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RESEARCH ARTICLE

Research and Trends in the Field of Environment Education from 2012 to 2016: A Content Analysis of MA Theses and Ph.D. Dissertations in Turkey**

İkramettin DASDEMIR*
University of Ordu, Ordu, TURKEY

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Abstract

This paper aims at making a content analysis of 124 MA and Ph.D. theses in the field of environmental education that were published by Turkish universities from 2012 to 2016. These were selected based on keywords about environmental education. Among the 133 theses on the environment by in the Turkish universities, 124 out of them were identified as being related to the topic of solely environment education. In the analysis, first, these theses were cross-analyzed by published years, university, department and research topic. Next, these theses on different sub-topics were analyzed according to their research settings, participants, research design types, and research methods. The findings showed that the highest number of these were carried out in Gazi University, MA, most theses were carried out in the department of sciences, mixed method was mostly used in these theses, the setting of environmental education and the importance of environmental education were mostly chosen as research topics, the population of the study was mostly chosen among the university students and secondary school students, environmental attitude scale was mostly used as data collection tool and parametric tests were frequently used. Suggestions about the future studies on environmental issues were made at the end of the study.

Keywords: Environmental Education, MA theses, Ph.D. dissertation, Qualitative research, Content analysis.

Introduction

The environment is a setting where human beings and all other living species come together and interact with each other (Aktepe & Girgin, 2009). Human activities have both negative and positive effects on the environment (Özmen & Özdemir, 2016). In this sense, understanding the effects of lifestyles and daily activities on environment maybe valuable to constraint the negative effects on the environment (Chepesiuk, 2007). For example, technology development may affect human activities. The technological advancement not only facilitates human life but it also negatively impacts upon natüre and human life (Özbey & Şema, 2017; Yılmaz, Aydın & Bahar, 2015). Further, the development of the technology can also threaten the life quality and even the health of the societies (Akçay & Pekel, 2017). As a result of deterioration of the natural and artificial environment, Environmental problems are encountered not only in the places they are observed but also they can be seen nearly all over the world and this has led the societies to find a solution to their own environmental problems (Akçay & Pekel, 2017; Yılmaz, 2012). Raising the individuals' environmental awareness and consciousness may be one of the effective solutions (Akçay & Pekel, 2017). In this sense, environmental education should be provided to individuals to increase awareness and sensitivity to find solutions some environment problems (Akçay & Pekel, 2017; Yılmaz, 2012). It is believed that promising solutions can be generated with such

an education (Reynolds, 2010; Scholz & Binder, 2011). Environmental education is a process that allows individuals to develop environmental awareness, to gain positive and permanent environmentally friendly behavioral changes towards environment; further, it refers to understanding natural, historical, cultural, and socio-esthetical values (Erdoğan, 2016; Özoğlu, 1993). The topic of environmental education has become a current issue in order to create more healthy and safer environment for human beings (Yıldırım, 2015). Because of the importance of environmental education, almost all countries around the world have become sensitive to environmental education. Especially, the developed countries consider that environmental education must be included in their curricula (Akçay & Pekel, 2017) and they think that the foundations of environmental education in the primary and secondary education are crucial (Summers, Kruger & Childs, 2000). In such an education curriculum, generating positive environmental awareness within the individuals and to develop behaviors may be possible (Alp *et al.,* 2008; Flowers, 2007; Yılmaz, 2012; Yıldız, Sipahioglu & Yılmaz, 2008). Including particular subjects about environmental issues in teaching and learning environments can enhance research in this field by teachers and students and researchers (Markle 2008; Yılmaz, 2012).

Particularly, the researchers have begun to conduct more studies about environment because of the following reasons: a) industrial and technological developments, b) nature and damages on natural habitats, c) their negative effects on human health, air, water, d) land pollution caused by radiation and poisonous gases released by industries, e) decreasing life quality, and e) emergence of their effects at the beginning of the 21st century and threatening both humans and natural habitat (Yılmaz, 2012).

In the last decade, several studies on environmental education have been carried out (Özbay & Şema, 2017). The topic of environmental education has also attracted many postgraduate researchers. Such post-graduate level theses and dissertations can guide many further studies and they also generate solutions for the problems existing in the literature (Özbay & Şema, 2017). Although the postgraduate thesis studies have been increasing constantly, there are not many studies to examine the trend directions in the field of environmental education (Karadağ, 2009). Nevertheless, the available postgraduate level of research has focused on different aspect of the field (Yılmaz *et al.,* 2015). For example, among these studies, the experimental studies have focused on global sustainability (Leiserowitz, Kates & Parris 2004), on chemical bonds (Ünal *et al.*,2006), on science education, education technologies, computer technologies, and education sciences (Çalık *et al.*, 2008; Karadağ, 2009; Şimşek *et al.*, 2008; Uğur-Erdoğmuş, 2009), on energy concept (Kurnaz & Çalık, 2009), computer-assisted language learning (Uzunboylu & Özçınar, 2009). Moreover, the recent literature has shown that several studies have focused environmental education, including MA thesis and Ph.D. dissertations. Trend analysis has been used in different fields to examine frequently investigated topics and methods used in research such as language education (Han & Burgucu, 2012). In the field of environmental education, Leeming et al. (1993) investigated the trend in environmental education between 1974 and 1993. Sümer (2009) examined the environmental issues included in the theses carried out in local government. Yılmaz (2012) analyzed the theses published about environmental education between 1992 and 2011. Özbay and Şema (2017) examined only 65 theses on environmental education published between 2012 and 2016. Yılmaz et al. (2015) analyzed both full texts and abstracts of the theses on environmental education between 1992 and 2011.

The previous literature has indicated that very few studies investigated the trend in the field of environmental education in the postgraduate level studies in Turkey. Amon these studies, the researchers reached a very limited number of studies. The aim of this paper is to bridge the research gap by examining all 133 master's theses and Ph.D. dissertations published on environmental education in Turkey between 2012 and 2016. These theses should be given as a whole so that they can guide the researchers. It is important to carry reliable and inclusive studies which can lead to new studies by interpreting so much information (Akgöz, Ercan & Kan, 2004).

Methodology

Content analysis, one of the qualitative research methods, was used in this study. Content analysis is helpful in terms of increasing the quality of journals, the decisions and policies made for allocating resources and funds, and proposing the future directions for the field (Maurer & Khan, 2010). On the other hand, content analysis is one of the common qualitative research techniques that is used to interpret meaning from written data (Hsieh & Shanno Un, 2005).

Data Collection

The postgraduate theses carried out about environmental education between 2012 and 2016 were explored and investigated in this study. As a result of scanning of National Theses and Dissertations Centre's database of Higher Education Research Council, 133 theses on environmental education that were carried out between 2012 and 2016 were reached. Out of these 133 theses, 100 of them are full-text studies and 33 of them are abstracts. As a result of the investigation of the theses, 124 of them were considered appropriate for the study. Out of these 124 theses, 100 of them are master's theses and 24 of them are doctoral dissertations. To secure the validity and reliability of this study, a scheme adapted from previous research was used in this study. The schema includes two parts: a) general information about the thesis and dissertations (e.g. publication year, authorship, and institution affiliation, region and country/territory of focus), b) coding methodologies of the articles (e.g research areas, research approaches, research methods, analysis techniques, and application of statistics). In this study, the two coders received a Ph.D. degree in the field of education. The keywords of the articles were used to determine the research areas of the thesis and dissertations. The coders were given the specific topics and keyword list (see Table 5). They analyzed a total of 133 theses published in the 41 universities in Turkey. There was a weak agreement between the two coders. Nine theses were reconsidered by another coder. The reliability of coding was measured, using Miles and Huberman (1994) reliability formula (Reliability= agreement/ agreement + disagreement x100). The reliability was calculated to be 0.92.

Data Analysis

A schema for coding the variables by Yılmaz (2012) was adapted for the data coding in this present the study. After the form was adapted, two experts checked the schema and necessary corrections were made in line with their views. This form consists of the year when the theses were written, types of theses, the university where the theses were carried out, department, research topic, the study group (the population of the study), research method, teaching method, data collection tool, and data analysis techniques. The data obtained from the schema were analyzed, considering each research problem and the statistics depending on frequency distribution related to the variables.

Findings

In this section, the findings of the theses examined within the context of the study were presented. Descriptive information regarding the type of the studies (e.g. MA and Ph.D.) was presented in Table 1.

Table 1.

Descriptive information belonging to the thesis type of the studies

Types of Theses	Frequency	Percentage
Master's Thesis	100	80,7
Doctoral Thesis	24	19,3
Total	124	100

The Table 1 shows that a total 124 post-graduate theses consisting of 100 master's theses and 24 doctoral theses were carried out between the years 2012-2016. Table 2 presents the distribution of these theses by years.

Table 2.

Distribution of theses published on environmental education according to years

Types of Thesis	2012	2013	2014	2015	2016	Total
Master's Thesis	28	21	17	17	16	100
Doctoral Thesis	3	7	4	7	4	24
Total	31	28	21	24	20	124

The Table 2 shows that the master's theses and doctoral dissertations on environmental education were published mostly in 2012 and very few studies were carried out in 2016.

Table 3 exhibits distribution of theses by topic.

Table 3.

Distribution of theses on environmental education in terms of research topics

Research Topics	Frequency
Biological diversity	4
*Attitudes towards the environment	18
*Raising awareness of the environment	11
*Environmental knowledge	6
Environmental consciousness	8
The place and importance of environmental education	34
Perceptions about environmental education	5
Environmental literacy	8
* Environmental problems	17
Preservation of the environment	5
*Perceptions about the environment	6
Environmental education in the natural environment	2
*Recycling	2
Environmental education in out-of-school settings	3
Sustainable environmental education	10
Total	139

The ones with the sign* were explored with different subjects

The Table 3 shows that the MA thesis and dissertations focused on different research sub-topics on environmental education. The following topics were studied frequently: the place and importance of environmental education (f=34), attitudes towards

environment (f=18), environmental problems (f=17), raising environmental awareness (f=11) and Sustainable environmental education (f=10) respectively. Table 4 presents the distribution of theses carried out about environmental education by departments.

Table 4.

Distribution of the master's theses and doctoral dissertations carried out about environmental education by departments

Departments	Master's Theses	Doctoral Theses	Total
Department of Family and Consumer	1	-	1
Department of Biology Education	12	6	18
Department of Geography Education	2	1	3
Department of Environmental Education.	4	2	6
Department of Education Sciences	1	-	1
Department of Education Programs	6	1	7
Department of Education Management and Inspection	3	-	3
Department of Philosophy and Science of Religion	1	-	1
Department of Science Education	48	7	55
Department of Public Administration	1	-	1
Department of Chemistry Education	1	1	2
Department of Architecture	-	1	1
Department of Pre-school	5	3	8
Department of Landscape Architecture	1	-	1
Department of Art Teaching	1	-	1
Department of Primary School Teaching	4	-	4
Department of Social Sciences Teaching	9	-	9
Department of Social Environment Sciences	-	2	2
Total	100	24	124

The Table 4 shows that the maximum number of studies about environmental education was carried out in the Department of Science Education (f=55). Table 5 presents the universities where the master's and doctoral theses published in.

Table 5.

Distribution of master's and doctoral theses published by the universities and years

The University where The Study is carried out	Master's Theses					Doctoral Theses					
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016	Total
Abant İzzte Baysal Unv.	1		1							1	3
Adıyaman University				1							1
Adnan Menderes University	1		1		1						3
Afyon Kocatepe University.	1			1							2
Ahi Evran University	2				1						3
Aksaray University				1							1
Ankara University						1	2				3
Atatürk University				1			1		1		3
Balıkesir University		1									1
Bilkent University	1				1						2
Boğaziçi University	1						1				2
Çanakkale Onsekiz Mart		1	1		1						3
Çukurova University			1								1
Dokuz Eylül University	2	1						1		1	6
Ege University			1								1
Erciyes University	3										3
Fatih University			2								2
Fırat University				2	1						3
Gazi University	3	8	2	4	2		2	2	4		27
Gazi Osman Paşa University	1		1		1						3
Hacettepe University	3	2							2		7
İnönü University	1	2				1					4
İstanbul University			1								1
Kafkas University	1										1
Karadeniz Teknik University	1	2					1				4
Kastamonu University		2			1						3
Marmara University					1	1					2
Mehmet Akif Ersoy University	1										1
Mersin University				1	1						2
MuğlaSıtkı Kocaman University	1			1	1						3
Necmettin Erbakan University	1		1	1							3
Orta Doğu Teknik University		1	1					1			3
Ondokuz Mayıs University										2	2
Ömer Halis Demir University	2		1	1	1						5
Pamukkale University	1			2	1						4
Sakarya University		1									1
Süleyman Demirel University			1								1
Trakya University					1						1
Yeditepe University			1	1							2
Yüzüncü Yıl University					1						1
Total	28	21	17	17	16	3	7	3	7	4	124

The Table 5 indicates that Gazi University published the maximum number of both master's theses and doctoral dissertations (f=27) and doctoral dissertations were not carried out in most of the universities. Table 6 presents the distribution of theses by study group.

Table 6.

Distribution of the master's theses and doctoral dissertations carried out about environmental education by the study group

Study Group	2012	2013	2014	2015	2016	Total
Pre-school students	1	1	-	4	2	8
*Elementary school students	4	2	1	-	1	8
*Secondary school students	16	11	3	7	8	41
*High education students	4	4	4	5	-	17
University students	11	9	8	8	5	41
*Teachers	3	1	2	2	2	10
* Adults/Public	2	-	2	-	-	4
Document	1	-	2	-	2	5
Total	42	28	22	26	20	138

The ones specified with the sign *were included in some studies with different study groups

The Table 6 shows that university students (f=41) and secondary school students (f=41) were the most frequent study groups or samplings while adults (f=4) were the least selected participants. Table 7 presents the distribution of the research methods by years.

Table 7.

Distribution of the research methods used with the theses published on environmental education by years

Research Method	2012	2013	2014	2015	2016	Total
Action research		1				1
*Descriptive study	7	3	3	2		15
Experimental study	5		2	5	5	17
Case study		3	1			4
Document analysis			2		1	3
Phenomenography			1			1
*Relational screening		5	1	1		7
Mixed method	10	8	5	6	8	37
*Cross-sectional study	1			1		2
Correlation			1			1
*Causal study		1				1
Phenomenology	1					1
Screening model	6	8	3	8	4	29
Not specified	2		3	1	2	8
Total	32	29	22	25	20	127

The ones with the sign* were explored with different *research methods*

The Table 7 shows that 13 different research methods were used. The following methods were used frequently: mixed method (f=37), screening model (f=29), experimental design (f=17) and descriptive study (f=15) respectively. Table 8 presents the data collection tools used in these environmental education postgraduate studies.

Table 8.

Data collection tools used with the theses published on environmental education

Data collection tools	Frequency
Open-ended question	9
Achievement test	18
Testimonial-document	4
The scale of biodiversity literacy	1
Biology attitude scale	1
Environmental attitude/ awareness/ knowledge scale	102
Behavior scale	11
Critical thinking scale	3
Science/matching attitude scale	3
Interviews	19
Observation form	5
Word association	2
Interview	4
Self-evaluation form	5
Writing and drawing	2
Total	191

The Table 8 shows that different data collection tools were used in the theses. The most frequently used data collection tool is environmental awareness/ knowledge attitude scale (f=102). Next, interviews (f=19) and environmental knowledge tests (f=18) were used frequently. Table 9 presents the teaching methods used in the theses.

Table 9.

Teaching methods used in the theses

Techniques used	Frequency
Active learning techniques	11
Nature education	9
Computer-assisted environmental education	2
Implementation of environmental education program	2
Total	24

The Table 9 shows that different teaching methods were used in the theses. The most frequently used method is active learning techniques (f=11). Next nature education (f=9), implementation of the environmental education program (f=2) and Computer-assisted environmental education (f=2) were more frequently employed in the studies. Table 10 presents the data analysis techniques used in the studies.

Table 10.

Data analysis techniques used in the studies carried out about environmental education

Data Analysis Technique	Frequency
*Descriptive statistics	13
*Descriptive/ content analysis	40
*Parametric tests	54
*Non-Parametric tests	18
Not specified	14
Total	139

The Table 10 shows that parametric tests (f=54) and content analysis (f=40) were the most common data analysis techniques in the studies.

Results and Discussion

The study examined the trend in the post-graduate thesis studies on environmental education in Turkey between the years 2012-2016. Overall, first, it was found that the number of master's theses (% 80,3) was more in number than doctoral dissertations. It is considered that this situation was due to the number of master's program in universities, that is, there are more master's programs in this field than doctoral programs in Turkey.

Because the requirements for the opening doctorate level postgraduate program in Turkey more challenging than opening a master degree program as such there must be more faculty members with an associate degree or full professor in the related department. Further, program requirements for student admission are more than those of master degree programs.This result is compatible other content analysis research with the result in the literature (Çiltaş, Güler & Sözbilir, 2012; Polat, 2013; Temel, Şen & Yılmaz, 2015; Yavuz, 2016; Yılmaz et al. 2015)

Second, it was found that there has been a considerable increase in the number of the theses during the last five years. This result is in line with the previous research (Akdemir & Karakuş, 2016; Leeming *et al.,* 1993; Onwuegbuzie, & Daniel, 2003; Özbay & Şema, 2017).

Third, it was found that the number of theses on environmental education between the years 2012-2016 differed by the years as such the number of postgraduate theses were the highest in number in 2012 (f=31), indicating that environmental problems attracted more attention during these years. This may be because that higher education council in Turkey launched a new law that requires the departments in the education faculties in Turkey can only produce postgraduate studies in the education field. This finding is in line with a study by (Yılmaz *et al.*, 2015), in which the postgraduate studies between the years 1992-2011 were analyzed. In that study, it was found that the number of post-graduate theses differed according to the years and the maximum number of theses were completed between 2008 and 2011.

Fourth, it was found in the study that the theses published on environmental education were mostly carried out in Gazi University (f=27) as Gazi University had a larger number of academic staff and postgraduate programs. This result is complementary with the result of Yılmaz et al. (2015). Similarly, Yılmaz et al. (2015) found that Gazi University was the most prolific university as most of the thesis studies between 1992 and 2011 were completed there. Further, it was found that Department of Science Education carried out most studies (f=55). The reason for this situation may be that science teaching program includes subjects related to nature and environment.

Fifth, regarding the study groups or samplings of the master's theses and doctoral dissertations, higher education students (f=41) and secondary school students (f=41) were more frequent. This result is in line with the previous studies (Çalık *et al.,* 2008; Tatlı & Adıgüzel, 2012; Uğur- Erdoğmuş, 2009; Yılmaz, 2012,). In a study by Çalık et al. (2008), it was found that the post-graduate theses carried out about science education between 1990 and 2007 used 7th-grade students as study sample. In a study by Uğur - Erdoğmuş (2009), tertiary level students were used as the study group of the thesis studies carried out about computer technologies. It is indicated that this may be due to context and the reaching sample groups easily.

Sixth, regarding the research sub-topics, most of the studies focused on the place and importance of environmental education (f=34), attitudes towards environment (f=18) and Environmental problems (f=17). This result is in line with the result of Yılmaz et al. (2015) in which attitudes towards environment (f=63), environmental consciousness (f=43), environmental knowledge (f=34), and environmental problems (f=2) were more frequent sub-topics. Maybe it is assumed that environmental education can solve most of the environmental problems.

Seventh, 13 different research methods were used and mixed-method approach was the most preferred method (f=37). This result is not in line with the previous studies (Bacanak *et al.*,2011; Çalık *et al.,* 2008; Karadağ, 2010; Leiserowitz, Kates & Parris, 2004; Şimşek *et al.*, 2008; Tavşancıl *et al.*,2010 ; Uğur-Erdoğmuş, 2009; Yılmaz *et al.*,2015). In a study by Yılmaz et al. (2015), it was found that the theses studies between 1992 and 2011 used frequently experimental design. Recently, research in this field has frequently employed mixed-method approach (Yavuz, 2016).

Further, different teaching techniques were used with the master's theses and doctoral dissertations. This result is in line with the studies of Kurnaz & Çalık (2009) and Yılmaz et al. (2015). The result of the study conducted by Kurnaz & Çalık (2009) showed that using student-centered teaching techniques were more common. On the other hand, Yılmaz et al. (2015) found 27 different teaching methods employed in the postgraduate level studies. The reason for this situation is that with the renewal of the curricula in elementary and secondary education and higher education beginning in 2014, student-centered teaching techniques have been included more in the curriculum.

Next, different data collection tools were used in the master's theses and doctoral dissertations. Among these data collection tools, it was revealed that environmental attitude/ awareness/ knowledge scale was most frequently used (f=102). It can be implicated that attitude scale may have been preferred frequently in the data collection as they are easy to use and widely available tools (Baş, 2005). This result is in line with previous studies in which questionnaires, attitude scales, and achievements tests were the most commonly used measurement tools (Leiserowitz *et al.*,2004; Şimşek *et al.,* 2008; Tavşancıl *et al.,* 2010; Uğur- Erdoğmuş, 2009; Yılmaz *et al.*, 2015).

Finally, it was also found that parametric tests were the most frequently preferred data analysis methods in the master's theses and doctoral dissertations as found in previous research by Tavşancıl et al. (2010) and Yılmaz, (2012), indicating that parametric tests are more reliable.

Recommendations

1. It is suggested that because of the limited number of studies carried out with the adults about environmental education, adults should be chosen as a study group in the future studies.

2. It is suggested that different teaching techniques used in the teaching of environmental education should be comparatively analyzed.

3. It is suggested that a trend analysis over the journal articles on environmental education should be conducted.

4. It is suggested that phenology research should be studied over environmental education

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2012-2016 Yıllarında Çevre Eğitimi Alanı Eğilim Araştırması: Türkiyede Üretilen Yüksek Lisans ve Doktora Tezlerinin Bir İçerik Analizi

İkramettin DASDEMİR
Ordu Üniversitesi, Ordu, TÜRKİYE

Özet

Bu çalışmanın amacı, 2012-2016 yılları arasında Türkiye'de çevre eğitimi ile ilgili yapılan lisansüstü tezleri inceleyerek, tezler hakkında genel yönelimleri ortaya çıkarmaktır. Bu tezlerin seçimini çevre eğitimi anahtar kelimesiyele tespit edilmiştir. Bu anahtar kelimeyle 133 teze ulaşılmıştır. İnceleme sonucunda 124 tezin uygun olduğu tespit edilmiştir. Çalışmada nitel araştırma yaklaşımlarından içerik analizi kullanılmıştır. Tezlerin analizinde yayın yılı, üniversite, bölüm, araştırma konusu, örneklem, araştırma yöntemi, araştırma testleri, yer almıştır.Araştırma sonucunda 2012-2016 yılları arasında yüksek lisans tezlerinin doktora tezlerinin sayısından oldukça fazla olduğu, en fazla tezin gazi üniversitesinde, en fazla fen bilgisi anabilim dalında olduğu, bu tezlerde en fazla karma yönteminin uygulandığı, konu olarak en fazla çevre eğitiminin yeri ve öneminin seçildiği, örneklem gruplarının en fazla yüksek öğretim öğrencileri ile ortaokul öğrencilerinden oluştuğu, veri toplama aracı olarak en fazla çevre tutum ölçeğinin kullanıldığı ve en fazla parametrik testlerin kullanıldığı tespit edilmiştir. Çalışma sonucunda çevre eğitimi ile ilgili yapılacak çalışmalara yönelik önerilerde bulunulmuştur.

Anahtar Kelimeler: Çevre Eğitimi, Lisansüstü tezler, Nitel araştırma, İçerik analizi.

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Development of an Ecoliteracy Scale Intended for Adults and Testing an Alternative Model by Structural Equation Modelling

Emel OKUR-BERBEROGLU*
LIC (Livestock Improvement Corporation), Hamilton, NEW ZEALAND

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Abstract

Ecoliteracy is to understand and internalise sustainable ecological relationship in the nature and to transfer this sustainable lifestyle to daily life despite the fact that ecoliteracy does not have only one and unique definition. However, it is difficult to measure ecoliteracy due to it being a complex concept. There are many subsets of ecoliteracy. One of the the aim of this study is therefore to develop an ecoliteracy scale intended for adults which is based on ecological intelligence, social intelligence, emotional intelligence, economy and green consumer behaviour. The other aim of the study is to test an alternative model among these subsets. According to this model economy, emotional and social intelligences are subsets of ecological intelligence. Ecological intelligence has directly link to green consumer behaviours at the second stage of the model. All the goodness of fit values are at an acceptable level according to the explanatory and confirmatory factor analysis. The results are Cronbach alpha: 0.78; KMO: 0.830; X^2/df: 4.09; RMSEA: 0.087; SRMR: 0.0783; GFI, AGFI, IFI, and CFI ≥ 0.80. There are 20 items within the scale.

Keywords: Ecoliteracy, ecological intelligence, emotional intelligence, economy, social intelligence, green consumer behaviour, explanatory factor analysis, confirmatory factor analysis

Introduction

When I was a child, my grandmother wanted me to pick 'gundelia' (The local name at Mediterranean Mountains is 'kenger'; the Latin name is *Gundelia tournefortii)'* and 'purslane' (The local name at Mediterranean Mountains is 'tokmakan'; the Latin name is *Portulaca oleracea)* up from the mountains in order to make coffee and cook. We were living in a rural area and it was difficult to find any stuff easily. Later I learned that if there was a scarcity, people were using 'gundelia' as a kind of coffee and 'purslane' as a food resource. We were going to the mountains as a group of children and picking up what and how much we needed to gundelia and purslane therefore we knew that we could pick them up next seasons. These were informal sustainability learnings for me because I was 6 or 7 years-old at that time however I can still remember that gundelia and purslane are used in order to make coffee and food.

I have nomadic ancestors and we have learnt some of the knowledge by intergenerational oral and experiential transfers. Nevertheless, Shipibo indigenous people from Peru (Roberst& Dev, 2015) or Ubuntu philosophy from Africa (Shumba, 2011) have similar environmental and sustainable transfers in order to survive such as cooking, healing, appreciation, celebration. Shumba (2011) determines this kind of ethical and sustainable environmental issues as ecological intelligence.

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***E-mail: emelokur17@gmail.com**

Moreover, Goleman (2006, 2009) and McCallum (2005) also enrich ecological intelligence concept with social intelligence, emotional intelligence and economy. Both researchers evaluate ecological intelligence in terms of Western perspective by economy. Similarly Esposito (2009) and Kapogianni (2015) evaluate ecoliteracy within environment-economy relationship however these experimental studies are not enough to determine ecoliteracy.

Ecoliteracy

According to the literature, ecoliteracy is to understand and internalise sustainable ecological relationship in the nature and to transfer this sustainable lifestyle to daily life despite the fact that ecoliteracy does not have only one and unique definition (Öhman, 2016; ESD, 2015; Kapogianni, 2015; Lira, Steinicke & Garcia, 2015; Tursi, 2015; McBride, Brewer, Berkowitz and Borrie, 2013; Esposito, 2009).

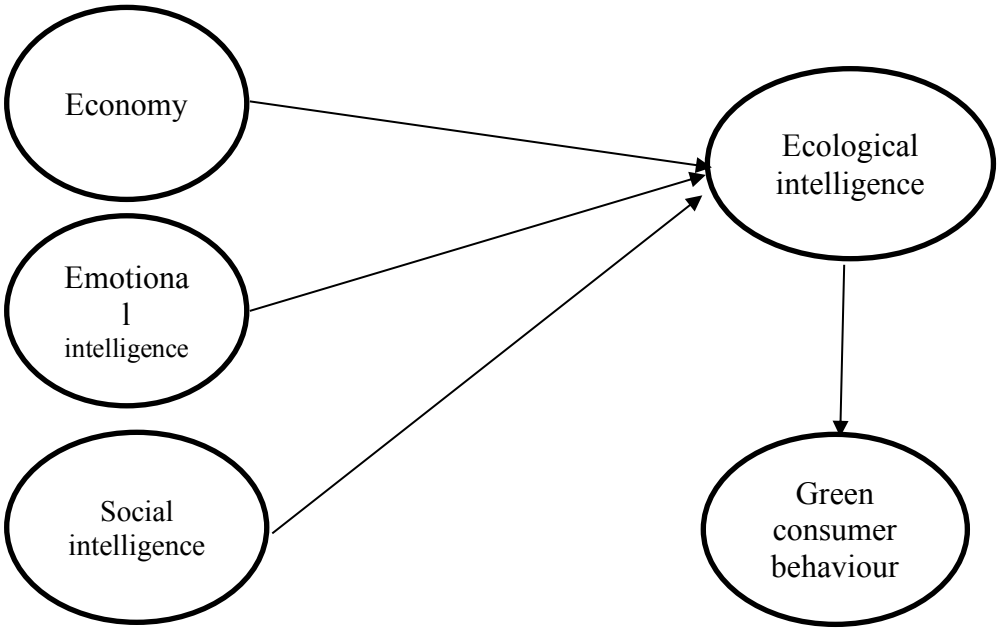

Figure 1. Alternative model of ecoliteracy

The core subject of ecoliteracy is sustainability (Orr, 1992; Öhman, 2016) and ESD Report (2015, p.38) especially emphasizes that everybody who works and studies on sustainable development should design indicators and metrics in order to evaluate ecoliteracy. The aim of this study, therefore, is to develop an ecoliteracy scale intended for adults and to test an alternative ecoliteracy model (Figure 1). There has not been found yet any ecoliteracy scale or alternative model according to the literature review.

The common points of ecoliteracy are to have sustainable, affective, cognitive, behavioural roots (Goleman et al., 2012; McBride et al, 2013; Pilgrim, Smith & Pretty, 2007; Orr, 1992).These roots refer to some subcomponents such as ecological intelligence, social intelligence, emotional intelligence, economy and green consumer behaviour. I designed an ecoliteracy model with these subcomponents according to the literature (Figure 1). According to this model economy, emotional and social intelligences are subsets of ecological intelligence. Ecological intelligence has directly link to green consumer behaviours at the second stage of the model.

Ecological intelligence

One of the main subsets of ecoliteracy is ecological intelligence because this concept is related to either holistic perspective or sustainability. The main aims of ecological intelligence are to develop social and environmental responsibility (Shumba, 2011; Sterling, 2009) and awareness, to think critically (Bowers, 2010), to pursue cooperative learning (Sterling, 2009), and to bring about behavioural change in the long-term (ESD, 2015; Bowers, 2010; Sterling, 2009). Ecological intelligence is related to the cognitive and affective areas of the brain (Shumba, 2011; Sterling, 2009); therefore both side of learners' brains should be supported. Ecological intelligence does not also ignore individual differences because individual background have an impact on social community (Shumba, 2011; Bowers, 2010; Sterling, 2009).

The other important point of ecological intelligence is to have holistic perspective because there are seen and unseen webs among biotic and abiotic factors in the world. Each behaviour, related to consumption or not, might have an impact directly or indirectly on the environment. People therefore should take responsibility for their each behaviour to their environments and social communities (Goleman 2006, 2009; McCallum, 2005). Individualism is unfortunately in the foreground due to capitalist perspective. However the human being is a social creature and s/he should not isolate herself/himself from the social area because ecological intelligence is a social and collective process. Each environmental acquisition is transferred by intergenerational communication such as language; therefore environmentally responsible behaviour also needs to involve responsible social and economic behaviours. (Bowers, 2008, 2009, 2010; Goleman 2006, 2009; McCallum, 2005; Shumba, 2011; Sterling, 2009)

Social intelligence

The other important subset of ecoliteracy is social intelligence and social intelligence refers to social responsibilities of people in terms of sustainability. For instance, people should be able to think about how a stuff is produced or whether there is any environmental or social/human exploitation in this production process (Goleman 2006, 2009; McCallum, 2005; Orr, 2002). However the improvement of social intelligence is not easy due to migration because there are two sides of the migration; migrants and host cities/countries. Migrants are cheap labour sources for host cities/countries and this is named as brown revolution (Economist, 2002; FAO, 2003).

The migrant population settles urban area and this massive population also stresses on urban life especially in Asia, Sub-Sahran Africa, Latin America (FAO, 2015). The rural population is also exposed to nonadaptation in urban social life and a gap is become between expectation and reality in terms of social and economic lives. On the one hand the Economist (2002) says that the brown revolution is unstoppable. On the other hand, the stopping the brown revolution is not desirable in terms of economic perspective; however it might be slowed (FAO, 2003). FAO 2015 Report utters that governments should support the rural population life with internal and external policies. The Economist (2002) emphasizes the revival of rural population as 'green revolution' because ecologic development of rural area related to the economy (FAO Report, 2003)

Economy

One other subset of ecoliteracy is economy. McCallum (2005) and Orr (2002) recall that the history of Western science has negatively affected to understand the natural environment; therefore ecology and economy are considered as two different subjects. On the contrary, they should actually be considered as complementing to each other (Goleman, 2009; Kahn, 2010; Orr, 2002) because economy needs environmental and human resources in order to continue the development (Kumar & Budin, 2006). Kahn (2010) and Orr (2002) especially emphasize that economy should be based on

sustainable development instead of exploitation of environmental and human resources such as brown revolution. People should be able to think that all their needs they bought such as foods, clothes, shelters are based on the natural resources; therefore we have to think and sense about our effects on the environment. The sense of environment refers to emotional intelligence.

Emotional intelligence

Emotional intelligence is one of the important subset ecoliteracy and Goleman, Bennett and Barlow (2012) merge ecological, social and emotional intelligences under ecoliteracy. In terms of emotional intelligence, people should be able to sense what their negative impacts are on other people, natural environment and the other living organisms. McBride et al. (2013, p. 14) determine also this kind of ecologic, affective, and cognitive relationship within ecoliteracy as "head, heart, hands and spirit" connections.

Emotional intelligence is the affective side of ecoliteracy and it is related to human senses (Schutte, Malouff, Hall, Haggerty, Cooper, Golden, & Dornheim, 1998). People have feelings and emotions however they might not be aware of them or know how to express them. In terms of environmental subjects, if people feel (such as pain, hurt, anxiety, fear, empathy) the natural environment, then they might have a connection with the environment (Haskell, 2000; Lazarus & Cohen, 1977; Martin, 2004; Ozdemir, 2010; Reis & Roth, 2009). The main subject here is if human activities disturb lives of other living things what s/he feels and whether they have empathy. Ringness (1975) also points out that adults are not very open to change, explore and express their feelings like children; therefore affective domains of adults should be developed in order to be able to deal with the social and consumption problems.

Green consumer behaviour

Due to increasing consumerism, adults tend to spend and consume more regardless of whether they actually need to do so (Aracıoglu & Tatlıdil, 2009; Esposito, 2009). However, they barely think over what raw materials have been used during the making of these goods and commodities and how the nature has been affected by the production process (Goleman, 2009). Goleman (2009) recalls that what needs to be done in order to minimize the damage is to purchase ecological products. It is also stressed that ecological items are more expensive than others (Aracıoğlu & Tatlıdil, 2009).

Goleman (2009) underlines that even though ecological products are more expensive, the producers will market more ecological products if the consumers tend to buy these products, leading to harmonization with the nature. As a result, industrial production will not do any harm to the nature. What needs to be stressed here is collective action; in other words, public awareness on use of ecological products will be of great help. The collective action of green consumers refers to ecoliteracy because environmental responsible behaviours or green consumer behaviours at the visible/observable side of ecoliteracy (Kapogianni, 2015; McBride et al., 2003).

Methodology

The study was approached quantitatively (Yildirim & Simsek, 2006). Explanatory and confirmatory factor analysis were carried out within this approach. The explanatory factor analyses had inductive perspective (Buyukozturk, 2007; Sencan, 2005) while the confirmatory factor analyses had deductive perspective (Simsek, 2007). It is aimed that to have more reliable scale which has strong theoretical background, reliable and validity within these two perspectives.

The study consists of three stages including

a. Literature review, determination of the scale items and development of the ecoliteracy model.
b. Preparation and implementation of the scale
c. Measurement of the reliability and validity.

a. Literature review; determination of the scale items and development of the ecoliteracy model.

The literature was reviewed and 30 items and five themes were determined. Secondly the ecoliteracy model was designed (Figure 1). These items were evaluated as potential indicators of ecological intelligence by an ecology specialist and an environmental education specialist.

b. Preparation and implementation of the scale

The trial scale was designed based on 5 Likert style. Simsek (2007) emphasized that 5 Likert style was a good option in order to test any model and one of the step of this study was to test alternative ecoliteracy model. It was, therefore, decided to use 5 Likert style scale.

The affirmative items were scored as 1- Completely disagree, 2- Partly disagree, 3- Not sure, 4- Partly agree, and 5- Completely agree. A complete reverse scoring was applied to the negative set of items. The scale was completed by 405 adults between 18-65 years of age via Google drive and QR code. Sencan (2005) notes that the sample size was acceptable if it was sufficient to ensure at least five events per entry, therefore a sample size of 405 respondents was satisfactory for this study.

c. Measurement of the reliability and validity

For the analysis of the scale, the verified correlation value between the Cronbach Alpha reliability coefficient and the entries was reviewed by relying on the SPSS 13 software. The scale was evaluated as reliable if the Cronbach Alpha coefficient level was more than 0.70 (Buyukozturk, 2007; Sencan, 2005). Entries with a correlation value below 0.30 were removed from the analysis. The explanatory factor analysis was run in order to locate the validity of the scale and to dimension the entries included in the scale after determination of their factor loads.

Buyukozturk (2007) and Sencan (2005) stressed that the factor load value should be 0.40 or higher when sorting the entries. It was noted that when the principal axis factoring and direct oblimin analysis were used together, they would facilitate formation of factors in the presence of an assumption of correlation within the factor (Hill, 1987; Creed & Machin, 2003). Principal axis factoring and direct oblimin were preferred in this study considering that this was the first work to develop a scale (Simsek, 2007).

In the explanatory factor analysis, the Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett test were analysed together. It was noted that a KMO value over 0.60 and a significant Bartlett test ($p<0.05$) indicated that a factor could be derived from the data (Buyukozturk, 2007; Sencan, 2005).

Subsequent to the explanatory factor analysis, the confirmatory factor analysis was run with LISREL 8.0 (Joreskog and Sorbom, 1993; cited at Simsek, 2007) statistics software. In the review of the confirmatory factor analysis, diagram and goodness of fit criterias and correction recommendations were considered.

In the diagram evaluation, the standardized values and the t value were taken into account. The standardized values were evaluated for the ability of each entry to

represent its variable. The t value was reviewed to check the relevant entry had $p< 0.05$ significance.

With respect to the goodness of fit, the harmony between the relations in the model and the data was considered (Simsek, 2007). Here the ratio between the Chi square and the degree of freedom was evaluated. This ratio was expected to be a maximum 3-4. The other criteria included RMSEA (Root Mean Square of Approximation), CFI (Comparative fit index), IFI (Incremental fit index), standardized RMR (SRMR), GFI (Goodness-of-fit index) and AGFI (Adjusted goodness of fit index). Some researches (Simsek, 2007; Fossati et al., 2003) note that the RMSEA and SRMR may fall below 0.08 and argued that a value below 0.05 could indicate a better fitness. Simsek (2007) noted that CFI and IFI values above 0.80 referred to a better fitness while Doll, Xia and Torkzadeh noted that GFI and AGFI values between 0.80 and 0.89 referred to a reasonable fit.

In the correction recommendations, the ratio between the Chi-square and the degree of freedom was considered. The impact of the correction on the decrease of the Chi-square value indicated an improved model. The factor loads of the dimensioned items were evaluated to develop a five-dimensional scale inclusive of 20 items.

Participants

One of the most important points for the study was to decide the sample group. My aim was to reach adults who had different backgrounds. The sample group of this study included housewives, undergraduate students, in-service teachers, academicians, engineers, health and media employees, the other government employees and laboratory technicians (App 3). The literature did not specify the importance of an individual group. Nevertheless Goleman (2006, 2009) and McCallum (2005) mentioned the importance of adults on the economy, environment and social interactions, therefore data was collected from adults.

Findings

According to Cronbach Alpha reliability analysis and factor analysis, 10 items had low correlation values and factor loads were under 0.40, so were removed from the scale. These 20 items were run by the confirmatory factor analysis. The 14th item which's factor load was under 0.40 was only kept in the analysis due to the decision of the environmental education specialist. All goodness of fit values can be seen at Table 1.

Table 1.

The goodness of fit results of explanatory and confirmatory factor analysis

Goodness of fit values			Recommended values	The values of ecoliteracy scale	The values of alternative model
Explanatory factor analysis		Item number		20	
		Theme number		5	
		Cronbach alpha	≥ 0.70	0.78	
		KMO	≥ 0.60	0.830	
		Bartlett test	< 0.05	0.000	
Confirmatory factor analysis		X^2/df	3-5	4.09	4.06
		p-değeri	<0.05	0.000	0.000
		RMSEA	≤ 0.08	0.087	0.087
		SRMR	≤ 0.08	0.0783	0.08
		GFI	≥ 0.85	0.854	0.856
		AGFI	≥ 0.80	0.807	0.812
		IFI	≥ 0.80	0.830	0.829
		CFI	≥ 0.80	0.828	0.827

As can be seen from Table 1, KMO was greater than 0.60, indicating the presence of themes in this scale. The Bartlett test was less than 0.05 and it showed that the sample size was sufficient to determine the themes. The scree plot graph (Figure 2) showed five sharp drops, indicating the presence five themes.

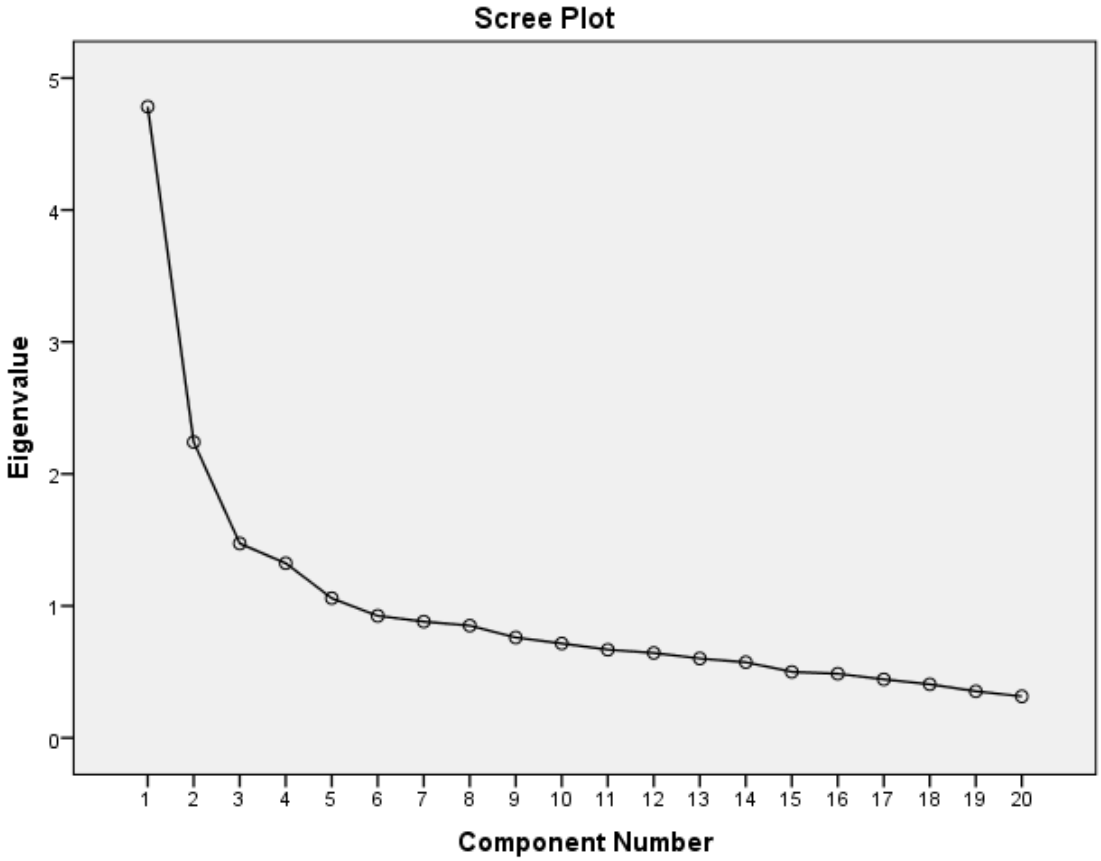

Figure 2. Scree plot- eigenvalue graph

The first theme as indicated sharp drop had a percentage variance related to eigenvalue of 23.914. The second theme's percentage of variance was 11.206; the third theme's percentage of variance was 7.366; the fourth theme's percentage of variance was 6.617 while the fifth theme's percentage of variance was 5.292 according to explanatory factor analysis. The other drops were very close to each other. According to the results, it was decided that the ecoliteracy scale had five themes: ecological intelligence, social intelligence, emotional intelligence, economy and green consumer behaviour (App 2) and these five themes have also respectable Cronbach alpha values either for each theme or for the whole scale (Table 2).

Table 2. *Themes and factor loads of the ecoliteracy scale*

	Themes and factor loads				
Scale items	**I (Economy)**	**II (Emotional intelligence)**	**III (Social Intelligence)**	**IV (Ecological Intelligence)**	**V (Green Consumer)**
6	0.799				
7	0.791				
8	0.720				
1	0.620				
23		0.667			
4		0.665			
5		0.528			
18		0.522			
3			0.859		
2			0.836		
17			0.672		
14			0.357		
28				0.677	
13				0.515	
12				0.498	
16				0.439	
11					0.729
10					0.684
15					0.679
9					0.560
Cronbach alpha coefficient values of each theme	0.654	0.562	0.715	0.632	0.624
Cronbach alpha coefficient value of whole scale	0.781				

As can be seen from Table 2, the Cronbach Alpha reliability coefficient value of whole scale was 0.781 while the coefficient values for economy, emotional intelligence, social

intelligence, ecological intelligence and green consumer behaviour were respectively 0.654, 0.562, 0.715, 0.632, and 0.624. These results indicated that the reliability scores were at a satisfactory level. The factor loads were more than 0.40 except the 14th item. The 14th item factor load was under 0.40 however the environmental education specialist suggested that this item represented the social intelligence theme very well. This meant that each item represented that theme very well.

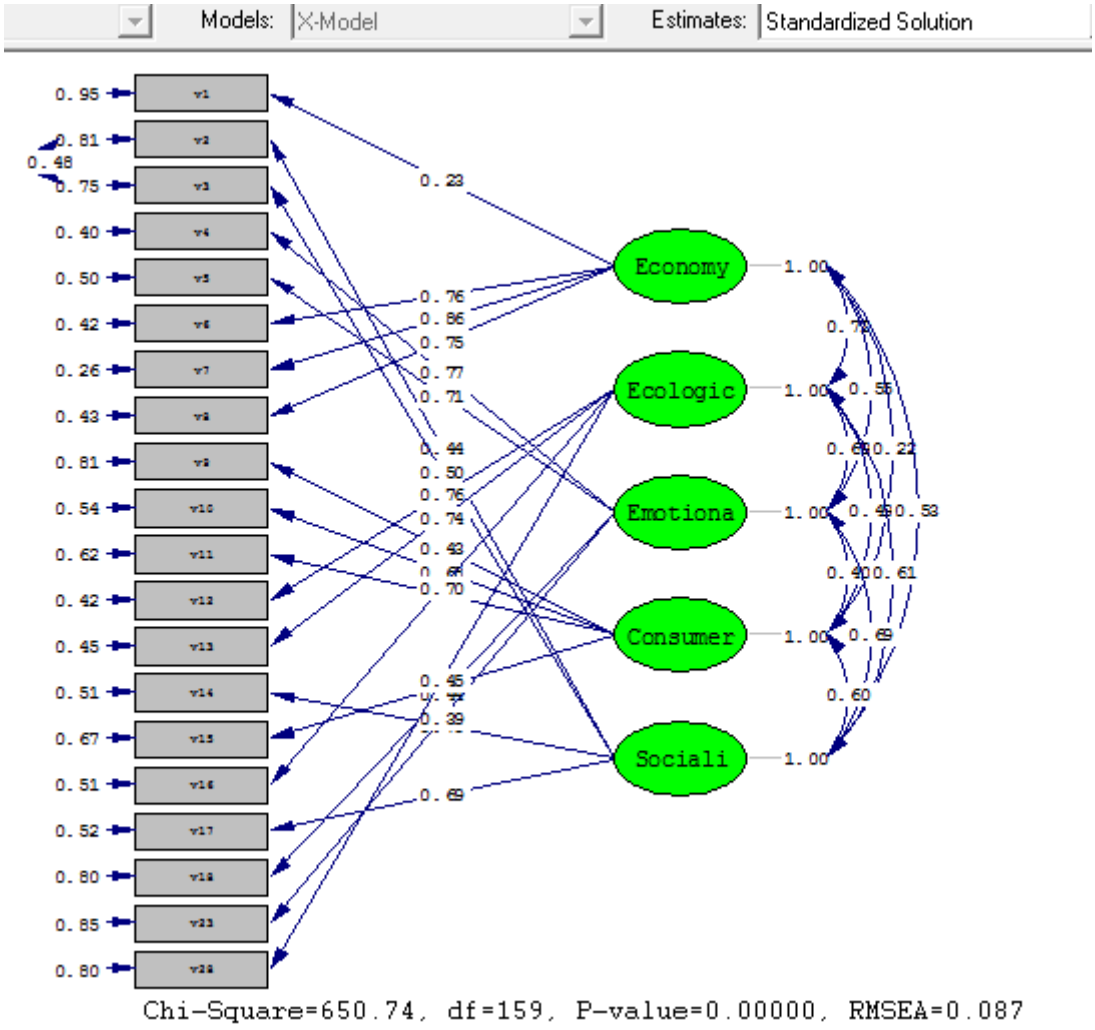

Figure 3. Path graph based on standardised solution of the ecoliteracy scale

Table 1 and Figure 3 showed that the ecoliteracy scale had goodness of fit values. All the results were confirmed by recommended values. According to Figure 3, each item represented a theme very well due to of standardised solutions being greater than 0.40 and t results less than 0.05 (App 1). The scale was reliable, had validity and strong theoretical background.

Testing of an alternative ecoliteracy model

According to the literature review, I thought that the main item of ecoliteracy was ecological intelligence. Ecological intelligence had three subsets (economy, emotional and social intelligences) and if ecological intelligence was improved then it would effect on the green consumer behaviour (Figure 1). I tested Figure 1 on confirmatory factor analysis one more time and Figure 4 occurred.

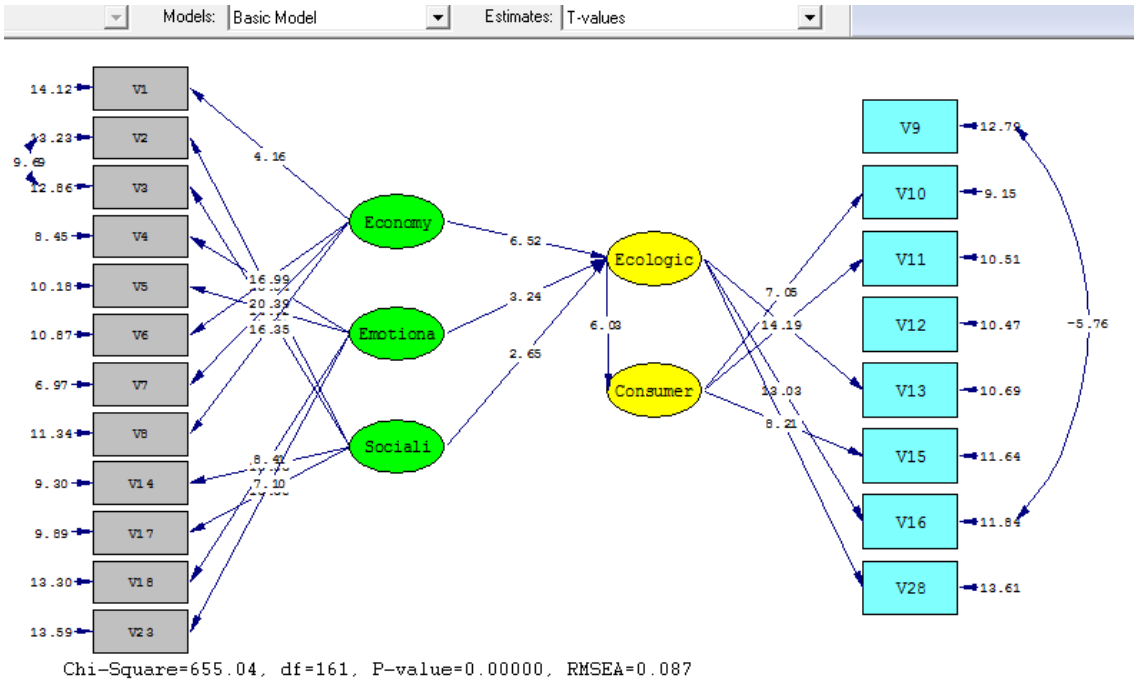

Figure 4. Path graph based on t values of the ecoliteracy model

As can be seen Figure 4, the model did not give any red signal and it meant that the significant levels among observable variables and latent variables were less than 0.05. The model only gave two correction warnings between the second- the third items and the ninth- the sixteenth items (Figure 4). The first warning between the second- the third items also happened at the first stage of the scale analysis (Figure 3). The second warning happened at the alternative model analysis. As can be seen from Table 1, goodness of fit values of ecoliteracy model were at a satisfactory level and very close to ecoliteracy scale's values after the correction analysis.

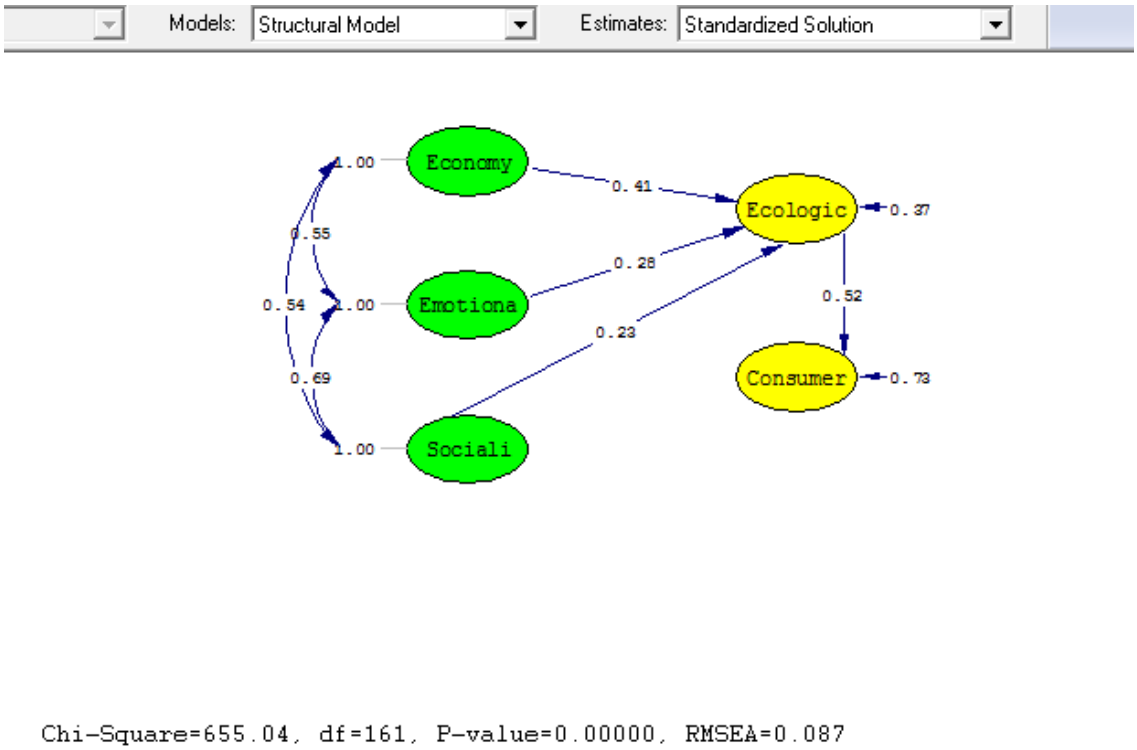

Figure 5. Path graph based on standardised solution of the alternative model

When it was compared Figure 1 and Figure 5, it could be clearly seen that both model overlapped. In terms of inductive and deductive perspective, this study showed that ecoliteracy scale and alternative model had strong theoretical background.

Discussion

According to the literature in introduction, five themes are determined for an ecoliteracy scale: ecological intelligence, social intelligence, emotional intelligence, economy and green consumer behaviour. At the first stage of the study, these five themes are confirmed as a subset of ecoliteracy (Table 1 and Figure 3). All the analysis results are at a satisfactory level (Table 1, 2 and Figure 3). At the second stage of the study, an alternative ecoliteracy model is tested (Figure 1). According to this model economy, emotional and social intelligences are subsets of ecological intelligence. Ecological intelligence has directly link to green consumer behaviours. Figure 4 and 5 confirm that ecoliteracy model has a satisfactory level and strong theoretical background. As can be seen at Figure 3 and 4, there are two corrections on the models.

Ideally, there should not be any correction on the scale development process and if there were many correction warnings, it meant that the model had very weak theoretical background (Simsek, 2007). However there were only two corrections on the alternative ecoliteracy model. Nevertheless, there is a gap between theoretical and experimental research on ecoliteracy (ESD, 2015); this study, therefore, might be an important starting point for experimental ecoliteracy studies.

Ecoliteracy is not a new concept. Researchers have begun to discuss about this concept for the last two decades. The main problem here is that ecoliteracy does not have a common definition (ESD, 2015; Kapogianni, 2015; Lira et al., 2015; Tursi, 2015; McBride et al, 2013; Esposito, 2009). Experimental studies related to ecoliteracy are very limited (Kapogianni, 2015; Tursi, 2015; Esposito, 2009) and they are mostly based on economy-

ecoliteracy relationship (Kapogianni, 2015; Tursi, 2015). These studies are used some surveys however ecoliteracy is only a subset of these surveys. It is obvious that the studies related to ecoliteracy have started to increase however there is a problem how to measure ecoliteracy (ESD, 2015). This study, therefore, refers to fill an important gap between theory and practice in terms of ecoliteracy.

Despite the fact that it is determined five subsets for ecoliteracy, the main aim of these subsets and ecoliteracy is sustainability (Goleman, 2006). Goleman (2006) also names ecolitearcy as sustainability literacy. The most popular definition of ecoliteracy is to use existing natural resources while considering next generations (UN Brundtland Declaration, 1987). This definition has been enriched with 'global citizenship' concept recently (Öhman, 2016). Many research mention theoretical background of ecoliteracy such as environmental knowledge, attitude, awareness, consciousness (ESD, 2015; Kapogianni, 2015; Lira, Steinicke & Garcia, 2015; Tursi, 2015; McBride, Brewer, Berkowitz and Borrie, 2013; Esposito, 2009; Orr, 1992, 2002). However it is not clear how to achieve sustainability learning and to transfer sustainability applications to the real life. It is clear that formal education is not enough to improve sustainability learning.

As can be seen from my case study at the beginning of the paper, informal learning and local culture are also very important in order to achieve sustainability and global citizenship. My grandmother, I and my friends did not know the meanings of sustainability or global citizenship but our behaviours were very coherent with sustainability. On the one hand the main subject here is to behave according to the local environment and local culture. This scale might be enriched with local cultures and information because one size does not fit all. I cannot say that this scale might work at research of all countries. It should be tested and improved. On the other hand there was an intergenerational transfer between my grandmother and grandchildren. In terms of local culture intergenerational transfers should not ignored because these transfers include collective acquisitions and systemic thinking (Shumba, 2011; Sterling, 2009). Intergenerational transfers refer to informal learning and informal learning might be main subject and methodology in terms of education programme development.

Research usually goes to from theory (literature review) to praxis (experimental/experiential applications). In terms of ecoliteracy, this way might be thought from opposite side. Researchers might go to from praxis to theory. For example, there are many people like my grandmother in rural areas or indigenous people. Researcher might observe these people and learn how they transfer local acquisitions to next generations. This might a new learning model for ecoliteracy and sustainability education.

As a conclusion, ecoliteracy has five subsets: ecological intelligence, social intelligence, emotional intelligence, economy and green consumer behaviour. Social intelligence, emotional intelligence and economy has connection with ecological intelligence while ecological intelligence has relationship with green consumer behaviour. If social intelligence, emotional intelligence or economy subjects are improved then they might affect on the development of ecological intelligence and thereby they might be effective on green consumer behaviour according to the alternative ecoliteracy model.

Implications

- This scale is not a perfect scale however it might be an important starting point for the other researchers. Researchers might try to develop another ecoliteracy scales with different subsets.
- This scale should be tested by other researchers. According to the results, the scale has very goodness of fit values however it is not clear whether it might work at different studies.

- Local cultural information is very important in terms of ecoliteracy and sustainability. Other researchers might develop different ecoliteracy scales based on local cultures.
- The main group of this study was adults. Future research could investigate different subsets of ecological intelligence among various demographics of backgrounds.

The scale could be adapted for different age groups and various demographic backgrounds. Researchers could also develop new ecoliteracy scales for different age groups and various demographic backgrounds.

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▪ ▪ ▪

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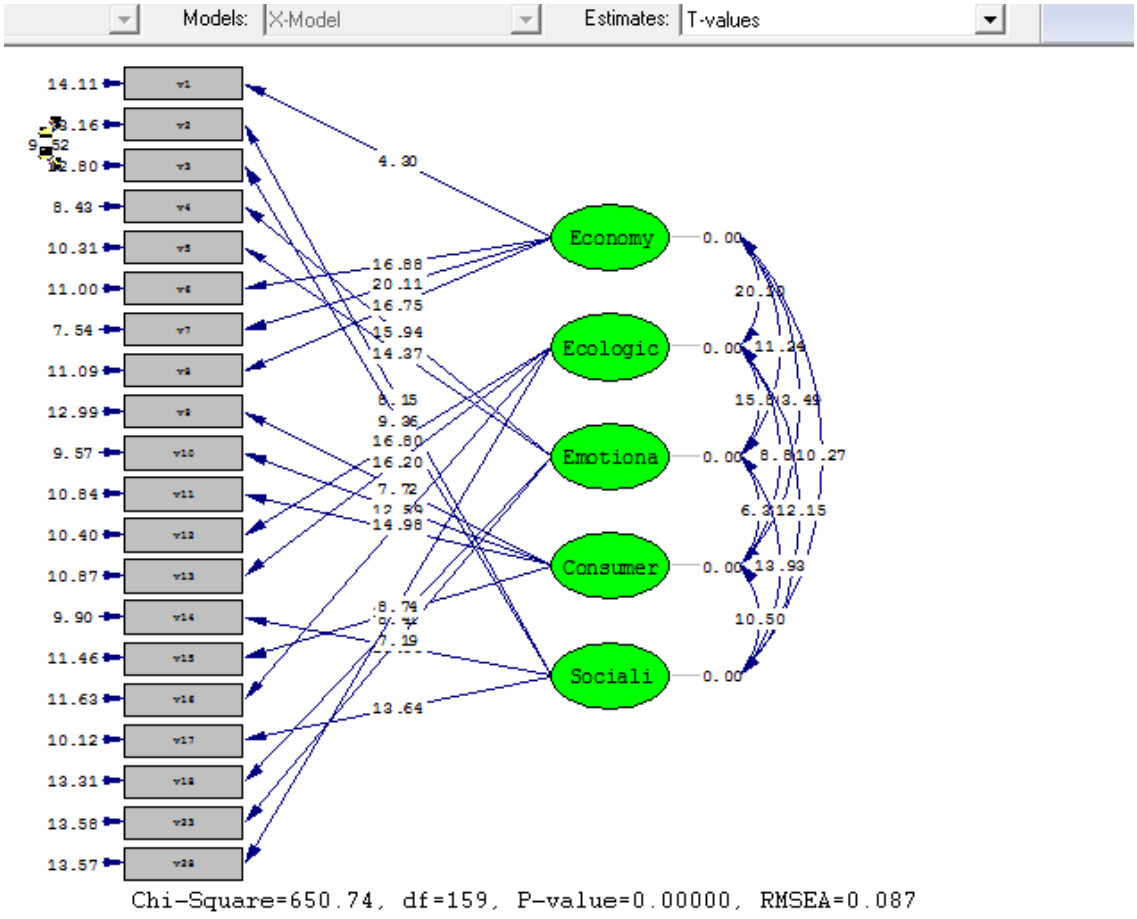
Appendix 1. Path graph based on t values of the ecoliteracy scale



Appendix 2. Final version of the ecoliteracy scale

Themes	Items	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
Economy	1. I cannot afford sustainably produced goods.					
	6. Global companies flourish at the expense of local businesses.					
	7. Local businesses lay off workers when trying to compete with global companies, which is one of the reasons for migration to urban centres.					
	8. Immigration serves as a source of cheap labour for global companies.					
Social intelligence	2. I avoid cheap goods from overseas if I am aware that their production involves unjust labour conditions.					
	3. I avoid cheap goods from overseas if I am aware that their production involves the use of child labour.					
	14. I prefer to buy local produced vegetables and fruits.					
	17. I don't feel good when I learn that the production of a good I bought involved unjust labour conditions.					
Emotional intelligence	4. I try to emulate individuals who live sustainably.					
	5. I believe that environmental education is one of the ways to combat obesity.					
	18. I feel bad when I notice that nature has the power to defeat human progress.					
	23. I would be a much more laid-back person if I knew nothing about environmental issues.					
Green consumer	9. I try to reuse plastic bags.					
	10. I try to avoid using plastic bags when I go shopping.					
	11. I have my own water bottle with me at all times.					
	15. I try to extend the life of my clothes by sewing and patching them.					
Ecological intelligence	12. Environmental disasters can unfold in several parts of the world simultaneously.					
	13. The effects of an environmental disaster are not limited to the area where it took place.					
	16. I worry when I learn about increase in incidents of cancer among people living in industrial areas					

Appendix 3. Number and percentage of participants

Participants	N	%
Undergraduate students	132	32.6
In-service teacher	97	24.0
Civil servant	48	11.9
Housewife	46	11.4
Academician	37	9.1
Health sector employee	16	4.0
Media sector employee	11	2.7
Engineer	9	2.2
Laboratory technician	9	2.2
Total	405	100

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ARAŞTIRMA MAKALESİ

Yetişkinlere Yönelik Ekolojik-Zeka Ölçeğinin Geliştirilmesi ve Alternatif Bir Modelin Doğrulaycı Faktör Analizi ile Test Edilmesi

Emel OKUR-BERBEROGLU
LIC (Livestock Improvement Corporation), Hamilton, NEW ZEALAND

Özet

Ekolojik okur-yazarlığın tek bir tanımlaması olmamasına rağmen ekolojik okur-yazarlık, doğadaki sürdürülebilir ekolojik ilişkilerin anlaşılması, içselleştirilmesi ve bu sürdürülebilir yaşam şeklinin, günlük hayata aktarılabilmesi olarak tanımlanabilir. Bununla beraber karmaşık yapısı nedeniyle, ekolojik okur-yazarlığı ölçmek de zordur. Ekolojik okur-yazarlığın pekçok alt bileşeni vardır. Bu nedenle bu çalışmanın bir amacı, alt bileşenleri ekolojik zeka, sosyal zeka, duygusal zeka, ekonomi ve yeşil tüketici davranışı olan yetişkinlere yönelik bir ekolojik okur-tazarlık ölçeği geliştirmektir. Çalışmanın bir diğer amacı, bu alt bişenler arasındaki ilişkiyi gösteren bir modeli test etmektir. Bu modele göre ekonomi, duygusal ve sosyal zeka ekolojik zekanın alt bileşenleridir. Modelin ikinci aşamasında ise ekolojik zeka, doğrudan yeşil tüketici davranışı ile bağlantılıdır. Doğrulayıcı ve açıklayıcı faktör analizine göre uyum iyiliği değerleri, kabul edilebilir düzeydedir. Bu değerler Cronbach alpha: 0.78; KMO: 0.830; X^2/df: 4.09; RMSEA: 0.087; SRMR: 0.0783; GFI, AGFI, IFI, ve CFI ≥ 0.80 şeklindedir. Ölçekte 20 madde bulunmaktadır.

Anahtar Kelimeler: Ekolojik okur-yazarlık, ekolojik zeka, duygusal zeka, sosyal zeka, ekonomi, yeşil tüketici davranışı, doğrulayıcı faktör analizi, açıklayıcı faktör analizi

ISSN: 2146-0329
***E-mail: emelokur17@gmail.com**

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RESEARCH ARTICLE

Air Pollution Awareness in the Scope of the Community Service Practices Course: An Interdisciplinary Study

Funda AYDIN-GÜÇ*
Giresun University, Giresun, TURKEY

Müge AYGÜN**
Giresun University, Giresun, TURKEY

Derya CEYLAN*
Giresun University, Giresun, TURKEY

Seda ÇAVUŞ-GÜNGÖREN*
Çanakkale On Sekiz Mart University, Çanakkale, TURKEY

Ümmü Gülsüm DURUKAN*
Giresun University, Giresun, TURKEY

Yasemin HACIOĞLU*
Giresun University, Giresun, TURKEY

Ayşe Dilek YEKELER*
Giresun University, Giresun, TURKEY

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Abstract

The aim of this study is to determine the effect of the interdisciplinary (the disciplines of Turkish, Social Science, Natural Sciences, Mathematics and Public Administration) activities performed in the scope of the Community Service Practices Course on the air pollution awareness (APW). This study has been performed as a multiple case study. Participants consisted of 32 pre-service elementary school teachers and 122 elementary school students enrolled in a 4th grade. Data were collected using the Air Pollution Awareness Questionnaire, Know-Want-Learn forms and interviews. Content analysis was used for analysis of data. The APW of participants have increased. It has been determined that the pre-service elementary school teachers have evaluated the implementation as being generally successful. Also it has been seen that the implementation has served different purposes out of the study aim for the pre-service elementary school teachers like providing teaching experience and how to teach the interdisciplinary subjects.

Keywords: Air Pollution Awareness, Community Service Practices Course, Interdisciplinary Approach, Pre-Service Teachers, Primary School Students

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*** All authors contributed equally to this study and listed in alphabetical order.**
****E-mail: muge.akpinar@giresun.edu.tr**

Introduction

Alongside being an increasingly important problem, air pollution is a major issue regarding various fields such as environment, health, economy and politics. Numerous definitions of air pollution exist in the literature (Güney, 2004; Özey, 2009; Devinny, Deshusses & Webster, 1998; Flagan & Seinfeld, 2013, etc.). Combining these definitions, air pollution in general can be described as the increase in the rate of harmful gases and particles in the atmosphere (Özey, 2009). This increase has negative impact on the living conditions. For example, according to World Health Organization (WHO), millions of people have lost their lives due to causes related to air pollution in 2012 (URL-1). It can also be stated that while air pollution affects human health as well as other living organisms (Oanh et al., 2006), it also has negative effects on historical artifacts, technological devices and buildings (Ridker & Henrick, 1967; Paulos, Honicky & Goodman, 2007; Hyslop, 2009). Moreover, since it causes economical and legal problems for countries (Rothbard, 1982; Best & Collins, 1982; Selden & Song, 1994), emergency measures have to be taken regarding air pollution. For this purpose, in order to reduce the air pollution and bring its negative effects to a minimum on an international scale, various studies are being conducted (Oanh et al., 2006; Paulos, et al., 2007; Semenza et al. 2008), laws and legislations are being prepared (exhaust emission law, etc.), and various studies are conducted in order to assess the current situation and determine the possible steps to be taken (e.g. KYOTO Protocole, 1997; Paris Convention, 2015). Additionally, it is also part of educational curricula as a subject or theme, in order to develop public knowledge and raise awareness (Ministry of National Education [MNE], 2013, 2009a; National Council of Mathematics Teachers [NCTM], n.d., etc.).

Improving the educational level and raising environmental awareness are essential for reducing the air pollution (Selden & Song 1994). In studies conducted in various fields, air pollution is found to be one of the major important problems regarding the environment according to students and pre-service teachers (Demirbaş & Pektaş 2009; Özdemir, Yıldız, Ocaktan, & Sarışen 2004; Vaizoğlu, et al., 2005; Uluçınar-Sağır, Aslan, & Cansaran, 2008). On the other hand, it is also evident that the knowledge levels of students and pre-service teachers about the air pollution are low, and they lack the scientific point of view (Darçın & Sert Çıbık, 2009; Sert Cibik & Darcin 2009; Thornber, Stanisstreet, & Boyes, 1999; Yeung, Boyes, & Stanisstreet, 2004). Therefore, increasing the knowledge level and awareness of not only the students but also the pre-service teachers who will teach them, by way of providing guidance with a purposeful and planned education is highly important(Demirbaş & Pektaş, 2009; Güven & Aydoğdu, 2012).Although there are various studies in the literature about the impact of active learning on the knowledge of students about air pollution (Önal & Güngördü, 2008) and about determining the understanding of the participants about air pollution/quality (Bickerstaff & Walker, 2001, 2003; Şahin, 2004; Paulos et al., 2007), no study can be found that is planned and implemented in order to raise air pollution awareness only. Hence, despite it is considered that the individuals acquire awareness about air pollution generally through media or publicity campaigns (Hyslop, 2009; Beaumont, Hamilton, Machin, Perks, & Williams, 1999; Bonnett & Williams, 1998); Bickerstaff & Walker (2001) determined that personal experiences have more impact on raising awareness on pollution. This fact suggests that the awareness can only be acquired after the pollution takes place. The reason to raise awareness of the individuals on air pollution is to ensure that they take the necessary measures against the air pollution before it takes place. Therefore, awareness practices should be implemented with the cooperation of the government and the educators (Alp, Ertepınar, Tekkaya, & Yılmaz, 2008).

During the formal education, air pollution is part of the curriculum both as a subject in various courses and as a theme in discipline specific subjects (see MNE, 2013, 2009a; NCTM, n.d., etc.). This education process starts with differentiating between the clean and polluted environment, and continues in the primary school level with increasing the details of contents. Classroom teachers who are proficient in different disciplines are expected to raise awareness on the subject by carrying out learning/teaching activities in schools. Since air pollution awareness raising practices are socio-scientific and interdisciplinary in nature, they can be conducted with an interdisciplinary approach (Bonnett & Williams, 1998; Hamalosmanoğlu & Güven, 2014; Karataş & Aslan, 2012).

Community Service Practices Course (CSPC) is one of the courses where the interdisciplinary approach can be applied during the education of teachers. CSPC is a course that aims the pre-service teachers to acquire social responsibility in theory and practice, and ensure to enhance their cooperation, solidarity, effective communication and self-evaluation skills. In accordance with this purpose, the pre-service teachers are expected to determine the current social problems and work towards solutions for these problems (Tezbaşaran, 2009). While this course is covered as service-learning course in countries such as USA and England (Beldağ, Yaylacı, Gök, & İpek, 2015), it is conducted as 1 hour theory and 2 hour practice course in Turkey. During the course, pre-service teachers organize social activities or participate in such activities under the guidance of a faculty member (Council of Higher Education [CHE], 2006). The pre-service teachers take active roles, and the faculty member observes and guides the activities of the students. Moreover, they provide the pre-service teachers with opportunities to work on the subjects they are interested in and want to learn by ensuring that they work with the public in person, rather than doing course work in a classroom environment (Aksoy, Çetin, & Sönmez, 2009). Gökçe (2012, p.589) states that within the scope of CSPC, activities targeted at addressing the environmental issues which enable the students to actively participate can also be carried out. Hence, through this course, the pre-service teachers can raise awareness in the public on various areas, including environmental issues (Talas & Karataş, 2012); because CSPC is a course that enables both interdisciplinary studies and where issues which affect the society such as air pollution can be addressed.

There are various studies in the literature that use interdisciplinary approach to environmental issues. These studies have various different subjects such as the contribution of doing activities about various environmental themes that are designed by the researchers and carried out by the classroom teachers with their students on raising their awareness (Güven 2012; Hamalosmanoğlu & Güven 2014), and the reaction of the schools to such studies (Şimşekli, 2004), awareness raising activities via Ecology Based Summer Camp Project as a novel implementation towards teachers and students (Karataş & Aslan, 2012), or determining the impact of environmental education in primary schools towards the attitudes of the students towards nature and environment (Bonnett & Williams, 1998). These practices have been carried out under the guidance of one or more faculty members or teachers, and pre-service teachers or students attended these practices as participants. These studies which are about raising awareness are mostly carried out under a more general theme that can include various different such as environment or environmental pollution, rather than focusing on specific subjects as air pollution. However, in this study, instead of addressing all sub-themes under a general theme, the theme of air pollution is directly at the focus in all the activities. Generally, the studies on CSPC in the literature focus on evaluating the course by determining the opinions of participating pre-service teacher about the course process (Arcagök & Şahin, 2013; Uğurlu & Kıral, 2012; Gökçe, 2011; Sönmez, 2010; Çetin & Sönmez, 2009; Kesten, 2012; Ekşi & Cinoğlu, 2012; Özdemir & Tokcan, 2010). The aim of this study is to determine the impact of the activities on both the pre-service teachers and the students who are the target audience for the community practices

carried out within the scope of the course. From these two perspectives, this study can be considered a novel work in this area.

In light of all these facts, the aim of this study is to determine the impact of interdisciplinary activities carried out within the scope of CSPC on the air pollution awareness. In order to achieve this goal, actions have been taken towards three main objectives as listed below:

- Determining the level of awareness on air pollution of pre-service teachers
- Determining the level of awareness on air pollution of fourth grade primary school students
- Determining the opinions of pre-service teachers about the CSPC

Methodology

Since this study contains two separate study groups that are related with each other, and it investigates the differences emerging from two interrelated cases, it is considered as a nested multiple case study, which is one of the qualitative research methods. The changes in the air pollution awareness of both study groups are investigated by comparing the data obtained before and after the study.

Study Groups

The study group of the research consists of 32 pre-service teachers who are in the third year of university education, and 122 primary school fourth grade students. The aim of the study is to raise a public awareness on air pollution which is an interdisciplinary subject. For this purpose, the study was conducted with pre-service teachers who will be the future educators in various different disciplines. CSPC is considered the most suitable course for the purpose of community service.

In Turkey, the classroom teachers teach in the primary school from 1st to 4th grades. In the educational curricula between 2014 and 2016, during which this study was conducted, the disciplines have begun to differentiate at the 4th grade. 4th graders are found to be the most suitable group to conduct the study, since their experience towards different disciplines make them ideal for handling the subject of air pollution with an interdisciplinary approach.

Data Collection Instruments

Three different data collection instruments have been used in this study. The first one is the Air Pollution Awareness Questionnaire (APAQ), which was developed by the researchers and comprised of seven questions. The aim of APAQ is to determine the view of air pollution of pre-service teachers and students with a general approach, the causes and effects of air pollution, the preventive measures that can be taken against air pollution and their level of awareness about the air pollution in their immediate surroundings. The city of Giresun which is by the Black Sea and the city in which the participants live is considered as the immediate surroundings. The questionnaire have been applied on both the pre-service teachers and primary school students before and after the implementation of the study, and the development stages of the questionnaire are elaborated in Authors (In review).

The second instrument is the Know-Want-Learn (KWL) form, applied to pre-service teachers in order to present the self-assessment of the pre-service teachers on air pollution. The first two questions of the KWL form have been answered in the first day of CSPC, and the last question has been answered in the last day by the pre-service teachers.

The third instrument is an interview form comprising of ten questions created by the researchers in order to determine the views of pre-service teachers on the CSPC process. After some trials, the form has been reevaluated and reduced to four questions. This form has been used in order to determine the opinions of pre-service teachers on the CPSC process, whether the coursework is successful in reaching the course aims, whether the course is successful in fulfilling its community service purpose, knowledge gained from different groups during the course and the opinions of pre-service teachers on the general process. The interviews have been conducted with 10 volunteer pre-service teachers, two from each discipline group in the study.

Implementation

At first, during the design phase of the study, in order to determine the essential focus points in raising awareness on air pollution, a needs analysis has been performed after applying APAQ to a different group. Basic concepts, causes, effects, future status and precautions are found to be the focus points as a result of the needs analysis. The contents of these focus points have been compared to the contents of the primary school fourth grade curriculum. As a result, a discipline has been appointed to each focus point. During the course of the study, a field expert has been appointed by the researchers for each discipline.

The study has been conducted in the faculty with CSPC and as seminars in the primary schools. As a result of the pilot applications, changes have been made to the data collection instruments, focus points, content and the order (Aydın Güç, et al., 2017). The relation between the air pollution and focus points, content and disciplines in the actual implementation are presented in Table 1.

Table 1.

Focus Points, Content and Disciplines

Focus Point	Content	Discipline
Basic concepts	Basic concepts on air pollution	Turkish
Causes and effects	The effects of air pollution on human health and social effects within the scope of natural sciences	Natural Sciences
Causes and effects	Natural and human causes and effects of air pollution	Social Sciences
Future status	The state of air pollution in the past and today, and predicting the future status based on the current conditions	Mathematics
Precautions	Clearing up/summarizing the presentations of previous groups, laws and legislations, implementations in different countries, public opinion	Public Administration

The activities performed during the implementation phase within the scope of the course have taken place in three stages, before, during and after seminars. Before and after stages have been conducted during the CSPC class time in the faculty, and the seminars have been conducted in the primary schools. The actual implementation plan of the study is presented in Table 2.

During the preparation stage before the seminars, the pre-service teachers conducted preliminary research on what air pollution is, its causes and effects, and national and international practices. Afterwards, groups have been created from below the average pre-service teachers. During this process, the related field experts have presented the contents of the focus points for each discipline, and the groups have been asked to research the relation between the focus points and the disciplines. The pre-service teachers have determined the gains for their disciplines and accordingly, developed course plans for these focus points. Following the schedule in Table 2, the course plans have been presented to the other groups.

Table 2.

Community Service Practices Course and The Plan of Implementation of Service Practices

Week	Faculty of Education	School A	School B	School C
1	Pre-tests, preliminary research			
2	Creation of the groups			
3	Study with the consultants			
4	Distribution among groups			
5	Turkish group presentation	Pre-test		
6	Natural Sciences group presentation	Turkish	Pre-test	
7	Social Sciences group presentation	Natural Sciences	Turkish	Pre-test
8		None implementation (Midterm)		
9	Mathematics group presentation	Social Sciences	Natural Sciences	Turkish
10	Public Administration group presentation	Mathematics	Social Sciences	Natural Sciences
11	Sharing of experiences	Public Administration	Mathematics	Social Sciences
12	Sharing of experiences	Post-test	Public Administration	Mathematics
13	Sharing of experiences		Post-test	Public Administration
14	Sharing of experiences			Post-test
15	Post-tests			
16	Interviews			

The course plans have been finalized after the feedbacks from the consultants and other groups, and they are presented in Table 3.

During the seminars, the pre-service teachers have applied the course plans they prepared at primary schools in groups. The duration of these seminars are two class hours. Each group has completed their seminars in three weeks, at a different school each week. During this period, without telling them that they will conduct the course under different disciplines, the primary school students have been explained that they will be studying air pollution under different focus points in class. While the seminars are underway in primary schools, the groups who have not yet presented have kept their preparations for the seminar going. The groups which have completed their seminars shared their experiences of their work in the primary schools with consultants and other groups. The groups have tried to determine the negative and positive aspects of the implementation by discussions with other groups.

Table 3.

Disciplines, Gains Included in The Course Plans and Course Plan Summaries

Discipline	Gains in the course plan	Course plan summary
Turkish	Making deductions from what they listen to. Making comparisons based on what they listen to. Researching the meaning of words they do not know. Sharing the things they listen with others. Developing vocabulary by making use of visuals. Guessing the meanings of the words they do not know from what they listen to. (MNE, 2009b)	Watching a drama piece about basic concepts on air pollution, guessing the meaning of words from what the students listen to, making deductions and comparisons from what they listen to, examining images about basic concepts and improving vocabulary by making use of these images, trying to solve puzzles about basic concepts, researching the meanings of newly encountered words during this stage.
Natural Sciences	Comprehending the mutual interaction between humans and the environment. Keeping the immediate surroundings clean in order to prevent pollution of the environment. (MNE,2013)	Making experiments in order to observe air pollution, discussing the effects of the results of the experiment on the health of living beings together with the human causes and effects of air pollution, watching and discussing related animations, taking note of the importance of mutual interaction between humans and the environment.
Social Sciences	Making distinction of the natural and human elements seen in the surrounding environment. (MNE, 2009a)	Explaining the natural and human causes and effects of air pollution by including drama pieces and visual materials about the natural and human elements related to the causes and effects of air pollution.
Mathematics	Creating bar charts. Interpreting bar charts. (MNE, 2009c)	Investigating the data of air pollution from previous years in our city, creating and interpreting bar charts using these data, solving problems aimed at predicting the future status with the help of the charts.
Public Administration	Examining the laws and regulations on air pollution. Being curious about the opinions of the public and government officials about air pollution.	Watching drama pieces about national laws and regulations, international conventions made for prevention of air pollution, comparisons of the status of air pollution between different countries; watching and discussing interviews about the public opinion.

Data Analysis

The collected data have been evaluated with content analysis. Suitable codes are created and categories are determined accordingly, and thus the analysis is concluded. Analyses from two different researchers have been compared, their differences have been discussed and an agreement has been reached.

Results

In this section, the results obtained from the study are presented together with the related data collection instruments.

Results Obtained from KWL Form

The results on the self-evaluation of the pre-service teachers about their air pollution awareness are presented in Table 4.

Table 4.

The Self-Evaluation of The Pre-Service Teachers About Their Air Pollution Awareness

Category	What do I know?	What do I want to learn?	What have I learnt?
Air pollution description	5	-	2
Causes of air pollution	27	8	31
Effects of air pollution	18	6	19
Actions that can be taken in order to prevent air pollution	8	25	11
Awareness raising activities that can be done in order to prevent air pollution	-	15	6
Interdisciplinary nature of air pollution	-	-	2
Statistical information on air pollution	-	-	6
Government Policies/Projects/Institutions related to air pollution	-	7	12
The regional/national/international status regarding the air pollution	-	-	11

The results indicate that the pre-service teachers answer the question “What do I know?” with the causes of air pollution, effects of air pollution and actions that can be taken in order to prevent air pollution. It is also determined that a small number of pre-service teachers can describe air pollution. Examining the question “What do I want to learn?”, it can be seen that the pre-service teachers want mostly to be able to learn about the actions to be taken in order to prevent air pollution and awareness raising activities. In addition, it can also be determined that they are curious about the causes and effects of air pollution, and the government policies regarding the air pollution. For the question “What have I learnt?”, they state that they have learnt the causes and effects of air pollution, the current situation and government policies regarding the air pollution, and what actions to take in order to prevent air pollution (Table 4).

Results Obtained from APAQ

The answers given by the pre-service teachers and students to the question “What is air pollution?” are presented in Table 5. The table indicates that the pre-service teachers and students focus on the causes and effects while describing the air pollution.

Under the causes theme, both groups mention the causes “human activities” and “increase in harmful gases/polluters/foreign substances in the air, decrease in oxygen in the air” most, both before and after the implementation. For both groups, the frequency of explaining the air pollution with “increase in harmful gases/polluters/foreign substances in the air, decrease in oxygen in the air” increased after the implementation. Moreover, while the number of responses from students with “human activities” increases, it decreases for pre-service teachers. While neither groups mention the “natural causes” before the implementation, these causes get to be mentioned, although with low frequency, after the implementation.

It has been observed that in both groups, the number of students that describe the air pollution by taking the effects into account decrease after the implementation. In addition, the codes “pollution of clean air”, “weather activities/dust clouds” and “negative environmental conditions” under the causes theme, and “material damage”, “extinction of living beings”, and “foul odor” codes under the effects theme are only addressed by the students.

Table 5.

Description of Air Pollution According to Pre-Service Teachers and Students

Theme	Code	Pre-service Teach.				Students			
		Pre		Post		Pre		Post	
		f	%	f	%	f	%	f	%
Cause	Human activities	16	50	9	28,1	57	46,7	68	55,7
	Natural causes	-	-	5	15,6	-	-	1	0,8
	Increase in harmful gases/polluters/foreign substances in the air, decrease in oxygen in the air	22	68,8	29	90,6	51	41,8	54	44,3
	Pollution of clean air	1	3,1	-	-	7	5,7	8	6,6
	Weather activities (such as smog)/dust clouds	-	-	-	-	5	4,1	6	4,9
	Negative environmental conditions	-	-	-	-	4	3,3	3	2,5
Effect	Harm to living beings/health	5	15,6	13	40,6	16	13,1	8	6,6
	Harm to humans/human health	8	25,0	4	12,5	9	7,4	1	0,8
	Harm to ecosystem	3	9,4	6	18,8	-	-	1	0,8
	Visual pollution	1	3,1	-	-	-	-	-	-
	Material damage	-	-	-	-	6	4,9	4	3,3
	Extinction of living beings	-	-	-	-	1	0,8	1	0,8
	Foul odors	-	-	-	-	2	1,6	-	-

Note. Pre and Post: Pre-implementation and post-implementation

The answers given by the pre-service teachers and students to the question “What can be the causes of air pollution?” are presented in Table 6. According to this table, the causes of air pollution are gathered under two main themes as human and natural causes.

Under the human causes theme, both groups mention mostly “exhaust smoke”, “industry”, “heating” and “personal care” as the causes for air pollution before and after the implementation. It can be seen that “unsuitable agricultural activities” is only stated after the implementation. “Unplanned urbanization” is only mentioned by the pre-service teachers before the implementation. Moreover, it should be noted that the frequency of mentioning “destruction of forests” by both groups decrease after the implementation. The code “lack of education” is also addressed less by the pre-service teachers after the implementation.

The natural causes theme is addressed relatively less than the human causes by both groups. In addition, it can be observed that the pre-service teachers mention the natural causes more after the implementation. It should also be noted that in contrast to pre-service teachers, no “volcano eruptions”, “earthquakes”, “methane gases”, “flood” and “global warming” codes come up in the answers of the students.

Table 6.

Causes of Air Pollution According to Pre-Service Teachers And Students

Theme	Code	Pre-service Teach.				Students			
		Pre		Post		Pre		Post	
		f	%	f	%	f	%	f	%
Human causes	Humans	4	12,5	1	3,1	4	3,3	3	2,5
	Exhaust smoke	21	65,6	26	81,3	65	53,3	80	65,6
	Industry	25	78,1	23	71,9	56	45,9	88	72,1
	Heating	13	40,6	18	56,3	60	49,2	59	48,4
	Personal Care	11	34,4	19	59,4	3	2,5	23	18,9
	Destroying forests	4	12,5	1	3,1	16	13,1	1	0,8
	Unplanned urbanization	3	9,4	-	-	-	-	-	-
	Lack of education	9	28,1	1	3,1	2	1,6	2	1,6
	Wastes	5	15,6	1	3,1	6	4,9	7	5,7
	Unsuitable agricultural activities	-	-	3	9,4	-	-	1	0,8
	Smoking	1	3,1	1	3,1	4	3,3	13	10,7
	Fires	2	6,3	4	12,5	4	3,3	9	7,4
	Population increase	2	6,3	1	3,1	1	0,8	-	-
Natural causes	Volcano eruptions	-	-	8	25,0	-	-	-	-
	Earthquake	-	-	1	3,1	-	-	-	-
	Methane gas emission	-	-	1	3,1	-	-	-	-
	Flood	1	3,1	-	-	-	-	-	-
	Global warming	1	3,1	-	-	-	-	-	-
	Geographical location	-	-	1	3,1	3	2,5	5	4,1
	Dust storms	-	-	-	-	3	2,5	2	1,6

The answers given by the pre-service teachers and students to the question “What could be the effects of air pollution?” are presented in Table 7. The table indicates that both groups state outcomes regarding bringing harm to the living beings, environment and cultural environment.

Under the harming the living beings, both groups mention the code “health” the most before and after the implementation. It is noteworthy that while the pre-service teachers do not mention the harm to the “plants” due to air pollution before the implementation, they do mention this code after the implementation. In the harming the environment theme, it can be seen that the responses from both groups show no noticeable difference before and after the implementation. After examination of harming the cultural environment theme, it can be seen that while the opinions of pre-service teachers on this the increase in the post-test, the opinions from the students on this theme decrease.

Table 7.

The Effects of Air Pollution According to Pre-Service Teachers and Students

		Pre-service Teach.				Students			
		Pre		Post		Pre		Post	
Theme	Code	f	%	f	%	f	%	f	%
Harming living beings	Health	28	87,5	29	90,6	73	59,8	76	62,3
	All living beings	7	21,9	9	28,1	8	6,6	9	7,4
	Plants	-	-	7	21,9	2	1,6	8	6,6
	Animals	2	6,3	1	3,1	3	2,5	1	0,8
	Extinction	1	3,1	6	18,8	2	1,6	2	1,6
	Life time	2	6,3	3	9,4	8	6,6	18	14,8
	Mental health	1	3,1	-	-	3	2,5	1	0,8
	Social life	3	9,4	1	3,1	-	-	-	-
	Genetic degradation	1	3,1	-	-	-	-	-	-
	Humans	3	9,4	1	3,1	-	-	1	0,8
Harming the environment	Global warming	4	12,5	3	9,4	3	2,5	-	-
	Disturbing the ecological balance	2	6,3	3	9,4	1	0,8	1	0,8
	Climate change	1	3,1	1	3,1	2	1,6	-	-
	Ozone layer/atmosphere depletion	2	6,3	3	9,4	6	4,9	1	0,8
	Acid rains	2	6,3	2	6,3	2	1,6	4	3,3
	Pollution of other environmental elements (water, land)	3	9,4	3	9,4	6	4,9	10	8,2
	Visual pollution	3	9,4	-	-	2	1,6	-	-
	Decrease in/lack of oxygen	2	6,3	1	3,1	7	5,7	11	9,0
	Melting of the polar icecaps and rising water levels	-	-	-	-	1	0,8	-	-
	Foul odors engulfing the environment	-	-	-	-	6	4,9	2	1,6
Harming the cultural environment		1	3,1	9	28,1	5	4,1	3	2,5

The answers given by the pre-service teachers and students to the question “What can be done in order to prevent air pollution?” are presented in Table 8. In this table, it can be seen that both groups state that precautions can be taken under the themes of education, fuel usage, nature, individual activities and government policies.

For the case of precautions to be taken regarding education, it can be seen that both groups mention “awareness raising activities” the most. The “formal education” code is only addressed by the pre-service teachers after the implementation.

It is noteworthy that regarding the precautions towards air pollution, both groups have the most awareness on the theme of fuel usage, both before and after the implementation. In both pre-service teachers and students, the awareness on using filters, under the theme of fuel usage increases after the implementation, and this increase is especially more prominent for the students. Moreover, after the implementation, “quality/responsible fuel usage” code is addressed more by the pre-service teachers and less by the students.

Table 8.

Actions to be Taken in Order To Prevent Air Pollution According to Pre-Service Teachers and Students

Theme	Code	Pre-service Teach.				Students			
		Pre		Post		Pre		Post	
		f	%	f	%	f	%	f	%
Education	Awareness raising activities	18	56,2	18	56,2	4	3,3	3	2,4
	Formal Education	-	-	2	6,3	-	-	-	-
Fuel usage	Filters	20	62,5	26	81,3	46	37,7	82	67,2
	Chimney cleaning	-	-	1	3,1	2	1,6	3	2,5
	Reducing gas emissions	-	-	-	-	1	0,8	1	0,8
	Reducing fossil fuel usage	2	6,3	-	-	-	-	-	-
	Heat isolation	1	3,1	-	-	-	-	-	-
	Quality/responsible fuel usage	9	28,1	12	37,5	36	29,5	22	18,0
Activities towards nature	Forestation	5	15,6	4	12,5	24	19,7	13	10,7
	Preventing forest fires	3	9,4	4	12,5	1	0,8	5	4,1
	Protecting the nature	-	-	-	-	2	1,6	1	0,8
Individual activities	Recycling	1	3,1	-	-	-	-	1	0,8
	Reducing chemical substance usage	4	12,5	9	28,1	1	0,8	4	3,3
	Using public transportation	5	15,6	14	43,8	17	13,9	17	13,9
	Using renewable energy sources	-	-	-	-	3	2,5	3	2,5
Government policies	Criminal action	-	-	2	6,3	1	0,8	1	0,8
	Inspection	4	12,5	1	3,1	-	-	3	2,5
	Laws	1	3,1	1	3,1	-	-	1	0,8
	Urban planning	2	6,3	1	3,1	5	4,1	1	0,8
	Situation assessment, planning	1	3,1	-	-	-	-	-	-
	Banning smoking	-	-	-	-	1	0,8	1	0,8

In the individual activities theme, while an increase can be observed for the “reducing the usage of chemical substances” and “using public transport” codes in pre-service teachers after the implementation, no significant change is observed for the students.

In the activities towards nature and government policies themes, small changes are encountered in the frequency of codes for both groups before and after the implementation. While in the question about the causes of air pollution the students responded with the “destruction of forests” code less after the implementation, in this question, the “preventing forest fires” code is mentioned more frequently for preventing air pollution.

The answers given by the pre-service teachers and students on the question “Do you think there is air pollution in Giresun?” are presented in Table 9. In this table, it can be seen that both groups state their opinions under the themes of “yes” “no” and “partially”.

Table 9.

Air Pollution in Giresun According to Pre-Service Teachers and Students

Theme	Code	Pre-service Teach.				Students			
		Pre		Post		Pre		Post	
		f	%	f	%	f	%	f	%
Yes	Air color	-	-	-	-	2	1,6	3	2,5
	Foul odor	-	-	-	-	4	3,3	2	1,6
	Coal usage	19	59,4	13	40,6	22	18,0	13	10,7
	Unfiltered chimneys	1	3,1	1	3,1	7	5,7	10	8,2
	Wastes	1	3,1	-	-	3	2,5	6	4,9
	Bad quality/irresponsible fuel usage	2	6,3	2	6,3	14	11,5	9	7,4
	Smoke	11	34,4	5	15,6	77	63,1	60	49,2
	Forest destruction	-	-	-	-	10	8,2	9	7,4
	Harm to living beings	3	9,4	3	9,4	4	3,3	4	3,3
	Not using public transportation (there are too many private vehicles)	-	-	-	-	9	7,4	12	9,8
	Irresponsible behavior	-	-	-	-	12	9,8	12	9,8
	Personal care	-	-	-	-	1	0,8	4	3,3
	Scientific deduction (the experiments we have done)	-	-	-	-	-	-	2	1,6
	Geographical structure/location	-	-	4	12,5	2	1,6	2	1,6
	No reason	-	-	-	-	9	7,4	11	9,0
No	No factories	1	3,1	-	-	4	3,3	12	9,8
	Woodland	-	-	-	-	-	-	4	3,3
	Transition to natural gas	-	-	-	-	-	-	4	3,3
	Small city	1	3,1	-	-	-	-	4	3,3
	Little industry	1	3,1	-	-	-	-	-	-
	Responsible behavior	-	-	-	-	-	-	6	4,9
	Clean environment	-	-	-	-	6	4,9	-	-
	Small number of vehicles	-	-	-	-	-	-	4	3,3
	Scientific deduction (values between 0-53, reports)	-	-	-	-	-	-	8	6,6
	No reason	1	3,1	-	-	2	1,6	8	6,6
Partially	There is none, according to the measurement reports; however, the color of the air/coal usage	-	-	2	6,3	-	-	-	-
	There is none, according to the measurement reports; however geographical structure/location	-	-	1	3,1	-	-	-	-
	Seasonal	-	-	1	3,1	-	-	-	-

Before and after the implementation, the pre-service teachers who think that there is air pollution in Giresun show “coal usage” as the reason, and the students show “smoke in the air” as the reason the most. In both groups, the mentioning frequency of the other codes under the “yes” theme, and codes under “no” and “partially” themes are significantly low before and after the implementation. However, especially in the codes under the “there is not” theme, there is an increase for the students.

The answers given by the pre-service teachers and students to the question "What kinds of regional or national activities/events do you encounter in your daily life about air pollution?" are presented in Table 10. It can be seen in this table that both groups respond under the themes of education, social events, heating, government policies, situation assessment and agricultural activities.

Table 10.

Regional or National Activities and Events That The Pre-Service Teachers and Students Encounter in Their Daily Lives About Air Pollution

Theme	Code	Pre-service Teach.				Students			
		Pre		Post		Pre		Post	
		f	%	f	%	f	%	f	%
Education	Scientific activities (panel, symposium, conference, meeting)	-	-	1	3,1	-	-	-	-
	Awareness raising activities (campaigns, slogans, public service announcements, seminars, presentations, theatre plays, poems, application practices, our project, TV, newspapers, advertisements)	1	3,1	13	40,7	21	17,2	28	22,9
	Information from teachers	-	-	-	-	1	0,8	-	-
Social events	Rally, protest, awareness activities (trekking)	2	6,3	1	3,1	4	3,3	10	8,2
	Institutions/clubs, associations, environment protectors, Greenpeace, World Health Organization	5	15,6	6	18,8	20	16,4	12	9,8
Heating	Filter usage preference	-	-	-	-	2	1,6	2	1,6
	Natural gas usage preference	2	6,3	-	-	1	0,8	-	-
Government Policies	Smoking ban, smoke-free air space project	-	-	6	18,8	-	-	1	0,8
	Exhaust/criminal action, increasing public transportation	-	-	-	-	1	0,8	2	1,6
	Activities of ministry of environment and urbanization	-	-	-	-	4	3,3	6	4,9
	Protocols between countries, treaties, KYOTO	-	-	2	6,3	-	-	2	1,6
	Important days and weeks	-	-	-	-	1	0,8	1	0,8
Situation Assessment (Surveys)		2	6,3	-	-	13	10,7	7	5,7
Agricultural activities (Forestation)		5	15,6	5	15,6	11	9,0	7	5,7
I do not encounter any		5	15,6	5	15,6	18	14,8	15	12,3

It can be seen that in both groups, the frequency of mentioning the codes under the education theme is quite low before the implementation, and there is a noticeable increase especially in the "awareness raising activities" code for the pre-service teachers after the implementation. Moreover, the codes under social events, heating, government policies, situation assessment and agricultural activities themes show no significant change in mentioning frequency after the implementation.

Results Obtained from Semi Structured Interviews

The interviews indicate the evaluation of the pre-service teachers about the CSPC process. The responses of the pre-service teachers to the question "Do you think the work you have done is successful?" are presented in Table 11.

Table 11.

The Opinions of The Pre-Service Teachers on Whether The Work Done Within The Scope of The Course is Successful

Theme	Category	Code	f
General aim	Successful	Raising awareness on air pollution	1
		Receiving positive feedbacks from the students	3
		The implementation in general going well	1
	Partially successful	The concepts about air pollution not being at a suitable level for the students	1
		Learning process not being fully actualized	1
		Working in different places during the implementation	1
	I don't know	Not watching the seminars given by the other groups at schools	1
Aim of the groups	Successful	The seminars given at schools being effective	6
		The seminars given at schools going well	3
		Receiving positive feedbacks from the students	2
	Partially successful	Difficulty in attracting the attention of the students in seminars	3
		The physical conditions in which the seminars were conducted being different	1

According to Table 11, the pre-service teachers in general have responded that the work done has been successful in terms of the general aim and group aims. Moreover, the pre-service teachers have stated that the concepts about the air pollution are not at suitable levels for the students, the learning process have not been fully actualized and they conducted the work at different locations throughout the implementation; all of which have negative impact in achieving the general aims of the study. One of the pre-service teachers has stated that he/she has not attended the seminars given by the other groups at schools as audience and therefore has no idea whether the study has been successful in general terms. In addition, pre-service teachers also have stated that they have partially succeeded due to difficulties in attracting the attention of the students during seminars and the fact that the physical conditions of the locations of seminars being different each time. The answers given by the pre-service teachers to the question "Do you think you serve the community with this study?" are presented in Table 12.

Table 12.

The Opinions of The Pre-Service Teachers on The Aim of The Course For Serving The Community

Category	Code	f
Serve the community	Raising air pollution awareness at a young age	6
	Attracting the community's attention to the subject of air pollution	1
Partially serve the community	The target audience being restricted to primary school students	2
	The subject being restricted to air pollution	1

The pre-service teachers frequently mention raising awareness on air pollution at a young age and attracting the community's attention to the subject of air pollution, and consider themselves serving the community in this respect with the work they have done for the course. There are also some pre-service teachers who think that the course work partially served the community due to the subject and target audience choice (Table 12).

The answers given by the pre-service teachers to the question “Has the work done by the other groups contributed to your knowledge?” are presented in Table 13.

Table 13.

Opinions of Pre-Service Teachers About The Knowledge Gained From Other Groups Within The Context of The Course

Group	Code	f
Turkish	Gasses that have roles in air pollution (CFC, CO2, …)	2
	Concepts and definitions for air pollution	3
	Definition of air pollution	2
	No explanation	1
Social Sciences	Natural and human causes of air pollution	1
	Levels of air pollution in different countries	1
	Nothing (familiar topics)	1
	No explanation	5
Natural Sciences	Effects of air pollution (negative effects on living beings, humans, nature)	2
	Possible experiments about air pollution	1
	Which gas causes which disease	1
	Nothing (familiar topics)	1
	No explanation	3
Mathematics	Demonstrating the rates of gases over the years with tables and graphs	3
	Limit values for air pollution	4
	No explanation	1
Public Administration	Impact of air pollution in different countries	2
	Action taken by various countries in order to prevent air pollution	1
	Nothing (familiar topics)	1
	No explanation	4

It should be noted that the knowledge gained by the pre-service teachers from the other groups about air pollution throughout this course is generally in accordance with the focus points, content and discipline of the groups (Table 13). One of the participants state that he/she has learnt about “levels of air pollution in different countries” from the social sciences group, while the topic is in fact covered in the public administration discipline. It can be seen that pre-service teachers especially mention the contents covered by the groups working on Turkish and Mathematics disciplines. Some of the pre-service teachers make no mention of the topics learnt from social sciences, natural sciences and public administration groups. The answers given by the pre-service teachers to the question “What are your thoughts on the implementation of this study?” are presented in Table 14.

Table 14.

Opinions of the Pre-Service Teachers on The Implementation of The Course

Theme	Category	Code	f
Positive opinion	Experience	Gaining teaching experience	8
		Encountering students in an early stage of teacher education	10
		Realizing the importance of providing feedback to the students	2
	Learning	Being permanent	1
		Learning new things	6
	Group work	Having balanced workload among group members	5
		The group work being successful	1
	Consultant's attitude	Motivation from consultants	1
	Interdisciplinary education	Learning how to teach interdisciplinary subjects	8
	Feelings	Entertaining/pleasing	4
		Group work being pleasing	2
		Teaching without the stress of grading	2
Negative opinion	Group work	The group work not being balanced	1
		Groups being too crowded	1
		Failing to achieve group integrity during seminars	1
		Having troubles in gathering together	2
	Consultant's attitude	Making negative comments	3
		Having problems with the consultants	1
	Teacher's attitude	Negative attitudes from primary school teachers	3
	Time	The implementation period being too long	1
	Volunteering	Not being willing to conduct such study	2
	Interdisciplinary education	The chosen subject not being suitable for interdisciplinary study	2
	Feelings	The whole process being tiresome	1
		The whole process being hard	2
		The whole process being stressful	1

It should be noted that the positive opinions of the pre-service teachers on the implementation are more than the negative opinions (Table 14). It can be seen that the most frequently mentioned positive aspect is gaining teaching experience and the least frequent positive aspect is the attitude of the consultants. On the other hand, most frequent negative opinions are on the group work and least frequent are on timing. It can be observed that the participants state both negative and positive opinions on group work, consultant's attitude, interdisciplinary education and feelings throughout the implementation.

Discussion

In this section, the results obtained from this study which has been devised in order to determine the impact of interdisciplinary activities performed within the context of CSPC on the air pollution awareness is discussed under several aspects.

Determining the Awareness of Pre-service Teachers on Air Pollution

The results from the KWL form indicate that the pre-service teachers do not have knowledge on the activities for raising awareness for actions to take in order to prevent air pollution and related government policies prior to the implementation of the study, but have the willingness to learn more on this matter. After the implementation, the pre-service teachers have stated that they gained knowledge on these subjects. Beaumont et al. (1999) establish that the society has an expectation to be informed on air pollution and in this respect, state that the increase in level of knowledge would raise awareness and this in turn can be effective in acting more carefully. The fact that the pre-service teachers of today, who will become the teachers in the future, are aware of their lack of knowledge on air pollution and with this study have compensated for this to some extent, is a light of hope for the living conditions of future generations. Despite not being among their expectations prior to the implementation, the pre-service teachers have stated in the KWL form that by the end of the study, they have learnt new statistical information about the current situation of air pollution. Statistical information can often be the driving force for noticing the direness of the current situation and taking preventive actions accordingly. Ostro (2004)' states that in order for the society to have awareness on air pollution and take precautions for the future, sharing statistical information on the effects of air pollution is beneficial.

Comparing the pre- and post-application results of the APAQ form, it can be noted that although pre-service teachers see lack of education as the main cause of air pollution prior to the implementation, they almost never mention this subject after the implementation. This situation can be attributed to the increase in frequency of mentioning other factors, as well as to the fact that they hold other aspects more important than education. Moreover, it is evident that the pre-service teachers mostly mention the necessity of education as actions to take in order to prevent pollution, both before and after the implementation. Works in the literature also indicate education as the most essential solution for the problems regarding the environment (Şimşekli, 2004; Değirmenci, 2012).

In addition, the pre-service teachers have also gained awareness on the interdisciplinary nature of the subject of air pollution. Uğurlu & Demirer (2008) who emphasize the importance of noting the interdisciplinary nature of environmental issues, demonstrate this with the example of an environmental engineer and a manager dealing with the environmental issues. While the steps taken by the environmental engineer can be ineffective due to lacking knowledge on management or economy, the case is also similar with the manager who may be just as ineffective due to lack of knowledge on engineering. Therefore, environmental issues should be handled with an interdisciplinary approach in order to prevent such inconveniences. In various studies on environment education, it has been emphasized that this education should be given with an interdisciplinary approach, and it is noted that otherwise specific concerns inherent to disciplines may prevent raising awareness (Bonnett & Williams, 1998; Hamalosmanoğlu & Güven 2014; Karataş & Aslan, 2012). In this respect, it can be stated that this study achieves raising awareness that overcomes the specific concerns of different disciplines to some extent.

It is noted that after the implementation, both in KWL form and in APAQ, the pre-service teachers lean more towards the scientific definition of air pollution, and provide detailed answers. This may indicate that the knowledge of pre-service teachers on the scientifically accurate description of air pollution has increased. Moreover, after the implementation, the pre-service teachers focus more on the causes of air pollution, which may imply that without ignoring the effects of air pollution, they think the causes are more important. This can be interpreted as there is an increase in the awareness of pre-service teachers on taking preventive measures before the pollution takes place. Removing the source of the problem before the emergence of the problem is essential

and this practice requires education (Şimşekli, 2004). Low levels of knowledge and awareness of individuals on environmental problems are important causes of negative attitude and behavior towards these problems, so it is highly essential that the pre-service teachers, who are the educators of future generations, are guided with a goal oriented and planned education in order to prevent the environmental problems (Güven & Aydoğdu, 2012).

In the APAQ form applied after the implementation, the pre-service teachers mention both natural and human causes of air pollution and they can explain these causes in a more comprehensive manner than before the implementation. Similarly, while stating the causes of air pollution in the KWL form, they mention the harmful gases by their names. The fact that the pre-service teachers can explain the causes of air pollution in a systematical manner by using scientific expressions indicate the increase in their knowledge on the subject as well as the development in their awareness. In order for pre-service teachers who want to share the regional studies on air pollution with their students should know the related basic concepts in order to comprehend what they read on the subject. In this respect, it can be said that this study is successful. On the other hand, the implementation is not as effective at the expected level in raising awareness on natural causes, because other than volcanic eruptions, natural causes are not mentioned much after the implementation. This can be due to the fact that there are not many natural causes leading to air pollution in the region where the study has been conducted. On the other hand, the pre-service teachers can be regarding the human causes to be more effective than the natural causes in creating pollution. Nevertheless, the pre-service teachers being more aware of the natural causes, even partially after the implementation, will in turn lead them to be more aware on the necessity of taking precautions against possible related issues. There is a study in the literature that explains the lethal impact of the air pollution in Malaysia caused by a forest fire that occurred in Indonesia due to natural causes (Sastry, 2002). It is also seen that both before and after the implementation, very few pre-service teachers mention the code for deforestation/destruction of forests as the cause of pollution and as means of preventing pollution, as well as not mentioning the forest destruction as the cause of air pollution in Giresun region at all. In light of these three cases and also taking the fact that Giresun is famous for its green nature and has large pine forest areas, it can be inferred that the pre-service teachers do not consider forest destruction as one of the causes of pollution.

It is noteworthy that the frequency of mentioning exhaust smoke emission, heating and personal care as human causes for pollution increased more than industry after the implementation. This situation can be interpreted as the pre-service teachers being more aware of their contribution or the contribution of individuals of around them to the air pollution. Similarly, while talking about the precautions against air pollution, the pre-service teachers mostly mention the individual efforts that they can perform more after the implementation. Since it would be a utopic approach to expect a small number of individuals and institutions who are experts on environment to prevent the environment/air that everyone pollutes, it is necessary that each individual is aware of the responsibility in carrying his/her individual activities by taking care of the environment (Uğurlu & Demirer, 2008). In this respect, it is hoped that the pre-service teachers who are aware of the human causes of air pollution would be one step ahead of other pre-service teachers in both controlling their own actions and raising awareness on their future students.

The pre-service teachers mostly mention the harm done on humans for the effects of air pollution. While no pre-service teacher mentions the harms caused by the air pollution on plant life before the implementation, they mention this issue afterwards, which implies that they no longer view the issue with just the human aspects and they have become aware to the fact that other living organisms can also be negatively affected by air

pollution. Similarly, while almost none of them mention the impact of pollution on the cultural heritage before the implementation, it is observed that the pre-service teachers address this issue among the negative effects of air pollution after the implementation. The views of pre-service teachers about the air pollution in the Giresun region in which the study has been conducted have not changed much after the implementation. Since it was winter time for Giresun during the implementation, the smoke and pollution accumulating due to solid fuel consumption in the densely populated areas of the city can be observed even with the naked eye. According to Giresun Province Environmental Status Report (MEU, 2012), Giresun encounters air pollution throughout the year and the air around the province can be considered quite clean, but there is seasonal air pollution due to coal consumption during winter. Although activities have been conducted that emphasize the air pollution in Giresun at the time of the implementation is seasonal, these activities have not been effective as expected in raising the awareness to the desired level. Individuals being aware of the fact that the air pollution is seasonal would be beneficial for acting more responsibly regarding the preventive measures (Mayer, 1999).

It is observed that before the implementation, the pre-service teachers are almost completely unaware of regional or national activities related to air pollution in their daily lives. Mentioning the awareness raising activities after the implementation can be an indication of the fact that the conducted study has a positive impact in this regard. Moreover, despite the fact that none of the pre-service teachers mention the practices regarding the government policies, after the implementation, they mention the indoors and outdoors smoking ban enforced with the “Protect Your Air: Smoke-free Air Space” project (URL-2; URL-3) developed by the Ministry of Health under the context of their campaign against tobacco usage. On the other hand, expected level of awareness could not be raised with this study on the international institutions, protocols or treaties. It is observed that the pre-service social sciences teachers do not include international institutions or convention in their remarks about the social participation for environmental issues (Karatekin, Kuş, & Merey, 2014). This situation indicates that not only pre-service classroom teachers but also pre-service teachers from various branches have low level of awareness in similar issues.

Determining the Level of Awareness on Air Pollution in Primary School Students

According to the results obtained from APAQ, after the implementation, similar to pre-service teachers, students also tend towards the scientific description of air pollution and provide detailed answers, and they mention the causes more than the effects in order to explain the pollution. They most frequently mentioned human causes and the increase in harmful gases or polluters in the atmosphere in order to define the air pollution. In contrast to pre-service teachers, after the implementation, there is an increase in the frequency of the answer of industry for the cause of air pollution. In addition, similar to the pre-service teachers, there is an increase in the frequency of exhaust emissions and personal care products answers as the causes for pollution, while the frequency of mentioning heating has remained nearly constant after the implementation. As the youngest members of the society today and decision makers of the future, the primary school students being aware of the causes of air pollution and knowing the roles of human activities in this issue brings hope for the future livable environmental conditions. Although environmental education can be given to people at all ages, an education starting at a young age (primary school) can have more successful outcomes (Budak, 2008; Değirmenci, 2012; Karataş & Aslan, 2012; Darçın & Sert Çıbık, 2009; Seçgin, Yalvaç, & Çetin, 2010; Ünal & Dımışlı, 1999). However, as with the case of pre-service teachers, the conducted practices are not effective in raising awareness on the natural causes of air pollution. This can give an idea on the importance of teachers in raising awareness of students on an issue. Insufficient level of awareness in pre-service

teachers as well as in the students can be due to the fact that these issues have not been properly emphasized during the seminars. However, since the students are unable to respond to the pollution from natural causes, they may have overlooked this issue, or they may be considering the human causes to be more important than the natural causes. Air pollution from natural causes should not be undermined, because pollution is not only an outcome of human causes, but rather a complex interaction of natural and human causes (Mayer, 1999).

Regarding the precautions against air pollution, it is proposed that there is a relation between the decrease in the answers of the students related to the quality/responsible fuel consumption and increase in the answers related to filter usage after the implementation. Due to the fact that the study groups are in Giresun and the usage of natural gas in this city is not yet widespread, the precautions against low quality fuel consumption are emphasized during the implementation. In this context, this result is expected. The students mention very little about the educational activities that can be carried out in order to prevent air pollution, despite the fact that teachers frequently address this topic after the implementation. The difference can be caused from the differences in the points of views of the students and pre-service teachers. The pre-service teachers may have addressed this issue frequently because they will be able to carry out educational activities as the future teachers. Similar to the pre-service teachers, students also show no increase in their awareness about the precautions that can be taken against air pollution. This may again be attributed to the importance of the teacher in raising awareness and the fact that these issues have not been properly addressed during the activities performed.

Prior to the implementation, while almost all the students have stated that there is air pollution in Giresun, there is a significant increase in the number of students who state that there is no pollution after the implementation. This outcome is close to expectations, but is not exactly the anticipated result, because according to the Giresun Province Environmental Status Report (MEU, 2012), there is seasonal air pollution in Giresun, in which the study has been conducted. However, there is no mention of year round air pollution. Therefore, it is expected that the students answer this question as “partially”. This can be interpreted as the pre-service teachers not addressing the topic of seasonal pollution in their activities, as well as the students giving a general answer to a question asked in a general manner.

In the answers related to the regional or national events and activities about air pollution the students encounter in their daily lives, there is significant increase only in the answers about the education theme. This may imply that the educational activities have impact on the students. However, the fact that there is no increase in other themes indicates that the students’ attention could not be attracted to activities around these themes during the implementation. Since a similar situation is also the case for pre-service teachers, it is also expected for the students, because it is the teachers who will raise the awareness of the students, and one cannot expect the teachers raise the awareness of the students when they lack the awareness themselves. Therefore, in environmental education, it is essential that the primarily the pre-service teachers receive an education/training that will enable them to gain knowledge and awareness about the subject (Alım, 2006; Özdemir & Yapıcı, 2010; Sert Cibik & Darcin, 2009; Ünal & *Dımışlı, 1999).*

Determining the Opinions of the Pre-service Teachers on CSPC

According to the results of the interviews, the activities carried out by the pre-service teachers within the scope of the course have been successful, community service purpose has been fulfilled, and the different groups created have gained fresh knowledge. Regarding the implementation of CPSC, the pre-service teachers usually

expressed positive opinions on matters such as encountering the students at an early stage of teacher education and learning how to teach interdisciplinary subjects.

Some of the pre-service teachers state that the conducted practices have partially reached their aims. As the reason, they mention that they have experienced difficulty in attracting the attention to the subject in the primary schools and the differences in the physical conditions of schools. The difficulties encountered in dealing with these issues may be caused by the fact that the pre-service teachers have not previously come across students in a teaching-learning environment. In fact, they refer to the experiences they encountered during the course of the study as positive towards their personal development in the teaching profession, including their experiences with the students.

Some of the pre-service teachers state that the community service aim of the course is partially achieved. There seems to be two main reasons for this. Firstly, the society is not entirely made up of primary school students. Secondly, care for the elderly, activities that can be done in the child protection centers or cleaning activities are also necessary for community service. This may be due to the fact that the activities within the scope of CSPC are usually conducted in most education departments with the aforementioned groups and subjects. The pre-service teachers who think that the community service is achieved express the importance of raising awareness at a young age.

Regarding the knowledge gained from other groups during the course, it can be seen that the pre-service teachers usually mention the groups which work on Mathematics and Turkish disciplines. This may be due to the fact that despite they encounter the subject of air pollution in their courses related to natural sciences and social sciences disciplines, the subject is not mentioned during their Turkish and Mathematics courses. Accordingly, some of the pre-service teachers state that they never thought or imagined that air pollution can be a subject in a mathematics course. However, NCTM (n.d.) stated that data on air pollution can be used in the mathematics education in some subjects, and recommended teachers to do so.

Regarding the implementation of CSPC, the pre-service teachers expressed positive opinions the most on gaining teaching experience and the least on consultant attitude. In addition, they expressed negative opinions the most on group work and the least on time. There are both negative and positive opinions from the pre-service teachers on group work, consultant attitude, interdisciplinary education and their feelings during the process. Regarding the group work, the fact that the pre-service teachers stating there is both balanced and unbalanced work load among the group members can be explained through in-group dynamics. Similarly, the fact that there are both positive and negative experiences with the consultants can also be explained through in-group dynamics as well as differences between consultants' attitudes.

Conclusion

The conclusions drawn from this study, which aims to determine the impact of interdisciplinary activities carried out within the scope of CSPC on air pollution awareness, are as follows:

The awareness on air pollution of both the pre-service teachers and the students has increased. This increase is more for the pre-service teachers compared to the students:

- At the end of the implementation, both in KWL form and APAQ, it is observed that the pre-service teachers lean more towards the scientific definition of air pollution and provide detailed answers.

- In both groups, before the implementation, there is awareness on the human causes of air pollution, and they do not mention the natural causes. However, after the implementation, it is observed that there is an increase in awareness on natural causes although not as significant as on human causes.
- Both before and after the implementation, regarding the effects of air pollution, it is observed that both groups mention the human health problems more than other effects. After the implementation, it is observed that the pre-service teachers have gained awareness on the harm caused by the pollution to the plant life as well.
- It is determined that in both groups and both before and after the implementation, there is awareness most on exhaust emission, industry, heating and personal care as the human causes of pollution. In addition there is a development in awareness on unsuitable agricultural activities after the implementation.
- In pre-service teachers, the awareness of the harm caused by the air pollution on cultural environment has increased after the implementation; however, the expected increase in awareness of the students is not observed.
- Regarding the precautions against air pollution, it is observed that both before and after the implementation, both groups have most awareness on fuel usage. While the awareness of pre-service teachers on reducing the usage of chemical substances and using public transportation have increased, no significant change for the awareness of students on this issue is observed.
- Regarding the precautions, while for both groups, the awareness for the necessity of education is quite low before the implementation, there is an increase of awareness in this issue, especially of pre-service teachers.

The implementation is not sufficient to improve the awareness on some issues about air pollution:

- It is observed that the awareness of the pre-service teachers and students about the precautions against air pollution has not improved to an expected level.
- For both groups the awareness on the natural causes of air pollution has not improved to an expected level.
- For both groups the awareness on the existence of air pollution in Giresun has not improved to an expected level.

Pre-service teachers in general find the implementation to be successful:

- It is observed that prior to the implementation, the pre-service teachers have no knowledge on the possible awareness raising activities that can be done in order to prevent air pollution and the related government policies, but are eager to have more knowledge on these issues. At the end of the implementation, they state that they gained knowledge on these issues.
- The pre-service teachers think that the activities conducted within the scope of the course have been successful.
- The pre-service teachers think that the implementation achieves its aim in terms of community service.

The implementation also served causes other than its original purpose:

- The implementation enabled the pre-service teachers to have the teaching experience in their early years of teacher training before starting their profession.

- The implementation has contributed to the pre-service teachers in learning how to teach interdisciplinary subjects.

Recommendations

In this interdisciplinary study, although the focus points are determined according to the needs analysis, the expected success in raising awareness in some subjects could not be achieved. If another study is conducted in the similar context, more emphasis can be given to how the air quality is determined and air pollution measuring stations in the city can be visited. Similar interdisciplinary learning environments can be designed by making use of the results of this study.

The pre-service teachers state that they had difficulty in attracting the attention of the students to the subject. Moreover, some of the pre-service teachers think that the varying physical conditions in which the seminars are conducted, namely the fact that they have worked at different schools throughout the project have negative impact in reaching the aims of the project. In order to overcome this advantage, the implementation can be designed such that one group conducts all the seminars in one school, in contrast to this study. Hence, each group can make use of course plans from other groups and interdisciplinary education can be conducted in a single school. It should however be noted that this kind of learning environment may pose different advantages and disadvantages, since it has not been tried out before.

Determining the impact of the study on the parents of the primary school students and other segments of the society is not in the content of this study. For similar studies in the future, it is recommendated that the researchers should also take this aspect into consideration in order to improve the extent of the impact of the study. It is proposed that similar kinds of projects on many different socio-scientific subjects that involve the community can be carried out within the context of CSPC.

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ARAŞTIRMA MAKALESİ

Topluma Hizmet Uygulamaları Dersinde Hava Kirliliği Farkındalığı: Disiplinlerarası Bir Çalışma

Funda AYDIN-GÜÇ*
Giresun Üniversitesi, Giresun, TÜRKİYE

Müge AYGÜN**
Giresun Üniversitesi, Giresun, TÜRKİYE

Derya CEYLAN*
Giresun Üniversitesi, Giresun, TÜRKİYE

Seda ÇAVUŞ-GÜNGÖREN*
Çanakkale On Sekiz Mart Üniversitesi, Çanakkale, TÜRKİYE

Ümmü Gülsüm DURUKAN*
Giresun University, Üniversitesi, TÜRKİYE

Yasemin HACIOĞLU*
Giresun University, Üniversitesi, TÜRKİYE

Ayşe Dilek YEKELER*
Giresun Üniversitesi, Giresun, TÜRKİYE

Özet

Bu çalışmanın amacı, Topluma Hizmet Uygulamaları Dersi kapsamında gerçekleştirilen disiplinlerarası (Türkçe, Sosyal Bilimler, Fen Bilimleri, Matematik ve Kamu Yönetimi disiplinleri) faaliyetlerin hava kirliliği farkındalığına etkisini belirlemektir. Bu çalışma çoklu durum çalışması olarak yürütülmüştür. Araştırmanın uygulaması, 32 sınıf öğretmeni adayı ve 122 ilkokul dördüncü sınıf öğrencisi ile gerçekleştirilmiştir. Veriler Hava Kirliliği Farkındalığı Anketi, Bil-İste-Öğren Formları ve mülakatlar ile toplanmıştır. Veriler içerik analizi ile değerlendirilmiştir. Araştırma sonucunda katılımcıların hava kirliliği konusundaki farkındalıkları artmıştır. Öğretmen adaylarının uygulamayı genel olarak başarılı olarak değerlendirdikleri saptanmıştır. Ayrıca, uygulamanın, öğretmen adayları için öğretmenlik deneyimi sağlamak ve disiplinler arası konuları öğretme gibi farklı amaçlara da hizmet ettiği görülmüştür.

Anahtar Kelimeler: Hava Kirliliği Farkındalığı, Disiplinlerarası Yaklaşım, Topluma Hizmet Uygulamaları Dersi, İlkokul Öğrencileri, Öğretmen Adayları

ISSN: 2146-0329
*** All authors contributed equally to this study and listed in alphabetical order.**
****E-mail: muge.akpinar@giresun.edu.tr**

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RESEARCH ARTICLE

Investigation of Turkish Seventh Grade Students' Awareness about Nature

Ugur KIRAZ,
Ministry of National Education, Kutahya, TURKEY

Umran Betul CEBESOY*
USAK University, Uşak, TURKEY

Mehtap DONMEZ SAHIN
USAK University, Uşak, TURKEY

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Abstract

The aim of this study is to determine Turkish middle school seventh grade students' awareness about the biotic and abiotic factors which constituted nature and to examine the effects of various variables including gender, living place, the mother' and father' educational level and socio-economic status. For this purpose, The Awareness of Nature Scale is used. A total of 427 students living in rural and urban part of Kutahya provience participated in the study. The gathered data is analysed by using frequency tables and percentages. Besides, independent sample T-test and Analysis of Variance (ANOVA) are used for examining the effect of various variables. The results revealed that middle school seventh grade students' awareness about biotic and abiotic factors is insufficient. No statistically significant effect for gender is detected. The students who live in the urban areas are found to be more aware of the biotic and abiotic factors when compared to the students who live in rural. Moreover, the students who have educated parents and high family income are found to be more aware of the biotic and abiotic factors.

Keywords: Abiotic factors; awareness; biotic factors; nature; middle school students

Introduction

Everything that is formed without human involvement, is described as nature and the entities including soil, underground resources, water, air, plants and animals, living organisms are accepted as the components that form the nature (Keles & Hamamcı, 1993). While the entities including air, water and soil are known as abiotic factors, the entities including microorganisms, plants and animals are known as biotic factors. Biotic and abiotic factors are tied with undetectable bonds and there are ongoing and mutual connections among these factors (Cepel, 2006; Basoglu, 2014). In any case that these mutual connections are flawed by any reason, the natural balance among these factors will be deteriorated (Yildiz, Yilmaz & Sipahioglu, 2005). The individuals who have higher awareness about nature are expected to have better understanding of the nature. Moreover, the individuals who are knowledgeable about the biotic and abiotic factors that form the nature will be more responsible towards their environment and the problems related with environment.

The number of related studies with respect to environment have increased lately. Specifically, environmental problems, and participants' attitudes, perceptions towards

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***E-mail: ubetulcebesoy@gmail.com**

environmental problems have become a topic for investigation both in national (e.g., Ahi, Balci & Alisinanoglu, 2017; Demirbas & Pektas, 2009; Guven & Uyanık, 2012; Higde, Oztekin & Sahin, 2017; Tuncer, Sungur, Tekkaya & Ertepinar, 2004) and in international contexts (e.g., Bunting & Cousins, 1985; Hinds & Sparks, 2008; Liefländer, & Bogner, 2014; Loughland, Reid, Walker & Petocz, 2003; Prokop, Tuncer & Kvasničák, 2007). While most of these studies focused on attitudes of students from various age groups (primary school, middle school, college students and pre-service teachers), the effects of many factors including age (Liefländer & Bogner, 2014: Loughland et al., 2003: Kellert, 1985), gender (Aydin & Cepni, 2012, Erol & Gezer, 2006: Loughland et al., 2003), parents' education level (Aydin & Cepni, 2012: Erol & Gezer, 2006), parents' monthly income (Aydin & Cepni, 2012), and places that the participants live in (rural or urban) (Aydin & Cepni, 2012, Buyuksahin & Demirci-Guler, 2014: Hinds & Sparks, 2008: Tuncer et al., 2004), have been investigated.

The literature investigating these factors present us the aforementioned factors influence individuals' environmental concerns, attitudes and awareness. For instance, Van Liere and Dunlap (1980) emphasized that the factors including occupation, family income and education level are positively associated with the students' environmental concerns. In a similar manner, the studies investigating the effect of age reported that the younger students had more positive attitudes when compared to older students (Liefländer & Bogner, 2014: Loughland et al., 2003: Kellert, 1985). On the other hand, studies exploring the effect of gender presented conflicting results. While some studies reported that girls were more sensitive to environment implying that they held positive attitudes towards environment and environmental problems (Aydin & Cepni, 2012; Erol & Gezer, 2006; Loughland et al., 2003), there also were other studies reported no gender difference (Ahi et al., 2017; Liefländer & Bogner, 2014; Meydan & Dogu, 2008). Other line of research investigating the effect of living in rural or urban on student attitudes revealed similar conflicting results. While some studies reported that the student living in rural are more sensitive and more aware about the nature and the plantations as well as animals living in the nature (Bunting & Cousins, 1985; Hinds & Sparks, 2008; Kellert, 1985), other studies reported students living in urban areas are more aware about their environment (Buyuksahin & Demirci-Guler, 2014; Tuncer et al., 2004).

While most of the aforementioned studies focused on students' attitudes about environment and environmental problems (e.g., Ahi et al., 2017; Aydin & Cepni, 2012; Loughland et al., 2003), there are limited studies that investigated students' awareness. These studies mainly focused on students' awareness about plants or biodiversity (e.g., Yalcinkaya, 2012). Even the nature comprised of biotic and abiotic factors together, there are limited study that focused on students' awareness about biotic and abiotic factors. In fact, Chapman and Sharma (2001) reported that students tended to perceive themselves apart from nature. They believed that the environment and their lives are separate entities. Same finding was reported by numerous studies (Ahi et al., 2017; Chapman & Sharma, 2001; Desjean-Perotta, 2013; Moseley, Desjean-Perotta & Utley, 2010). For instance, investigating pre-service science teachers' mental models about environment by using teacher-generated drawings, Ahi et al. (2017) reported that many teachers did not include human beings as part of environment and tended to draw biotic factors with no interaction with other factors in the environment. Thus, we believe that regardless age (students or pre-service teachers), individuals tended to perceive themselves apart from the biotic and abiotic factors comprising the nature. Increasing individuals' awareness about environment and all the issues related with environment is possible with exploring individuals' awareness about the biotic and abiotic factors. As individuals' awareness about environment tended to decrease with respect to age (Loughland et al., 2003, Van Liere & Dunlap, 1980), it becomes more important to determine young individuals' awareness about biotic and abiotic factors. Thus, we explored middle school seventh grade students' awareness about biotic and abiotic

factors. In addition, we also explored the effects of some factors which are found in literature including gender, living in rural or urban, family income, parents' occupation and parents' education level. As environmental education aims to raise young generations with required knowledge and skills in order to live in harmony with nature and develop positive attitudes towards environment (North American Association for Environmental Education, [NAAEE], 2004), it is crucial to determine young students' awareness about the biotic and abiotic factors that comprises the nature.

Specifically, this study aimed to answer the following research questions:

1. What is the seventh-grade students' awareness about biotic and abiotic factors?
2. Are there any significant differences between seventh grade students' awareness with respect to factors including gender, living in rural or urban, parents' education level and family income?

Context of the Study

At the time of data collection 2013 science curriculum was being used in elementary schools. In Turkey, middle school science curriculum beginning grade 3 to grade 8 has been revised in 2013 and the revised curriculum strongly emphasized the importance of scientific literate individuals who are have required knowledge, skills, positive attitudes, perceptions and values towards science as well as have understanding about the relationship among science, technology, society and environment relationship. These individuals, also, expected to have science process skills which can lead them to discover the nature and enable them to understand the science and environment relationship (Ministry of National Education [MONE], 2013). When the objectives about the nature in the science curriculum examined, it could be seen that the objectives related to nature are appeared from beginning grade 3. The biotic and abiotic factors are introduced in grade 3. The objectives related to microorganisms and their importance are found in grade 4 program. Classification of living things, microorganisms as well as fungi types are appeared in grade 5. Moreover, the students learn how soil is formed, the importance of water, soil and air as well as the pollution types during fifth grade. Students learn the plant classification (phanerogam and cryptogram) and animal classification (fish, amphibians, reptiles, birds and mammals) in grade 6. In grade 7, the students are expected to learn all the previous objectives and expected to develop an understanding about the biotic and abiotic factors comprising the nature (MONE, 2013). Thus, we preferred to focus on seventh grade students' awareness about the nature.

Another revision in science curriculum has taken place from the beginning of 2017. However, the revised curriculum also emphasized the role of nature beginning from the third grade. Similar to 2013 science curriculum, the biotic and abiotic factors are still placed in grade 3. The objectives related to microorganisms are moved to grade 5. The objectives related to fungi types and classification of living things as animals, plants, fungi and microorganisms are still placed in grade 5. While objectives related to environmental problems are found in grade 5, 6, 7 and 8; the objectives related to plant and animal classification are removed in this revised curriculum.

Methodology

This study aimed to investigate seventh grade middle school students' awareness about the biotic and abiotic factors and whether there are any significant differences with respect to a list of variables (gender, living in rural or urban, parents' education level and family income). In order to investigate these research questions, this study was designed as using survey model. Cross-sectional survey type which the data is collected at one point of time is used in present study (Fraenkel, Wallen & Hyun, 2011).

Sample

A total 427 seventh grade middle school students from 15 different public schools living in rural and urban areas of Kutahya which is located in Aegean part of Turkey participated in the study. The sample constituted of 197 boys (46.1%) and 230 girls (53.9%). Among 15 public schools, while six schools were located in urban areas, the other nine schools were located in rural areas of the city. With respect to living in rural or urban, 225 (52.7%) of participants lived in urban and 202 (47.3%) of them lived in rural. The education levels of parents were presented in Table 1.

Table 1.

Distribution of parents' education levels

Parents' education level	Father's education level (%)	Mothers' education level (%)
Illiterate	.2	1.9
Primary school	23.2	41.9
Elementary school	27.2	34.9
High school	35.4	15
Undergraduate degree	12.2	5.9
Graduate degree (Master, PhD)	1.9	.5

When parents' education level examined, it can be seen that majority of the students' parents did not have a graduate degree. While more than a quarter of students' fathers were graduated from high school (35.4%), 15% of their mothers graduated from high school. Very few were reported to be illiterate (0.2% and 1.9% respectively).

With respect to family monthly income, 14.8% of participants' family income was under minimum wage determined by the Turkish Ministry of Labor and Social Security (TMLSS) (0-1000 Turkish Liras-TL). The minimum wage of 2017 was determined as 1404 TL by TMLSS. While more than a quarter's family received minimum wage (30.4%), 26.2% of them received a wage slightly over the minimum wage (1500-2000 TL). 16.2% of participants' family received a wage between 2000-3000 TL. Only 12.4% of the families received a wage over 3000 TL. This implies that the participating students were mid-social class in Turkey.

Data collection tools

Nature awareness scale which was developed by the Kiraz (2016) was used in the study as data collection tool. The scale consisted of two parts. The first part is the demographic information page that includes questions regarding participants' demographic characteristics including gender, the place that the participants lived in (rural or urban), the family income and parents' education levels. The second part is the Nature Awareness scale which also consisted of two parts. In first part, we used written items about the biotic and abiotic factors. In second part, we used visuals in order to examine whether the participants were able to determine the biotic and abiotic factors living in the nature presented in the visuals.

Nature Awareness Scale

Nature awareness scale was developed by Kiraz (2016) was used in this study. It consisted of two parts: While there were items about the biotic and abiotic factors in first part, there were visuals about plants, animals and microorganisms in the second part. The aim of using visuals in second part was determine whether the participants were able to determine the biotic and abiotic factors living in the nature presented in the visuals. For this purpose, an item pool was created by considering the objectives in the science curriculum which was revised in 2013. Two science teachers and three experts in science education department reviewed the items and the visuals in the scale for ensuring content validity. Accordingly, 63 written items and 23 visuals were found in the scale. The scale was dichotomously scored (1 point for correct answers and 0 point for incorrect answers) for written items. The scale was initially pilot tested with 35 seventh grade students. The data obtained from pilot study was subjected to ITEMAN Item analysis program. Item discrimination index (D) and item difficulty index were computed by using ITEMAN. The discrimination index lower than .19 were removed as suggested by Crocker and Algina (1986). Accordingly, the final form of the Nature awareness scale consisted of 40 written items and 23 visuals. Some visuals consisted more than one question. For instance, regarding animals, students were asked to determine whether the visuals are vertebrate or invertebrate. In second part, we asked students to determine the class of the animal presented in the visual (bird, fish, Amphibia, reptiles or mammals). Thus, the students can get a score of maximum 40 points from the visual part of the scale. As a result, a student who answered both parts of the scale (written items and visuals) correctly could get a score of maximum 80 points.

While item difficulty index was computed as .50 indicating a medium difficulty (Oosterhof, 2001), the item discrimination index was computed as .48 implying the scale was constructed with reasonably good items (Ebel & Frisbie, 1986). The scale has a medium difficulty and had a discrimination index over than .20 was considered to be good (Oosterhof, 2001). Finally, the reliability coefficient Kuder Richardson-20 (KR-20) was computed as .82 which is over .70 recommended by Fraenkel et al. (2011). Thus, the scale was considered to reliable as well.

Data analysis

Descriptive statistics were used for describing students' awareness about the items in the Nature Awareness Scale. Students' answers were analyzed by using frequency table. Then inferential statistics (independent sample t-test and Analysis of Variance) were run after checking normality and linearity assumptions (Pallant, 2010). The skewness and kurtosis values were found between +2 and -2 which show the data was not skewed from normal curve. The Kolmogorov-Simirnov test result showed that the data was normal ($p > .05$).

Findings

Findings are presented under two headings as Descriptive statistics and Inferential Statistics.

Descriptive statistics

In this part, students' answers to the Nature Awareness Scale was presented. Of a possible 80 correct response in the scale, students attained a mean of 53.15 (SD=8.87) implying a moderate level of awareness. Students' answers with respect to biotic factors (plants, animals, microorganisms and fungi) are presented in Table 2.

Table 2.

Students' responses to the items related with biotic factors

Sample Items	Correct answer (%)	Incorrect answer (%)	Do not know (%)
Plants			
1. Seeds are alive	61.2	16.6	22.2
2. Fruits only grow on trees	15.5	77.5	7
3. Seeds cannot photosynthesize during germination.	30.9	28.6	40.5
Animals			
4. Human beings are classified as animals	58.8	28.6	12.6
5. Mice breastfeed their offspring	39.3	23.9	36.8
6. Any flying animals with wings are classified as birds	32.6	55.5	11.9
Microorganisms			
7. All the microorganisms are harmful	18.3	60.2	21.5
8. We can see microorganisms with bare eyes	22.5	63.2	14.3
9. There are bacteria in yoghurt	66.3	15.7	18
Fungi			
10. Bread mold is alive	55.6	16.4	29
11. Parasol mushrooms are plants	51.1	27.6	21.3

When Table 2 examined, it could be seen that students' awareness of biotic factors in the nature varied. Regarding plants, more than half of the students (61.2%) were aware about the seeds being alive. But the remaining percentage was either did not know or gave incorrect response. In a similar manner, majority of students (77.5%) believed that the fruits only grow on trees which is actually wrong. More than a quarter (30.9%) knew that the seeds cannot photosynthesize during germination. With respect to animals, half of the students (55%) were aware that not all the flying animals are classified as birds. On the other hand, most of the students did not know that mice breastfeed their offspring (60.7%) and that the human are classified as animals (41.2%). When compared to previous biotic factors (plants and animals), students were more knowledgeable with respect to the items about microorganisms. Students were aware that not all the microorganisms are harmful (60.2%), they cannot see the microorganism with bare eyes (63.2%) and there are bacteria in yoghurt (66.3%). Lastly, while nearly half of the participants were aware that the bread mod is alive (55.6%), majority of them were not aware that parasol mushrooms are not plants (72.4%).

Students' awareness with respect to the biotic factors (soil, air and water) was examined in following section.

Table 3.

Students' responses to the items related with abiotic factors

Sample Items	Correct answer (%)	Incorrect answer (%)	Do not know (%)
Soil			
1. Soil is formed in a long time	88.8	2.6	8.7
2. There can be countless number of organism in the soil	80.1	5.6	14.3
3. Dead plant and animal remains make the soil rich and fertile	55	16.2	28.8
Air			
4. Water vapor is found in the air	70.7	8.4	20.8
5. Life cannot exist without atmosphere	73.5	6.1	20.4
6. The ozone layer protects the living things from sun's harmful rays	69.6	8.7	21.8
Water			
7. Aquatic animals can live without getting oxygen	32.3	45.2	22.5

8.	Natural mineral water is an example to surface water	32.8	27.9	29.3
9.	The clouds are formed from evaporation of water	60.2	14.8	25.1

Close examination of the items related to abiotic factors revealed that students were more knowledgeable when compared to biotic factors. Majority of student were aware that the soil is formed in a long time (88.8%) and there are countless organisms living in the soil (80.1%). On the other hand, half of them were aware that dead plant and animal remains make the soil rich and fertile (55%). In a similar manner, majority of students were aware the existence of water vapour in the atmosphere (70.7%), the importance of atmosphere for life (73.5%) and the role of ozone layer (69.6%). While half of them were aware that aquatic animals cannot live without oxygen (45.2%), 60.2% did know that the clouds are formed from evaporation of water. Whereas more than a quarter knew that the natural mineral water is an example to surface water (32.8%).

In second part of the scale, some pictures were presented to the students about animal and plant classification. First, the students were asked to determine whether the given pictures are classified as plant or not. If they thought the picture belonged to a plant, they were asked to determine if the plant is a phanerogram or cryptogam. Their answers were presented in Table 4.

Table 4.

Students' answers to the pictures about plant classification

Samples in the pictures	Plant (%)	Not plant (%)	Phanerogam (%)	Cryptogam (%)
Rose	99.3	.7	97.4	1.9
Apple	87.4	12.6	74.7	12.6
Sword fern	96.3	3.7	14.5	81.7
Parasol mushrooms	54.3	45.7	7	47.3
Pine	92.3	7.7	24.8	67.4

A great majority of students were aware of that rose, apple, pine and sworn ferns were classified as plants. On the other hand, half of them thought that parasol mushrooms were also classified as plants which is actually incorrect (54.3%). After classifying the pictures as plant or not plants, they also classified the plants as a phenerogram or cryptogam. While great majority were aware of that rose is phanerogam (97.4%), 74.7% were aware that the apple is also classified as phanerogam. Whereas only a quarter knew that pine is classified as phanerogam. Lastly, 81.7% were aware that sword fern is cryptogam.

The other pictures found in the scale belonged to animal classification. Five animal examples were presented and students were asked to classify which classes those animals belong to. After determining the animals' classes, they were asked to determine whether these animals were vertebrate or invertebrate. While great majority were aware that the rabbits are mammals (83.6%), nearly half thought that the bats and hedgehogs are also mammals (48.5% and 50.8% respectively). On the other hand, 45.2% of

students thought that bats belong to bird class. With respect to vertebrate and invertebrate classification; the students were aware that the rabbits, the bats and the hedgehogs are vertebrates (96.3%, 73.3% and 70.5% respectively).

Inferential statistics

For investigating second research question of this study, we used independent sample t-test and analysis of variance (ANOVA). First, the effect of gender was investigated. Independent sample t-test was conducted in order to investigate the effect of gender and living place (rural or urban). There was no significant difference in awareness scores for boys (M = 53.12, SD = 8.02) and girls M = 53.16, SD = 8.52; $t(424)$ = -.042, p= .97 implying that the gender did not affect the students' awareness about the biotic and abiotic factors. The t-test results with respect to students' scores living in rural and urban revealed that the students living in urban had higher mean scores (M = 54.99, SD = 8.56) when compared to the students' mean scores living in urban (M = 51.09, SD = 7.45); $t(424)$ = 5.03, p < .05. This result implied that the students living in urban were found to be more aware about the biotic and abiotic factors comprising the nature (see, Table 5).

Table 5.

T-test results with respect to students' living in rural and urban

Living place	N	Mean	Standard Deviation (SD)	*t*	*p*
Urban	225	54.99	8.56	5.03	.00
Rural	202	51.09	7.45		

p<.05

In order to investigate parents' education level, one-way between groups ANOVA was used. First, the effect of mothers' education level was investigated. The ANOVA results revealed that there was a statistically significant difference in students' awareness about nature with respect to the students' mothers' education level; $F(5, 421) = 8.06$, $p < .001$. Post-hoc comparisons using Scheffe test revealed that the students' whose mothers holding graduate degree (X=60.48, SD=6.78) had significantly higher scores in the scale than the students whose mothers were illiterate (X=45.37, SD=9.88), primary school graduate (X= 52.48, SD = 8.16) and middle school graduate (X= 51.98, SD = 7.95). In a similar manner, students whose the mothers holding high school diploma had significantly higher scores (X= 55.75, SD = 7.55) than the students whose mothers were illiterate (see, Table 6). Altogether, these results indicated that the students with more educated mothers were found to be more aware with respect to the biotic and abiotic factors comprising the nature.

Table 6.

Analysis of variance results with respect to mothers' education level

	Sum of squares	df	Mean Square	*F*	*p*	Difference*
Between groups	2548.23	5	509.65	8.06	.00	*5*-1
						5-2
Within groups	26634.77	421	63.27			*5*-3
						4-1
Total	29182.99	426				

(Illiterate=1, primary school=2, middle school=3, high school=4, undergraduate degree=5, graduate degree=6)

*Italics indicates education level in which differences mostly appeared in favour

We, then, examined the effect of fathers' education level. The ANOVA results revealed that there was a statistically significant difference in students' awareness about nature with respect to fathers' education level; $F(5, 421) = 7.18$, $p < .001$. As shown in Table 7, the post-hoc comparisons using Scheffe test showed there were significant differences between the students' mean scores whose fathers had graduate degree (X= 57.50, SD = 7.87) and had primary school degree (X = 52.33, SD = 7.91) as well as whose fathers were illiterate (X = 52.53, SD = 8.12). Fathers' education level was also found to be an effective variable on students' awareness about the nature. In a similar manner, there was significant difference between the students' mean scores whose fathers had high school degree (X = 53.83, SD = 8.02) and had primary school degree (X = 50.53, SD = 8.12). The mean differences among fathers' education level indicated that the students who had more educated fathers were more aware about the nature.

Table 7.

Analysis of variance results with respect to fathers' education level

	Sum of squares	df	Mean Square	*F*	*p*	Difference*
Between groups	1862.74	5	465.68	7.18	.00	*4*-2
						4-3
Within groups	27296.64	421	64.84			*3*-2
Total	29159.37	426				

(Illiterate=1, primary school=2, middle school=3, high school=4, undergraduate degree=5, graduate degree=6)

*Italics indicates education level in which differences mostly appeared in favour

As part of second research question of this study, whether family income does effect students' awareness was investigated. While the students whose family income were under minimum wage got a score of 49.79 (SD = 6.77), the students whose families received minimum wage got a mean score of 52.48 (SD = 7.50). The students who had families receiving a wage between 2000-3000 TL (X= 54.43, SD = 7.86) had higher mean scores than the students who had families just slightly over the minimum wage (X = 53.56, SD = 9.39). Lastly, the students who had families receiving over 3000 TL got a mean score of 56.19 (SD = 8.28). It was noted there were an increase in mean scores

when the family income increased. Thus, we performed ANOVA in order to determine the existed differences were statistically significant. The results were shown in Table 8.

Table 8.

Analysis of variance results with respect to family income

	Sum of squares	df	Mean Square	*F*	*p*	Difference*
Between groups	1389.58	4	347.40	5.28	.00	*5*-1 *4-1*
Within groups	27793.42	422	65.87			
Total	29183	426				

(Below the minimum wage (under 1404 TL) = 1; minimum wage = 2; slightly over the minimum rage (1500-2000 YL) =3; the wage between 2000-3000 TL= 4; the wage over 3000 TL = 5)

*Italics indicates family income in which differences mostly appeared in favour

The ANOVA results revealed that there was a statistically significant difference in students' awareness about nature with respect to family income; $F(4, 422) = 5.28$, $p < .001$. Scheffe test showed there were significant differences between the students' mean scores whose family received over 3000 TL (X= 56.19; SD = 8.28) and had family income lower than the minimum wage (X= 49.79; SD = 6.77). Likewise, the students who had family income between 2000-3000 TL (X= 54.43, SD = 7.86) had significantly higher mean scores when compared to the students who had family income lower than the minimum wage. It can be concluded that students who had higher family income tended to be more aware about the biotic and abiotic factors comprising the nature.

Discussion

This study aimed to investigate seventh grade students' awareness about biotic and abiotic factors and whether the factors including gender, living in rural or urban, parents' education level and family income have significant effect on students' awareness. With this respect, we first discussed the findings related to students' awareness about biotic and abiotic factors.

The descriptive statics about biotic and abiotic factors revealed that participants' awareness varied with respect to factor being investigated. The students were mainly unaware about the biotic factors comprising plants, animals, microorganisms and fungi. For instance, more than half of the students were not aware that the fruits do not only grow on trees. While most of the students were able to identify the most of the plants correctly, they were less aware of the plant is phanerogam or cryptogam. Most of the students thought that pine is cryptogam as they do not see flowering plants like in apple or rose. Actually, pines are gymnopserms and the seeds are not enclosed in fruits, thus, most of students thought that the pines are not seed bearing plants. In fact, previous studies related with plants and plant identification also reported similar results (Anderson, Ellington & Jones, 2014; Bebbington, 2005; Gatt, Tunnicliffe, Borg ve Lautier, 2007; Yakisan, Selvi & Yuruk, 2007). While Yakisan et al. (2007) reported that students had difficulties in identifying cryptogam and phanegoram plants, Anderson et al. (2014) reported that students tended to draw flowering plants more when compared to other type of plants. Likewise, Bebbington (2005) also indicated that while students were able to recognize some plants such as daisies which the students commonly encounter in

children's books, only a few students were able to identify more than three wild flowers. These findings implied that the students could identify the plants as having flowers and tended to ignore other phanerogams which do not produce flowers (gymnosperm). Another explanation about students' insufficient knowledge regarding plant is that the plants are not well covered as animals in national curriculum as Bebbington (2005) refereed. Most of the students in present study also thought that seed can photosynthesize during germination which is reported to be a common misconception in the literature (Toman, Odabasi Cimer & Cimer, 2015).

With respect to animals, most of the students knew that the human beings classified as animals. Whereas, they had difficulties in understanding that the mice are mammals which breastfed their offspring and any flying animals with wings cannot be classified as birds. In a similar manner, only half of the students were able to identify the bats are mammals in visuals. This finding is parallel with the findings of similar study which reported that students had difficulties in animal classification and they believed that flying animals like butterflies and bats are classified as birds as well as believing that penguins, seals and dolphins are fish (Dikmenli, Cardak & Turkmen, 2002). This may be related with students' insufficient understanding about animal classification which can stem from students' daily life experiences.

Students in our sample also have moderate understanding regarding microorganisms. Even they knew there are bacteria in the yoghurt, they indicated all the microorganisms are harmful and the microorganisms can be seen by bare eyes. This common misconception about all the microorganisms as being harmful supports the findings of previous studies which showed that the microorganisms were regarded as pathogens (Williams & Gillen, 1991; Gillen & Williams, 1993). Students also were moderately knowledgeable about the fungi. Half of the students did not know that the bread molds are alive and thought that the fungi were plants. This might be due to students' understanding about the mushrooms are grown in the soil, so do the vegetables. Thus, they could think the fungi are plants. Indeed, previous studies (Anderson et al. 2014; Tunnicliffe & Reiss, 2000) also reported similar findings. The interviews conducted with students showed that the students believed that mushrooms are plants as because they are eatable and collected from the soil (Anderson et al. 2014). This can be another explanation as being eatable make the mushroom belong to plant class because plants are also eatable for most students.

When the descriptive results regarding abiotic factors are examined, it could be seen that students were more aware about the abiotic factors including soil, air and water when compared to biotic factors. Actually, this finding contradicts Prokop et al.'s (2007) finding which reported that students tended to draw biotic factors including animals and plants more frequently when compared to abiotic factors such as sun or soil. On the other hand, some studies suggested that students were aware what is needed for a plant to stay alive. Thus, they were aware of the abiotic factors as Tunniccliffe and Reiss (2000) indicated. In similar manner, Anderson et al. (2014) also stated that students were aware about the abiotic factors including sunshine, water and soil which are needed for plants.

The second research question of this study investigated whether factors including gender, living in rural or urban, parents' education level and family income affect students' awareness. Statistical analyses did not reveal any gender difference with respect to students' awareness. In fact, Van Liere and Dunlap (1980) explained that there is no consensus about whether gender is associated with participants' environmental concerns. They reviewed a wide range of past studies and reported that the gender was not substantially associated with environmental concerns. While there were studies which support lack of relationship between gender and environmental concerns (e.g., Ahi et al. 2017; Meydan & Dogu, 2008), there were other studies which

reported contradicting results with Van Liere and Dunlap's (1980) study (e.g., Aydin & Cepni, 2012; Erol & Gezer, 2006; Loughland et al. 2003). In some of these studies, girls were reported to be more concerned toward environment and environmental problems (Erol & Gezer, 2006; Loughland et al. 2013). Whereas, Aydin and Cepni (2012) reported vice versa.

Regarding the residence (living in rural or urban), the students living in urban were found to be more aware about the biotic and abiotic factors comprising the nature. This finding supports the previous studies which reported that students living in urban areas were more aware about the nature and the plantations as well as animals living in the nature (Buyuksahin & Demirci-Guler, 2014; Tuncer et al. 2004; van Liere & Dunlap, 1980). There could be two explanation about students' awareness living in urban: First, the students in the urban areas could be more aware about the effects of industrialization on the environment (Tuncer et al. 2004). The second explanation is the individuals living in urban are faced with the effects of environmental problems more frequently when compared to their counterparts living in rural (Van Liere & Dunlap, 1980). Whereas, there are other studies which reported no effect of residence (Erol & Gezer, 2006) and reported that children in rural had more positive attitudes towards environment (Hinds & Sparks, 2008, Kellert, 1985). Hinds and Sparks (2008) explained the reason of rural children holding more positive attitudes as those children are more connected to the environment they live in.

We revealed that parents' education level affected students' awareness towards nature. The students with more educated parents were tended to be more knowledgeable about the biotic and abiotic factors. In line with this finding, Aydin and Cepni (2012) reported that students with more educated fathers held more positive attitudes towards environment. Van Liere and Dunlap (1980) also reported a positive association between environmental concerns and education level. They explained this positive association as educated and upper/middle classes fulfilled their basic needs and thus, more concerned with environmental issues. Indeed, in our study, we also found that the students who had higher family income tended to be more aware about the biotic and abiotic factors comprising the nature. Even Van Liere and Dunlap (1980) indicated existence of a positive association between environmental concerns and education level, they failed to report a positive association between income and environmental concern.

Conclusions, Limitations and Implications

To conclude, this study focused on identifying seventh grade students' awareness about biotic and abiotic factors comprising nature as well as determining the effects of various factors which are reported to be related with students' environmental attitudes and concerns including gender, residence (living in rural or urban), family education level and family income. The results revealed students' awareness about biotic and abiotic factors were insufficient. This result left us bigger question: How can we increase our students' awareness about biotic and abiotic factors? In fact, previous studies also reported that the students tended to perceive themselves apart from the nature (e.g., Ahi et al. 2017; Chapman & Sharma, 2001, Desjean-Perotta, 2013; Moseley et al., 2010). Unless increasing their awareness towards the factors comprising the environment they live in, it would be difficult to hold positive attitudes toward environment as well as take responsibility of their actions in environmental problems. Previous studies also reported that students' positive attitudes towards environment tended to decrease with age (e.g., Loughland et al., 2003, Kellert, 1985; Van Liere & Dunlap, 1980). Thus, it is a necessity to focus on students' awareness about the biotic and abiotic factors beginning from early ages. With this study, we tried to present some significant findings which can lead both national and international environmental educators and science teacher educators as

well as science teachers to focus on biotic and abiotic factors more in their lessons, national science programs and in their courses.

This study also had some limitations which can prevent our findings to further generalize Turkey population. As we specifically focused on seventh grade students' awareness of biotic and abiotic factors living in rural and urban areas of Turkey, the researchers needed to choose a location for data collection. the selection of location was done conveniently. Thus, in future, we propose more locations to collect data in order to increase the generalizability of the study.

Even we presented some significant findings, our findings were quantitative and were limited to the items found in the instrument which was developed by Kiraz (2016). Thus, conducting qualitative or mixed method studies for presenting more evidences about students' awareness of biotic and abiotic factors will be useful to get more in-depth views about the students' awareness.

The literature reported that extracurricular activities including school garden projects (e.g., Urey & Cepni, 2014), eco-schools (e.g., Chapman & Sharma, 2001) and field trips (e.g., Prokop et al., 2007) can be useful in enhancing students' knowledge about ecology concepts and helping students to develop more positive attitudes towards environment. Thus, it could be an effective way for science teachers to benefit from these kinds of extracurricular activities.

Teacher themselves should be aware of biotic and abiotic factors comprising the nature itself. Besides science textbooks which were reported to mainly focus on animals and neglect plants and other factors, Bebbington (2005) emphasized science teachers had little knowledge about plants and animals. Thus, another recommendation may be implementation of in-service training programs aiming to increase awareness towards biotic and abiotic factors for science teachers.

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RESEARCH ARTICLE

7. Sınıf Öğrencilerinin Doğa Hakkındaki Farkındalıklarının İncelenmesi

Uğur KİRAZ
Milli Eğitim Bakanlığı, Kütahya, TÜRKİYE

Ümran Betül CEBESOY*
Uşak Üniversitesi, Uşak, TÜRKİYE

Mehtap DÖNMEZ ŞAHİN
Uşak Üniversitesi, Uşak, TÜRKİYE

Özet

Bu araştırmanın amacı, 7. Sınıf öğrencilerinin doğayı oluşturan biyotik ve abiyotik faktörler konusundaki farkındalıklarını ve cinsiyet, yaşam alanı, anne-baba eğitim düzeyi, sosyoekonomik durum gibi çeşitli değişkenlerin öğrencilerin farkındalıklarına etkisini incelemektir. Bu amaçla, Kiraz (2016) tarafından geliştirilen Doğa Elemanları Farkındalık Ölçeği kullanılmıştır. Çalışmaya Kütahya ilinde bulunan köy ve şehir merkezinde öğrenim görmekte olan 427 öğrenci katılmıştır. Toplanan veriler, betimsel olarak analiz edilmiş ve T-testi ve ANOVA testleri kullanılarak çeşitli faktörlerin etkileri incelenmiştir. Sonuçlar, ortaokul 7. Sınıf öğrencilerinin biyotik ve abiyotik faktörler konusundaki farkındalıklarının yetersiz olduğunu ortaya koymuştur. Cinsiyetin etkisi bulunmazken, şehir merkezinde yaşayan ve gelir düzeyi yüksek olan öğrencilerin farkındalıklarının köylerde yaşayan öğrencilere göre daha yüksek olduğu bulgular arasındadır.

Anahtar Kelimeler: abiyotik faktörler, farkındalık, biyotik faktörler, doğa, ortaokul öğrencileri.

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***E-mail: ubetulcebesoy@gmail.com**