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RESEARCH ARTICLE

The Short Term Effectiveness of an Outdoor Environmental Education on Environmental Awareness and Sensitivity of In-service Teachers*

Emel OKUR-BERBEROGLU[a]
LIC (Livestock Improvement Corporation), Hamilton, NEW ZELAND

Hasan Göksel OZDILEK
Canakkale Onsekiz Mart University, Canakkale, TURKEY

Şükran YALCIN-OZDILEK
Canakkale Onsekiz Mart University, Canakkale, TURKEY

Abstract

Outdoor education is mostly mentioned in terms of environmental education. The aim of this research is to determine the short term effectiveness of an outdoor environmental education program on biodiversity awareness, environmental awareness and sensitivity to natural environment. The data is collected from an outdoor environmental education project which is financed by TUBITAK and its name is 'Nature-based Outdoor Environmental Education in Canakkale and Suburbs, 2008.' There are 27 in-service teachers in the project and the project is only for 10 days. An environmental awareness and sensitivity scale is developed for the study. The research design is pre-posttest design. The data is analysed by Wilcoxon signed rank test because of the data is non-parametric. It is found that the nature-based outdoor education program is effective to improve environmental awareness and sensitivity to natural environment; on the other hand it is not successful to improve biodiversity awareness.

Key words: Outdoor education, environmental education, in-service teachers, TUBITAK, Turkey

Introduction

Ecosystem is a quite complex system and composed of many elements which are connected to each other directly or indirectly (Bowen & Roth, 2007; EETAP, 2002). The pressure of the human population and industry has caused increasing of debates on ecosystem, sustainability, future of the world, etc. (Pavlov & Shishkin, 2003). Hence, the education has been started to mention more.

According to a study of Independent Commission on Environmental Education, environmental subjects are examined under other scientific titles (Kassas, 2002; Disinger, 1997). However, environmental education has more specific characteristics than the other science education disciplines. Firstly, environment and environmental education is an interdisciplinary subject and interactions among environmental components are quite complex (Erentay & Erdogan, 2009; Bowen & Roth, 2007; Stevenson, 2007; Robottom & Sauve, 2003; Kassas, 2002; Gayford, 2000; Dreyfus, Wals, & Weelie, 1999; Vester, 1997). Secondly, long-term observations may generally be required in environmental education. Physics and chemistry are usually based on experimental studies and they have relatively results in a short term. However it is so

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*Corresponding Author: Emel OKUR-BERBEROGLU,
E-mail: emelokur17@gmail.com

difficult to understand complex interactions of environment (Stevenson, 2007) and environment education (Kasapoğlu& Turan, 2008; Rickinson, 2001) in a short period.

Different approaches in environmental education bring about varied outputs such as increasing environmental knowledge level, having favourable environmental attitude, increasing environmental awareness, environmental behaviour change, actively participate in solution of environmental problems etc (Erentay & Erdogan, 2009; Stevenson, 2007; Storksdieck, Ellenbogen, & Heimlich, 2005; Hadlock & Beckwith, 2002; Kassas, 2002; Rickinson, 2001; Dori & Herscovitz, 1999). All these outputs are also named as 'environmental literacy' (EETAP, 2002). One of the ways of succeeding environmental literacy is 'outdoor education' (Siegel, 2007; Powers, 2003; Ford, 1986).

Natural environment is used as a natural laboratory area within outdoor education (Carrier, 2004). Outdoor education is not an unplanned program and should absolutely have a program (Tsai, 2006; Carrier, 2004). Environmental Education and Training Partnership (EETAP, 2002) supports outdoor environmental education and notes that environmental literacy advances with outdoor environmental education.

Literature review

There are many international (OECD/ CERI, 2008; Chenoweth, Wehrmeyer, Lipchin, Smith, & Gazit, 2007; Bolstad& Baker, 2004; Rauch, 2002; Rickinson, 2001; Ballantyne, Fien, & Packer, 2001; Palmberg & Kuru, 2000; Breidler, 1999; Eder, 1999; Elliot, 1999; Hart& Nolan, 1999; Bogner, 1998; Bell, Russel, & Plotkin, 1998; Mansaray, Ajiboye, & Audu, 1998; Pfaffenwimmer, 1998; Chen, 1997) and national (Erdoğan & Ok, 2011; Çakır, İrez, & Doğan, 2010; Okur, Yalcin-Ozdilek, & Sahin, 2010; Özbay, 2010; Aktepe& Girgin, 2009; Erdoğan, Marcinkowski, & Ok, 2009; Öztaş & Kalıpçı, 2009; Bozkurt & Kaya, 2008; Kahyaoğlu, Daban, &Yangın, 2008; Kasapoğlu& Turan, 2008; Özden, 2008; Tuncer, 2008; Gökçe, Kaya, Atay, & Özden, 2007; Yalcin & Dogan, 2007; Alp, Ertepınar, Tekkaya, & Yılmaz, 2006;Yalcin- Ozdilek, Kaska, Olgun, & Sonmez, 2006; Erten, 2005; Gökdere, 2005; Tuncer, Ertepınar, Tekkaya, & Sungur, 2005) studies related to environmental education. When we evaluate these international studies, it has realised that some points are common and very remarkable. These points are;

a. Existed some education programs are not enough for environmental literacy. Hence different environmental education programs should be designed and professional development of teachers should be supported in terms of environmental education (Chen, 1997),

b. There is a gap between theory and application (OECD/ CERI, 2008; Bolstad & Baker, 2004; Elliot, 1999; Hart& Nolan, 1999; Mansaray et al., 1998),

c. Some different environmental activities or outdoor education should be used in order to fill this gap (OECD/ CERI, 2008; Bolstad & Baker, 2004; Rauch, 2002; Breidler, 1999; Eder, 1999; Elliot, 1999; Posch, 1999; Bell et al., 1998; Pfaffenwimmer, 1998).

On the other hand Rickinson (2001) evaluates 110 environmental education research which consists of journal articles, books, and government/international projects' reports between 1993- 1999. But he only considers some research which is related to primary and secondary school students. These studies also include outdoor educations. According to this evaluation Rickinson comes up with:

a. Indoor or outdoor environmental educations are effective on gaining environmental knowledge and having favourable attitude but we do not know how these effects happen and there is not enough explanation about it.

b. Most of the research are for a short term and following up processes are not sufficiently carried out after educations.

c. Hence there should be studied which education programs are effective on which outputs and how these outputs come out.

When we evaluate national programs, it is realised that they have some common suggestions. These are:

a. Existed education programs are not enough so these programs should be reviewed. New programs should be designed and these programs should include 'sustainability' much more than old ones (Çakır et al., 2010; Erdoğan et al., 2009; Öztaş& Kalıpçı, 2009; Özden, 2008; Tuncer, 2008; Alp et al., 2006; Tuncer et al., 2005),

b. There should be used new teaching methods in environmental education (Gökdere, 2005) like outdoor education (Erdoğan & Ok, 2011; Özbay, 2010; Bozkurt& Kaya, 2008, Gökçe et al., 2007)

c. Following up process should be carried out (Kasapoğlu& Turan, 2008),

d. Different governmental institutions and NGOs' should cooperate (Erdoğan et al., 2009; Tuncer, 2008),

e. Teacher education at university level and professional development of in-service teachers should be supported in terms of environmental education (Okur et al., 2010; Özbay, 2010; Aktepe& Girgin, 2009; Erdoğan et al., 2009; Bozkurt& Kaya 2008; Özden, 2008; Kahyaoğlu et al., 2008;Erten, 2005).

As seen above national and international research point out and emphasize same subjects. Especially as said Chen (1997), education programs in Turkey is not enough to develop 'environmental literacy. These programs are just enough for knowledge transfer (Okur et al., 2010) but are not enough participate in solution of environmental problems. At this point TUBITAK (The Scientific and Technological Research Council of Turkey) has started to support some outdoor environmental education projects intended for in-service teachers since 1999 (Erentay & Erdogan, 2009). The aims of these projects are to teach environmental subjects via an actual language, to gain environmental awareness and attitudes, behavioural change, and to participate in solutions of environmental problems (TUBITAK Invitation Paper, 2013), in another word learning/ having environmental literacy. The projects are carried out within collaboration with the universities.

There are many outdoor environmental education projects financed by TUBITAK (TUBITAK Report, 2010) but unfortunately we do not have enough academic outputs of them. Academic publications about outdoor environmental education projects intended for teachers of TUBITAK are very limited:

Guler (2009) carries out an outdoor education projects intended for teachers in 2008. There are 24 in-service teachers at the project which is only for 12 days. The aims of the research are to figure out expectations of the in-service teachers from the project, to determine self-efficacy level of teaching about environmental subjects, and to determine the changing of personal ideas about environmental education. The project data is collected by semi-structured interview and analysed by discourse analysis. As a result, the participants disclose that their expectation form project is to have environmental knowledge, and they have it. They also express they are very glad to have favourable perspective to the world, they sense more responsible to natural environment, and they will explain and teach what they have learnt. However some teachers express that they do not have enough knowledge and skills about environmental subjects so they do not have enough self-confidence to teach them. Lugg and Slattery (2003) has found similar results with Guler. They study with the

teachers at a national park in Victoria, Australia. Outdoor environmental education activities are carried out at this park and the teachers bring students to the park in order to gain environmental knowledge, increase environmental awareness. The teachers say that they do not have enough environmental knowledge and skills so they come to the national park. They collect data via semi-structured interview, observation, and survey within a case study. The teachers do not teach; an instructor on duty at the park carries out activities with the students. At the end of the study the teachers say that their environmental knowledge and awareness level has increased with students after activities. However they complain about that not to have enough outdoor education experience so they cannot direct the park instructor and reflect their explanations. Lugg and Slattery offers that activities should be placed-based, problem-based, and supported of professional development of teachers in terms of either environmental education or outdoor activities.

Keles, Uzun, Varnaci-Uzun (2010) carries out an outdoor education projects intended for pre-service teachers in 2009. 25 pre-service teachers attend to the project which is for 10 days. The aims of the research are to increase environmental awareness and attitudes of the participants by the quantitative approach. The scales are applied as pre/post/postpost test (after 3 months). As a result, it is determined that environmental awareness of the participants is increased, and environmental attitude is changed as favourable.

Eryaman, Yalcin-Ozdilek, Okur, Cetinkaya, and Uygun (2010) apply an outdoor education projects intended for teachers in 2009. The project is 10 days, and there are totally 40 in-service teachers at the project. The participatory action research is used. The aim of the project is to determine tendency of the participants to participate in solving any environmental problem. As a result, the researchers find that the participants are very enthusiastic in order to participate in solving any environmental problem. However the researchers state that they cannot follow up the participants. This is the limitation of the research.

As seen above, every project program has similar or different outputs but beside this each of them searches one side of environmental literacy. On the other hand international studies related to outdoor educations are mostly based on adventure education (Irwin, 2010; Piller, 2002) and environmental education is just a part of this program. These education programs are also carried out with students (Preston, 2004; Preston& Griffiths, 2004; Piller, 2002; Palmberg& Kuru, 2000), not with teachers. Irwin (2010) especially emphasize that outdoor environmental education programs are not enough to have environmental literacy and learn sustainability so outdoor education programs should be evaluated in terms of each side. At this point this research focuses on one side of environmental literacy: environmental awareness and sensitivity and some gaps mentioned above:

a. The target group is in-service teachers,

b. An outdoor environmental education program is developed for professional development of the in-service teachers,

c. Active teaching methods are used at outdoor,

d. There is collaboration between TUBITAK, a university, and local institutions.

Within this perspective, the aim of this research is to determine the short term effectiveness of an outdoor environmental education program on biodiversity awareness, environmental awareness and sensitivity to natural environment.

Methodology

This study is based on the quantitative approach and has pretest/posttest research design. There is no sample- universe selection. All the research as seen above (Guler, 2009, Keles et al., 2010; Eryaman et al., 2010; Okur-Berberoglu et al., 2013) do not use sample universe selection. The universe is all the participants of the project. The data is collected from an outdoor environmental education project which is financed by TUBITAK and its name is '108B023 coded Nature-based Outdoor Environmental Education in Canakkale and Suburbs, 2008.'

Education program

The literatures determine some characteristics of an outdoor environmental education program so the education program of this project is design according to these characteristics:

-One of them is the program should be designed within interdisciplinary perspective (Brookes 2004; Piller 2002; Bunderson & Cooper 1997). In this perspective, there are 22 different and interrelated environmental subjects in the program (App. 1) and each subject is explained within the connection of the other subjects. Each subject is explained by a lecturer who has PhD degree in the related discipline.

-The other point is to design the program as placed-based and problem-based (Harrison 2010; Irwin 2010; Brookes 2004; Lugg & Slattery, 2003; Piller, 2002; Emmons, 1997). All the activities in the program are based on Canakkale and the educators firstly explain the environmental subjects and problems within Canakkale (local level), and secondly at global level.

Participants' selection

A web-site was set up for this project and the web-site advertisement was posted to e-mail addresses of all primary and secondary schools. The project was publicized by newspapers, and a local TV channel. The volunteer enrolments were collected by the web-site. It was wanted the participants to fill out an online questionnaire. The questionnaire was composed of some demographic information and a specific question, 'why do you want to join this project?'. The participants were selected according to the reply of this question. The researchers were decided to 27 in-service teachers at the end of the evaluation.

Data collection

A scale was developed according to aims if the research. 46 items were prepared at the initial stage. The items were checked by three experts. The scale was designed within 5 Likert Scale. The Likert scale was coded from 1 to 5; as (1) I totally disagree, (2) I disagree, (3) I partly agree, (4) I agree and (5) I totally agree. Negative items were handled with reverse scoring.

The pre-application of the scale was become with 230 people. SPSS.13 package program was used for the analysis. Exploratory factor analysis was considered for validity, and Cronbach Alpha value was considered for reliability. The items, which factor value are above 0.4, are accepted to the scale (Buyukozturk, 2007). It was found that Kaiser- Meyer-Olkin (KMO) value was 0.792, and Bartlett test was 0.000. It meant that sample size was enough and there were themes at this scale (Daniel, 2011; Buyukozturk, 2007; Connolly, 2007; Sencan, 2005).

There were totally 30 items at the last stage of the analyses (App. 2), and whole scale was called 'Environmental awareness and sensitivity scale'. Three themes are determined within 30 items, and they were named as 'biodiversity awareness, environmental awareness and sensitivity to natural environment.' There were 8 items

at the biodiversity awareness theme, 12 items at the environmental awareness theme, and 10 items at the sensitivity to natural environment theme. Every theme's Cronbach alpha value was above 0.65 and Cronbach alpha coefficient value of the whole scale was 0.736. These results were evaluated as the scale is 'suitable' (Daniel, 2011; Buyukozturk, 2007; Connolly, 2007; Sencan, 2005; Karasar, 2003) for the aims of the research.

Firstly, Kolmogorov- Smirnov test was used in order to decide whether the data was parametric or nonparametric. If the significant value is less than 0.05, it means that the data is nonparametric (Daniel, 2011; Buyukozturk, 2007; Connolly, 2007). Wilcoxon signed rank test was used for this research because we had small sample size, the data was nonparametric. The scale was carried out two times as pre/posttest. The confidence interval was chosen as 95% (Daniel, 2011; Buyukozturk, 2007; Connolly, 2007). The Wilcoxon signed rank was carried out four times. One of them was for the total score of whole scale, and three of them were the total score of the each theme.

Results and discussion

We find that the nature-based outdoor education program is effective to improve environmental awareness and sensitivity to natural environment ($p<0.05$); on the other hand it is not successful to improve biodiversity awareness ($p>0.05$) in a short term.

Table 1.

The comparison of pre/posttest total scores of whole scale by Wilcoxon Signed Rank

Pre/posttest	*n*	*Mean*	*Total*	*Z*	*p*
Negative column	6	11,58	69,50	2,87*	0.004
Positive column	21	14,69	308,50		
Equal	0				

* Based on negative column

Table 1 shows that the comparison of pre/posttest total scores of the whole scale. It is found that there is a statistically meaningful difference between the total scores of test ($z=2.87$, $p<0.05$). According to this result, the nature-based outdoor environmental education is effective to improve environmental awareness and sensitivity to natural environment of the participants.

Table 2.

The comparison of pre/posttest total scores of the sensitivity theme by Wilcoxon Signed Rank

Pre/posttest	*n*	*Mean*	*Total*	*z*	*p*
Negative column	7	12,43	87	2,45*	0.014
Positive column	20	14,55	291		
Equal	0				

* Based on negative column

Table 2 shows that the comparison of pre/posttest total scores of the sensitivity theme. It is found that there is a statistically meaningful difference between the total scores of the sensitivity theme ($z=2.45$, $p<0.05$). As a result, the nature-based outdoor environmental education is effective to improve sensitivity to natural environment of the participants.

Table 3.

The comparison of pre/posttest total scores of the environmental awareness theme by Wilcoxon Signed Rank

Pre/posttest	*n*	*Mean*	*Total*	*Z*	*p*
Negative column	4	12,75	51	3,008*	.003
Positive column	21	13,05	274		
Equal	2				

* Based on negative column

Table 3 shows that the comparison of pre/posttest total scores of the environmental awareness theme. There is a statistically meaningful difference between the total scores of the environmental awareness theme ($z=3.008$, $p<0.05$). It shows that the nature-based outdoor environmental education is effective to improve environmental awareness of the participants.

Discussion and Conclusions

At the end of this study, we have found that the nature-based outdoor environmental education program is effective to improve environmental awareness and sensitivity to natural environment. Keles et al (2010) have found similar results at their studies. Although both studies have similar results, we do not know the content of the educational programs. We really do not know which factor really affects to have these outputs; the content of the program or to have education at the outdoor or both of them? Rickinson (2001) offers that educational research should focus on how the

outputs happen. This research is a summative, as well because there is not enough output about the outdoor environmental education projects and their outputs in Turkey. At the further stage, the research can focus on formative evaluation of the programs or the specific evaluation of each activity or how the outputs happen because any factor in an activity might cause the improving of environmental awareness and sensitivity to natural environment.

The program design might also cause to emerge awareness and sensitivity outputs because this program was designed placed- based and problem based (Harrison 2010; Irwin 2010; Brookes 2004; Lugg & Slattery, 2003; Piller, 2002; Emmons, 1997), in other words our priority was Canakkale and its problems. This program might repeat at other places and results might compare in terms of in-service teachers.

Most of the research support that professional development of in- service teachers should be supported with varied educations (Okur et al., 2010; Özbay, 2010; Aktepe& Girgin, 2009; Erdoğan et al., 2009; Bozkurt& Kaya 2008; Özden, 2008; Kahyaoğlu et al., 2008; Erten, 2005; Lugg & Slattery, 2003; Chen, 1997). We have also learnt that some teachers do not have enough self-confidence to teach environmental subjects (Guler, 2009; Lugg & Slattery, 2003). We have not reached to this result at our study because of quantitative approach but this study might cause same output. We also take part different outdoor environmental education projects. One of the participants who is a Biology teacher at a program has mentioned that she and her colleague do not have enough knowledge about environmental subjects and how to teach them but they are ashamed to mention this deficiency. We must need deep research within qualitative approach in order to determine this deficiency.

Qualitative approach might be used in order to determine biodiversity awareness because this research program is unsuccessful on biodiversity awareness. The other research has not mentioned biodiversity theme. Their programs should probably mention biodiversity however they might not need to evaluate biodiversity as a theme whereas Young (2001) and Kassas (2002) say that biodiversity is an important part of ecology, and it should be pointed out. On the other hand quantitative approach has advantages and disadvantages. One of the disadvantages of quantitative approach is to limit the people how they think by scale items (Tracy, 2013; Bas & Akturan, 2008; Yildirim & Simsek, 2006). The scale items of biodiversity awareness might be insufficient. If we also use qualitative approach, we might determine improving at the biodiversity awareness theme. The qualitative and quantitative approaches can be used together in further researches. The using both approaches together is called mixed methodology (Tashakkori & Teddlie, 1998). Guler (2009), Eryaman et al (2010) uses also the qualitative approach. This research and Keles et al (2010) use quantitative approach.

The other shortage of the scale is to be formed by the explanatory factor analysis. Recently, the confirmatory factor analysis is used in order to develop a scale (Okur & Yalcin-Ozdilek, 2013; Okur & Yalcin-Ozdilek, 2013; Okur-Berberoglu & Uygun, 2012; Morais & Ogden, 2011). The explanatory factor analysis has the inductive perspective, and the confirmatory factor analysis has the deductive perspective therfore using both perspectives in order to develop a scale helps the researcher to eliminate disadvantages of both perspectives.

Another shortage of this study is that not to have following up procedure although literatures offer to follow up (Kasapoğlu& Turan, 2008; Rickinson, 2001). We could only evaluate the short term effects of the education program whereas Keles et al (2010) applied following up after three months and could evaluate the long term effects of their program. The long term effects of the education might happen in further times (Barr & Gilg, 2007). Maybe increasing of biodiversity awareness might determine in future

times. If the further research also uses following up procedure, they might have more coherent results.

This study tries to determine the effectiveness of an outdoor environmental education program but we did not focus on demographic properties of the participants (For example, age, gender, education level, job, living area –urban or rural-, socio-economic status etc.). On the other hand Brymer and Davids (2012) criticise summative research. They say that the environmental education programs which focus on effectiveness of a program has 'one size fits all' perspective. Whereas each person has different background so outputs of the people will be varied. Each person can even reflect on same output in different timescales so they offer 'ecological dynamics model' for environmental education programs. (Brymer & Davids, 2012) The ecological dynamics model or individual evaluation might be used in further studies.

This research results are very important in terms of evaluation of an outdoor environmental education program although having some shortages. There are some gaps (introduction) in terms of environmental education and this study has helped to fill these gaps. There are many more educational outputs. In fact, environmental education is a comprehensive subject. People have to have holistic perspective because of complex interactions of nature. In other words, human (Homo sapiens sapiens) is not the governor of the world; is only a part of the world. This is the starting philosophy of the outdoor environmental education (Halligan, 2007; Carrier, 2004; Ford, 1986). Maybe the comprehensive structure of the environmental education might cause the different outputs (Young, 2001). Fien and Tilbury (1996) determine fifty seven different outputs within environmental education. This study only mentions two of these outputs related to environmental literacy. As say Irwin (2010) and Rickinson (2001), each output may be evaluated within different studies. A scale or survey might be developed related to environmental literacy or its subthemes in further researches.

The other debate of the environmental education is education place. School comes to mind when somebody mentions 'education'. Storksdieck et al. (2005) emphasize that it is difficult to achieve desired outcomes within existing school programs. The school is found for mass education from the beginning of the 19th century and its aims are to grow up generations who are able to have critical thinking, handle social themes, do research, become problem solver, participate in decision making process in environmental and political events (Stevenson, 2007). From the perspective of environmental education, it is underlined that there are some negative aspects of schools. Vester (1997) suggests that mental abilities start to leave form physical activities faster within school education. As a result, human-environment relationship damages at the most sensitive point. A research conducted in the Netherlands and Israel revealed that there is no connection between providing great deal of information related to environment and the favourable change in environmental awareness and environmental behaviour (Dreyfus et al., 1999). Fadigan and Hammrich (2004) hypothesize that a large part of the learning takes place outside of schools despite the fact that they spend most of the time in schools. However, Tsai (2006) and Kassas (2002) note that the subjects about nature can be given after combination of in-door school learning with school-related extracurricular activities. Fadigan and Hammrich (2004) underline that learning can happen in schools as well as at homes, museums, science centres; also it is argued that extra-curricular activities might increase student's academic achievement, team-work skill, competition, take of responsibility and self-confidence (Mitchell, 2008; Halligan, 2006; Tsai, 2006; Shanely, 2006; Powers, 2004; Palmberg & Kuru, 2000). Outdoor education might be also used in order to have social and psychological outputs.

The outdoor environmental education is a huge and complicated subject. Outdoor or indoor activities and their effectiveness should be evaluated one by one. TUBITAK

especially wants to educate in-service teachers in order to have common effect on public. The projects educate in-service teachers; the teachers educate students and share their acquisitions/ learning with their family, friends, and students. It should be researched which one is more effective in order to have environmental education outputs: outdoor, indoor, or both of them, or none of them.

At this point, institutionalization comes forward. School is an institution and indoor or outdoor activities can be done within schools. There are also outdoor education institutions or centres. A museum or science museum, zoo, aquarium, some of sport/adventure centres, national parks etc are evaluated in terms of outdoor education (Irwin, 2010; Bozdogan, 2007; Tsai, 2006; Lugg & Slattery, 2003; Ford, 1986). Lugg and Slattery (2003) have studied with in-service teachers in a national park in Australia and there are instructors in order to show outdoor environmental activities in a park.

The outdoor education centres in Turkey are very limited. Last decade, TUBITAK has started to support to open more outdoor education centres (Bursa Science Museum, 2013; TUBITAK Legislation, 2012) but then again, there is still shortage about 'outdoor environmental education centres'. The outdoor environmental education centres are at the institutionalization level in Australia and New Zealand (Auckland City Council, Waikato Environmental Trust, Canterbury Environmental Trust, etc) and there are many centres. There is also a specific department about the sustainability and outdoor education at the Canterbury Polytechnic Institute of Technology (CPIT, 2013). The universities in New Zealand support the sustainability via different applications. For example the University of Otaga is very successful about sustainability applications and it has 'Centre of Sustainability' (The University of Otago, 2013). As a result, in-service teachers, students, and public can easily have environmental education and sustainability applications. These institutions are good samples for sustainable development and present new job vacancies for young generation.

The chancellors of 436 universities from 52 different countries come together in Tallories, France in 1999 and discuss the responsibilities of the universities for sustainability, the programs of the future environmental education at all education levels, cooperation of non-governmental organizations and schools (Tallories Declaration, 2012). According to the document, Ankara University from Turkey only signs this declaration (Tallories Declaration Action Plan, 2012), however Ankara University does not have a sustainability centre. This result might be another research subject. It is unknown sustainability or environmental education applications of schools and universities in Turkey. On the other hand, TUBITAK's supports are very valuable in terms of environmental education. We believe that if project teams publish their results, then more quality educational programs might be developed. The number of the environmental education centres should be increased. TUBITAK projects usually carry out in summer. However, if centres are set up, then they would be open to education.

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APPENDIX 1.

The context of the education program which is based on Canakkale

1. The Astrophysic and Big Bang Theory
2. The geological structure of Canakkale
3. The macrovertebrates of Canakkale
4. Marine acosystem and marine biodiversity of Canakkale
5. Stream ecology and water micro invertebrates.
6. Forest ecosystem of Canakkale
7. Endemic plants of Canakkale
8. Energy production: 'Can' Thermal Reactor and the effects on the nature
9. Water resources, and Atikhisar Dam
10. Etnobotanic
11. Folkloric structure of Canakkale
12. National Parks in Canakkale
13. Tourism and sustainability
14. Ecoturism
15. Biologic combat
16. Recreational areas in Canakkale
17. Canakkale Wars and effects on Gallopoli Peninsula
18. Troia Antic City and the roots of the civilization
19. Recycling and compost production
20. Geographic Information System and orienting
21. Architectural structure of Canakkale
22. First aid

APPENDIX 2.

The scale of nature- based outdoor environmental education

	I totally agree	Agree	I am not sure	I do not agree	I never agree
1. I do not know how my life will be affected if a species becomes extinct in nature.	Sensitivity to the natural environment (SE)				
2. I cannot relate between 'the biodiversity' and the environmental problems.	Biodiversity awareness (BA)				
3. I think that all the insects damage to the other species.	BA, Negative item (NI)				
4. It is contended with harmful animal and plant by the chemicals.					
5. It is inevitable to convert the forest area to the agricultural area in order to satisfy the food need.					
6. I believe that the nature has a complex process which human cannot perceive.	SE				
7. I do not know the alternative energy resources.	SE, NI				
8. The nature renews own self so it is not necessary to protect it.					
9. It is an absurd thinking that all the animals and plants, which I can see or not, are a part of my life.	BA, Negative item (NI)				
10. It is enough to protect the plants which are only important for the economy.					
11. It is not richness for an area to have many animal and plant species.					
12. It is enough to grow up a plant, which is close to being extinct, in an artificial area.					
13. People do not know how to protect the World.	Environmental awareness (EA)				
14. It is not important how much a new car pollutes the air.					
15. Using the private car instead of the bus is to damage our lives.					
16. People wonder about the environmental problems pointlessly.	SE, NI				
17. People need more motorways in order to increase their relationship.					
18. Every city must have an airport.					
19. The draining the swamp is a kind of combat with mosquitos.	EA, NI				
20. The factories should be set up distant from the living areas.	EA				
21. It is not effectively possible to use solar energy in Turkey.	SE, NI				
22. Everything in nature is for human.					
23. There is no connection between a thermal reactor and ground-water pollution.	EA, NI				
24. The thermal reactor is one of the green energy resources.					
25. There is no connection between the geological structure and biodiversity of the soil.					
26. People must solve the environmental problem in order to improve their lives.	EA				
27. The nature is damaged while the technology is using.					
28. The organic agriculture is a kind of agriculture that there is no using of a chemical.					
29. Every soil structure is suitable for the organic agriculture.					
30. The aim of the organic agriculture is to increase the quantity.	EA, NI				

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RESEARCH ARTICLE

Okul Dışı Çevre Eğitiminin Öğretmenlerin Çevre Bilinci ve Hassasiyeti Üzerindeki Kısa Dönemli Etkisi

Emel OKUR-BERBEROGLU[a]
LIC (Livestock Improvement Corporation), Hamilton, NEW ZELAND

Hasan Göksel OZDILEK
Canakkale Onsekiz Mart University, Canakkale, TURKEY

Şükran YALCIN-OZDILEK
Canakkale Onsekiz Mart University, Canakkale, TURKEY

Özet

Okul dışı eğitim çoğunlukla çevre eğitimi ile ilişkilendirilir. Bu araştırmanın amacı bir okul dışı eğitim programının biyoçeşitlilik farkındalığı, çevre bilinci ve doğal çevre hassasiyeti üzerindeki kısa dönemli etkisini belirlemektir. Veriler, TUBITAK tarafından finanse edilen bir okul dışı çevre eğitimi projesinden elde edilmiştir. Söz konusu projenin adı 'Çanakkale ve Yakın Çevresinde Ekoloji Bilinci Kazandırmak Amaçlı Doğa Eğitimi, 2008' şeklindedir. Projede 27 öğretmen yer almıştır ve proje sadece 10 gün sürmüştür. Çalışma için bir çevre bilinci ve hassasiyeti ölçeği geliştirilmiştir. Öntest sontest araştırma deseni kullanılmıştır. Veriler parametrik olmadığı için Wilcoxon İşaretli Sıralar Toplamı Testi ile analiz edilmiştir. Doğa tabanlı okul dışı eğitim programının çevre bilinci ve doğal çevre hassasiyetini geliştirmede etkili olduğu fakat biyoçeşitlilik farkındalığını geliştirmede etkili olmadığı tespit edilmiştir.

Anahtar Kelimeler: Okuldışı eğitim, çevre eğitimi, öğretmen, TUBITAK, Türkiye

ISSN: 2146-0329
*Corresponding Author: Emel OKUR-BERBEROGLU,
E-mail: emelokur17@gmail.com

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RESEARCH ARTICLE

Exploring Pre-Service Elementary Teachers' Mental Models of the Environment*

Fatma TASKIN-EKICI[a]
Pamukkale University, Denizli, TURKEY

Erhan EKICI
Pamukkale University, Denizli, TURKEY

Hulusi COKADAR
Pamukkale University, Denizli, TURKEY

Abstract

This study aims to explore pre-service elementary teachers' understandings of the environment. A survey method was carried out in this study. A close-ended questionnaire and Draw-An-Environment Test (DAET) are administered to pre-service teachers (N=255) after instruction of an Environmental Education course. A rubric (DAET-R) is used for assessing the mental models or images of the environment held by pre-service teachers. Results of this study suggest that the participants' mental models of the environment are incomplete. Majority of participants' drawings reflect biotic and abiotic environment. Few drawings include human beings as a part of the environment. The results shows that mean scores do not differ regarding to gender, environmental education background, high school type, parental education level, parental occupation, and monthly family income.

Key words: Mental model, environment, education, pre-service teachers, drawing

Introduction

Though the development in science and technology increases the life standards of people, the development reveals a lot of environmental issues. While humans develop science and technology, they cause emergence of new environmental problems. According to this point of view, peoples' attitudes and behaviors are origin of environmental issues and this is an educational issue. Loughland, Reid and Petocz (2002) have stated that environmental education is seen to be an important strategy in achieving environmental improvement. The general purpose of environmental education is to provide individuals with the knowledge and skills necessary to protect and improve the environment for all living things (Moseley, Desjean-Perrotta, & Utley, 2010). Teachers must be aware of that factors that shape their environmental understanding to get through the goals indicated by North American Association for Environmental Education "NAAEE" (2004a). The Guidelines for the Initial Preparation and Professional Development of Environmental Educators of the NAAEE, (2004b) states,

> The goal of environmental education is to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones (p. 2).

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*Corresponding Author: Fatma TASKIN-EKICI,
E-mail: fekici@pau.edu.tr

According to the Guidelines, "educators must possess the understanding, skills and attitudes associated with environmental literacy," and "environmental literacy hinges on understanding the processes and systems that comprise the environment, including human systems and their influence" (p. 7) (NAAEE 2004b). A large part of our environmental understanding that directs our environmental behavior is derived from sociocultural factors and formal education (Duit, 1991; Payne, 1998).

"Students' conceptualizations of the environment or their mental models shape the ways in which they understand an environmental issue and guides their environmental behaviors" (Shepardson, Wee, & Harbor, 2007; p328), and this fact is also true for teachers (Moseley et al., 2010). According to these researchers, before teachers can understand environmental issues, firstly they must conceptualize what the environment is, what factors are present in the environment, and how those factors interact to shape and characterize the environment. So, investigating future educators' knowing and understanding about environmental issues is more important. In order to accomplish the general purpose of the environmental education, individuals both pre- and in-service teachers and students understand the factors that shape their beliefs and perceiving the environment (Moseley et al., 2010).

Theoretical Framework

This research is grounded in mental model theory. Drawings have been used to expose thinking patterns of pre-service elementary teachers in this study. Coll and Treagust (2003) have been defined mental models as representations of reality that people use to understand specific phenomena and make sense of the physical world. Individuals create cognitive or mental models that are based on prior knowledge, existing ideas and past experiences in order to interpret and explain events in the world around them (Moseley et al., 2010). Mental models are incomplete, imprecise and incoherent with the specific domain knowledge (Reinfried, 2006). Although these specific features, Greca and Moreira (2000) states that they are useful, since they are powerful explicative and predictive tools for the interaction of an individual with the world. Reinfried (2006), in her study, asserted that diagnosing the students' incorrect preconceptions and mental models would be a crucial step of teacher-facilitated mental model building process at all grade levels.

Mental Models

The term "mental model" has been used in many contexts and it plays a significant role in human reasoning. It was formulated, initially, by Kenneth Craik in 1943. Craik proposed that people reason, in general, by carrying out thought experiments on internal models (Nersessian, 1992). Mental models refer to individuals' internal, mental representations of external, physical phenomena or systems (Gilbert, Boulter, & Elmer, 2000; Vosniadou & Brewer, 1992, 1994). The major feature of this mental representation is its analogous structure to what is represented. That is, a mental model can be thought of as an imaginary structure that corresponds to the externally represented or perceived system in terms of the spatial arrangement of elements involved in the system and the relationships between or among these elements (Chiou & Anderson, 2010). Mental models influence cognitive functioning and can provide science education researchers and teachers with valuable information about the learners' conceptual framework, that is, their underlying knowledge structures (Vosniadou, 1994). Mental models may serve a number of purposes and function to provide explanations and justifications and to serve as mnemonic devices for memory enhancement (Coll & Treagust, 2003). An important, often overlooked, function that

mental models serve is to predict behavior (Williams, Hollan & Stevens, 1983). Mental models can also be divided into physical and conceptual mental models, where physical models represent the physical world; conceptual models represent more abstract matters (Johnson-Laird, 1983). Physical mental models are mental constructs of physical entities—real or imagined, whereas conceptual mental models are mental constructs of concepts, models, or abstractions (Coll & Treagust, 2003).

Drawings

Researchers have used drawings to examine thoughts and attitudes about various content areas for years. These studies usually involve elementary students, rather than the teachers themselves (Burton, 2012). The reason that drawing studies is done with elementary level students may be easier to summarize their ideas with drawings than to receive answers or to obtain verbal or written data during these ages.

Peoples have cognitive or mental models in the base of their prior knowledge, experience and related ideas and they serve the mental and/or cognitive models for the aim of explaining things in their life. Strauss (2001) suggested that mental models are the appropriate psychological entity to be addressed in the study of teacher cognition. Strauss asserted that an implicit mental model organizes thinking and teaching behaviors. Similarly, Haim, Strauss and Ravid (2004) explored how teachers' mental models related to their subject-matter knowledge. Contrary to traditional claims of the importance of subject-matter knowledge in their instructional behaviors, they found teachers' mental models, rather than teachers' depth of content knowledge, drove their instructional practices. Therefore, investigating and summarizing mental and/or cognitive models of pre-service and/or in-service teachers related to environment is important.

A lot of research studies have been done related to students' mental models in "physics education" (e.g. Borges & Gilbert, 1999; Hubber, 2006; Jabot, & Henry, 2007), "chemistry education" (e.g. Adbo & Taber, 2009; Chittleborough, 2004; Coll & Treagust, 2003a,b; Lin & Chiu, 2010; McClary & Talanquer, 2011), "biology education" (e.g. Chang, 2007; d'Apollonia, Charles & Boyd, 2004; Patrick, 2006), "environmental education" (e.g. Reinfried, 2006; Shepardson, Choi, Niyogi, & Charusombat, 2011; Shepardson, Wee, Priddy & Harbor, 2007), "earth sciences education" (e.g. Gobert, 2000; Panagiotaki, Nobes, & Potton 2009), "astronomy education" (e.g. Cin, 2013; Samarapungavan, Vosniadou & Brewer, 1996; Vosniadou & Brewer, 1994).

Drawing images before writing or verbalizing ideas can foster more creative responses and help generate ideas, because often language can slow down the creative process (Caldwell, & Moore, 1991). In addition, it has been stated that exploration of ideas through drawing does not require the cognitive demands often found when using language. Therefore, drawings are usable with adults, as well as children, to explore both conscious and unconscious thoughts, experiences, and emotions. Several researches have also been done related to pre- and in-service teachers' mental models about "science teaching" (Minogue, 2010; Tatar, Yildiz Feyzioglu, Buldur, & Akpinar, 2012; Subramaniam, 2013; Ucar, 2012; Wilke & Losh, 2012), "specific scientific issues" (Chiou & Anderson, 2010; Heywood, Parker & Rowlands, 2013) "technology" (Krauskopf, Zahn & Hesse, 2012; Zhang & Xu, 2011), "ideal teacher" (Mensah, 2011), "environment" (Desjean-Perrotta, Moseley, & Cantu, 2008; Moseley et al., 2010), and "classroom structure" (Matteson, Ganesh, Coward, & Patrick, 2012).

Environmental education research studies have frequently examined the relationships between environmental knowledge, attitudes, behaviors, and literacy. Examples for these studies are Boeve-de Pauw and Van Petegem, (2011), Carrier (2007), Digby

(2010), Evans (2007), Prabawa-Sear and Baudains (2011), Robelia and Murphy (2012), Tal (2010), and Teksoz, Sahin and Tekkaya-Oztekin (2012). There are a few studies about individuals' mental models of the environment (Moseley et al., 2010).

Pre-service teachers will play a critical role as they will be responsible for the education of a significant proportion of the young people in the future. Teachers have also key role for effective environmental education in the classroom and teachers can influence pupils' worldviews and attitudes, their interactions with the environment, participation in decision-making and ability to make informed responsible choices (McKeown and Hopkins 2002). If teachers (or pre-service teachers as teachers of the future) lack knowledge, skills or commitment, it is unlikely that they will succeed as leaders of environmental change in schools and produce environmentally literate students (Wilke 1985; NAAEE 2004). For this reason, in this research, we aimed to investigate pre-service elementary teachers' mental models of the environment.

Research Questions

Two research questions guided this study in pre-service elementary teachers' mental models of the environment. First, "what are pre-service elementary teachers' mental models of the environment?" Moseley and her colleagues (2010) suggested an investigation whether learners' mental models differ according to their age, gender, socioeconomic status (SES) and cultural structure in their report for future researches. Therefore, the second research question is, "Are there a significance between pre-service elementary teachers' drawing scores by their socioeconomic status, gender, parental education level and parental occupation, family income?"

Methodology

Participants and Course Context

Participants in this study were 255 second-year students (n=255; male, n=75; female, n=180) from a state university of Education Faculty, elementary level teacher program. The aim of this program is to prepare elementary teachers for grades 1-4. Two instructors teach the Environmental Education course in third semester of the program in six classes. The Environmental Education course is offered to students after accomplishment other specific science courses (e.g. biology, chemistry). The compulsory course content includes the some issues such as basic concepts and principles of ecology, ecosystems, food chain, food web, habitat, competition, symbiosis, mutual life, survival of life, soil biomes, energy flow, circulation of matter, increasing of population, ecological impact, erosion, deforestation, urban environment, behavioral pollution, environmental pollution, marsh and waste waters, environment-related decision-making, soil and water resources and their management, environmental sensitivity, environmental institutions and organizations in Turkey and in the World.

Research Instruments

To answer the research questions, a survey method was used by an instrument consisting of fixed-response and open-ended sections. The former includes questions to compile participants' demographic characteristics (gender, age, mother's education, father's education, mother's occupation, and father's occupation). The latter section of the instrument (Draw-An-Environment Test, DAET) was asked participants to draw and

define the environment. DAET was adapted by Desjean-Perrotta, Moseley and Cantu (2008) from an instrument was developed by Shepardson (2005). The first part of the DAET has the prompt 'My drawing of the environment is…' with room on the page for a drawing. The second part of the instrument contains the prompt to complete the sentence 'My definition of the environment is…' (Appendix A). Open-ended responses have limitations: They may be short, lack depth, and possibly be difficult to code if the writing is illegible or the grammar or sentence construction is difficult to understand.

Draw-An-Environment-Test Rubric (DAET-R) was used for assessing the participants' drawings. It was developed, by Moseley et al. (2008), using the definition of the environment in NAAAE (2004b) as a filter. There are four factors – humans, other living organisms (biotic), physical environment (abiotic) and built and designed environment – were used as rubric categories for scoring the drawings. The DAET-R is divided into four sections that focus on degree of evidence in the drawings of interactions of the four environmental factors with each other: a) factor not present, b) factor present, c) factor interacting with other factors, and d) two or more factors interacting within a system approach (Moseley et al., 2010). Based on the rubric, it could be assigned degrees of evidence of these factors using a score of 0-3. For example, assessing of drawings regarding to abiotic factor is given in Table 1.

Table 1.

Scores for abiotic factor of rubric from Moseley et al. (2010)

Factor	Non Present	Present	Interactions with other factors	System interactions made explicit	
Abiotic	Drawing does not contain pictures of abiotic factors.	Abiotic items (mountains, rivers, Sun, or clouds) drawn without any apparent interaction with other factors.	Abiotic items drawn interacting with other abiotic items and/or another factor (e.g., wind blowing a palm tree), but without special emphasis placed on the influence of the interaction on the environment.	Abiotic items drawn with obvious deliberate emphasis placed on interaction with one or more factors and the influence of that interaction on the environment through the use of special indicators such as conceptual labels and/or arrows.	Total Score: (…..) from this factor
	0 Point	*1 Point*	*2 Point*	*3 Point*	

For each factor, if the factor is merely present in a drawing, a score of 1 is given. If any particular factor is seen as interacting with one or more factors, a score of 2 is given. If the participant tried to indicate an interaction among factors with an emphasis on a system approach to the definition of environment, a score of 3 is given. A score of zero is given if there was no evidence of a factor in the drawing. For any drawing, a participant can take a total score from 0 to 12. The higher the score, the more evidence there is of the participant's understanding of the environment's interactions between the four factors (Moseley et al., 2010).

The Collection of Data

Data were collected during an Environmental Education course hour in last week of December 2012 (at the end of the semester). Instructors, in six sections of the course for participants, administered the DAET using a common set of directions as printed on the survey. Pre-service teachers first drew a picture of the environment and then wrote their definition of the environment by completing an open-ended sentence. Their drawings were intended to provide not only a complementary source of how they represented their mental models in addition to their verbal reports but also a means of gaining rich information about their inner analogue representations of the environment. No time limit was given to complete the survey, but most of the surveys were completed in an average of 20 minutes. The pre-service teachers' surveys were collected and coded to assure anonymity.

Data Analysis

A descriptive analysis method was used to evaluate data. Initially, the background characteristics of the participants had been recorded and documented in frequencies and percentages. Then, participants' drawings evaluated according to the DAET-R and individual scores were compared and consensus was achieved among the scorers for each drawing. Lastly, data were used to determine frequency of factors and interactions of those factors. Statistical significance was determined using $\alpha = .05$ alpha level. Independent samples t-test and one-way ANOVA were used in data analysis.

Validity and Reliability of the Instrument DAET-R

In order to assess the reliability and validity of the DAET-R, both percent agreement measure and Pearson's product-moment correlation were used to determine the degree of consistency among scorers (Moseley et al., 2010). Analyses have been repeated for re-evaluation of the validation and reliability of the DAET-R. For this study, percent-agreement among the three scorers ranged from 62% to 83% on each factor. Correlation coefficients of inter-rater reliabilities among three scorers were summarized in Table 2.

Table 2.

Pearson's product-moment correlation coefficients (n=255).

Factors	*Scorer 1&2*	*Scorer 1&3*	*Scorer 2& 3*
Human	0,708**	0,753**	0,722**
Living	0,567**	0,523**	0,510**
Abiotic	0,539**	0,406**	0,462**
Built or designed	0,625**	0,744**	0,673**
Overall	0,778**	0,726**	0,760**

Results

Demographic Characteristics

The participants included 255 second-year pre-service teachers. The gender profile of the participants indicates that more than two-thirds are female. Gender data revealed that more women than men took place in the elementary teacher education program. This is in line with Saban's (2003) findings in a Turkish context and with a cultural belief that teaching profession is more appropriate for women than for men (Hatch, 1999). The socioeconomic background of the participants reveals that more than half of the mothers as well as one-thirds of fathers have primary level of education or less, and that the majority of the participants have one-parent working families (See Table 3).

Table 3.

Participants' demographic information

Characteristics	f	%	Characteristics	f	%
Environ. Educ. Background			*Gender*		
Have	19	7.5	Male	75	29.4
Don't have	236	92.5	Female	180	70.6
Secondary schooling			*Monthly income of family*		
General high school	93	36.4	275 USD and below	135	52.7
Anatolian high school	156	61.1	276-550 USD	95	37.5
Foreign Language Supported	6	2.5	551 USD and more	25	9.8
Mother's education			*Father's education*		
Uneducated	17	6.7	Uneducated	0	0
Primary school	146	57.1	Primary school	95	37.2
Middle school	25	9.9	Middle school	43	16.9
High school	46	18.1	High school	74	29.0
Post-secondary	21	8.3	Post-secondary	43	16.9
Mother' occupation			*Father's occupation*		
Housewife	207	80.8	Civil servant	39	15.2
Civil servant	22	8.6	Employee	56	21.9
Employee	8	3.2	Artisan	52	20.3
Farmer	5	2.2	Farmer	33	12.9
Retired	9	3.6	Retired	65	25.2
Unemployed	4	1.6	Unemployed	10	4.3

Drawing Scores of Factors

The scores of drawings for each factor in frequencies and percentages were summarized in Table 4.

Table 4.

Frequencies and percentages of the factors in drawings.

Factors / Points	Human		Living Things		Abiotic		Built	
	f	%	*f*	%	*f*	%	*f*	%
0	64	25.1	20	7.8	26	10.2	47	18.4
1	111	43.5	181	71.0	182	71.4	83	32.5
2	68	26.7	49	19.2	43	16.9	116	45.5
3	12	4.7	5	2.0	4	1.6	9	3.5

Humans; Table 4 suggests that some pre-service elementary teachers do not consider humans to be an integral component of the environmental system. A quarter part of the participants' drawings didn't contain any human image (Fig. 1). Forty-four percent of them drew humans with no obvious interaction with other factors in the environment. Thirty-one percent of the participants drew humans interacting with other factors. Only 5% actually indicated any kind of system approach in their drawings of human.

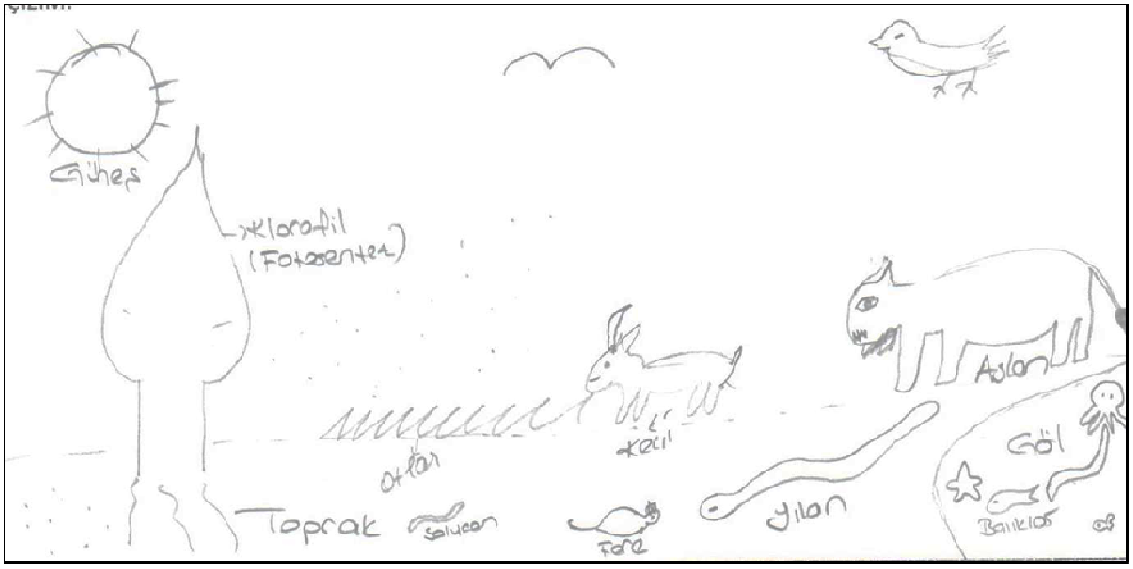

Figure 1. A drawing example does not contain the human

Living Things; In Table 4, eight percent of pre-service elementary teachers don't consider living things (cat, dog, fish, cow, tree, flower, etc.) to be component of the environmental system (Fig. 2). Seventy-one percent of the participants drew living

things with no obvious interaction with other factors in the environment. Twenty-one percent of the participants drew living things interacting with other factors. Only two percent of them actually indicated any kind of system approach in their drawings of living things.

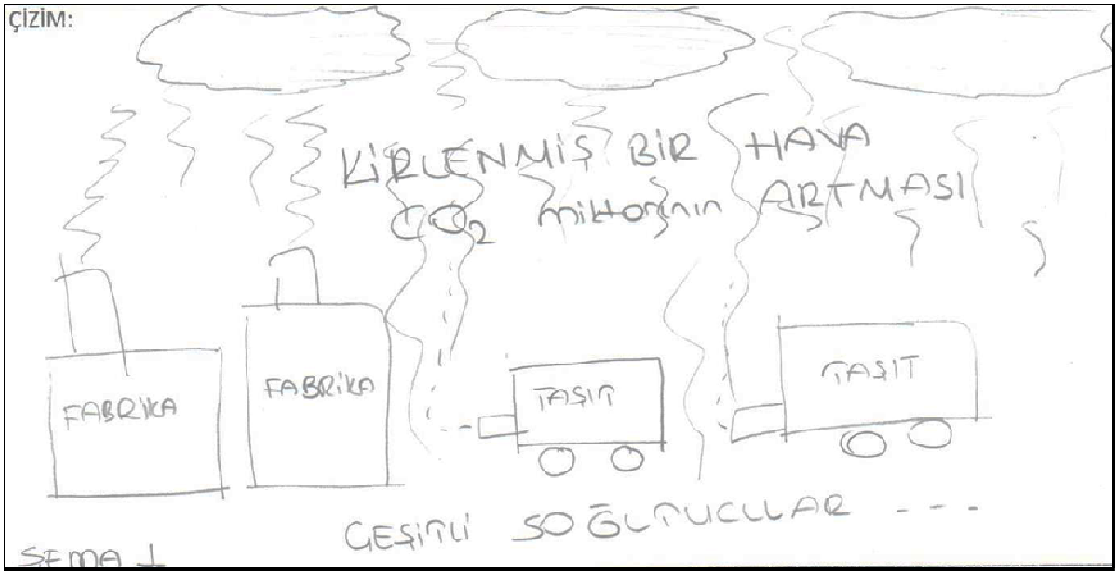

Figure 2. A drawing example does not contain living things

Abiotic; According to Table 4, ten percent of participants do not consider abiotic components (e.g. mountain, sun, cloud, river, etc.) as a part of the environmental system (Fig. 3). Seventy-one per cent of the participants drew abiotic components with no obvious interaction with other factors in the environment. Seventeen percent of the participants drew abiotic interacting with other factors. Only two percent of them actually indicated any kind of system approach in their drawings of abiotic (non-living).

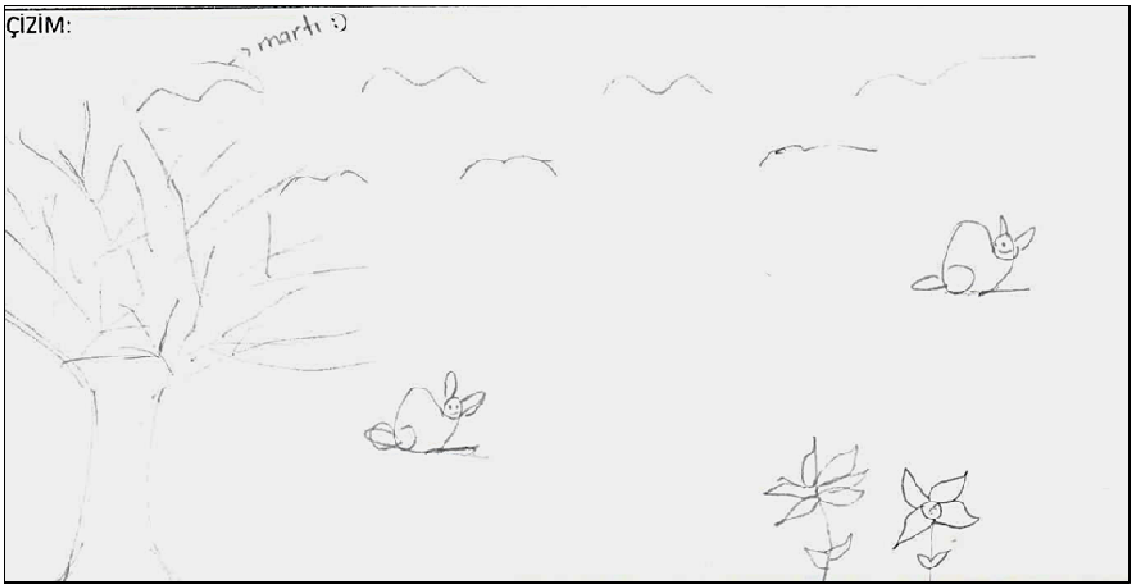

Figure 3. A drawing example does not contain the abiotic components

Human Built or Designed Objects; According to Table 4, eighteen percent of the pre-service elementary teachers don't consider human built or designed objects (e.g. factory, car, building, etc.) as a component of environmental system. Thirty-two percent of the participants drew objects with no obvious interaction with other factors in the environment (Fig. 4). Forty-nine percent of the participants drew human built or designed objects interacting with other factors. Only four percent of them actually indicated any kind of system approach in their drawings of human built or designed objects.

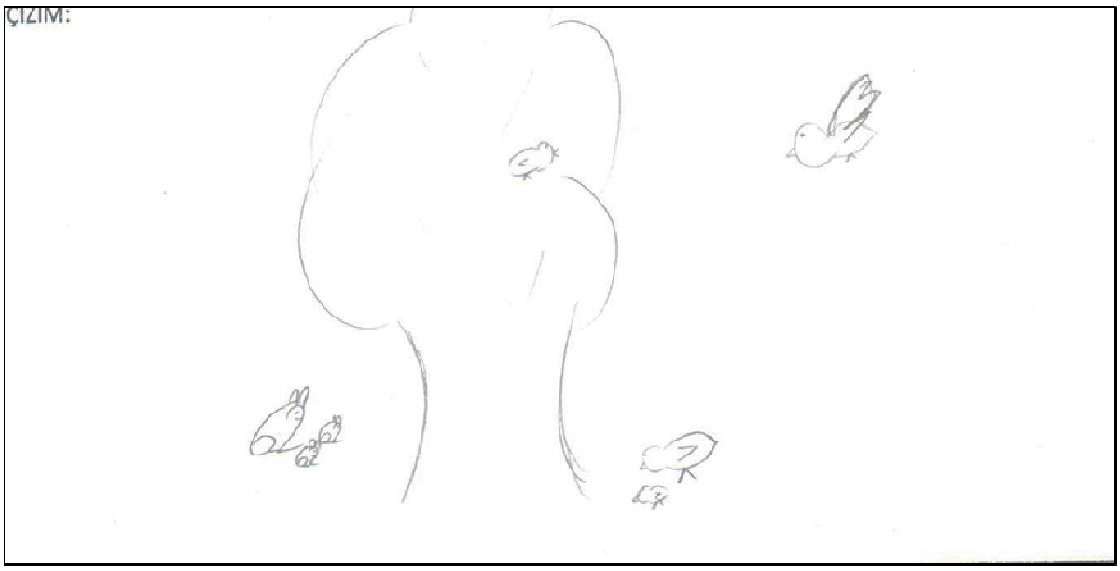

Figure 4. A drawing example does not contain built or designed objects

Participants' total scores of drawings were divided into three broad categories; Model 1: one or more factors present, Model 2: one or two factors interacting with another factor, and Model 3: two or three factors interacting within a system approach (Table 5). These categories were defined for the participants' mind models. Model 1 has one or more factors, 43.5% of participants have this model. Model 2 has one or two factors interacting with another factor and 52.5% of participants have this model. Model 3 has two or three factors interacting within a system approach. Only 4.0% of participants have this model.

Table 5.

Frequencies and percentages of total scores in three categories

Total Points	*Categories*	*f*	*%*
0-4	Model 1: Factor present	*111*	43.5
5-8	Model 2: Factor interacting with other factor	*134*	52.5
9-12	Model 3: Factor interacting with two or more factor with system approach	*10*	4.0

Forty-four percent of the drawings scored a four or less points, indicating factors the lack of one or more factors in the drawings. Only four percent of the drawings scored 9-12 points, indicating factors depicting interactions within a system approach. That is, ten participants at least in one factor, presented interaction with system approach. In fact, there is no any drawing scored 12 points.

Total Scores and Socioeconomic Characteristics

The mean scores of males and females are compared with independent samples t-test (Table 6). Results show that mean scores do not differ between males (M=4.93, SD=2.00) and females (M=4.61, SD=2.11) at the .05 level of significance (t=1.149, p=.252). Although there is not a significant differences between means, on average score of females is higher than the score of males.

Table 6.

t-test results of total scores by gender of participants

Gender	*M*	*SD*	*n*	*t*	*df*	*p*	*95% CI for Mean Difference*
Male	4.93	2.00	75	1.149	253	.252	-0.234, 0.889
Female	4.61	2.11	180				

p > .05

The mean scores of participants who have or not have environmental education background compared with independent samples t-test (Table 7). The results of analysis show that mean scores does not differ between the participants who have environmental education background (M=5.00, SD=1.97) and the participants who have not background (M=4.68, SD=2.09) at the .05 level of significance (t=0.650, df=253, p=.517). Although there is not a statistically significant difference between mean scores, on average score of participants who have environmental education background is higher than the participants who have not.

Table 7.

t-test results of total scores by environmental education background of participants

Env. Educ. Background	*M*	*SD*	*n*	*t*	*df*	*p*	*95% CI for Mean Difference*
Have	5.00	1.97	19	0.650	253	.517	-0.654, 1.298
Not Have	4.68	2.09	236				

p > .05

Analyses were completed using one-way ANOVA with the mean scores of participants by graduated high school, parental education levels, occupations and their family income. Analysis of mean scores did not reveal significance by high school type [F(2.252)=0.164, p=.849], by the fathers' [F(3.251)=0.970, p=.407] and mothers' [F(4,249)=1.917, p=.108] education levels. Analysis of mean scores did not reveal significance by their mothers' occupations [F(5.248)=0.788, p=.559], but did reflect a significant effect of their father's occupations [F(5.249)=2.531, p=.029]. Post hoc comparisons using Tukey HSD test indicated that the mean score of the participants whom father's occupation is artisan (M=5.42, SD=2.17) was significantly different from than the mean score of the participants whom father is retired (M=4.29, SD=2.12). There was not a significant effect of family income [F(2.252)=2.217, p=.112] on mean scores of participants.

Discussion

The aim of this study is to examine pre-service teachers' perceptions about the environment and whether the mean scores differ regarding to several variables or not. For this purpose, drawings of the environment and demographic characteristics of pre-service teachers have been collected. Moseley and her colleagues (2010) also offered an investigation about how learners' mental models affected by age, gender, socioeconomic status (SES) and cultural structure in their research for future researches. The relationships among some of these variables were investigated in this study and the obtained results were reported. Even though the mean score of pre-service teachers does not differ significantly by gender, mean score of females was higher than of males. For this reason, we can say that the females are more responsive for environmental issues rather than males. It has been found that the girls were more sensitive to environment than boys (Taylor et. al., 2007), some studies have reported gender differences, with males scoring higher in environmental knowledge (Coyle, 2004; Kollmuss & Agyerman, 2002; Tikka et al., 2000).

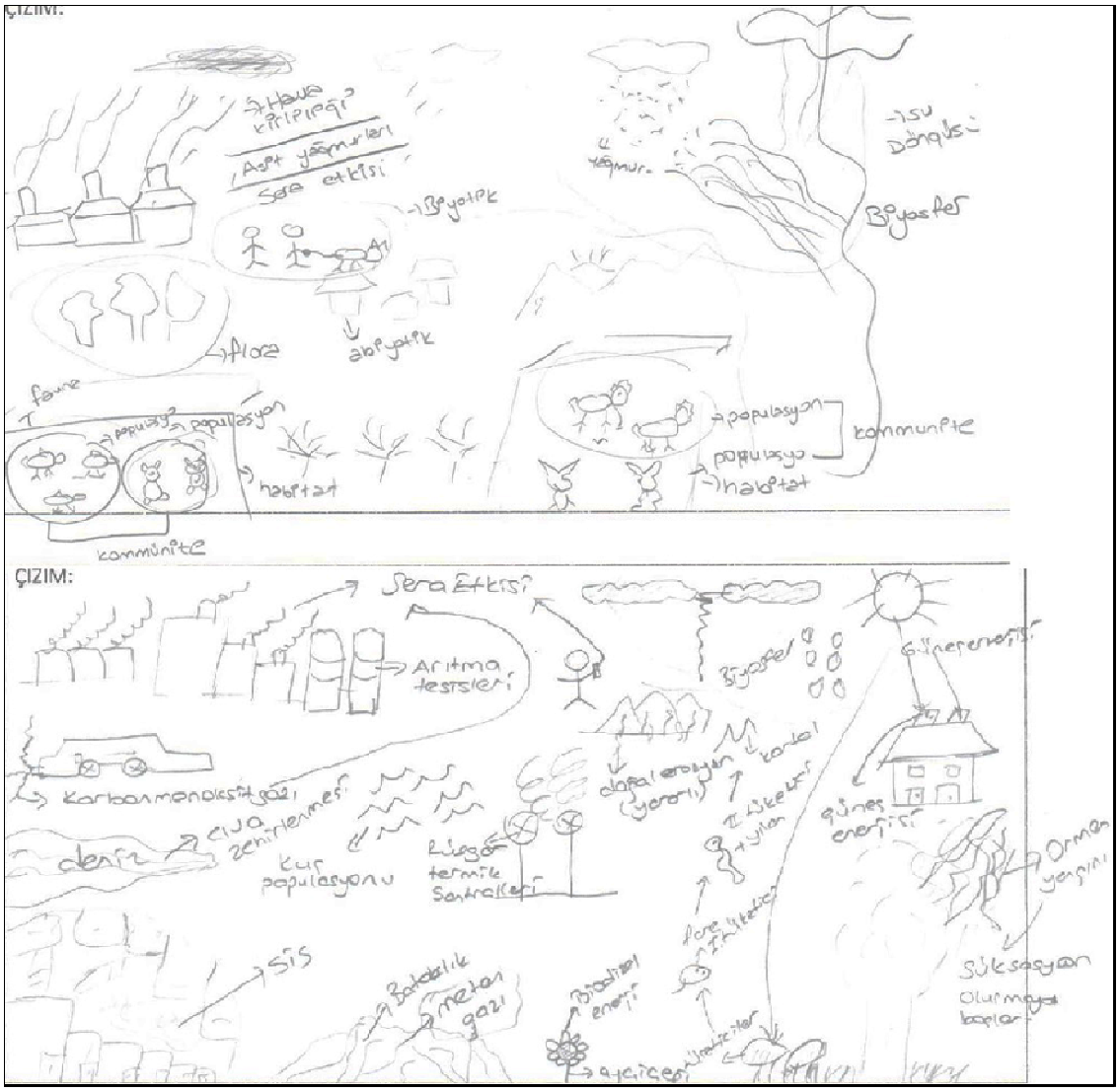

Figure 5. Drawing examples have high total scores

Another result is average scores of participants do not differ by their family income, and educational levels of their parents. Although there is no significant effect of environmental education background on average score, participants with environmental education background have higher scores than who have not.

Another result of this study is majority of pre-service teachers perceive the environment as abiotic and living things. It is an impressive result that few participants' drawings included humans as a part of environment. In the literature, it has been put forwarded that students perceive environments as living area (Burgess, & Mayer-Smith, 2011; Köşker, 2013; Wilhelm, & Schneider, 2005). Furthermore, the results of this research get along with the literature. In this study, when the pre-service teachers' drawings were investigated, it has been seen that the majority of drawings included polluting elements and facts (factory, motor vehicles, etc.). Thus, it can be said that most of them have awareness about environmental pollution and polluting factors. Environmental issues which known as the vast majority derived from human-induced factors are not only problem of a country but also the entire world's problem. Melting of glaciers, the increasing number of extinctions and climate change that we couldn't

explain the meaning threats both our planet and living things. Because the best part of the cause of environmental problems are arisen by the humans, we need to think about the reasoning requirement whether all individuals, including especially teacher candidates have this environmental consciousness or not. Otherwise, future generations will not be as lucky as we about the environment.

Teaching actual cause of environmental problems to the individuals is very important for a sustainable environment. Creating this awareness and giving this responsibility for future generations depends on consciousness about sustainable environment of teachers as architects of the future. This situation reveals that the importance of environmental education in education faculties. Environmentally knowledge and skills of future teachers will be herald for a healthy environment.

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APPENDIX 1.

Draw an Environment Test (DAET)

Date: _____ ID#_____

In the space below draw a picture of what you think the environment is. Below that, please provide your definition of the environment (in words).

My drawing of the environment is:

My definition of the environment is:

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RESEARCH ARTICLE

Sınıf Öğretmeni Adaylarının Çevreye Yönelik Zihinsel Modellerinin İncelenmesi

Fatma TAŞKIN-EKİCİ
Pamukkale Üniversitesi, Denizli, TÜRKİYE

Erhan EKİCİ
Pamukkale Üniversitesi, Denizli, TÜRKİYE

Hulusi ÇOKADAR
Pamukkale Üniversitesi, Denizli, TÜRKİYE

Özet

Bu çalışmanın amacı sınıf öğretmeni adaylarının çevreye ilişkin algılarının incelenmesidir. Çalışmada tarama yöntemi kullanılmıştır. Çevre eğitimi dersinin verilmesinin ardından 255 öğretmen adayına kapalı uçlu bir ölçek ve Çevre Çizimi Testi (Draw-An-Environment Test [DAET]) uygulanmıştır. Öğretmen adaylarının çevreyle ilgili olarak sahip oldukları zihinsel model ya da imgelerin değerlendirilmesinde bir rubrik (DAET-R) kullanılmıştır. Çalışmanın sonuçları katılımcıların çevreye ilişkin zihinsel modellerinin eksik olduğunu ortaya koymaktadır. Katılımcıların büyük çoğunluğunun çizimleri canlı ve cansız çevreyi yansıtmaktadır. Az sayıda çizim çevrenin bir parçası olarak insanlara yer vermektedir. Sonuçlar, ortalama puanların cinsiyet, çevre eğitimi geçmişi, lise türü, ebeveyn eğitim düzeyi, ebeveyn mesleği ve aylık aile gelirine göre farklılık göstermediğini ortaya koymaktadır.

Anahtar Kelimeler: Zihinsel model, çevre, eğitim, aday öğretmen, çizim

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*Corresponding Author: Fatma TASKIN-EKICI,
E-mail: fekici@pau.edu.tr