Development and Validation of Children's Environmental Affect (Attitude, Sensitivity and Willingness to take action) Scale

Mehmet Erdogan
Akdeniz University, TURKEY

Thomas Marcinkowski
Florida Institute of Technology, USA

This study focuses on the design, development, validation, and psychometric properties of the Children's Environmental Affect Scale (CEAS). The following steps were taken in developing the CEAS. A substantial review of literature on environmental affect and EL helped the researchers identify several scales and questionnaires that, in turn, help establish the item pool. The initial scale derived from this item pool was reviewed by the selected experts (n=17) and then pilot tested with 673 students in 4th -5th grades. These pilot data were subjected to Explanatory Factor Analysis (EFA) to reveal the dimensions underlying these pilot items. Later, the revised version of the scale was administrated to 2412 students in 5th grade as part of a national assessment. The data from this full study were used to validate the factorial structure observed in EFA through using Confirmatory Factor Analysis (CFA) procedures in AMOS. The final version of the CEAS employs a Likert-type scale to measure 14 items that reflect three sub-scales; Willingness to take environmental action (5 items, α= .87), Environmental Attitudes (5 items, α= .82) and Environmental Sensitivity (4 items, α= .67).

Keywords: Children, environmental affect, scale.

INTRODUCTION

Even though natural and environmental studies back date to the late 1890s, on an international scale, the field of environmental education (EE) began in the late 1960s and early 1970s (e.g., Disinger, 1983; Schmeider, 1977). The development of EE during this period was aided by support by UNEP for UNESCO to develop an International EE Programme (e.g., Stapp, 1979). During this early period, EE was often defined in a few

sentences (e.g., Disinger, 1983; Schmeider, 1977). A number of efforts were made to analyze these and other early writings for the purpose of identifying key characteristics of EE (e.g., Harvey, 1977a, 1977b; Hart 1981). During this same period, those working with UNESCO's International EE Programme developed objectives and guiding principles for the emerging field of EE during the Belgrade Workshop and the Tbilisi Intergovernmental Conference (UNESCO, 1976, 1977, 1978). The resulting Tbilisi Objectives served as one of the most widely recognized, if not accepted, definitions of EE (e.g., UNESCO, 1987, 2007).

The Tbilisi Objectives represent learning outcomes for EE, and for this reason they function as one of the earliest environmental literacy (EL) frameworks: Awareness, Knowledge, Attitudes, Skills, and Participation. These objectives also represent the relationship between EE and EL: the mission of EE is

Correspondence to: Mehmet Erdogan ,
Akdeniz University, Faculty of Education, Department of Educational Sciences, 07058, Campus, Antalya, TURKEY.
E-mail: mmerdogan@gmail.com
doi: 10.12973/eurasia.2015.1347a

State of the literature

- Over 35 year, environmental affect (e.g. awareness, attitudes) has received greater attention in the field of EE research.
- Environmental affect (including attitude, values, sensitivity etc) is one of four main components of environmental literacy which is ultimate aim of environmental education.
- Several efforts has been undertaken to develop a valid and reliable instrument for assessing this component of environmental literacy, but most these efforts are for environmental attitudes, values and so on, not for overall component.

Contribution of this paper to the literature

- There are various instrument developed and validated to assess environmental attitudes, environmental values and so on, but very limited instrument was observed in the available literature to assess overall environmental affect.
- Furthermore, most of the instruments in the literature were developed for high school and university students. Lower grade students have been received very little attention.
- In Turkish literature, the instrument will be beneficial to readers and also researcher working on environmental education, more specifically environmental affect.

to foster the development of an environmentally literate citizenry; i.e., one that is aware, knowledgeable, skilled, and dedicated (e.g., Stapp et al., 1969; Harvey 1977a; Hungerford, Peyton & Wilke, 1980). Particular interest of this study were two of these Tbilisi objectives: "Awareness: to help social groups and individuals acquire an awareness of and sensitivity to the total environment and its allied problems" and "Attitudes: to help social groups and individuals acquire a set of values and feelings of concern for the environment, and the motivation for actively participating in environmental improvement and protection" (UNESCO, 1978, pp. 26-27, emphases added).

Over the past 35 years, there has been extensive research in areas relevant to these and other selected features of Awareness and Attitudes. For example, there have been several reviews of research into significant life experiences as they relate to the development of environmental sensitivity (e.g., Chawla, 1998; Sward & Marcinkowski, 2001). In addition, reviews of research in EE have pointed out repeatedly that attitude is one of its most commonly assessed variables in EE and related fields (e.g., Bamberg & Moser, 2007; Hines, Hungerford, & Tomera, 1986/87; Iozzi, 1984; Rickinson, 2001; Volk & McBeth, 1997),

although there have been cautions about its measurement, using as an outcome of EE, and using as a predictor of behavior (e.g., Hungferford & Volk, 1990; Kolmuss & Agyeman, 2002). At the same time, these reviews of research and other recent reviews of theory (e.g., Jackson, 2005; Darnton, 20087) have pointed out that affective constructs and variables other than attitude have received increasing and much deserved attention from the EE and wider environmental research communities. These constructs and variables include worldview (e.g., Dunlap, 2008; Hawcroft & Milfont, 2008, 2010), values, personal and social norms, self-efficacy and locus of control, and intention, among others (e.g., Ajzen, 1985; Bamberg & Moser, 2007; Fishbein & Ajzen, 1975; Stern, 2000; Vining & Ebreo, 2002).

These and other reviews of theory and of research have pointed out that Tbilisi Objectives were "bursting at the seams" to accommodate the ever-growing list of cognitive, affective, and behavioral variables of relevance to EE and EL. Thus, over the past 25 years, a third way of defining EE has emerged: the formulation of environmental literacy frameworks (e.g., Hungerford & Volk, 1990; Roth, 1992; Simmons, 1995; Wilke, 1995; Hollweg et al., 2011). Frameworks such as these can be adjusted to accommodate advances in theory and research more easily than sets of goals and/or objectives (i.e., the second way of defining the field). By design, these EL frameworks extend beyond the common-but-limited K-A-B (knowledge, awareness/ attitude, behavior) model to include different sets of skills and abilities as well as the wider range of affective variables mentioned above (e.g., Hollweg et al., 2011; Hungerford & Volk, 1990; Kollmuss & Agyeman, 2002).

NATIONAL ASSESSMENTS OF ENVIRONMENTAL LITERACY

Just as there have been some changes to the way in which EE and its outcomes have been defined over time, there also have been changes to the ways in which EE outcomes have been assessed in large-scale studies over time. The first wave of assessments measured only knowledge and attitudes. Over time, large-scale assessments began to measure other variables, including behavior. However, in an attempt to push beyond the K-A-B framework toward broader and more comprehensive assessments, national research teams began to plan and conduct national assessments of environmental literacy shortly after 2000. The first of these was undertaken in Korea over 2002-03 (Shin et al., 2005), and this was soon followed by national assessments in Israel (Negev et al., 2010), the U.S. (McBeth& Volk, 2010), and Turkey (Erdogan, 2009; Erdogan & Ok, 2011). Since then, at least one additional national assessment has been completed in Taiwan, as

has a report of the comparison of geoscience and environmental science items included in the PISA 2006 Science Assessment (OECD, 2009).

Assessing Affective Components of Environmental Literacy

The development and validation of the CEAS described in this article was undertaken as part of the national assessment of environmental literacy among 4th and 5th grader students in Turkey (Erdogan, 2009). As a result, it was a conscious decision by the researchers to include attitude as well as other affective variables apparent in the Tbilisi Objectives, notably sensitivity and willingness (i.e., as a measure of intention). As described in the previous section, there is a growing list of affective variables to consider. Hollweg et al. (2011) pointed out:

> At this point in time, it is clear that this is a very complex domain and it is virtually impossible to assess all of its [EL]components and features in any single assessment…there is simply too much to be assessed in any depth within a single large-scale international or national assessment. (p. 4-1, emphasis added)

In addition to concerns over what or how much can be assessed in a valid and practical manner in any large-scale assessment, there are other matters that deserve careful consideration. One of these is developmental appropriateness. Although there is no single set of guidelines for determining this, there are multiple cognitive, affective and developmental theories, as well as research on the variables under consideration. Many of affective variables listed previously require a backlog of experience and/or a level of cognitive and affective functioning than is greater than what is common in the target population in this study, 4thand 5th graders (e.g., worldview, values, norms, locus of control). As a result, only a limited number of affective variables appropriate for this population were included in this study. In addition, a decision was to include items that measured these students' affective dispositions toward the natural world (sensitivity), toward human uses of and impacts on the environment (attitudes), and toward the need for and willingness to participate in environmental protection (intention).

A review of the Turkish literature pointed out that there have been efforts to develop instrument for assessing affective component of environmental literacy. However, almost all of these efforts were aimed at the development and validation of environmental attitude scales for elementary school students (e.g. Gökçe, Kaya, Aktay & Özden, 2007), middle (secondary) school students (e.g. Yücel &Özkan, 2014), high school students (e.g. Ugulu, Sahin & Baslar, 2013; Uzun & Sağlam, 2006) and university students (e.g. Berberoğlu &

Tosunoğlu, 1995). Beyond this, very few studies assessed other dimensions of environmental affect, such as environmental sensitivity (Yeşilyurt, Gül & Demir, 2013) and environmental awareness (Güven & Aydoğdu, 2012). Bearing in mind the scales in the Turkish literature and the general EE literature, this study focuses on the design, development, validation, and psychometric properties of the Children's Environmental Affect Scale (CEAS). It contains three sub-scales, each of which measures one dimensions of environmental affect: attitudes, sensitivity, and intention. It is believed that the instrument developed and validated here can be used in other research studies with the aim of assessing the general environmental attitudes, sensitivity and intentions of elementary students, regarding the environment.

METHOD

Sample

During the development and validation of CEAS, two different samples were used. Sample 1 was selected to reveal the initial dimensionalities of the scale using EFA, whereas Sample 2 was used to validate the factor structure emerged in EFA using CFA.

Sample 1 (n= 673)

Sample 1 consisting of 673 students was selected among 4th (n= 322, 47.8%) and 5th (n=351, 52.2%) graders from 28 classes in nine different elementary schools in the capital city of Turkey. Of 673 students, 329 (48.9%) were females and 339 (50.4%) were males. A small number of students (n=5, 0.7%) did not report their gender. Most of the students (n=584, 86.8%) were from public school and the remaining (n=89, 13.2%) were from private schools. Their ages ranged from 10 to 11 years. The initial version of CEAS, which consisted of 20 items, was administrated to Sample 1 to examine the dimensionalities underlying the scale via EFA using SPSS version 2.0.

Sample 2 (n=2412)

Sample 2, which consisted of 2412 students, included 5th graders from 78 schools in 26 provinces of Turkey. Of the students, 1207 (50%) were females and 1185 (49.1%) were males. Again a small number of students (n=20, 0.9%) did not report their gender. As for school type, 1891 students (78.4%) were from public schools and 521 students (21.6%) were from private schools. The revised version of CEAS, which consisted of 14 items, was administrated to Sample 2 to run CFA using AMOS18 as a confirmatory test of the factorial structure observed in the EFA.

Instrumentation

Development and validation of CEAS was undertaken in several steps given below.

Review of literature and establishing item pool

This step was designed for going through and revealing the constructs of environmental affect. In the first step of the instrumentation, a comprehensive review of literature on environmental affect and also EL was surveyed in order to examine the possible dimensions. Theory behind components of EL (e.g. Fishbein & Ajzen, 1975; Harvey, 1977; Hines, et al., 1986/87; Hungerford & Volk, 1990; Roth, 1992; Simmons, 1995; Volk &McBeth, 1997; Volk &McBeth, 2005; Wilke, 1995), and previous empirical studies and published scales / questionnaires on environmental attitudes (e.g. Bonnett & Williams, 1988; Bradley, Walickzec & Zajicek, 1999; Eagles & Demara, 1999; Grob, 1995; Kaiser, Ranney, et al., 1999; Kaiser, Wölfing et al. 1999; Makki, et al., 2003; Reid &Sa'di, 1997; Scott & Willits, 1994), environmental sensitivity (e.g. Chawla, 1998; Sia et al., 1985/86; Sivek & Hungerford, 1990), environmental concern (Schultz & Zelezny, 1999), willingness to act / intention (e.g. Harland, Staats & Wilke, 1999), and combination of any of these dimensions (e.g. Bogner & Wiseman, 1997; Chu et al., 2007; Chan, 1996; Hsu, 2004; Hsu & Roth, 1998, 1999; McBeth, 2006; Lee et al., 2003; Negev et al., 2006) were carefully examined to establish an item pool.

Obtaining expert opinion for assuring the content validity

This step was undertaken to assure the content validity of the scale. A review panel with 17 experts on different expertise (science education, environmental education, curriculum and instruction, measurement and evaluation, book writers, and 4th and 5th grade teachers) was established to ensure the content validity of the scale. This panel was asked to examine the initial version of the scale in terms of clarity, understandability, comprehensiveness and content of the items. For this purpose, a questionnaire named "External Validity Panel Evaluation Questionnaire" with three sections; a) demographic information on the panel, b) general opinions on the items (cultural, ethnic, social and regional bias; timing of the instrument; appropriateness of the items for 4th and 5th graders; and practicality of the items); and c) opinions on whether the items are valid measures of environmental affect was prepared by the authors. In addition to this questionnaire, the panel also was sent several supporting documents, including information on the theory of environmental affect, a guide how to assess the items in the scale, and 20 items selected drawn from the item pool for the initial version of CEAS. Furthermore, a Turkish language expert (who is writing books for elementary school students) was asked to check whether the items were clear, understandable and relevant for students in these grades.

Pilot testing

In this step, dimensionalities of the scale were examined though using EFA. Having obtained a permission to carry out such pilot testing with 4th and 5th graders in public and private schools in the capital city of Turkey (Ankara), a contact with the selected schools was enabled and initial version of CEAS was administrated to Sample 1 (n = 673) drawn from one private and seven public elementary schools. One forth and one fifth grade classroom were randomly selected from each school. The data collected from Sample 1 were entered into SPSS data set and then subjected to factor reduction process using EFA to reveal the dimensionalities (factors) behind the scale.

Validating of the factor structure (confirmatory factor analysis)

In this step, factor structure of the scale observed in EFA was validated through performing CFA. The revised version of CEAS was administrated to Sample 2 (n= 2412) as a part of nationwide survey undertaken with fifth graders in 26 provinces of Turkey (Erdogan, 2009). A data set established after nationwide survey was converted to AMOS program to test the proposed model observed in EFA. A CFA was run using this program to validate the factor structure.

Data Analysis

In order to examine the factor structure of the CEAS, EFA using Principle Component Analysis (PCA) was run via SPSS using data collected from Sample 1. Having observed the factor structure and revised the CEAS, new data were collected from Sample 2 and the initial factor structure were cross-validated by performing CFA through using of AMOS. At the end, a reliability analysis was performed to calculate each factor's Cronbach's alpha (α) coefficient score.

RESULTS

Initial form of CEAS

After the related literature was reviewed, the initial form of the CEAS was designed to include a total of 20 items to be ranked on a six-point scale, ranging from strongly agree to strongly disagree. However, fourth and

fifth grade teachers and a measurement and evaluation expert on the external validity panel did not believe that fifth grade students could understand the word "strongly." Thus, the options strongly agree and strongly disagree were excluded from the scale. Thus, initial from of the scale included 20 items on a four point Likert type scale (agree, agree a little, disagree a little, and disagree).

The initial set of 20 items in the scale were designed to assess five affective components of EL: environmental sensitivity, environmental attitude, locus of control, environmental responsibility and willingness to act / intention. The sensitivity component was designed to assess students' feelings and their life experience related to environmental sensitivity. These items were mainly extracted from MSELI developed by McBeth (2006) on environmental sensitivity. The attitude items were designed to assess students' attitude toward natural resources, environmental problems, environmental pollutions, landscapes and biodiversity. Locus of control items were designed to assess whether students are intrinsically motivated to solve environmental problems. In order to assess students' perception of individual and governmental responsibility for dealing with environmental problems, the responsibility items were included on the basis of the prior research study, including individual and governmental responsibility. The willingness items were written to assess students' willingness to participate in various types of efforts aimed at helping to solve environmental problems.

EFA; Factor Structure of CEAS Using Sample 1

An EFA was performed to examine the factor structure behind the initial form of CEAS with 20 items. Before running the factor analysis, the data were cleaned by screening the normality of each variable (skewness and curtosis), outliers and missing cases. Normality assumption was ensured with the accepted level ($\pm$ 3.29) of skewness and curtosis values. The skewness and curtosis values were found to fall in this range. As for the missing case analysis, each variable were subjected to frequency analysis to observe the missing cases (those not reported). It was observed that each of the cases had missing value, but these were less than 5 % of the given responses. Thus, missing cases (blanks) were replaced with sample means (Tabachnick & Fidell, 2001). Univariate outlier(s) were examined by use of scatter plot and multivariate outlier(s) were examined by use of Mahalanobis distance. Three multivariate outliers and 17 univariate outliers were observed and then deleted from the data set.

In order to examine the construct validity and factor structure, 20 items in the initial form was subjected to EFA with Principle Component Analysis (PCA) method using the data collected from Sample 1.The results pointed out that 6 items were found to have very low item-total correlation and commonality score. Due to the fact that these values were found to be lower than .25 (George &Mallery, 2001) for these six items (# 3, 4, 8, 9, 15 and 18) which is not an acceptable contribution to the total variance, they were excluded from the scale. A second EFA with PCA was run with data from this reduced form of the CEAS (item umber = 14). Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy test (measuring whether distribution of values is adequate for performing factor analysis) yielded .816, which was well above the acceptable level (Field, 2005). This meant that factor analysis could be performed adequately with this sample size. Bartlett's test of sphericity (measuring multivariate normality and testing whether the correlation matrix is an identity matrix) had significant value [χ^2 (91) = 711.96, p<.0001], which meant that the normality assumption was met but the identity matrix assumption not. The factor analysis indicated four-factors structure with all eigenvalues greater than 1.0 (Hair et al., 2006). However, the scree plot revealed three slopes with a sharp descent and that other plots starts to level off. Then, EFA was run again for the rotation for three factors by using oblique rotation with Kaiser Normalization. Three factors accounted for 44.69 % of the total variance in the participants' responses. Eigenvalue of factor I was 3.68 (accounted for 26.31 %), of factor II was 1.39 (accounted for 9.99 %) and of factor III was 1.17 (accounted for 8.38 %). The factors were interpreted by considering their size of factor loading, and then named according to conceptual framework used in the recent EL literature (Lee at al., 2003; McBeth, et al., 2007; McBeth, 2006; Negev et al., 2006; Volk & McBeth, 1997). Table 1 summarizes factor names, abbreviations, eigenvalues, and variances of each factor.

Table 1. Factor Names, Abbreviations, Eigenvalues and Variances of Factors

Factor name	Abbreviation	Eigenvalues	% of Variance
Willingness to take environmental action	INTENTION (Factor 1)	3.684	26.311
Environmental Attitudes	ATTITUDE (Factor 2)	1.399	9.99
Environmental Sensitivity	SENSITIVITY (Factor 3)	1.174	8.389

Table 2. Factor Loadings and Communalities

Item Number	Factor Loadings			Communality
	Factor 1	Factor 2	Factor 3	
Affect19	.707			.504
Affect 20	.664			.481
Affect 14	.537			.319
Affect 13	.509			.449
Affect 12	.474			.395
Affect 10		-.717		.504
Affect 1		-.695		.556
Affect 7		-.596	-.320	.493
Affect 17		-.547		.364
Affect 11		-.479	.383	.404
Affect 5			.743	.555
Affect 16			.544	.389
Affect 2		-.365	.490	.452
Affect 6	.361		.461	.393

Collectively, these results showed three dimensions underlying the revised 14-item scale. The factor loadings of each item are given in Table 2. Factor loading less than .30 (Stevens, 2002) were not given any further consideration and therefore are not reported.

As far as the items loading on factor 1 were concerned, item 12, 13, 14, 19, and 20 only loaded on factor 1. Thus, factor 1 included six items. Conceptually, item 19 and 20 are more related to intention, item 12 and 13 are related to locus of control and item 14 are related to environmental responsibility, but all these items loaded on the same factor. This factor and the loading items were given to two different experts. Both experts (one was on EE and the other was on educational psychology) came to the conclusion that all these items are quite related and they seems to measure a similar affective disposition. Based upon what they suggested and relevant literature, this factor was named as Willingness to Take Environmental Action (INTENTION).. Further, Item 1, 10 and 17 loaded only on factor II. On the other hand, item 7 and 11 loaded both on factor 2 and factor 3. However, these two items were conceptually related with other three items. Thus, five items were considered as attitude items and grouped under factor 2. Based on the content of the items and the conceptual framework, this factor was named as Environmental Attitude (ATTITUDE). Finally, Item 5 and 16 only loaded on factor 3. On the other hand, item 2 loaded both on factor 3 and factor 2. Similarly, item 6 loaded both on factor 3 and factor 1. Conceptually, item 2 and 6 were categorized under factor 3. Since these items were related to sensitivity, factor 3 was named as Environmental Sensitivity (SENSITIVITY).

CFA; Validation of Factor Structure Using Sample 2

In order to validate the factor structure emerged in the EFA, a CFA was performed using data from Sample 2 by employing a statistical package of analysis of moments structures (AMOS.18) (Byrne, 2010). First, a model was proposed that included observed variables and unobserved constructs. Later, the proposed model was tested by computing sets of criteria (indexes) to observe whether the model fit the data. A CFA using AMOS.18 was run to validate the factor structure in the EFA. The indexes of NFI, CFI and RMSEA were considered to determine the fitness between the hypothesized (proposed) model with 14 items and the data (gathered from Sample 2). This CFA showed that the model with three factors and 14 items best fit the data [$\chi2$ (74) = 603.124, p<0.001] with the fit indexes of NFI = .963, CFI = .967 and RMSEA = .054. All path coefficients also were found to be significant at p< .001 and their contributions were ranged from .50 to .90, meaning that each item significantly contributed to the related factor. Figure 1 presents the significant path coefficient of three factor model of CEAS validated using CFA.

Reliability Coefficient(s) for CEAS

Cronbach's alpha correlation coefficient, which refers to internal consistency among the items, was calculated for each sub-scale through using SPSS v.20. This analysis yielded satisfactory results. Cronbach's alpha (α) reliability coefficient of first factor with five items (Willingness to take environmental action) was found to be .87; of second factor with five items
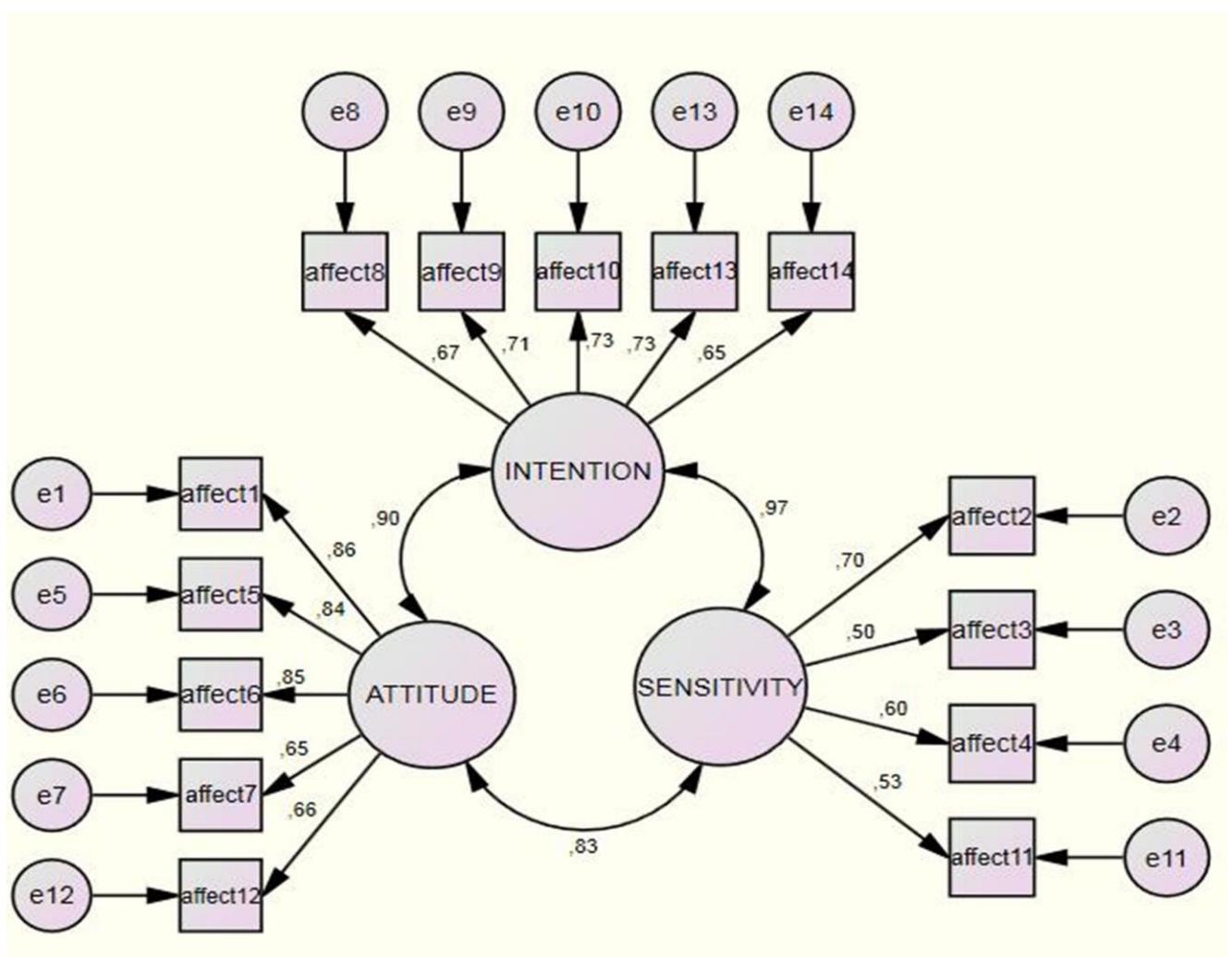
Figure 1. Standardized coefficients for the three-factor model for CEAS based on CFA through using AMOS. All coefficients are significant at p<.001. [χ² (74) = 603.124, p<0.00; NFI = .963, CFI = .967 and RMSEA = .054.]. IN TENTION = Willingness to take environmental action; *SENSITIVITY* = Environmental Sensitivity; and *ATTIT UDE* = Environmental Attitude.

(Environmental Attitudes) was found to be .82. and of third factor with four items (Environmental Sensitivity) was found to be .67. Also, the item-total correlation scores, which show the contribution of each item to the related sub-scale, were observed to be higher than .30 (Field, 2005), which is satisfactory to include items in each sub-scale.

Final version of CEAS

Final version of CEAS with three sub-scales and 14 items, all measured using a four-point Likert type scale, is presented in Table 3 both in English and Turkish. Since the instrument was developed and validated in Turkish, it was translated later into English by bilingual translator fluent in both languages.

DISCUSSION

Environmental Affect (EA) is one of the main components of Environmental Literacy (EL). Even though there have been numerous efforts to develop instruments to measure environmental attitudes, limited efforts have been dedicated to develop instruments that assess the wider range of affective constructs and variables apparent in reviews of the environmental research literature (e.g., Bamberg & Moser, 2007; Hines et al., 1986/87; Volk & McBeth, 1997). This study represents one such effort. The CEAS, with three factors and 14 items measured on a four-point Likert type scale, was developed and validated in five steps: (1) a comprehensive review of literature on environmental affect and EL, (2) development of an item pool; (3) assuring the content validity of items by obtaining expert opinions from the external panel (n=17); (4) a pilot testing of the initial version of the CEAS to reveal

Table 3. Items in Children's Environmental Affect Scale on a Four Point Likert Type Scale
(*T* = Turkish version; *E* = English version)

No	Turkish and English version of the items
1	*T.* İnsanlar çevreye önem vermelidir
	E. People should give importance to the environment.
2	*T.* Kendimi çevreye çok duyarlı olarak görüyorum
	E. I believe that I am sensitive to the environment.
3	*T.* Sık sık çevre ve doğa ile ilgili yazılar (kitap, dergi vb.) okurum.
	E. I often read texts (books, magazines etc) related to the environment and nature
4	*T.* Televizyonda ne zaman çevre ve doğa ile ilgili bir program olsa izlerim.
	E. Whenever there is a program about the environment and nature on TV, I watch it
5	*T.* Doğal kaynaklar dikkatli kullanılmalıdır.
	E. Natural resources should be used carefully.
6	*T.* Toprak kaymasını ve erozyonu önlemek için daha çok ağaç dikilmelidir.
	E. More trees should be planted in order to prevent landslide and erosion
7	*T.* Yılan, kartal gibi yırtıcı ve vahşi hayvanlar öldürülmemelidir, çünkü onların da yaşama hakkı vardır.
	E. Predacious and wild animals such as snakes, eagles should not be killed because they also have right to live.
8	*T.* Çevre problemlerinin çözümü için bu konuda çalışan insanlara yardım edebilirim.
	E. I can help the people working for the solution of environmental problems
9	*T.* Canlıların doğal yaşam alanlarının korunmasına yönelik benim de yapacak olduğum birşeyler olduğunu düşünüyorum
	E. I think I have something to do protect the habitat of the living creatures
10	*T.* Çevre kirliliğinin önlenmesinde, kişisel sorumluluk çok önemlidir.
	E. Personal responsibilities is very important to prevent environmental pollution.
11	*T.* Doğal kaynakları korumak için, yaşam tarzımda değişiklik yapabilirim.
	E. I can change my lifestyle to protect the natural resources
12	*T.* Çevre sorunlarını önlemek için tedbirler (geri dönüşümlü ürünler kullanmak, yerlere çöpatmak vb.) almak isterim
	E. I want to take measures (to use recyclable materials, not to drop litter etc.) so as to prevent environmental problems.
13	*T.* Çevreyi korumaları için insanları birşeyler yapmaları konusunda teşvik etmek isterim.
	E. I want to encourage people to do something so as to protect the environment.
14	*T.* Çevrenin korunması için devlet yetkilileri ile konuşmak isterim.
	E. I want to talk to the authorities to protect the environment.

Responses: 4 – Katılıyorum / Agree, 3 – Biraz Katılıyorum / Little Agree, 2 – Biraz Katılmıyorum / Little Disagree, 1 – Katılmıyorum / Disagree

the factor structure using EFA; and (5) validating the three-factor model from the EFA using CFA and calculating the reliability scores of each sub-scale. This hypothesized three-factor model, based on the structural model in EFA, was validated through CFA which resulted in acceptable (.50 to .90) and significant (p< .001) path coefficients. This means that each item has a significant contribution to the related sub-scale. Furthermore, all indexes (NFI, CFI and RMSEA) observed in CFA output yielded satisfactory results [best fit if NFI and CFI are higher than and equal to .90 (Kelloway, 1998) and RMSEA equal to and less than .06 (Hu & Bentler, 1999), which means that the hypothesized model fits the data. Thus, EFA and later CFA results provided satisfactory evidence for the construct validity of CEAS for the sample of elementary school students. Reliability analysis for each sub-scale resulted in satisfactory values which fell in the

acceptable limit of .70 (Georgy & Mallery, 2001), but the alpha (α) for factor III (environmental sensitivity) was found to be a bit lower (α = .67) than this criteria. This could be due to the number of the items (n=4) in the factor or to the diversity of the items being measured (Field, 2005). These satisfactory results are indications of the acceptable properties of the final 14-item version of the CEAS.

The three-factor model underlying the CEAS assesses elementary school students' feelings and tendencies toward the environment and environmental issues. All items are measured on a four-point Likert type scale ranging from agree (4) to disagree (1). The first factor, named as Willingness to Take Responsible Action, refers to perceived skills and empowerment in taking responsible action for environmental protection or dealing with environmental problems, and also one's own ability to influence the resolution of environmental

problems. This factor, as intention (to act), is previously observed in the well know models of Fishbein and Ajzen (1975), Hines et al. (1986/87), Hungeford and Volk (1980), and Bamberg and Moser (2007), among others. The second factor named as Environmental Attitude a set of statements designed to elicit the individuals' feelings, pros or cons, favorable or unfavorable, toward particular aspects of the environment and/or objects associated with the environment (Hines et al., 1986/87). The last factor named as Environmental Sensitivity refers to personal inclination toward and empathetic views of the environment. Environmental sensitivity has long been equated with significant life experiences (Chawla, 1998; Sward & Marcinkowski, 2001). Stapp (1974) referred to environmental sensitivity with regard to exposure to, exploration of, appreciation of, respect for (Sward & Marcinkowski, 2001) and care about the environment (Hsu, 2004).

As described here, the CEAS was developed, validated and used with 4th and 5th graders in Turkey. The use of the CEAS with other populations within and beyond Turkey has not yet been tested, so the wider range of appropriate uses of the CEAS is not yet clear. Beyond this possible use, the steps used to design, develop, and validate the CEAS may be used by other researchers interested in developmentally appropriate scales to measure multiple affective variables in other youth and young adult (K-16) populations.

Implications for Further Studies on Environmental and Science Education

Having good psychometric properties, the CEAS could be used in further research for measuring elementary school students' tendencies, favorable and unfavorable feelings toward the environment and environmental issues, and willingness / intention to take environmental actions. Although the CEAS was developed and validated through using the data collected from 4th and 5th grade students, the use of this instrument for elementary (first cycle, 1st to 4th grade) and middle (second cycle 5th to 8th grade) school students, and learners of equivalent ages could and should be investigated. With minor changes, the instrument could be used for upper grades (third cycle, 9th to 12th grades). In this case additional items could be included into the items pool to be validated with the sample of selected group. Further, because the items in the instrument were developed by considering both the national (Turkish) and international literature, the CEAS could be used in other nations by adapting it to that nation's culture, language and context. Thus, the instrumentation process employed in the present study could be followed in future instrument modification and development studies of this kind (other age groups, other countries etc.)

Especially for the Turkish research community and literature, this instrument is vital due to the number of studies trying to assess various groups' affective dispositions toward the environment, and because environmental literacy (EL) is now receiving increased attention (Erdogan, Marcinkowski& Ok, 2009). Using only environmental attitude to represent the full range of affective components of EL will limit any study. In order to assure content validity of such kind of studies and report more comprehensive total scores for EL, instruments designed to measure the wider range of affective dispositions of EL that are developmentally appropriate for that population are needed. In this sense, it is clear that development of CEAS is an attempt to meet such gap in the literature. In many of the studies in Turkey, CHEAKS (Leeming, Bracken & Dwyer, 1995) or the Turkish version of CHEAKS (Alp, 2005) is used to assess students' tendencies, but this instrument only measures environmental knowledge and environmental attitudes. Other components of environmental affect are not assessed by the CHEAKS instrument, suggesting that the CEAS could be used with CHEAKS to broaden the range of affective components being assessed. In closing, despite a relatively small number of items, CEAS is an instrument developed following a careful instrumentation process and that correspond to the needs in the field of environmental education, specifically for instruments designed to measure affective components of EL.

REFERENCES

Ajzen, I. (1985). From intentions to action: A theory of planned behavior. In J. Kuhl and J. Beckman (Eds.), *Action Control: From Cognition to Behavior* (pp. 11-39). Heidelberg, Springer.

Alp, E. (2005). *A study on students' environmental knowledge and attitudes: The effects of grade level and gender.* Unpublished masters' thesis, Middle East Technical University, Ankara, Turkey.

Bamberg, S., & Moser, G. (2007). Twenty years after Hines, Hungerford and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behavior. *Journal of Environmental Psychology*, *27*, 14-25.

Berberoğlu, G., & Tosunoğlu, C. (1995). Exploratory and confirmatory factors analyses of en environmental attitude scale (EAS) for Turkish university students. *The Journal of Environmental Education, 26*(3), 40-43.

Bonnett, M., & Williams, J. (1998). Environmental education and primary children's attitude towards nature and environment. *Cambridge Journal of Education, 28*(2), 159-177.

Bogner, F.X., & Wiseman, M. (1997). Environmental perception of urban and rural pupils. *Journal of Environmental Psychology, 17*, 111-122.

Bradley, J.C., Waliczek, T.M., & Zajicek, J.M. (1999). Relationship between environmental knowledge and environmental attitude of high school students. *The Journal of Environmental Education, 30*(3), 17-22.

Chan, K.K.W. (1996). Environmental attitudes and behavior of secondary school students in Hong Kong.*The environmentalist, 16,* 297-306.

Chawla, L. (1998). Significant life experiences revisited: A review of research on sources of environmental sensitivity. *The Journal of Environmental Education, 29*(3), 11-21.

Chu, H-E., Lee, E. A., Ko, H. R., Shin, D. H., Lee, M. N., Min, B. M. & Kang, K. H. (2007). Korean year 3 children's environmental literacy: A prerequisite for a Korean environmental education curriculum. *International Journal of Science Education, 29*(6), 731-746.

Darnton, A. (2008). Reference report: An overview of behaviour change models and their uses. A GSR [Government Social Research] behaviour change knowledge review. London, UK: University of Westminster.

Disinger, J. (1983). *Environmental Education's Definitional Problem.* (ERIC InformationBulletin #2). Columbus, OH: ERIC Science, Mathematics, and Environmental Education Clearinghouse.

Dunlap, R. (2008). The New Environmental Paradigm Sale: From marginality to worldwide use. *The Journal of Environmental Education, 40*(1), 3-18.

Eagles, P. F. J., & Demare, R. (1999).Factors influencing children's environmental attitudes. *The Journal of Environmental Education, 30*(4), 33-38.

Erdogan, M. (2009). *Fifth grade students' environmental literacy and the factors affecting students' environmentally responsible behaviors.* (Unpublished doctoral dissertation). Middle East Technical University, Turkey.

Erdogan, M., & Ok. A. (2011). An assessment of Turkish young pupils' environmental literacy: A nationwide survey. *International Journal of Science Education, 33*(17), 2,375-2,406.

Erdogan, M., Marcinkowski, T, & Ok, A. (2009). Content analysis of selected features of K – 8 environmental education research studies in Turkey, 1997–2007. *Environmental Education Research 15*(5), 525–48.

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention and Behavior. An Introduction to Theory and Research.* Reading, MA: Addison-Wesley.

Georgy, D., & Mallery, P.. (2001). SPSS for windows, step by step: A simpleguideandreference. Boston, MA: Allynand Bacon.

Gökçe, N., Kaya, E., Aktay, S., & Özden, M. (2007). Elementary students' attitudes toward environment. [In Turkish] *Elementary Education Online, 6*(3), 452-468.

Grob, A. (1995). A structural model of environmental attitudes and behavior.*Journal of Environmental Psychology, 15,* 209-220.

Güven, E., & Aydoğdu, M. (2012). Development of an awareness scale and determination of teacher candidates' awareness levels regarding environmental programs. [In Turkish] *Journal of Teacher Education and Educators, 1*(2), 185-202.

Harland, P., Staats, H., &Wilke, H.A.M. (1999).Explaining pro-environmental intention and behavior by personal norms and the theory of planned behavior. *Journal of Applied Social Psychology, 29,* 2505-2528.

Hart, E.P. (1981). Identification of key characteristics of environmental education.*The Journal of Environmental Education, 13*(1), 12-16.

Harvey, G. (1977a). A conceptualization of environmental education. In J. Aldrich, A. Blackburn, and G. Abel (Eds.), *A Report on the North American Regional Seminar on Environmental Education* (pp. 66-72). Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

Harvey, G.D. (1977b). Environmental Education: A delineation of substantive structure. (Doctoral dissertation, Southern Illinois University at Carbondale, 1976).*Dissertation Abstracts International, 38*(2), 611A. (UMI No. 77-16622)

Hawcroft, I. J., &Milfont, T. L. (2008). *The use (and abuse) of the New Environmental Paradigm scale over the last 30 years: A meta-analysis.* Unpublished manuscript, University of Auckland, and Victoria University of Wellington, New Zealand.

Hawcroft, L. J. and T. L. Milfont (2010) 'The use (and abuse) of the new environmental paradigm scale over the last 30 years: A meta-analysis'. *Journal of Environmental Psychology, 30*(2): 143-158.

Hines, J., Hungerford, H., & Tomera, A. (1986/87). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *The Journal of Environmental Education, 18*(2), 1-8.

Hollweg, K. S., Taylor, J. R., Bybee, R. W., Marcinkowski, T. J., McBeth, W. C., & Zoido, P. (2011). *Developing a framework for assessing environmental literacy.* Washington, DC: North American Association for Environmental Education.

Hu, L., &Bentler, P. (1999). Cut off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1-55.

Hungerford, H., Peyton, R., &Wilke, R. (1980b). Goals for curriculum development in environmental education. *The Journal of Environmental Education, 11*(3), 42-47.

Hungerford, H.R., & Volk, T.L. (1990).Changing learner behavior through environmental education.*The Journal of Environmental Education, 21*(3), 8-22.

Hsu, S.J., (2004). The effects of an environmental education program on responsible environmental behavior and associated environmental literacy variables in Taiwanese college students. *The Journal of Environmental Education, 35*(2), 37-48.

Hsu, S.J., & Roth, R.E. (1998).An assessment of environmental literacy and analysis of predictors of responsible environmental behavior held by secondary teachers in the Hualien area of Taiwan.*Environmental Education Research, 4*(3), 229-249.

Hsu, S.J., & Roth, R.E. (1999).Predicting Taiwanese secondary teachers' responsible environmental behavior through environmental literacy variables. *The Journal of Environmental Education, 30*(4), 11-18.

Iozzi, L. (Ed.). (1984). *A summary of research in environmental education, 1971-1982. The Second report of the National Commission on Environmental Education*

Research.(Monographs in Environmental Education and Environmental Studies, Vol. #2). Columbus, OH: ERIC/SMEAC.

Jackson, T. (2005). Motivating sustainable consumption: A review of evidence on consumer behaviour and behavior change. A report to the Sustainable Development Research Network. Guildford, Surrey, UK: Center for Environmental Strategy, University of Surrey.

Kaiser, F.G., Ranney, M., Terry, H., & Bowler, P.A. (1999).Ecological behavior, environmental attitude, and feeling of responsibility for the environment.*European Psychologist, 4*(2), 59-74.

Kaiser, F.G., Wölfing, S., & Fuhrer, U. (1999).Environmental attitude and ecological behavior.*Journal of Environmental Psychology, 19*, 1-19.

Kelloway, E.K. (1998). Using LISREL for structural equation modeling: A researcher's guide. Thousand Oaks, CA: Sage.

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research, 8*(3), 239-260.

Leeming, F. C., Dwyer, W. O., & Bracken, B. A. (1995). Children's environmental attitude and knowledge scale: Construction and validation. *The Journal of Environmental Education, 26*(3), 22-31.

Makki, M.H., Abd-el-Khalıck, F., & Boujaoude, S. (2003).Lebanese secondary school students' environmental knowledge and attitudes. *The Journal of Environmental Education Research, 9*(1), 21-33.

Marcinkowski, T., Shin, D, Noh, K., Negev, M., Sagy, G., Garb, Y., McBeth, W., Hungerford, H., Volk,T., Meyers, R., &Erdogan, M. (2013). 31: National assessments of environmental literacy: Areview, comparison, and analysis. In R. Stevenson, M. Brody, J. Dillon, & A. Wals (Eds.), *International Handbook of Research on Environmental Education.* (pp. 310-330).Washington, DC: American Educational Research Association and Routledge.

McBeth, W. (Primary investigator – PI). (2006). National environmental literacy assessment of middle school students in the U.S. (A Special Project Award to the North American Association for Environmental Education [Award no NAO6SEC4690009] by the National Oceanic and Atmospheric Administration, U.S. Department Commerce). Washington, D.C.: NAAEE.

McBeth, W., & Volk, T. (2010). The National Environmental Literacy Project: A Baseline Study of middle grades students in the U.S. *The Journal of Environmental Education, 41*(1), 55-67.

Negev, M., Sagy, G., Tal, A., Salzberg A., Garb, Y. (2006). *Mapping environmental literacy in Israel.* A paper resented at 35th Annual NAAEE Conference: Building Environmental Education in Society, St. Paul, MN, U.S..

Negev, M., Sagy, G., Garb, Y., Salzberg, A., & Tal, A. (2008). Evaluating the environmental literacy of Israeli elementary and high school students. *The Journal of Environmental Education, 39*(2), 3-20.

OECD. (2009). *Green at 15? How 15-year-olds perform in environmental science and geoscience in PISA 2006.* Paris, France: Author.

Reid, I., &Sa'di, I. (1997). Joardian and British primary schoolchildren's attitudes toward environment. *Education Studies, 23(3),* 473-481.

Rickinson, M. (2001). Special Issue: Learners and learning in environmental education: A critical review of the evidence. *Environmental Education Research, 7*(3), 208-320.

Roth, C. (1992). *Environmental Literacy: Its Roots, Evolution, and Directions in the 1990s.* Columbus, OH: ERIC/SMEAC.

Schultz, P.W., &Zelezny, L. (1999). Values as predictors of environmental attitudes. *Journal of Environmental Psychology, 19*(3), 255-276.

Scott, D., & Willits, F.K. (1994). Environmental attitudes and behavior: A Pennsylvania survey. *Environment and Behavior, 26*(2), 239-260.

Shin, D., Chu, H., Lee, E., Ko, H., Lee, M., Kang, K., Min, B., & Park, J. (2005).An assessment of Korean students' environmental literacy. *Journal of the Korean Earth Science Society, 26*(4), 358-364.

Sia, A.P., Hungerford, H.R., &Tomera, A.N. (1985/86). Selected predictors of responsible environmental behavior: An analysis. *The Journal of Environmental Education, 17*(2), 3-40

Simmons, D. (1995). *Working paper # 2: Developing a framework for national environmental education standards.* In papers on the Development of Environmental Education Standards (pp. 53-58). Troy, OH: NAAEE.

Sivek, D.J., & Hungerford, H. (1989/90). Predictors of responsible behavior in members of three Wisconsin conservation organizations. *The Journal of Environmental Education, 21*(2), 35-40.

Stapp, W. B. (1974). Historical setting of environmental education. In J. Swam and W. Stapp (Eds.) *Environmental Education* (pp. 42-49). New York: J Willey and Sons.

Stapp, W. (1979). International environmental education - Developing Unesco's program. *The Journal of Environmental Education, 11*(1), 33-37.

Sward, L.L., &Marcinkowski, T. (2001). Environmental sensitivity; A review of the research, 1980-1998. In H. Hungerford, W. Bluhm, T. Volk and J Ramsey (Eds.), *Essential Readings in Environmental Education* (pp. 277-288). Champaign, IL: Stipes Publishing, L.L.C.

Tabachnick, B.G.,& Fidell, L.S. (2001). *Using multivariate statistics* (4th ed.). Boston: Allyn and Bacon.

Unesco. (1976). The Belgrade Charter. *Connect, UNESCO-UNEP Environmental Education Newsletter, 1*(1), 1-2.

Unesco. (1977). *Trends in Environmental Education.* Paris, France: Author.

Unesco. (1978). *Final Report: Intergovernmental Conference on Environmental Education.* Paris, France: Author.

Ugulu, I., Sahin, M., & Baslar, S. (2013). High school students' environmental attitude: Scale development and validation. *Int.J.Edu.Sci. 5*(4), 415-424.

Uzun, N., & Sağlam, N. (2006). Development and validation of an environmental attitudes scale for high school students. [In Turkish] *H.U. Journal of Education 30,* 240-250.

Volk, T. &McBeth, W. (2005).Environmental literacy in the Unites States.In H. Hungerford, B. Bluhm, T. Volk and J. Ramsey (Eds.) *Essential Readings in Environmental Education* (pp.75-80). Campaign, IL: Stipes Publishing Company.

Volk, T. &McBeth, W. (1997). Environmental literacy in the Unites States: What should be…What is…Getting from here to there. A report funded by the U.S. Environmental Protection Agency and submitted to the Environmental Education and Training Partnership, NAAEE. Washington, DC: U.S. EPA.

Wilke, R. (1995). Literacy model development and framework. In R. Wilke (ed.), *Environmental Education Literacy/Needs Assessment Project: Assessing Environmental Literacy of Students and Environmental Education Needs of Teachers*; Final Report for 1993-1995 (pp.5-6). (Report to NCEET/University of Michigan under U.S. EPA Grant NT901935-01-2). Stevens Point, WI: University of Wisconsin – Stevens Point.

Wilke, R. (Ed.). (1995). *Environmental Education Literacy/Needs Assessment Project: Assessing environmental literacy of students and environmental education needs of teachers; Final report for 1993-1995* (pp. 5-6). (Report to NCEET/University of Michigan under U.S. EPA Grant #NT901935-01-2). Stevens Point, WI: University of Wisconsin - Stevens Point.

Yeşilyurt, S., Gül, Ş., & Demir, Y. (2013). Biology teacher candidates' environmental awareness and environmental sensitivity: A scale development study. [In Turkish] *Mehmet Akif Ersoy Üniversitesi, Eğitim Fakültesi Dergisi, 13*(25), 38-54.

Yücel, A.Ö., & Özkan, M. (2014). Development of environmental attitudes scale for secondary school students. [In Turkish] *Uludağ Üniversitesi, Eğitim Fakültesi Dergisi, 27*(1), 27-48.

❖ ❖ ❖