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Development of Environmental Attitude Scale Towards Pre-Service Biology Teachers

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Abstract
Healthy life for all living creatures in nature is possible with a clean and habitable environment. Raising awareness of protecting environment in human landscape is important for conservation. Upbringing of informed individuals about environment and constitute behavioral changes by gaining their positive attitudes for nature have an important role in solutions of environmental issues. For this purpose, environmental attitude scale was developed to reveal the pre-service teachers' reflection and attitude for environment. This scale was applied 178 students who were the pre-service teachers in biology education department. Reliability calculation and exploratory factor analysis of the scale were computed via packaged software SPSS 13.0 while confirmatory factor analysis was computed via software Lisrel 8.80. Internal consistency coefficient of Cronbach alpha was found as 0.87 which signifies was a good value for reliability co-efficient. As the result of factor analysis, which was applied to obtained data, it was determined that eighteen itemized scale was five-dimensional. These dimensions were as follows: environmental issues, energy saving, waste products, environmental responsibility and environmental support according to cognitive, affective and behavioral statements. It was confirmed that, there was a positive and linear relation among the marks that students got and factors of the scales. Moreover, confirmatory factor analysis studies of the survey were computed via software Lisrel 8.80. In this current study, it was found as; RMSEA=0.050; SRMR=0.062; GFI=0.90; AGFI=0.86; CFI=0.97; NFI=0.92 and RFI=0.90, in the scope of confirmatory factor analysis. It has been confirmed that, the scale that was executed according to the results, can be used to as a reliable scale for environmental attitude.
Keywords: Environmental education, attitude, pre-service biology teachers

1. Introduction

Spending a healthy life without problems for all creatures is possible with a clean and habitable setting, namely with environment. It has significance to raise awareness about environment where they are living from birth to death and future of that environment and how to protect it (Dikmen, 1993).

A lot of factors such as thinking that nature is an unlimited source, increasing of world population rapidly, people's senseless consumption habits, daily growing technological developments, industrialization and unhealthy urbanization cause environmental issues. Environmental issues are not only the problem of a certain region or a country but also a factor that affects the entire world. As a result of activities that people acted to change environment in time, all living things experienced ecological balance collapsed and serious threatening environmental issues (Akbaş, 2007).

As a result of reconstruction and industrialization activities, in 1950s environmental issues came out and environmental awareness has emerged. Awareness of protecting environment was adopted by a large number of general public in society in 1860s, and it spread out expeditiously (Dikmen, 1993). Besides industrialization, air pollution, water pollution, dilution of the ozone layer, global warming, and increasing population bring along environmental issues (Alnıaçık and Koç, 2009). In 1970s as a result of environmental issues raised, activist groups began to collaborate to prevent those environmental issues. Most important ones of those works are "Human and Environment Conference", which members of United Nations attended in Stockholm-Sweden in 1972, "Tbilisi Manifesto", which was published in 1977, "Our Common Future Report" of United Nations in 1982, and "Rio Conference" in 1992. Especially, in Tbilisi Manifesto emphasized on environmental education and it was divided into five groups such as: awareness, knowledge, attitude, skill and attendance as general purposes of the education.

In our country, Turkey, the purpose of environmental education has been decided as helping individuals to grow up as citizens who are equipped with knowledge, skill and standards of judgments to support and allow individuals to act responsible about environment (DPT,1994). An attitude is a mental and neural state of readiness, organized through experience, exerting directive or dynamic influence upon an individual's response to all objects and situations with which it is related (Allport, 1967). There are three elements of attitudes as cognitive, affective and behavioral and it is assumed that there is internal consistency among these elements in general (Tavşancıl, 2010). These elements are mutually influence each other or they are affected by each other and mostly there is consistency among them (Aydın, 2000; Özgüven, 2004).

It is stated that, the source of acquired attitudes are as a result of parents rather than personal experiences. However roles and attitudes of factors change after the children started social interaction and it takes shape between

ages 12 – 30 and then continues from the beginning of 20s during lifetime (Morgan, 1995). Fundamentally, individuals need to do their duties for environment in order to give people and future generation opportunity to live in a healthy environment. Upbringing of informed and sensitive individuals about the nature and forming behavioral changes by making them gain positive attitudes for environment have an important role for the solution of environmental issues. It is certain that individuals who have negative attitudes against environment will be insensitive to environmental issues and they will carry on making trouble in environment.

The purpose of this study is to reveal the pre-service teachers' reflection and attitude for environment. From this viewpoint environmental attitude scale was developed to reveal it.

2. Method

2.1 Research Group

In this research the study group involves 178 pre-service biology teachers who were studying at biology teaching programme at one of the university in central Anatolia region. The study group compensates approximately fivefold sample criterion of item number, which was suggested for the usage of factor analysis technique.

2.2 Assessment Instrument

In the process of developing scale, 45 itemized pools were created by scanning resources, which measure environmental attitudes primarily. These items were reviewed by experts' views. According to the suggestions of these experts, 36 itemized pre-test form was created and applied to the study group. All the items were prepared for cognitive, affective and behavioral dimensions of the attitude.

Environmental Attitude Scale, which is used in the research, was developed with the purpose of biology students' environmental attitude levels. This 36 itemized scale includes 13 negative and 23 positive statements and it is on a 5-point Likert scale. After the scale was applied to the study group students, their answers were graded by considering negative and positive statements. In Likert attitude scales, negative and positive statements that are related to issued attitude are applied to a large number of students. The answers need to tick up one of the options that were created to reflect their ideas best among the items of the scale (Baş, 2001). In this research, for items, which have positive scale gradation; in order to get trustworthy and meaningful results in the process of developing scale, number of the study group's members need to be more (at least fivefold more) than the item numbers that take place on the pretesting form of the scale (Mueller, 1986). As a result of analysis, it was decided to omit items, 1, 2, 4, 6, 7, 8, 10, 12, 15, 16, 17, 18, 21, 22, 24, 32, 34, and 36 from 36 itemized pretesting form. Thus, impending 6 negative items and 12 positive items, in total Environmental Attitude Scale was formed with 18 items.

2.3 Analysis of Data

The reliability calculation and Exploratory Factor Analysis (EFA) of the scale were computed via software SPSS 13.0 while Confirmatory Factor Analysis (CFA) was computed via software Lisrel 8.80. The suitability of the scale's internal consistency coefficient for Cronbach alpha value and factor analysis of data were checked with Kaiser-Meyer-Olkin (KMO) coefficient and Barlett Sphericity test (Büyüköztürk, 2005). Data is suitable for factor analysis; exploratory factor analysis was used to examine factor's structure and structure legitimacy of Environmental Attitude Scale while principal component analysis was used as factorization technique. In analysis, common factor variance, which is on every variable of factors, factor loads, explained variance rates and its line chart were examined. Items' factor loads were selected as 40, at least. On the other hand, slued (varimax) principal components analysis was applied to examine factor's structures. Descriptive structure results and scree plot graph of obtained data of Environmental Attitude Scale were examined and ranges were viewed. As a result of examination of the items, which clustered in factor analysis; cognitive, affective and behavioral based 5 factors were examined by designating them and each factor was entitled according to these items.

For the 36 itemized scale that was applied to measure environmental attitudes of 178 students who were the sample of the research via software SPSS 13.0. First, it was marked as; "strongly agree" 5, "agree" 4, "not sure" 3, "disagree" 2, and "strongly disagree" 1, it was also marked for negative items as; "strongly agree" 1, "agree" 2, "not sure" 3, "disagree" 4, and "strongly disagree" 5, according to students' answers.

Internal consistency of Environmental Attitude Scale was calculated with Cronbach Alpha Reliability Analysis. According to results of the analysis, for Biology Teaching students' sample (N=178) Cronbach alpha reliability coefficient was found as 0.86.

Table 1. Reliability Statistics of Environmental Attitude Scale

Cronbach Alpha Coefficient	Cronbach Alpha Coefficient for Standardized Items	Number of Items
0,861	0,863	36

Findings related to standard deviation and averages of students' answers for each item were examined. The results showed that the analysis have homogeneous range as a result of averages' and standard deviations' closeness.

Those items, which were below 0.40 in interpretation of item-total score correlation shows the connection

between score of the test items and total score of the test, were omitted (Fraenkel & Wallen, 2006). Accordingly 1, 2, 4, 7, and 12 items whose coefficients were below 0.40 were omitted. It is observed that, the coefficients of the items differ between 0.41 and 0.70 (Table 2).

Table 2. Results of Item-Total Statistics

Numbers of Items	Corrected Item-Total Correlation	Numbers Items	Corrected Item-Total Correlation	Numbers of Items	Corrected Item-Total Correlation
item1	0.267	item13	0.59	item25	0.438
item2	0.281	item14	0.669	item26	0.447
item3	0.582	item15	0.55	item27	0.481
item4	0.253	item16	0.606	item28	0.474
item5	0.432	item17	0.428	item29	0.492
item6	0.489	item18	0.506	item30	0.417
item7	0.289	item19	0.554	item31	0.489
item8	0.538	item20	0.498	item32	0.612
item9	0.488	item21	0.411	item33	0.442
item10	0.533	item22	0.501	item34	0.426
item11	0.707	item23	0.429	item35	0.496
item12	0.282	item24	0.479	item36	0.438

As a result of factor analysis, the items, which load more than one factor, should be omitted from the scale if their factor loads are below 0.45 (Harrington, 2009). In the consequence of analysis, which was done for factor rotation it was monitored that some items loaded to a large number of factors, which led to obtaining factor loads that were less than 0.30. Items 6, 8, 10, 15, 16, 17, 18, 21, 22, 24, 32, 34 and 36 were omitted from the sample as a result of factor rotation.

3. Findings

Environmental Attitude Scale, which has 36 items in total, after 18 items were omitted and 18 left, analysis was done.

Table 3. Chart of the items that were left to analyse

Omitted items	Left items	Omitted items	Left items
item1	item3	item16	item25
item2	item5	item17	item26
item4	item9	item18	item27
item6	item11	item21	item28
item7	item13	item22	item29
item8	item14	item24	item30
item10	item19	item32	item31
item12	item20	item34	item33
item15	item23	item36	item35

Environmental Attitude Scale's internal consistency was found as coefficient 0.92 according to Cronbach Alpha Reliability analysis (Table 4). For factor analysis of items, Kaiser-Meyer-Olkin (KMO) and Bartlett Test analysis was done. Kaiser-Meyer-Olkin and Bartlett Test is an approach, which was developed to measure the consistency of item values. As a result of Kaiser-Meyer-Olkin (KMO) test, value relevance, which is close 1, shows that values under 0.50 cannot be accepted. In consequence of KMO sample adequacy measurement, the coefficient value was found as 0.894 (Table 3).

Table 4. Relevant Data for Factor Analysis Appropriateness of Environmental Attitude Scale

Measurement		Obtained Value
Cronbach Alpha Coefficient		0.924
Kaiser-Meyer-Olkin (KMO)		0.894
	Chi-square	1106.53
	Sd	153
	Sig	0

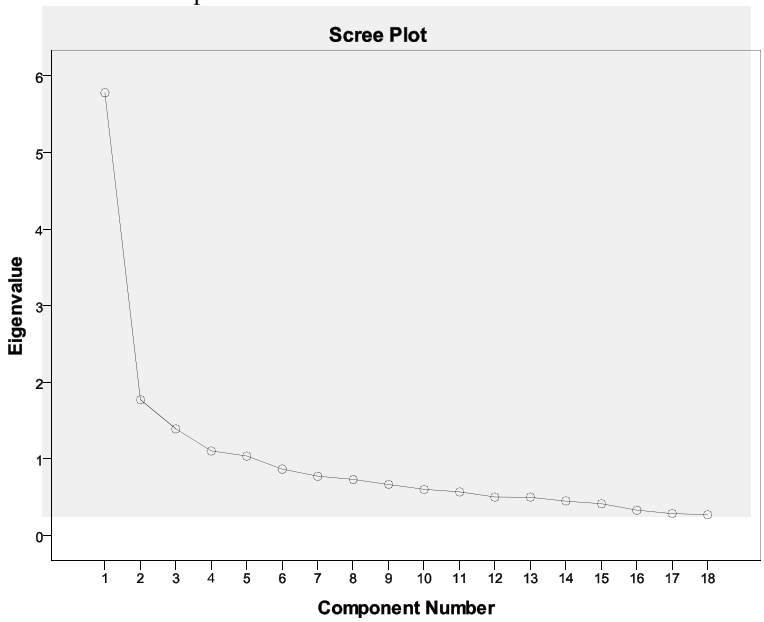
Factor analysis was completed to designate principal components by using varimax rotation. The findings of this analysis such as eigenvalue and variance percentages were reported in Table 5. 1st factor's eigenvalue was calculates as 5.89, for 2nd factor was 1.76, for 3rd factor was 1.31, for 4th factor was 1.10 and for 5th factor was 1.05.

Table 5. Factor Structures of Environmental Attitude Scale (Varimax Variance Values)

Factor	Eigenvalue	Variance Percentage	Total Variance Percentage
1st Factor	5.89	32.722	32.722
2nd Factor	1.766	9.813	42.535
3rd Factor	1.381	7.673	50.208
4th Factor	1.103	6.126	56.334
5th Factor	1.052	5.843	62.176

As a result of analysis, five factors, which were above 1 in terms of eigenvalue, were determined and total variance of these factors is 62.17%. First factor contributed 32.72%, second factor contributed 9.8%, third factor contributed 7.67%, fourth factor contributed 6.12 and fifth factor contributed 5.84% to analysis. It can be observed on scree plot graph (Figure 1). When eigenvalues were shown on vertical axis and factors were shown on horizontal axis in the scree plot graph.

Figure 1. Scree Plot Graph for Number of Factors of Environmental Attitude Scale



Scale's number of factors were designated, and factor based distribution of items was examined. Rotated component matrix was prepared in order to designate total variance statements of item and in which factor scale items have strong correlations. So it was examined that, whether overlapping and factor load values of items would compensate for level of acceptance or not. In order to overlap one of the items is that level of acceptance of an item shows high load value in more than one factor. The second one is that difference among load values of an item, which are in two or more factor, is less than value of 1 (Çokluk et al, 2012).

Items' factor loads were given in Table 6. According to the table it was determined that the scale has 5 factors. After the meanings by considering predominantly piled factors of items, factors were titled such as environmental problems, energy saving, waste products, environmental responsibility and environmental support.

Table 6. Factor Loads for Environmental Attitude Scale

	Factor Load				
	1st Factor	**2nd Factor**	**3rd Factor**	**4th Factor**	**5th Factor**
1. Since environment recleans itself, wastes do not cause a problem in terms of environmental pollution. (Item 3)	.661				
2. Natural disasters, which occur in any place on the earth do not have any effect on environment. (Item 5)	.617				
3. Spending energy sources of our country insensibly makes me anxious. (Item 13)	.764				
4. While some factors work with dangerous energy for environment makes me anxious. (Item 14)	.747				
5. Besides degeneration of ecosystem, break downs in environmental balance do not make me anxious. (Item 23)	.627				
6. I turn off unnecessary lights in home or school. (Item 27)		.835			
7. I turn off the taps when I see that they are running unnecessarily in home or school. (Item 28)		.770			
8. I do not pay attention whether it is plugged or unplugged after I charge my phone or computer. (Item 29)		.721			
9. I pay attention not to waste too much water while I am washing my hands in home or school. (Item 35)		.630			
10. Waste products like paper, metal, glass and plastic should be left into recycle bins by dividing into groups. (Item 9)			.842		
11. Buying drinking in glass bottles instead of plastic bottles does not provide benefit for environment. (Item 11)			.652		
12. I take care of leaving trashes by dividing them into groups appropriately in home or school. (Item 19)			.735		
13. Before buy a product, I pay attention to its recyclable feature. (Item 20)			.735		
14. I join environmental foundations. (Item 25)				.690	
15. I follow television programs and documentaries curiously, which are about environment on TV, radio or the Internet (Item 26)				.799	
16. I take care about not to harm any living creatures since they have their own duties in environment. (Item 33)				.648	
17. I support environmental foundations. (Item 30)					.859
18. I give importance environmental projects. (Item 31)					.766

Factor 1: Environmental Problems: First sub-dimension of the scale includes five items. Factor loads of these items differ between 0.617 and 0.747. First sub-dimension items were related to subjects about environmental problems.

Factor 2: Energy Saving: Second sub-dimension of the scale involves four items. Factor loads of these items differ between 0.630 and 0.835. Second sub-dimension items were related to subjects that were about energy saving in order to resolve environmental problems.

Factor 3: Waste Products: Third sub-dimension of the scale includes four items. Factor loads of these items differ between 0.652 and 0.842. Third sub-dimension items were related to appropriateness of waste products for recycle.

Factor 4: Environmental Responsibility: Fourth sub-dimension of the scale contains three items. Factor loads of these items were between 0.648 and 0.799. Fourth sub-dimension items were related to our duties as individuals for resolving environmental problems.

Factor 5: Environmental Support: Fifth sub-dimension of the scale has two items. Factor loads of these items were 0.766 and 0.859. These two items were related to individual support to provide a better protection for environment.

Internal consistency coefficients of Cronbach Alpha, which belong to sub-dimensions of Environmental Attitude Scale, were calculated and the results were obtained as follows: for the first dimension; 0.811, for the

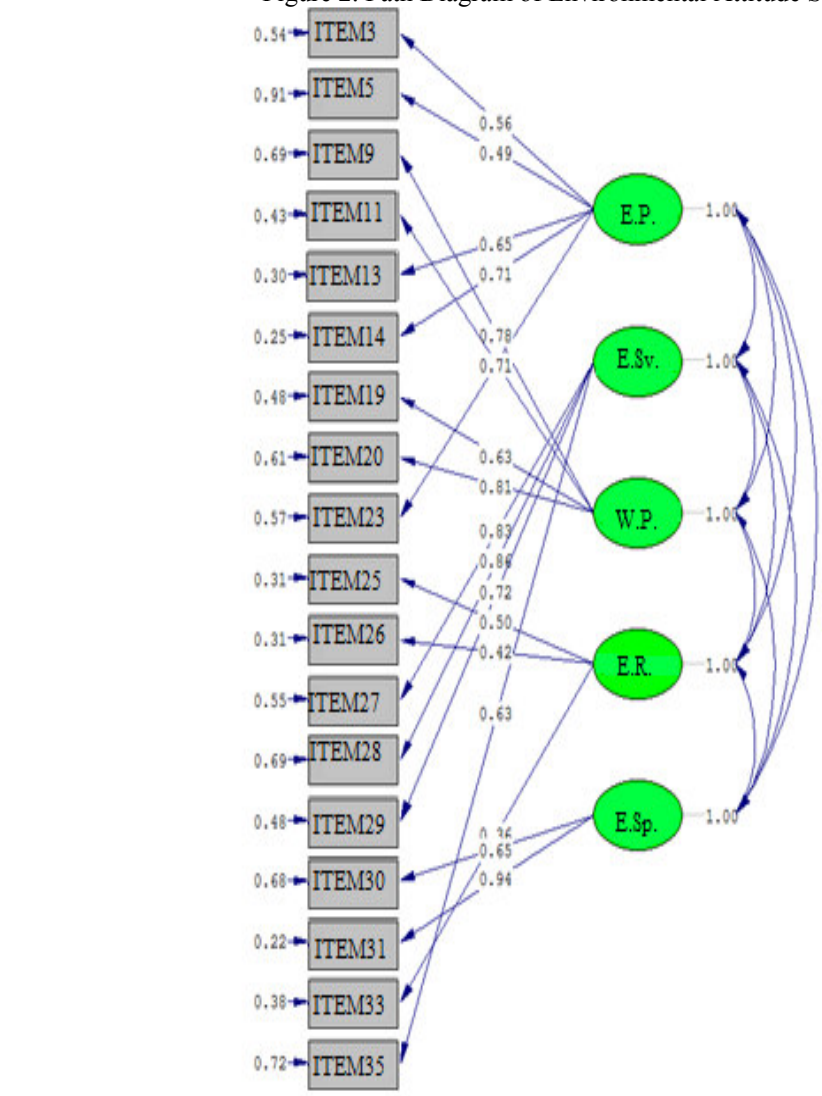
second dimension; 0.834, for the third dimension; 0.865, for the fourth dimension; 0.897, for the fifth dimension; 0.806 (Table 7). Bayram (2004) states that, it is enough for Cronbach Alpha value to be above 0.70 for reliability. Based on these results, it can be said that, Environmental Attitude Scale is a reliable measurement tool.

Table 7. Reliability Statistics for Sub-Dimensions of Environmental Attitude Scale

Factor	Cronbach's Alpha Coefficient
1st Factor	0.811
2nd Factor	0.834
3rd Factor	0.865
4th Factor	0.897
5th Factor	0.806

It is benefited from confirmatory factor analysis to designate whether variable groups, which provide benefit to determined number of factors, are sufficiently represented with these factors or not (Şimşek 2007). In these kinds of studies, it is assumed that more than one latent variable, which is structured by scale factors, are represented by another latent variable and the appropriateness of that assumption is tested (Şimşek, 2007; Kline, 2011; Devellis, 2003). Confirmatory factor analysis was done in order to determine whether variable groups, which also provided in Lisrel program according to SPSS program's Environmental Attitude Scale were sufficiently represented with these factors or not. According to the analysis, the results of five dimensions were obtained in confirmatory factor analysis, and five factorized scale was given in path diagram (Figure 2).

Figure 2. Path Diagram of Environmental Attitude Scale



Confirmatory factor analysis determined whether variable groups, which contributed to a factor, is sufficiently represented with these factors or able 7 summarizes fit criterion, decent fit values, acceptable fit values (Schermellerh-Engel & Moosbrugger, 2003) and fit values of the recommended pattern.

Table 7. Fit Criterions, Decent Fit Values, Acceptable Fit Values and Fit Values of Environmental Attitude Scale (EAS).

Fit Criterions	Decent Fit Values	Acceptable Fit Values	Fit Values of EAS
RMSEA	0.00<RMSEA<0.05	0.05<RMSEA<0.10	0.050
SRMR	0.00<SRMR<0.05	0.05<SRMR<0.10	0.062
GFI	0.85<GFI<1.00	0.90<GFI<0.95	0.90
AGFI	0.90<AGFI<1.00	0.85<AGFI<0.90	0.86
NFI	0.95<NFI<1.00	0.90<NFI<0.95	0.92
CFI	0.95<CFI<1.00	0.90<CFI<0.95	0.97
RFI	0.90<RFI<1.00	0.85<RFI<0.90	0.90

As a result of Lisrel Analysis; the decent fit value range was obtained as 0.05 which was an as acceptable fit value according to the RAMSEA fit criterion. According to the SRMR fit criterion, decent fit value range was given as 0.00<SRMR<0.05, and acceptable fit values were given as 0.05<SRMR<0.10. Since SRMR value of Environmental Attitude Scale was resulted as 0.062, it was an as acceptable value. According to GFI fit criterion,0.90 and AGFI fit criterion 0.86 were also an acceptable fit value. For NFI fit criterion the value of 0.92 and CFI fit criterion the value of 0.97 were in the range of acceptable fit values. Finally, the decent fit value was found as 0.90 according to RFI fit criterion, it compensates for decent fit value. Another fit index in the assessment is chi-square. In Environmental Attitude Scale, chi-square value was found as 179.24 and degree of freedom was found as 125. When these values were proportioned, it is observed that chi-square/degree of freedom ratio is 1.43. When this ratio is below 3, it equals to perfect fit; when this ratio is below 5, it equals to medium-level fit (Kline, 2011). In this context, it can be inferred that, this ratio shows perfect fit value for this analysis. It is clear that, items of Environmental Attitude Scale fit into five factorized structure.

4. Conclusion

In this study, the "Environmental Attitude Scale" was introduced. In the process of developing the scale, an item pool, which measure environmental attitudes primarily and in the direction of experts' views, pretesting form of the scale was created. After pretesting section, the scale took its final shape and the scale was applied to 178 pre-service biology teachers who were studying at one of the university in central Anatolia region. As a result of factor analysis that was applied to obtained data, it was determined that the scale had five dimensions. These dimensions were: environmental problems, energy saving, waste products, environmental responsibility and environmental support according to cognitive, affective and behavioral statements that items included. It was determined that there was a positive and linear relation among the scores that students got from scales and factors of those scales. Thus, it can be said that there is a consistency among subscales and factors. Reliability coefficient of Environmental Attitude Scale, which is consisted 5-point Liker typed 18 items, was calculated as 0.924 and KMO value of the scale was calculated as 0.894. Additionally, it was observed that obtained data of Environmental Attitude Scale had a normal distribution in average-median relation, standard deviation and scree plot graph. This result demonstrated that data of the scale covers the normal distribution, which is pre-condition in comparative tests like t-test or variance analysis. Furthermore, in the final part of the research, confirmatory factor analysis was done in Lisrel. In this study, within the context of confirmatory factor analysis, the following results were found: RMSEA=0.050, SRMR=0.062, GFI=0.90, AGFI=0.86, CFI=0.97, NFI=0.92 and RFI=0.90. Even if the results of analysis do not have perfect fit values, it can be said that these values can be still accepted. Thus, the obtained results showed that the developed scale can be securely used to measure environmental attitudes. When some resources related to Environmental Attitude Scale are examined, a large number of studies can be found. Berberoglu and Tosunoglu (1995) developed "Environmental Attitude Scale" for university students in their study and the scale was evaluated as being four dimensional, (population growth, energy saving, environmental problems and nuclear energy). Tuncer and others (2005) applied a questionnaire, which included 45 items and four factors (awareness of environmental problems, national environmental issues, solution of the problems, awareness of individual responsibility) in order to measure environmental attitudes of students. Yılmaz, Boone and Anderson (2004) developed 51 itemized "Attitude Scale for Environmental Problems" in their study. Pooley and O'Conner (2000) developed "Environmental Attitude Scale". In the study in which lesson programs were evaluated, it was found out that, attitude and behavior dimensions were neglected and programs aimed to inform. Since, examined scales were developed to measure different attitudes, even if they have similarities with some items of the scale, still it has importance in terms of being added new dimensions and being a new trustworthy scale.

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