans are the most important species to be protected, while 35.6% of them were undecided for this item.

Therefore, it can be inferred as a result that, in the present study, nursing students tend to use natural sources in an accountable and preventive manner. They believe in the significance of personal accountabilities as well as governmental measures. As a result, it can be said that nursing students have an eco-centric worldview.

Table 5. Nursing students' answers on environmental use items about environmental matter.

Item Nb	Items	Strongly Disagree %	Disagree %	Undecided %	Agree %	Strongly Agree %	Mean	SD
27	Special fields should be reserved for endangered species	12.2	5.0	11.2	17.3	54.3	3.96	1.40
28	Water quality laws should be stricter.	6.5	8.6	16.9	22.3	45.7	3.92	1.25
29	Wild animals that supply meat for humans are the most significant species to be preserved.	7.9	15.5	35.6	16.5	24.5	3.34	1.23
30	Poisonous snakes and insects should be killed as they pose a threat to humans.	34.5	16.2	25.9	14.0	9.4	2.47	1.34
31	Landowners should be permitted to use their drain wetlands for agricultural and industrial purposes.	14.0	16.9	31.3	18.7	19.1	3.12	1.29
32	It is significant that everyone be recognize of environmental problems.	7.9	6.1	20.1	22.7	43.2	3.87	1.26
33	People should be permitted to use their lands as they wish.	24.1	20.1	28.1	11.2	16.5	2.76	1.37
34	I think I have responsibility to solve environmental problems.	2.9	10.4	19.8	25.5	41.4	3.92	1.13
35	The government should regulate the use of private areas for wildlife conservation.	6.1	8.3	21.6	27.3	36.7	3.80	1.20
36	Humans should be held accountable for any harm they cause to the environment.	3.6	12.6	19.1	26.6	38.1	3.83	1.17
37	All plants and animals play a significant role in nature.	5.8	8.3	16.9	18.7	50.4	4.00	1.24
38	Technological changes have both benefits and harm for the environment.	3.6	9.0	18.0	27.0	42.4	3.96	1.14
39	Legislation should be prepared and implemented to make recycling obligatory.	6.8	7.9	17.6	22.7	45.0	3.91	1.25
40	Laws on air pollution are strict enough.	24.1	21.6	29.9	15.1	9.4	2.64	1.26
41	Science and technology play a significant role in resolving environmental problems.	7.2	7.6	19.8	33.1	32.4	3.76	1.19
42	Cultural modifications are very significant in resolving environmental problems.	5.8	13.7	30.6	28.8	21.2	3.46	1.14
43	Changes in humans' values will play a role in solving environmental problems.	6.1	7.6	20.9	37.1	28.4	3.74	1.13
44	Public participation has an important place in solving environmental problems.	3.2	7.6	17.3	29.1	42.8	4.01	1.09
45	Changes in living habits will play an important role in solving environmental problems.	4.3	5.0	14.4	30.9	45.3	4,08	1.09

* negatively-phrased items (29, 30, 31, 40)

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In Table 6, environmental concerns of the participants were evaluated with 9 items. Depletion of the ozone layer (65.5%), global warming (65.1%), poor drinking water quality (61.5%), hazardous waste (60.8%), industrial pollution (58.6%), smoke pollution (46.8%), automobile emissions (44.2%), and noise pollution (40.6%) were the problems that nursing students were very concerned. Accordingly, it is inferred that nursing students' the most concerned environmental problems are global warming and the depletion of the ozone layer. Noise pollution, on the other hand, is the least concerning item. It can be thought that the water shortage experienced in Turkey in the past years caused these problems to the top of the list.

Table 6. Nursing students' answers on environmental concern items about environmental matter.

Item Nb	Items	not concerned %	a little concerned %	Have no opinion %	somewhat concerned %	very concerned %	Mean	SD
46	Smoke pollution	10.1	5.0	14.0	24.1	46.8	3.92	1.31
47	Noise pollution	4.7	16.2	21.2	17.3	40.6	3.73	1.27
48	Automobile emissions	3.6	7.2	21.2	23.7	44.2	3.98	1.13
49	Industrial pollution	2.9	6.1	15.5	16.9	58.6	4.22	1.10
50	Hazardous waste	2.9	6.8	11.9	16.9	61.5	4.27	1.09
51	Poor drinking water quality	5.0	4.0	12.9	17.3	60.8	4.25	1.14
52	Indoor air pollution	2.9	9.0	12.9	24.5	50.7	4.11	1.12
53	Depletion of the ozone layer	3.6	1.8	14.7	14.7	65.1	4.36	1.03
54	Global warming	1.4	4.3	9.7	14.4	70.1	4.47	0.94

In Table 7, Spearman's rho Correlation was analyzed in order to find the relationship between the dimensions of the EL scale performed in this study.

The environmental attitude dimensions scale had a positive, weak and significant correlation with environmental knowledge: r(278)= .191, p=.000. In other words, depending on the rise in the environmental attitude points, the environmental knowledge points were also found to rise (Table 7).

The environmental use dimension scale had a positive, low and significant correlation with environmental knowledge: r (278)=.286, p = .000 (Table 7). In other words, depending on the rise in the environmental knowledge points, the environmental use points were also found to rise.

The environmental concern dimension scale had a positive, moderate and significant correlation with environmental knowledge: r (278)=.316, p = .000 (Table 7). In other words, depending on the rise in the environmental knowledge points, the environmental concern points were also found to rise.

The environmental use dimension scale had a positive, moderate and significant correlation with environmental attitude: r (278)=.548, p = .000 (Table 7). In other words, depending on the raise in the environmental attitude points, the environmental use points were also found to raise.

The environmental concern dimension scale had a positive, low level, and significant correlation with the environmental attitude dimension scale r (278)=.260, p=.000 (Table 7). In other words, depending on the raise in the environmental concern points, the environmental attitude points were also found to rise.

The environmental concern dimension scale had a positive, moderately significant correlation with the environmental use dimension scale r (278)=.467, p=.000 (Table 7). In other words, depending on the rise in the environmental concern points, the environmental use points were also found to rise.

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Table 7. Spearman's rho Correlation.

		Attitude	Use	Concern
Knowledge	r	.191**	.286**	.316**
	p	.001	.000	.000
	N	278	278	278
Attitude	r		.548**	.260**
	P		.000	.000
	N		278	278
Use	r			.467*
	p			.000
	N			278

In Table 8, the results of the Mann Whitney U Test scores on dimensions of the environmental literacy scale indicated that there was a significant difference based on gender (knowledge, attitude, use and concern) ($p<0.05$). The present study indicated a higher mean for environmental knowledge, attitude, use and concern level for female nursing students. Results showed that female students are more environmentally responsible than male students.

When scores of dimensions of the environmental literacy scale were examined, the mean point attained by the female students (4.70, SD 2.07) in the dimension of "knowledge" was statistically significant higher than that of the male students (4.05, SD 2.35). There was a statistically significant difference between the genders in terms of their "knowledge" dimension scale points (Mdn = 3.50, U= 7513.5, $p < 0.05$, r = 0.14). This presents a small effect for the gender data (it is below the 0.3 criterion for a medium effect size) [60]. The average rank score was higher for the female students (148.06) than in the male students (124.38) (Table 8).

The mean point attained by the female students "attitude" for dimension scale point (41.81, SD 6.80) was statistically significant higher compared to the males' point (38.98, SD 6.39). There was a statistically significant difference between the genders in terms of their "attitude" dimension scale scores (Mdn = 41.0, U = 6990, $p<0.05$, r = 0.19). This presents a small effect for the gender data [60]. The average rank score was higher for the female students (151.12) than the male students (119.44) (Table 8).

The females' use dimension scale point (M=71.06, SD 10.68) was statistically significant higher compared to the males' point (M= 64.41, SD 12.04). There was a statistically significant difference between the genders in terms of their use dimension scale points (Mdn = 71.0, U =6236.5, $p<0.05$, r = 0.26). This presents a small effect for the gender data [60]. Female students had a higher mean rank score (155.53) than male students (112.33) (Table 8).

The females' concern dimension scale point (M=38.77, SD 7.27) was statistically significant higher compared to the males' point (M=34.93, SD 9.06). There was a statistically significant difference between the genders in terms of their' concern dimension scale points (Mdn = 40.0, U= 6795, $p<0.05$, r = 0.31). This presents a medium effect for the gender data (it is between 0.3 and 0.5 for a medium) [60]. The mean rank score was higher in the female students (152.26) than in the male students (117.60) (Table 8).

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Table 8. The results of the Mann Whitney U Test of dimensions of the environmental literacy scale scores based on gender.

Variable	Sex							Mann Whitney U Testi			Efffect Size
		n	Mean	Median	Min	Max	SD	Mean Rank	U	p	r
Knowledge	Male	106	4.05	3.50	0.00	9.00	2.35	124.38			
	Famale	171	4.70	5.00	0.00	10.00	2.07	148.06	7513.5	0.016	0.14
	Total	277	4.45	5.00	0.00	10.00	2.20				
Attitude	Male	106	38.98	39.00	23.00	56.00	6.39	119.44			
	Famale	171	41.81	42.00	19.00	60.00	6.80	151.12	6990	0.001	0.19
	Total	277	40.73	41.00	19.00	60.00	6.77				
Use	Male	106	64.41	65.00	35.00	89.00	12.04	112.33			
	Famale	171	71.06	73.00	34.00	95.00	10.68	155.53	6236.5	0.0001	0.26
	Total	277	68.52	71.00	34.00	95.00	11.66				
Concern	Male	106	34.93	37.00	9.00	45.00	9.06	117.60			
	Famale	171	38.77	41.00	10.00	45.00	7.27	152.26	6795	0.0001	0.31
	Total	277	37.30	40.00	9.00	45.00	8.20				

In Table 9, the results of the Man Whitney U Test indicated that there was a statistically significant difference between having an environmental related course in terms of their environmental knowledge dimension scale points (Mdn= 5.00, U= 2028.5, $p < 0.05$, r= 0.30). This presents a medium effect for taking an environmental related course (it is between Cohen's criteria 0.3 and 0.5 for a medium) [60]. The knowledge score of nursing students who did not take an environmental related course (M=4.70, SD 2.12) was statistically significantly higher than the score of students who took an environmental related course (M=2.69, SD 1.92). The mean rank score of nursing students who did not take an environmental related course was higher (148.65) than the score of nursing students who had an environmental related course (75.96).

When the environmental literacy attitude dimension was analyzed, a statistically significant difference was determined in terms of having an environmental related course and the attitude dimension scale scores (Mdn=41.00, U=2571.5, SD 6.78, $p<0.05$, r = 0.18). This presents a small effect for taking an environmental related course. The "environmental attitude" the mean point of nursing students' taking an environmental related course (37.17, SD= 1.92) was statistically significant lower compared to the score than score of nursing students who did not take an environmental related course (41.27, SD 2.12). It is found that the mean rank score of nursing students who did not take an environmental related course was higher (144.97) than the score of nursing students who had an environmental related course (101.53) (Table 9).

When the environmental literacy dimension scales were analyzed, a statistically significant difference was determined between the had an environmental related course and the "environmental use" dimension-scale scores (Mdn = 71.00, U = 2571.5, $p < 0.05$, r = 0.23). This presents a small effect for taking an environmental related course. The "environmental use" mean point of students who took an environmental related course (61.26, SD 13.38) was statistically significantly lower than the score of students who did not take an environmental related course (69.60, SD = 11.03). It is found that the mean rank score of nursing students who did not take an environmental related course was higher (146.42) than the score of nursing students who had an environmental related course (91.47) (Table 9).

When the environmental literacy dimension scales were analyzed, a statistically significant difference was determined between the had an environmental related course and the "environmental concern" dimension-scale scores (Mdn = 40.00, U = 2174.5, $p < 0.05$, r = 0.28). This presents a small effect size for taking an environmental related course. The "environmental concern" mean point of students who took an environmental related

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course (30.97, SD 7.99) was statistically significantly lower compared to the score of students who did not take an environmental related course (38.24, SD = 7.83). It is found that the mean rank score of students who did not take an environmental related course was higher (148.05) than the score of students who had an environmental related course (80.13) (Table 9). The results of the current study indicate no impact of taking environmental related courses may be caused by the insufficient illustration given by the related item.

Table 9. The results of the Mann Whitney U Testi Test of the environmental literacy scale scores based on the status of taking environmental courses during their education.

								Mann Whitney U Testi			Effect Size
		n	Mean	Median	Min	Max	SD	Mean Rank.	U	p	r
Knowledge	Yes	35	2.69	2.00	0.00	7.00	1.92	75.96			
	No	243	4.70	5.00	0.00	10.00	2.12	148.65	2028.5	0.0001	0.30
	Total	278	4.45	5.00	0.00	10.00	2.20				
Attitude	Yes	35	37.17	37.00	20.00	56.00	8.06	101.53			
	No	243	41.27	41.00	19.00	60.00	6.43	144.97	2923.5	0.003	0.18
	Total	278	40.75	41.00	19.00	60.00	6.78				
Use	Yes	35	61.26	56.00	46.00	95.00	13.38	91.47			
	No	243	69.60	72.00	34.00	95.00	11.03	146.42	2571.5	0.0001	0.23
	Total	278	68,55	71.00	34.00	95.00	11.66				
Concern	Yes	35	30.97	27.00	20.00	45.00	7.99	80.13			
	No	243	38.24	41.00	9.00	45.00	7.83	148.05	2174.5	0.0001	0.28
	Total	278	37.32	40.00	9.00	45.00	8.20				

4. Discussion

Initially, nursing students were asked to respond to questions assessing their knowledge about environmental concepts such as biodiversity, waste etc. Nursing students' responses indicate that their level of environmental knowledge is low, given that out of all the questions most of the participants responded false to about most of the questions. In the present study, very few of the nursing students received a ''passing'' environmental knowledge grade based on the NEETF/ Roper Starch grading scale [58]. Most of the nursing students have inadequate environmental knowledge. Answers from nursing students reveal their misconceptions about environmental knowledge. Specifically, nursing students' misconceptions concern motor vehicles as sources of carbon monoxide, electricity generation, the ozone layer, garbage, and storing nuclear waste. For instance, nearly 1 in 10 nursing students answered correctly to the question related to the contribution of motor vehicles to air pollution and about 1 in 5 to that of the electricity generation in Turkey-hydro power plants. These findings were not considered satisfactory. This result can be expressed by the insufficient environmental education of nursing students. Similarly, most research has also highlighted the misconceptions held by participants in relation to specific environmental concepts [15,59,17,18,19,53,60,32,61,11,40]. Pe'er et al. stated that students demonstrated an extremely low level of environmental knowledge [22]. Goulgouti et al. reported, students' answers were moderate to low in Greece [17]. 23% of the respondents were determined to have inadequate levels of environmental literacy by Kaplowitz and Levine [9]. Aydemir conducted a study in Ankara and found that only a small number of respondents had sufficient knowledge levels about environmental concepts [62]. Buhan stated that teachers in Istanbul lacked adequate knowledge [63]. Gavrilakis et al. also stated that respondents' environmental knowledge was moderate, with hydrocarbons, carbon dioxide and chlorofluorocarbons (27%) or carbon dioxide alone (18%) [59].

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In this study, the environmental attitude dimension of environmental literacy was determined to be positive. This result was matched with many other studies [16,17,64,53,21,22,65,32,33,11,66,39,67, 68] participants of many other studies reported positive environmental attitudes.

In the present study, the third dimension of environmental literacy is defined as "use" which measures nursing students' tention to take part in pro-environmental behavior. This result is in congruent with many other studies [63,16,53,39]. However, our study results contrast with the study of Goulgouti et al. who determined that Greek students were willing to do more, but their responses on the behavior dimension did not generally reflect their positive attitudes [17].

The final dimension of environmental literacy in this research, the environmental concern level of the respondents was determined to be high. Similarly, Kahyaoğlu found that the concern level of the teachers was reported to be very high [53].

According to the results of this study, although their environmental knowledge is low, nursing students have a positive profile in terms of their attitudes towards the environment, its uses, and their concern for environmental problems. In particular, they gave highly positive answers to questions such as personal responsibilities and changes in life habits. Nursing students' positive participation in the items of attitude towards the environment showed that they have a pro-ecology view. Nursing students' responses to the Environmental Literacy Scale attitude dimension questions showed that the students, on average, have a pro-ecology worldview. It is argued that individuals with this view see themselves as part of nature and tend to take the necessary precautions for the protection of nature. At the same time, these students prefer to solve the problems by eliminating the conflicting situations between society and the environment [69]. Similarly, Tikka, Kuitunen, and Tynys, who conducted a similar study with the Finland sample, concluded that environmental knowledge has an increasing effect on the attitude towards the environment [70].

In this study, all dimensions of environmental literacy were determined to be positive, and the strongest correlations with each other ranging from low to moderate relations.

This study's results showed that scores of the environmental knowledge dimension scale had a positive, low, and significant correlation with environmental attitude and environmental use scale scores. Similar to this study result, Makki et al. and Kahyaoğlu revealed a low correlation between environmental knowledge and attitude [71,53]. However, our results contradict those of Tuncer et al. and Bar, and DeChano, who could not determine any correlation between knowledge and attitude components of EL [39,72,73]. Kahyaoğlu obtained a positive, weak, and statistically significant correlation between environmental knowledge and use [53].

In the present study, scores of environmental knowledge dimension scale had a positive, moderate, and significant correlation to environmental concern scale points. On the other hand, our study results contradict Kahyaoğlu, Who obtained the lowest correlation from knowledge and concern components [53].

In the present study, environmental attitudes were positive and moderate but significantly correlated with the environmental use dimension scale scores. Futhermore, Ökeşli and Kahyaoğlu found a strong correlation between attitude and use demensions of E.L. [74,53]. Moreover, Yavetz et al. also found the highest correlation between the attitudes and behaviors of the students [67].

In this study, the attitude towards environmental problems was positive and low but significantly correlated with the environmental concern. Similarly, Tuncer et al. determined a smaller correlation between the students' environmental attitudes and concerns [39]. On the other hand, this result contradicts Kahyaoğlu who found relatively stronger relationships between the environmental attitude dimension and the concern dimension [53].

In the present, environmental use was positive, moderate, and significantly correlated with the environmental concern dimension scale score. Depending on the raise in

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the points of nursing students on the scale of environmental use, their environmental concern points were also determined to rise. According to the results of this research, the environmental use of nursing students is a factor affecting the environmental concern scale scores. Similar results were obtained in the many studies conducted on this subject [53,73,74].

Depending on the rise in the points of students of nursing in the scale of environmental knowledge, their attitude towards environmental problems, environmental use, and environmental concern points were also determined to rise. As a result, it can be said that the environmental knowledge of nursing students is a factor affecting their environmental attitude, environmental use, and environmental concern scale scores.

Within the scope of this study, the effect of gender on environmental literacy of nursing students was also examined. Female nursing students are more concerned than male students about environmental problems, and they are also more knowledgeable about environmental issues. The present study indicated a higher mean for environmental knowledge, attitude, use, and concern level for female nursing students. Results revealed that female students are more responsible for the environment than male students. This result is supported by literature, females are more sensitive and concerned about environmental issues, which are an indicator of a healthy and quality life [75]. As Tikka, Kuitunen, and Tynys stated, while females have a stronger sensitivity towards nature, males are more inclined to dominate nature and benefit from natural resources [70]. In this respect, it is an expected result to determine the gender difference in favor of females in the dimensions of attitudes towards the environment and uses related to the environment. This difference should not be ignored while providing environmental education in nursing faculties, and appropriate in class activities should be prepared for both male and female students to be environmentally literate at a high level. Because the content of education for sustainable development, unlike environmental education, covers the economic and social effects and results of natural resource use as well as the environmental effects. This approach appeals to both females who have a stronger sensitivity to nature, and males who are inclined to benefit from natural resources [76].

This study indicated that there was a statistically significant difference between genders with overall dimension points of the environmental literacy scale. Similarly, other research studies found a statistical difference between genders in environmental concerns and attitudes toward the environment [16,40,39]. The present study result matched that of Kahyaoğlu and Tuncer Teksoz et al., who stated that men show greater environmental concerns [53,40]. But females' attitudes are more eco-centric than those of males; however, the present study results contradict with many other studies [17,21,77]. On the other hand, the present study results contradict those of Kroufek, Çelik and Can, who determined that the gender variable did not show any statistical difference except in the dimension of behavior [78].

The difference created by gender differences in environmental literacy can be balanced with sustainable development education, which has the content that can eliminate the above-mentioned difference in perception about natural resource use by males and females. In this context, one of the most basic goals should be to ensure that the entire public is environmentally literate. In order to achieve this goal, scientific studies will form an important infrastructure for the goal of a sustainable future.

There was a statistically significant difference between having an environmental related course during nursing students' education and the overall dimension scores of the environmental literacy scale. Although there are effects of taking environmental courses on environmental attitude, use, and concern, this research has revealed that taking environmental courses has no effect on environmental knowledge. Similarly, Owens studied urban secondary school teachers and obtained different results. It has been shown that taking pre-service and in-service environmental lessons had a positive effect on environmental behavior but had no effect on environmental knowledge [79]. Furthermore, Alagöz states that the social studies teacher candidates who took the environmental course did not have a sufficient level of knowledge about the environment [80]. On the other hand,

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there are also other studies showing the impact of taking an environmental course on environmental literacy [81,53]. These study results contradict those of Özyürek et al., who determined no statistically significant difference between all sub-dimensions of environmental literacy according to the status of teacher candidates taking the environmental course [82]. Moreover, Erol, in his study aiming to determine the attitudes of primary school teacher candidates towards environmental problems stated that taking environmental lessons did not create a change in their attitudes towards the environment [83]. Indeed, Karatekin found no statistically significant relationship between an environmental related course taking and attitudes towards the environment [84].

The suggestions based on the findings and results of the present study are as follows: In order to improve of the environmental literacy of nursing students, extramural supports and learning opportunities can be developed.

Similar studies to be carried out in other universities in Turkey will lead to the determination of the environmental literacy profile of higher education students, especially nursing students, to create strategies on environmental education in higher education in parallel with the determined profile and to take an important step towards the goal of sustainable use of environmental resources in the long run. And as the nurses of the future, they will play an important role in achieving the goal of a sustainable future. Therefore, it is extremely important to determine the objectives of environmental education in higher education and to provide support for scientific research on this issue.

Environmental education in higher education is very important in a developing country like Turkey, where natural resource use, consumption, and production movements are intense. The content of the course should be organized in a way that integrates global and national environmental problems, in accordance with the principle of "think globally, act locally", and taking into account the scope of education for sustainable development. Providing research support in determining the content of the course and evaluating the application results is important for effective environmental education, environmental literate university graduates, and sustainable development.

Non-formal education and in-service training can be complementary to the training on the subject for individuals who cannot benefit from basic programs as required. For this reason, studies should be focused on the preparation of formal and non-formal education programs that will inform individuals about environmental literacy and increase their level of environmental literacy.

5. Limitations of the Study

The present research has two limitations. First, due to the pandemic, the study was limited to undergraduate nursing students at the Faculty of Nursing of Akdeniz University and did not contain students at the other universities. Second, the study sample was unequal in terms of gender; 61.7% of the sample was female, while 38.3% was male.

6. Conclusions

Based on the study findings, the results have important implications for nursing education. It could be concluded that nursing students had a low level of environmental knowledge, which indicates students need support in environmental knowledge; however, students obtained the high scores for attitude, use and concern from dimensions of environmental literacy. Furthermore, there were statistically significant differences based on gender, grade level, and taking environmental courses with dimensions of environmental literacy. Moreover, all dimensions of environmental literacy were determined to be positively correlated and statistically significant with each other ranging from low to moderate relations.

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