

A Comparative Investigation of Sub-Components of the Environmental Literacy at the Secondary School Level

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ABSTRACT

The purpose of this research is to determine the correlation between “environmental knowledge”, “environmental affect” and “environmental behavior” which are accepted as environmental literacy components. “Environmental Knowledge Test (EKT)”, “Environmental Affect Scale (EAS)” and “Environmental Behavior Scale (EBS)”, which have been prepared by the researchers and their validity and reliability ensured, have been used as the measurement tools. The research group is composed of 364 students from 6 different secondary schools in the center of Amasya city providing education in the school year of 2011-2012. Correlational research method was used in the study. The Pearson Correlation Test has been used for analysis of the data. As a result of the research; it was found that there was a positive and *high* correlation at 0,858 strength between the “environmental knowledge” component and “environmental affect” component; a positive and *low* correlation at 0,426 strength between the “environmental knowledge” component and “environmental behavior” component; a positive *medium level* correlation at 0,502 strength between the “environmental affect” variable and “environmental behavior” variable. The results obtained from the investigation are of great importance in terms of shedding light on the issue for determination of how environmental literacy components affect each other.

Keywords: Environmental Literacy; Environmental Knowledge; Environmental Affect; Environmental Behavior.

INTRODUCTION

Humankind confronts with many environmental problems due to an increasing population in our country and in the world depending on industrialization, urbanization and technologic advances. The view about education is necessary for the prevention of environmental problems and they have been a main concern of many national or international studies, at some important environmental organizations, declarations and conventions (Stockholm, 1972; UNESCO, 1978; Peyton, et al., 1995; Kızıroğlu, 2000; Bülbül, 2007). These kind of conferences and meetings were held in order to enhance environmental consciousness among people across the world and it has been embodied in the concept of “environmental literacy” (Kibert, 2000). The concept of environmental literacy was defined as



“environmental knowledge and awareness level of an individual” in an article by Charles Roth the first time (Roth, 1968). Disinger and Roth (1992) have interpreted environmental literacy as “the capacity for being able to perform appropriate actions in order to perceive the relative health of the environmental systems, to interpret, to protect the health of these systems, to re-gain health to them or to develop these systems” by improving further this definition. Therefore, the people who are environmentally literate should be able to exhibit positive attitudes and behaviors in order to develop these environmental systems after becoming aware of the environmental systems.

It has been put forth by some researchers that environmental literacy was not only cognitive, but also related with affective and psychomotor aspects (Roth, 1992; Schneider, 1997). In other words, it can be said that an environmentally literate person is a human not only having knowledge about the environment, but also having affective characteristics as well, such as responsibility towards environment, sensitivity and perception. Such a person can acquire these characteristics as behaviors. It is required to take into account of environmental literacy components in determination of whether environmentally literate individuals can be raised/grown in a society (Altınöz, 2010). The environmental literacy components, which were recognized mostly in environmental education literature, have been defined by Disinger and Roth (1992), supported by Hsu (1997) and used in some studies through application. (Chu, Shin & Lee, 2006; McBeth, Hungerford, Marcinkowski, Volk & Meyers, 2008; Kışoğlu, 2009; Öztürk, 2009; Altınöz, 2010; Meuth, 2010; McBeth, & Volk, 2010; Karatekin, 2011; Kışoğlu, Gürbüz, Sülün & Alaş, 2011; Karatekin & Aksoy, 2012). The main components constituting the environmental literacy adopted by Disinger and Roth (1992) are four as being *knowledge, affective area, skill and behavior*. Investigation of whether there is any correlation between each of “knowledge”, “affect” and “behavior” towards the environment among these components is the subject of this study.

Environmental literacy is a broad concept encompassing not only an individual’s environmental knowledge or environmental attitude but also the environmental behavior and problem solving skills towards the environment (Roth, 1992; Hsu, 1997; McBeth et al., 2008). Generally in our country, although studies have been made like environmental knowledge, environmental affect (attitude), environmental behavior, no research has been encountered towards *secondary school 6., 7. and 8. grade students* wherein the correlation between each of these three important variables under the name of “environmental literacy”. Meanwhile Erdoğan (2009) has examined the correlation between each of these three components in a study made towards *secondary school 5th grade students*. In studies across our country, it has been encountered that mostly the correlation between environmental knowledge and environmental attitude (affect) (Atasoy, 2005; Atasoy & Ertürk, 2008; Ökesli, 2008; Varışlı, 2009; Teksöz, Şahin & Ertepinar, 2010) was investigated. Therefore, this study is very important in order to learn whether there is any correlation between *environmental knowledge, affective tendency towards the environment and environmental behavior* possessed by secondary school students. Besides, if there is any correlation between these sub-components, it is particularly important for correcting the deficiency in the literature upon finding out this at what direction (positive or negative) and at which level (low, medium and high). Thus, it is being thought that this will give an opinion to similar researches to be carried out in the field of environmental education and organizations performing activities related with the environment and to other researchers.

The main goal of this investigation is to determine whether there is any correlation between the “environmental knowledge”, “environmental effect” and “environmental behavior” components which are placed in the environmental literacy components.

The main problem of this research is whether there is any relationship between subcomponents of environmental literacy (environmental knowledge, environmental effect

and environmental behavior) that secondary school students have, or nat. In addition, if any, it is also research subject which level this relationship is at.

METHODOLOGY

This part contains information about the model of research, working group, data collection tools and the analysis of data.

a) Model of the Research

Correlational research method was used in the study. This study is a correlational study that carried on to determine cause and effect and relations between two or more variables (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel, 2010).

b) Working Group

The sample of the research is composed of 364 students at 6th, 7th, 8th grades from six different secondary schools in the center of Amasya city in the 2011-2012 academic year.

c) Data Collection Tool

In this study, Environmental Knowledge Test (EKT) composed of 19 questions, 5 point likert type Environmental Affect Scale (EAS) composed of 15 clauses, 7 point likert type Environmental Behavior Scale (EBS) composed of 12 clauses which were prepared by researchers as a data collection tool have been used. The pilot implementation, conducted at the stage of development of data collection tools, has been applied by the researcher himself to 258 8th grades students attending four schools selected randomly from the Amasya city in the 2011-2012 school year.

Environmental Knowledge Test (EKT)

The Environmental Knowledge Test is composed of 19 multiple-choice questions prepared in accordance with cognitive levels of students by taking into account of acquisitions with respect to the environment in science and technology lesson at 4th, 5th, 6th, 7th, 8th grades. The value of each question in the test is 1, and while the highest score to be obtained from the test is 19, the lowest score is 0.

The EKT, which had 20 questions prior to the pilot implementation, decreased to 19 questions by discarding one question after the pilot implementation. KR-20 (Kuder Richardson) formula has been used for ensuring the reliability of EKT. According to this analysis, the reliability of EKT was found to be 0,807. Additionally, an item analysis has been carried out of the EKT. As a result of the item analysis, item distinctiveness index of the 4th item was found as negative, this item was discarded from the test. The average difficulty of the test was identified as 0,545 (Arithmetic average of the scores=10,91)/(The possible highest score in the test=20). Even though the difficulty levels of each items in a test are different, it is a desirable situation for being around 0,50 of the test's average difficulty that to be found by averaging them (Çepni et al., 2008). Average difficulty value after the fourth item discarded from the test has been found to be 0,542 and the average difficulty of the test has not changed much.

Six lecturers and twelve science and technology teachers having expertise in their fields have been consulted for the scope and face validity of EKT. The test was taken its final form by considering necessary suggestions.

Environmental Affect Scale (EAS)

The Environmental Affect Scale is composed of 15 items and in 5 point likert type. The items associated with the gains of students by scrutinizing the acquisitions related to the

environment issue and suitable to the affective level of students while preparing the scale items. Prior to giving answers to the scale items, students were told that scale items are not correct and wrong and therefore each individual were asked to reflect own thought and to what extent they agree or not agree with these items. The answers given to the scale items were rated as 5 point likert type in the form of absolutely disagree, disagree, agree a little, agree and absolutely agree. Scoring of the scale was calculated as “absolutely disagree” 1 point, “disagree,” 2 points, “agree a little” 3 points, “agree” 4 points and “absolutely agree” 5 points. While the possible lowest score in EAS is 15, the highest score is 75.

Six lecturers and twelve science and technology teachers having expertise in their fields have been consulted for the scope and face validity of EAS. The test took its final form by considering necessary suggestions. Cronbach’s alpha reliability coefficient was observed for ensuring the reliability of EAS and this value has been found to be 0,860. Cronbach Alpha coefficient is often used in the cases where particularly responses are obtained from the rating scale (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel, 2010). In Büyüköztürk’s opinion, it is adequate for being 0,70 and above of the reliability coefficient. Accordingly, the reliability analysis result of the scale is sufficient for the actual application.

The factor analysis has been observed for the structure validity. According to this analysis, Environmental Affect Scale has been separated into 3 factors as being *environmental responsibility*, *environmental sensitivity*, *environmental perception*. Reliability values of sub-dimensions of EAS which was constituted as a result of the factor analysis was given in the following Table 1.

Table 1. Factor and Reliability Analysis Result of Environmental Affect Scale

Factors	Scale İtems	Rotated Component Matrix	Cumulative (%)	Reliability
Environmental Responsibility	1	,812	21,935	,867
	9	,808		
	10	,778		
	13	,763		
	14	,743		
Environmental Sensitivity	2	,785	19,180	,807
	6	,758		
	7	,746		
	11	,704		
	15	,683		
Environmental Perception	3	,786	17,959	,784
	4	,716		
	5	,715		
	8	,668		
	12	,633		
Total			59,075	,860
Kaiser-Meyer-Olkin Measure of Sampling Adequacy				,858
Bartlett's Test of Sphericity				1470,588
Sd				105
P value				,000

Acceptable lower limit of KMO sampling sufficiency is 0,50 and the KMO value is considered excellent for 0,80 and above (Durmuş, Yurtkoru & Çinko, 2011). The data set was considered suitable for factor analysis due to KMO value is over 0,80 (KMO=0,858) and Barlett test is significant at the 0,05 significance level ($\chi^2_{\text{Barlett test}}=1470,588, p=0,000$).

Environmental Behavior Scale (EBS)

The Environmental Behavior Scale is composed of twelve items and in seven point likert type. The answers given to scale items have been rated as seven point likert type in the

form of *never, 1 time, 2 times, 3 times, 4 times, 5 times and more than 5 times*. The scale grading has been calculated in the form of “never” 0 points, “1 time” 1 point, “2 times” 2 points, “3 times” 3 points, “4 times” 4 points, “5 times” 5 points, “more than 5 times” 6 points. While the possible lowest score in EBS is 0, the highest score is 72.

Content validity and construct validity was watched for identification of the validity of environmental behavior scale; and Cronbach Alpha (α) internal consistency coefficient was for its reliability. It was applied to the expert opinion for content validity, and to the factor analysis for construct validity. The EBS, which had 15 items prior to the pilot implementation, has taken its final shape as being 12 items by discarding two questions as a result of factor analysis after the pilot implementation, and one question depending on the expert opinion before the pilot implementation. It has been determined that EBS has three factors according to the factor analysis. These are; “*the behavior protective of natural balance*”, “*societal behavior*” and “*top level cognitive behavior*”. The Cronbach Alpha (α) internal consistency coefficient has been calculated for reliability of the final status of this measurement tool and this value has been determined as 0,773.

The factor analysis and reliability analysis results of EBS calculated as a result of the pilot implementation are seen in Table 2.

Table 2. Factor and Reliability Analysis Result of Environmental Behavior Scale

Factors	Scale Items	Rotated Component Matrix	Cumulative (%)	Reliability
The Behavior Protective of Natural Balance	6	,713	23,281	,774
	8	,691		
	9	,752		
	13	,670		
	14	,705		
Societal Behavior	1	,691	20,854	,743
	3	,651		
	10	,727		
	11	,772		
	15	,620		
Top Level Cognitive Behavior	2	,842	13,637	,708
	5	,838		
Total			57,772	,773
Kaiser-Meyer-Olkin Measure of Sampling Adequacy				,764
Bartlett's Test of Sphericity				819,730
Sd				66
P value				,000

d) Analysis of Data

SPSS 15 package program was used in analysis of data. Pearson Correlation Coefficient (Simple Correlation) was used to see the correlation between for each environmental literacy components. Pearson Correlation Coefficient, investigation of relation between variables, is carried out by utilizing statistical techniques depending on whether the correlation between them is linear (Büyüköztürk, 2011).

FINDINGS

In this part, the correlation between “Environmental Knowledge Test”, “Environmental Affect Scale” and “Environmental Behavior Scale” prepared by researchers have been examined; and the tables have been given from the obtained results of the survey and the findings of these tables have been included.

Frequency and Percentage Values of Independent Variables

In this section, the frequency and percentage values regarding to certain independent variables possessed by a number of students participated in the research were given.

The distribution of students participated in the research according to the “student group, gender and class level” variables is as follows.

Table 3. *The Distribution According To The Characteristics of Students Forming The Sample*

Variable	Characteristics	Frequency (F)	Percentage (%)
Gender	Girl	179	49,2
	Boy	185	50,8
Class level	6 th Class	121	33,2
	7 th Class	122	33,5
	8 th Class	121	33,2
	Total	364	100

According to the Table 3, gender distribution of students participated in the research is close to each other. 49,2% is (179) girl students, 50,8% (185) is boy students participated in the research. When the Table 3 is looked, 33,2% (121) is at 6th grade, 33,5% (122) is at 7th grade, 33,2% (121) is at 8th grade.

Table 4. *Descriptive Statistics of Environmental Knowledge, Environmental Affect, Environmental Behavior Score Averages*

Test/Scale	N	Average	Standard Deviation	Standard Fault	Highest Score
Environmental Knowledge	364	10,16	3,69	,193	19
Environmental Affect	364	51,27	6,81	,357	75
Environmental Behavior	364	39,17	10,55	,553	72

When the Table 4 is examined, descriptive statistical values of total points average belonging to Environmental Knowledge Test, Environmental Affect Scale and Environmental Behavior Scale of the students.

The Correlation between Environmental Knowledge, Environmental Affect and Environmental Behavior Score Averages

Pearson Correlation Coefficient (Simple Correlation) was used to indicate the relationship between *environmental knowledge total score average*, *environmental affect total score average* and *environmental behavior total score average* possessed by secondary school students participated in the study. Pearson correlation coefficient values are ranging between (r) $-1 \leq r \leq +1$. Here the r coefficient shows the direction and strength of the correlation. While the strength of correlation increases as the r value approaches to +1, it indicates that the strength of correlation is less as it approaches to 0. In this respect, although there is no definite limitations, the correlation under 0,50 shows the weak, the correlation between 0,50 and 0,70 shows the medium, the correlation above 0,70 shows the strong relationship (Durmuş et al., 2011).

Table 5. *The Correlation between Environmental Knowledge, Environmental Affect and Environmental Behavior Score Averages*

		Environmental Knowledge	Environmental Affect	Environmental Behavior
Environmental Knowledge	r	1	,858**	,426**
	P		,000	,000
	N	364	364	364
Environmental Affect	r	,858**	1	,502**
	P	,000		,000
	N	364	364	364
Environmental Behavior	r	,426**	,502**	1
	P	,000	,000	
	N	364	364	364

** Correlation is significant at the 0.01 level

When Table 5 is examined, it is seen that there is a positive and at 0,858 strength high correlation between the environmental knowledge variable and environmental affect variable. It has been determined that there was a positive and at 0,426 strength low correlation between the environmental knowledge variable and environmental behavior variable. Meanwhile, it is seen that there is a positive and at 0,502 strength medium level correlation between the environmental affect variable and environmental behavior variable.

DISCUSSION

The aim of this study was to learn whether there was any correlation between the components of “environmental knowledge”, “environmental affect” and “environmental behavior” among the significant components of environmental literacy and to determine if there is a relation between them. The findings obtained were discussed in this section.

It is seen that the correlation ($r=0,858$) between the *environmental knowledge and environmental affect* is a *positive and high* relationship according to the correlation among environmental literacy components. This finding shows parallelism with the findings in the researches made by Bradley, Waliczek and Zajicek (1999); Teksöz, Şahin and Ertepinar (2010). However, while the correlation between the environmental knowledge and environmental affect is *positive and at medium level* according to the researches of Kibert (2000), Atasoy (2005) and Atasoy and Ertürk (2008), Ökesli (2008) and Erdoğan (2009) have determined that there was a *positive and low level* correlation between the *environmental knowledge and environmental attitude* (affective). Therefore according to the finding derived, the knowledge possessed by students towards the environment, at the same proportion, might be affecting positively their affective characteristics towards the environment. So it can be said that if a student has sufficient information about the environmental issues, he/she also has positive affective characteristics towards the environment.

The correlation ($r=0,502$) between the *environmental affective and environmental behavior*, which is another finding in our study, has been found to be *positive at medium level*. Many studies (Hines, Hungerford & Tomera, 1986; Kuhlemeier, Van Den Bergh & Lagerweij, 1999; Kaiser, Sybille & Urs, 1999), contain findings supporting this finding in our study, regarding the correlation between the *environmental attitude and environmental behavior* is at *medium level and positive*. So, it can be said that the students have tendencies to convert most of their affective tendencies towards the environment into a behavior at the

medium level though they not acting in. Meanwhile in the study made by Erdogan (2009), as opposite to these findings, it has been found to be a negative correlation between the *environmental behavior* and *environmental affect* of the students.

The correlation ($r=0,426$) between the *environmental knowledge* and *environmental behavior*, which is another finding in our study, was determined as *positive* and *at low level*. The study made by Hines and colleagues (1986) and Erdogan (2009) seems to support this finding. This finding indicates that a student is not capable to change his knowledge about the environment into his behavior. For example, a student might know that the paper, glass or plastics should be thrown into the recycling boxes, but he/she might be not acting adequately.

In this study, which is researching whether there is a correlation between “environmental knowledge”, “environmental affect” and “environmental behavior” among the environmental literacy components; it has been determined that the correlation between the *environmental knowledge* and *environmental affect* was a *positive* and *high* correlation, the correlation between *environmental affect* and *environmental behavior* was *positive* and *at medium level*, the correlation between the *environmental knowledge* and *environmental behavior* was *positive* and *environmental knowledge*.

SUGGESTIONS

The following suggestions can be presented with respect to this research based on these conclusions.

- ✓ By taking into consideration of the *high level relationship* between the increment of students’ environmental knowledge level and affective characteristics towards the environment; it can be provided to enhance their affective characteristics towards the environment in parallel with this by enabling the students have sufficient knowledge about the environment.
- ✓ By taking into consideration of the *medium level* relationship between the students’ environmental affect level increase and behavior characteristics towards the environment; it may be effective if the students’ environmental curiosity; interest and sensitivity for the environment are united with acting in towards the environment in order to further enhance this relationship. Therefore if we can gain affective characteristics sufficiently to students towards the environment, we can expect more effective positive behaviors from students on environmental issues.
- ✓ By taking into consideration of the *low level* relationship between the students’ environmental knowledge level increase and behavioral characteristics towards the environment; practical environmental spaces should be arranged in which different methods and techniques are implemented to enhance this relationship and their impact levels on students’ behaviors should be examined.
- ✓ Observation technique should be included in the environmental education process given to students, these individuals’ affective characteristics and behaviors towards environmental events should be observed.
- ✓ To increase the positive behaviours of students towards the environment, it should be necessary to focus on practical environmental education including the students’ families.
- ✓ Secondary school students' desires on the environment should be satisfied by Science and Technology teachers through giving education on the “environment”.
- ✓ Within scope of the environmental education, students should not only be provided with environmental education but also practical activities should be organized in order to improve their affective characteristics and to convert these into environmental behaviors.
- ✓ Projects with environmental subjects should be concentrated at schools and the students should be ensured to adopt responsible behaviors towards the environment by participating in these projects.

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