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Ecological Dynamics Model and Ecopedagogy-Based Outdoor Experiential Education

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Abstract

Environmental awareness is evaluated related to cognitive and affective areas so it might be considered one of the important points in order to predict environmental behavioural change. One of the behavioural change models is ecological dynamics model (EDM) and this model's characteristics overlap with ecopedagogy-based outdoor experiential education (EOEE) and the titles of Agenda 21. The aim of this study is to examine the efficiency of an EOEE program intended for in-service teachers on environmental awareness and to evaluate EDM within EOEE. Mixed methodology was used and the data were collected by an environmental awareness scale, participants' diaries, non-participant observation, and meeting documents. The study found that the participants developed environmental awareness and tended to have holistic perspective at the end of the education. It is come up with that holistic perspective may be added to the EDM and this model can be checked out by mathematical models such as structural equation modelling.

Keywords: ecopedagogy, ecological dynamics model, environmental awareness, outdoor experiential education, in-service teachers

Introduction

The main aims of environmental education for sustainable development according to Agenda 21 are to achieve improvement of environmental awareness, values and attitudes, behavioural change and participate in decision making process (UN, 1992, 320). Agenda 21 emphasizes some other important points in order to increase environmental awareness: in-service teacher training programmes (p. 321), curricula which is based on activities (p. 323), a multidisciplinary approach (p.321) and innovative teaching methods (p.322). 36.24 (p.328) coded title mentions an 'exchange of experience concerning training and awareness programme' and this title is the spark point and the main scope of this research.

Achieving environmental behavioural change is not easy therefore the research in environmental pedagogy focuses on some steps such as environmental knowledge, environmental awareness or environmental attitude. Some researchers have also come up with models (US linear model; sociological models; altruism, empathy, prosocial behaviour models, model of pro-environmental behaviour, EDM) in order to achieve behavioural change (Burges, Harrison & Filius, 1998; Eisenberg & Miller, 1987; Kollmuss & Agyeman, 2002; Brymer & Davids, 2013).

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Kollmuss and Agyeman (2002, 257) especially place 'environmental awareness' into the pro-environmental behaviour model. The distinctive points of this model is to evaluate environmental awareness either with a knowledge- based component (cognitive) or perception based component (affective). Hence this study tries to interpret 'environmental awareness' an important point to predict behavioural change because environmental awareness affects both learning areas and might be seen as a bridge between cognitive and affective learning areas to kinaesthetic area. The aim of this study is to examine the effects of an outdoor environmental education programme on the environmental awareness of in-service teachers. Following that the paper will discuss the ecological dynamics model and evaluate the use of an ecopedagogy philosophy in order to develop an outdoor education programme.

Ecological dynamics model (EDM)

The environmental issues in environmental pedagogy are very complex (Misiaszek, 2015). Brymer and Davids (2013) suggest to use EDM in order to overcome this complicated way. EDM is based on experiential learning and has three important points: individual learning, environment (social and physical), and task. According to this model there is not any 'one size fits all' environmental educational programme because the background of every person is different to each other therefore outputs of people might be varied. People even can reflect same output in a different timescale. In addition, acquisition of people can be achieved by direct social (social environment) and natural environment (physical) interactions. People should be in a social dialog and carry out directly activities in nature. Moreover, these activities should be related to the daily life and people should be a part of the activities (Brymer & Davids, 2013). Brymer and Davids (2013)'s article only explains the theoretical framework of this model. However the characteristics of EDM overlap with EOEE and the title of Agenda 21. (Table 1)

Table 1.

Comparison of Agenda 21, EOEE, and EDM

	The title of Agenda 21	*EOEE*	*EDM*
a. Aim group	In-service teacher	In-service teacher	Individual learner
b. Programme characteristics	Curricula based on multidisciplinary approach and activities	Ecopedagogy-based curricula with community in practice	Environment -Social environment -Physical environment
c. Method	Innovative teaching methods	Outdoor experiential education	Task

EOEE (Ecopedagogy-Based Outdoor Experiential Education) Programme

The main aims of Agenda 21 refer to transformation of the society (Misiaszek, 2015). However this transformation is related to critical thinking about how to solve socio-

environmental problems. There are two main points here: society and environmental problems. Misiaszek (2015) points out that ecopedagogy is a valuable pedagogical perspective in order to understand and teach complex relationships between society and nature. EOEE is therefore one of the pedagogical tools in order to teach environmental issues.

EOEE programme with community of practice is the social side of this research. Ecopedagogy is a critical approach towards political, ideological and economic events within education (Antunes & Gadotti, 2009; Kahn, 2010). The key points of ecopedagogy include protection of natural environment (natural ecology), the impacts of human upon environment (social ecology) as well as the influence over civilization and economic, social and cultural composition (integrated ecology). The social interaction side of EOEE programme is community of practice.

Etienne Wenger has also put special emphasis upon education within a society. Etienne Wenger's (2004) conceptualization of 'community of practice' is defined as a learning of cooperation with a constructive approach (Johnson, 2001) and is considered as restructuring of the knowledge by praxis in a social environment (Baran & Cagiltay, 2006). In fact, community of practice is not a new perspective. Even though it was first introduced in the field of industry, this perspective is said to be traceable back to many centuries ago (Wenger, McDermott & Snyder, 2002). Community of practice is first determined as a field of subject which gather a group or community together; a group of people sharing the same goals and ambitions; the knowledge is learned via cooperation which is based on practice; knowledge and abilities are shared and may transmit from person to person (Wenger. 2004).

The features of the community of practice and the goals and content of the EOEE overlap in many respects. In the EOEE, a group of selected participants are gathered together to make sure that they learn the language of nature and subsequently develop holistic approach (Ozaner, 2004). In terms of selected participants, Misiaszek (2015) especially emphasizes that ecopedagogy might be use in teacher education because teachers should teach complex environmental issues rather than environmental knowledge. Three major titles stand out here: (a) a group of selected participants such as in-service teachers, (b) EOEE, (c) learning by practice. These three titles are also the main components of TUBITAK (The Scientific and Technological Research Council of Turkey) 4004 coded projects at the same time. In addition, TUBITAK has been financed EOEE programs intended for in-service teachers since 1999 (Erentay & Erdogan, 2009) in Turkey and expects projects to explain complex environmental issues with activities in nature via daily speech.

Literature review

There are studies related to EOEE intended for teachers within TUBITAK projects however the studies related to experimental application of EDM are very limited (Okur-Berberoglu, 2014). This research is just limited within TUBITAK 4004 coded projects because these projects are based on EOEE and the community of practice.

Guler (2009) managed an outdoor experiential education projects intended for in-service teachers in 2008. There were 24 in-service teachers at the project which was for 12 days. The aims of the research were to figure out expectations of in-service teachers from the project, to determine self-efficacy level of teaching about environmental subjects, and to determine the change of personal ideas about environmental education. The project data was collected by semi-structured interview and analysed by discourse analysis. As a result, the participants disclosed that their expectation form project was to have environmental knowledge, and they had it. They

also expressed that they were very glad to have favourable perspective to the world, they sensed more responsible to the natural environment, and they would explain and teach what they had learnt.

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

Eryaman, Yalcin-Ozdilek, Okur, Cetinkaya, and Uygun (2010) managed an outdoor experiential education projects intended for in-service teachers in 2009. The project was for 10 days. The participatory action research was used. The aim of the project was to determine tendency of the participants to take active role in order to solve environmental problems. As a result, the researchers found that the participants were very enthusiastic in order to take active role in order to solve any environmental problem. However the researchers stated that they could not follow up the participants. This was the limitation of the research.

Yalcin and Okur (2014) carried out an experiential education about electromagnetic area (EMA) within an outdoor education project in 2010. The project was ecopedagogy-based and for 10 days. There were 24 in-service teachers as participants. The triangulation mixed methodology was used within a case study. The participants were followed up after six months. The data was collected by the electromagnetic field awareness scale, diaries of the participants, the interview documents and 6th month following up data. It was identified that the participants' awareness was developed throughout the education and they tended to be careful about using of electrical devices in their daily life.

Okur-Berberoglu (2014) examined whether EDM within an EOEE programme was successful in order to achieve ecological behaviour change, direct and indirect actions. She carried out an EOEE project intended for teachers in 2011. The project was for 10 days and 24 in-service teachers joined to the programme. The qualitative approach was used within a case study. The participants were followed up after six months. She found that EDM within an EOEE programme was successful in order to achieve ecological behaviour change, direct and indirect actions.

Okur-Berberoglu (2015) tried to determine the effect of an EOEE on environmental awareness. The methods of the research was one group pretest-posttest quasi-experimental design without control group. The methodology of the research was quantitative approach. An awareness scale was carried out to 27 in-service teachers. The coefficient of Cronbach reliability was 0.891. The total scores having from pretest and posttest were analysed by Wilcoxon signed rank test, and a statistically meaningful difference was found. According to this result, EOEE was effective in order to increase environmental awareness.

As seen above the research aimed different points of the environmental education but none of them mentioned EDM except Okur-Berebroglu (2014)'s study. The aim of this study is to examine whether EDM within an EOEE programme is successful in order to develop environmental awareness.

Method

The data of this study was gathered from the project, of which it is named as 'Ecology in Canakkale and Suburbs, 2010.' Triangulation mixed methodology within a case study was used in the research. Qualitative and quantitative data were collected simultaneously.

Education programme

The education program was designed as an academic programme for 10 days in line with the ecopedagogic approach as well as the objectives of the science-society projects (TUBITAK Call for Paper 2010, 1-2). The goals of the academic programme are to ensure that the participant becomes part of the knowledge, perceive the nature as a whole and think like a scientist (McNeil, 1996). Within the academic program, knowledge and information are disseminated from simple to complicated version and connection with the other disciplines (McNeil, 1996). Bruner (1966) also expresses support for an academic perspective for the programs. The biggest criticism to the academic program is that no every teacher can be as knowledgeable as a scientist in any given subject (McNeil 1996). However, the educators were picked up in terms of community of practice. Different scholars from 21 different disciplines were brought together to create a learning environment of social and cognitive perspectives within the same goal.

The subject matters of the project included production of compost out of domestic organic waste, vertebral animals in Canakkale and its nearby towns, the geological history and outlook of the same vicinity, the endemic flora in the region, the river ecology, its importance and features, the Troy National Park since the Prehistoric era, ethno-botanic, seaweed and their crucial importance, the historical importance of Canakkale, underwater and sea ecology, underwater scuba-diving, ecotourism, the climate and aerial aspects of the region, electromagnetic field created by man and environmental safety and health, astrophysics, Can coal basin and water resources, ecological footprints, the role of insects in protection of the nature and biological combat, and deep ecology. For example the educator who lectured the 'vertebral animals in Canakkale and its nearby towns' lesson directed an activity at Kalkim Village. The educator demonstrated how to catch a vertebral animal at the area and wanted the participants to catch some vertebral animals. The participants found mostly tortoises and lizards but could not find any snake therefore the educator used the snake samples which were fixed in formaldehyde in order to show to the participants. (App 1)

Quantitative data collection and environmental awareness scale

Quantitative data was collected by an environmental awareness scale. The explanatory and confirmatory factor analysis were carried out in order to develop the environmental awareness scale. It was found that factor loads of items were 0.30 or above, the KMO was 0.867, the Bartlett Dimensionality test was 0.000, Cronbach Alpha reliability coefficient was 0.826.

Goodness of fit results were X2 /sd: 2.84, RMSEA: 0.073, SRMR: 0.056, CFI:0.90, IFI:0.90, GFI:0.91, and AGFI:0.87. These results confirmed that the validity and reliability of the scale was 'good' (Sencan, 2005; Buyukozturk, 2007) and the scale was theoretically strong (Simsek, 2007). The awareness scale had one dimension and it

was named as 'human ecology'. The last version of the scale was shown at Appendix 3.

Data analysis

Kolmogorov-Smirnov, Wilcoxon signed-rank, and effect size were calculated for the data analysis. Normal distribution of the data was checked out by Kolmogorov-Smirnov test. This test is preferred to confirm that the data do not show a normal distribution even if the number of samples in the research is less than 30. If 'p' significant value is above .05 within Kolmogorov-Smirnov test, it means that the data shows normal distribution (Buyukozturk, 2007). The p value was less than 0.05 within Kolmogorov-Smirnov test in this research therefore it was decided that the data did not show normal distribution and non-parametric tests were used for the analysis.

The data of the pre-post tests were analysed by the Wilcoxon signed-rank test. This test is used within repeated measures which are carried out to the same group and the data do not show normal distribution. The effect size was also calculated in order to evaluate the impact of independent variable on dependent variable. (Peers, 1996; Huck, 2004; Buyukozturk, 2007).

Qualitative Data Collection Method

Yildirim and Simsek (2006) emphasize that qualitative approach is an effective tool in order to better understand human behaviour. They also note that case study is a useful method in order to collect data on events and individuals (Yildirim & Simsek, 2006) and to draw definitive and explanatory conclusions (Morgan, Hamilton, Bentley, & Myrie, 2009) within qualitative approach. It is also underlined that case study is a reliable method in the literature to have a deeper understanding of the events (Schmitt, 2005; Yildirim & Simsek, 2006; Mitchell, 2008; Robinson, 2008).

The qualitative data was collected by participants' diaries. The researcher asked them to write down on a daily basis what they had learnt during the day, how they were planning to use these skills in their daily and professional lives, and how they felt about their daily acquisitions. It was aimed that the participants could make an independent and impartial comment on the programme and activities (Morgan et al., 2009). Morgan et al. (2009) note that individuals may express themselves more accurately when they make expressions independently and freely. A project meeting was held with the participants at the end of the programme. It was asked them to share their experiences about what was the most influential and amazing part of the project for them, and how they would plan to share their acquisition in their social, professional, and daily life in the future. The meeting was tape-recorded and transcribed after the meeting.

It is noted that additional techniques should be used in order to have more reliable qualitative data (Yildirim & Simsek, 2006; Morgan et al., 2009). One of these techniques is observation (Zanovello, 1999). Bas and Akturan (2008) recall that researcher might not be able to spend his/ her whole time with the participants or that the participants may act differently when they are with the researchers. Hence the project director and 4 project assistants observed the participants during the programme and took notes. At the end of the project, the diaries, the transcripts of the meeting, and the observation notes were analysed by content analysis.

Participant selection

TUBITAK wants greater involvement and participation of students, teachers, and civil servants who work in rural areas as well as graduate students in the target group for an

effective and reliable outcomes. The call for application in 2010 asked participation of the teachers working in the Darüşşafaka Education Institution, Childcare Institution regional boarding schools (YIBO) (TUBITAK Invitation Paper, 2010, 3). The priority was given to the teachers from the YIBO schools.

A survey was designed in order to select participants. A paper which explained the aim of the project and the survey e-mailed to all primary and secondary schools' e-mail accounts. It was asked the in-service teachers to write down an essay related to why they wanted to join to the project. All essays were collected via e-mail. The project director selected the participants according to the essays. She especially focused on learning enthusiasm of the participants about environmental subject on the essays. The total number of participants in the project was 24; 13 of them were male, 11 of them were female. The demographic characteristics of the participants were presented at Appendix 2.

Findings

It was found that there was statistically significant differences between pre and post-tests of the participants ($z = -2.665$, $p<.05$, r: 0.55, Table 2). It was evaluated that EDM within EOEE programme had high effect in order to increase environmental awareness. The following statements also supported this finding.

Table 2.

Comparison of the pre/ post tests total points by Wilcoxon signed-rank test

Post-test-pre test	*n*	*Mean Rank*	*Sum of Ranks*	*z*	*p*
Negative line	6	7.42	44.50	-2.665*	.008
Positive line	16	13.03	208.50		
Equal	1				

* Based on negative lines

Participant no 3 made the following statement after solid waste activity. He explained how raised his environmental awareness:

I have had first-hand information during the education about solid waste, how they emerged and how it should be handled and destroyed. I never realized how it was processed in our country; I had opportunity to ponder over how it was recycled or how its harm to the environment was minimized.

3rd participant mentioned second activity which was called 'Compost production from home waste' in the programme. The participants carried out compost process during the programme. The project team collected organic waste except meat from the hotel's kitchen. The participants collected dry grass from the hotel garden and filled up a container with the organic waste and dry grass. They also set up an oxygen motor into the container and measured the temperature of the inside of the container every day. At the end of the programme the participants evaluated the last form of the compost and temperature change with the lecturer. The lecturer especially emphasized the local and global effects of the compost and waste management, and daily life effects of them.

'Electromagnetic area (EMA)' activity had also impact on improving environmental awareness. It became apparent that the education on human-made EMA has

influenced the participants. During the training, the participants received theoretical knowledge while they also have experienced the electromagnetic influence and the power of the household applications such as computer and hair drier. Participant no 7 made the following statement on EMA:

I realized that we have intense contact with electromagnetic area. We live with the tools that we call indispensable. I learned what sort of measures I could take. I was particularly amazed by the potential danger posed by the hair drier.

The participants measured EMA level of some daily life devices, cables of wind stations, and cables of the classroom by a gaussmeter. People have installed electrical cables in a room or under soil. We do not see these cables however EMA spreads out over soil or wall. People have to use the electrical devices in their daily life but also learn how to protect themselves or minimize the negative effects of EMA. It is so clear that people are impressed very much when they are exposed to some negative effects directly. The activity was very impressive because they can see directly the invisible effect by the gaussmeter.

The other most inspiring activity was the 'Vertebras in and around Dardanelles'. Participants no 1 referred to this activity and said that it changed their minds on nature.

Participant no 1 made the following statement on the matter:

…..I had prior prejudices because I was not good at the animals; this has significantly changed owing to the professor. I never put myself in the place of the animals. I learned some new terms on vertebral animals. I went beyond my limitations in the practice session. I even touched a snake. I was pretty nervous before the class; but now I am perfectly fine. I also acquired extensive information on how to discern these animals.

The participants went to Kalkim region for this activity. The lecturer firstly explains how to catch a vertebrata around this place and wanted participants to catch a vertebrata. The participants caught turtles and lizards. They could not catch snake because of applying activity in the morning time. The lecturer also brought fixed specimens and some of them firstly touch to a vertebrata or snake. The most interesting specimen for the participants was to see lizard without tail because they thought that every creeper thing without tail was a snake. Most of the people put down these lizards although they were harmless. The participants had knowledge and were aware of importance of these animals for the world because they also learned the meaning of 'endemic species'. Participant no 2 made the following statement on the importance of endemic:

The notion endemic has been involved in my life. I have a better appreciation of how the species are protected, under what conditions they are hurt. I will teach this to my students to raise better climbers.

The other important activity was the 'Deep ecology'. In fact this activity covered all the other activities. It may be considered a kind of ecological philosophy. 9th, 11th, 15th, and 23th participants reflected their environmental awareness within the deep ecology at the last meeting of the programme. Participant no 9 made the following statement on his environmental awareness:

People develop attitudes towards the nature based on their profession or experiences; for instance, I majored in physics; after that, I took some advanced education. I realized that everybody here was devoted to education on a voluntary basis. Of course, I already knew that I had a lot to catch up during this process. I was particularly aware that my knowledge on biology was pretty poor; so during the course, I had a chance to fill this gap. I think I did amazing in this endeavour. Like I said, I tended to think by formula; but it is amazing to see that there are a lot in the nature affecting everything

going on around you. So this course has been particularly helpful to me in understanding the nature and the universe.

Participant no 11 expressed his feelings on awareness as follows:

I talked to my friends before; I am actually fond of nature; I truly love animals, the flowers, the trees and the plants; I really care about the nature. I remember myself sobbing because I witnessed mass killing of street animals. Because I am extremely concerned about the environment, I am really careful about dumping and littering. But I did not know I had actually a lot more to learn; this course made me realize there are a lot more to think about on nature and environment. This project made me see that the circle was actually bigger and larger than I used to think.

The following was a statement by participant no 15 on his environmental awareness:

Above all, I should note that the biggest benefit of this programme is its ability to address my prejudices. I have often stood against the people's reaction against, say, gold mining, or exploitation of natural resources for energy. I assumed that somebody was actually manipulating these people. I still think this is actually a possibility in at least some occasions. But I noticed during the project that such activities actually do harm on nature and the natural habitat of animals down there. I always say this: Turkey is more important to me; but it turns out the future of these animals was also important; and I realized this at this programme.

Participant no 23 siad his integrated approach towards nature by reliance on the notion equality:

I realized that I had some prejudices I have to get rid of. Everything in the nature plays a role whether you like it or not. All living things in the world are equal.

It was obvious that EDM within EOEE has increased environmental awareness of the participants and they have started to get holistic perspective to the natural environment. They realized that we were not alone in this world and universe (9^{th} and 23^{th}) and the environment was a complicated system with the biotic and abiotic components. In other words, these expressions were related to human ecology.

Discussion and Results

First and foremost, it was found that the EDM within EOEE was successful in order to develop environmental awareness. This result is coherent with the literature (Keles et al., 2010; Yalcin & Okur, 2014; Okur-Berberoglu, 2015) however the research did not mention EDM. It is obvious that the EDM and EOEE have similar theoretical framework (Table 1) and also the main characteristics of the EDM and TUBITAK 4004 coded projects overlap. Brymer and Davids (2013) just explained theoretical framework of EDM therefore at the first stage I examined the EDM on TUBITAK projects however these findings should be confirmed with other research. EOEE might be evaluated in terms of a kind of application of EDM.

Moreover, Okur-Berberoglu (2014) found that the EDM was successful in order to achieve behavioural change, direct, and indirect actions however only one result is very insufficient. She also followed up the participants after six months. In addition, the most remarkable limitation of this research was that not to have following up process. Following up process is important in order to determine behavioural change however I could not follow up the participants because of the project conditions. Researchers may investigate long-term effects of the EDM and EOEE in terms of environmental awareness, holistic perspective or behavioural change. Above all, it is obvious that the EDM and EOEE have common points and these points should not be ignored.

EDM focuses on individual learning however it also comes up with learning might be happened in a social area. An educational programme was carried out in this research however it does not mean 'one size fits all' because EOEE is based on critical thinking. It was succeed to increase environmental awareness, on the other hand individual outputs might be different to each other. The participants mention different subject (Findings). It might be related to the field of interests. David Irwin (2010) emphasizes that the role of educator in an outdoor experiential education is to stir the mind about environmental subjects/ problems; not to say what is true/ false. The participants should think ontological at the end of programme what I can do for the environment (Okur, 2012). Every environmental behavioural change model should be tested. Chawla (1999, 24) says that researcher cannot find a final unchanging behavioural model because each research has a social side. If there are almost 8 billion people all over the world then we may have 8 billion outputs. It was understood that the education programme of this study could stir the participants' mind about the complex relationships among the environmental subjects.

Furthermore, the participants tend to get holistic perspective within environmental awareness at the end of the programme. The views of the participants no 9, 11, 15 and 23 particularly confirm that some progress is made with the respect to development of a holistic approach. Participant no 9 majored in physics and currently works as a teacher of science and technology. He noted that they were trying to explain everything by formula and equations in physics education, adding that he realized at the programme that there were a lot of variables that require something greater than equations and formulae. This is further testified by a statement that participant no 11, a math teacher, made. McCallum (2008) recalls that reliance on a positivist approach to explain the universe via equations in the history of science has negatively affected the integrity of the nature. In other words, one single event may lead to several conclusions or vice versa. Participant no 15 realized that he was able to identify the complex relationship between the industry and ecology. In other words they are able to discern taking a look and seeing. This result is very impressive because the aim of the research is to increase environmental awareness however the environmental awareness explanation of Kollmuss and Agyeman (2002) may be effective to develop holistic perspective.

In addition, Kollmuss and Agyeman (2002) considered environmental awareness with cognitive and affective learning area. This study's programme might be effective on both areas because activities were related to the daily life. It was particularly determined that the participants were attracted to the EMA issue which made their minds to stay away from the EMA impacts. Apparently, the participants were influenced by the informative session on EMA because of its impact on individual health through the frequent encounters with the technological devices including computer, cell phone and driers. People tended to remain careful and cautious vis-à-vis the issues that directly affected them (Oztunali- Kayir, 2003; McCallum, 2008). Kollmuss and Agyeman (2002, 255) came up with that affective development might trigger pro-environmental behaviour. Holistic perspective should be added in environmental behavioural change models because of its cognitive and affective connections. There are modelling programmes such as Structural Equation Modelling. The models may be check over by these programmes.

Last but not least, the participants also mentioned 'endemic species', in other words 'biodiversity' (1st and 2nd participants). The United Nations declared 2010 as the year of biological diversity (CBD, 2010a). Biological diversity is also stressed by a motto reading "biological diversity is life itself and the life is biological diversity" (CBD, 2010a). Over all, Turkey holds a special place in terms of efforts over the matter given its rich biological diversity (Cepel, 2008). Under the current conditions, Turkey has

many biodiversity to lose unless proper measures are taken therefore different education programmes should be drafted to pay attention in order to preserve the local biological diversities.

To conclude, human tends to be more interested in issues which directly affect their lives. Indirect impacts also should be evaluated in order to have holistic approach. Biodiversity is affected both direct and indirect impacts very quickly therefore biodiversity should be an important subjects of education programmes (McCallum, 2008). The principle of conservation of biological diversity is adopted at the 1992 Rio Summit; however, its full implementation became possible only in 2010. It is not certain how many species have become extinct during this period and how this process of extinction has affected human life (CBD, 2010b). As the time runs out, it is obvious that a holistic perspective should be developed in order to understand complex relationship between species.

Finally, the complex relationship of ecology might be considered as a quadratic or cubic equations. The values of variables in the equation can change according to the values on the other side of the equation. This means that n∞ combination is possible because ecology is per se a complicated system. When we add human factor this system it becomes more complicated. It is believed that the optimal level of the equations is achieved by compliance with the world convention and respect for the human beings as well as the nature.

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Appendix 1.

Education programme

Date	Time	Name of the event	Place
25.07.2010	12:00-13:00	Opening speech and filling out preliminary surveys	ÇATOML (Çanakkale Vocational High School for Tourism and Hotel Management)
25.07.2010	13:00-14:00	E 25. Introduction and meeting	ÇATOML
25.07.2010	14:00-16:00	E. 1. First aid in emergency cases	ÇATOML
25.07.2010	16:30-18:30	E.2. Producing compost out of domestic waste	ÇATOML
25.07.2010	19:00-22:00	E3.Vertebral animals in Çanakkale and nearby towns-Theory	ÇATOML
26.07.2010	9:00 -12:00 (Theory) 13:00-17:00 (Practice)	E.4. Geological and historical structure of the region Theory and practice	Kalkım Municipality
26.07.2010	18:00-20:00	E.5. Endemic plants in the region Theory	Adatepe
27.07.2010	9:00-12:00	E3.Vertebral animals in the region Practice	Kalkım Municipality
27.07.2010	13:00-19:00	E 7. Rive ecology and its significance (Theory and practice)	Kalkım Municipality
28.07.2010	09:00-12:00	E 9.Troy national park since the prehistoric era	Troy National Park
28.07.2010	13:00-16:00	E 6. Ethnobotanic	Tevfikiye Village-nearby Troy National Park
28.07.2010	16:00-18:00	E 10. Improving national parks by focusing on preservation	Tevfikiye Village-nearby Troy National Park

28.07.2010	18:30-20:00	E 16.Seaweeds and their vital importance Theory and practice	Harmanyeri- Kepez Coast
29.07.2010	08:00-19:00	E 11. Historical importance of the city	Gallipoli Peninsula
29.07.2010	20:30-22:00	E 15. Underwater and sea ecology Theory	ÇATOML
30.07.2010	10:00-15:00	E 17. Scuba-diving event	Bozcaada
30.07.2010	16:00-17:00	E 15. Underwater and sea ecology Practice	Bozcaada
30.07.2010	18:30-19:30	E 13. Ecotourism	Bozcaada
31.07.2010	9:00-12:00	E 22. Climatic features of the region	ÇATOML (Theoretical) Çanakalan Wildfire check point
31.07.2010	13:00-17:00	E 12. Natural and human-made magnetic field and environmental health	Çanakalan Wind Stations
31.07.2010	20:30-23:00	E 20. Astrophysics: are we alone in the universe	Ulupınar Observation House (ÇOMÜ) Çanakkale
01.08.2010	9:00-15:00	E 18. Çan Coal reserves and water resources	Çan
01.08.2010	15:00-19:00	E 19. Drinking water filling facilities Atikhisar Dam-trip	Çanakkale-Çan Highway
01.08.2010	20:00-21:30	E. 24. Ecological footprints; life 100 years ago; life now	ÇATOML
02.08.2010	09:00-11:00	E 21. Role of insects in preserving the nature Theory and practice	ÇATOML (Theory) Dardanos Facilities (Practice)
02.08.2010	11:00-12:00	E 2. Producing compost out of domestic waste	ÇATOML
02.08.2010	13:00-16:00	Deep ecology	ÇATOML

02.08.2010	20:00-22:00	Interactive presentation Final surveys	ÇATOML
03.08.2010	09:00-11:00	Evaluation of the project by the participants	ÇATOML

Appendix 2.

Demographic characteristics of the participants

Participant No	*Gender*	*Age*	*Profession*
1	Female	25	Math teacher (elementary graders)
2	Female	26	Science and tech teacher
3	Male	20	Science and tech teacher
4	Female	31	Landscape teacher (Academic)
7	Male	49	Social science teacher
8	Male	35	Science and tech teacher
9	Male	32	Science and tech teacher
10	Male	37	Social science teacher
11	Male	26	Math teacher (elementary school)
13	Male	33	Primary school teacher
14	Male	24	Science and tech teacher
15	Male	35	Science and tech teacher
16	Female	29	Primary school teacher
18	Female	20	Biology teacher
21	Female	26	Science and tech teacher
22	Female	22	Science and tech teacher
23	Female	44	Biology teacher
24	Female	26	Primary school teacher

Appendix 3.

Last version of the environmental awareness scale

	Totally agree	Agree	Partly agree	Do not agree	Never agree
1. Rapid technological development causes technological pollution.					
2. Cell phones should renewed when a new production launches.					
3. Genetically modified foods threaten human and animal health.					
4. Every house may produce own electric by solar panels at sunny places.					
5. Energy may be produced by ocean waves.					
6. Recycling of papers is a way of protecting forests.					
7. Clothes should be washed by prewashed programme.					
8. Electrical devices should be switched off by on-off button.					
9. Energy saved electrical devices should be used.					
10. Electronic waste may be recycled like papers.					
11. Legally wind station should be compulsory at windy areas.					
12. Biogas may reduce to petrol dependence.					
13. Riding bicycle should be generalized in a city.					
14. Green energy resources should be found.					
15. Building insulation may be achieved by waste straw bundle.					
16. Olive seed may be used as fuel resource.					