

# The Effect of Ecological Dynamics Model on Behavioral Change, Direct and Indirect Actions

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Received: June 9, 2014; accepted: Nov 26, 2014

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## Abstract

The main aim of environmental education is to change environmental behaviour and there are some models to have this output. One of them is ecological dynamics model (EDM). One of the teaching methods of environmental education is outdoor education. Ecopedagogy-based outdoor environmental education (EOEE) which is one of the main subjects of this research, and EDM are based on experiential learning and properties of EDM overlap EOEE's properties, except interdisciplinary characteristic. Interdisciplinary perspective explains how an environmental education program should be. EOEE might be a kind of adaptation of EDM to education. The aim of this research is to evaluate the effect of EOEE and EDM on ecological behaviour change, direct and indirect actions within in-service teachers. Research methodology is qualitative approach. I observed and evaluated the participants throughout an EOEE program and followed them up after six months. I found that EOEE and EDM were successful in order to achieve ecological behaviour change, direct and indirect actions.

**Key Words:** *Ecological dynamics model, ecopedagogy, outdoor education, environmental education, behavioural change, in-service teacher education.*

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## Introduction

The main aim of environmental education research is to change environmental behaviour (Brymer & Davids, 2013a; Brymer & Davids, 2013b; Kollmuss & Agyeman, 2002) and there are some models (US linear model; sociological models; altruism, empathy, prosocial behavior models, model of pro-environmental behavior, ecological dynamics model etc) in order to have this output (Brymer & Davids, 2013a; Brymer & Davids, 2013b; Burges, Harrison & Filius, 1998; Eisenberg & Miller, 1987; Kollmuss & Agyeman, 2002). Jensen and Schnack (1997) say that ecological behavioural changes happen as two forms: direct action and indirect action. If a person actively

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participates in order to solve an environmental problem then it is a direct action. If a person impresses/canalizes other people in order to solve an environmental problem, it is an indirect action. Jensen and Schnack (1997) emphasize that a direct action emerges by experiential learning.

### **The properties of EOEE**

Experiential learning is the main part of ecopedagogy-based outdoor experiential education (EOEE) and the ecological dynamics model (EDM). EOEE and EDM are the main subjects of this research because the properties of EOEE and EDM overlap (Table 1). Brymer and Davids (2013b) suggest that EDM is a useful framework to design outdoor experiential education programs.

The properties of EOEE are:

- a. Program is designed according to an interdisciplinary perspective (Brookes 2004; Bunderson & Cooper 1997; Piller 2002). Environmental problems are very complicated so a subject can be evaluated within ecological, social, economic, historical, geographical etc contexts.
- b. Program is carried out within the community in practice with ecologic and social contexts (Preston 2004; Robottom 1987, in Fien & Rawling, 1996). One of the main subjects of environmental education is ecology. Also in a group dynamics people can learn either together or each other.
- c. Program is based on the ontological perspective - what I can do in order to solve/ prevent environmental problems (Thomashow, 1998; Ward, 1996). In terms of educational program evaluation, outputs are one of the main aims of a program. However every person's background is different each other so the evaluation of knowledge or transferring of knowledge to attitude, awareness, behaviour will be different each other.
- d. All activities are carried out as placed-based (Brookes 2004; Emmons 1997; Lugg & Slattery 2003; Harrison 2010; Irwin 2010; Piller, 2002) and as problem- based (Palmberg & Kuru 2000; Piller, 2002) having connection with actual environmental problems. The activities should be meaningful for people otherwise education would not be challenging. If the activities are related to local environmental problems, people would be interested what will happen at the end of the activity.

### **The properties of EDM**

Brymer and Davids (2013b) express that evolutionary biology, complexity sciences, ecological psychology, and non-linear dynamics are basis of EDM. EDM has three parts: individual learning, environment (social and physical), and task. According to this model there is not a 'one size fits all' environmental educational program because every person's background is different so outputs of persons will be varied. People can even reflect on the same output in different timescales. Foreseen and unforeseen outputs can be achieved by direct social (social environment) and natural environment (physical) interactions. People have to be in social dialog and directly apply activities in nature. These activities have to be related to daily life and people have to be part of the activities. (Brymer & Davids, 2013a, 2013b)

As seen Table 1, the properties of EDM overlap EOEE's, except interdisciplinary characteristic. Interdisciplinary perspective explains how an environmental education program should be. I could not find any research related to experimental application of EDM or an educational program based on EDM but there are some studies based on EOEE and in-service teachers which were applied in Turkey. At this point I thought that interdisciplinary perspective of EOEE was also suitable for EDM and I should firstly evaluate these researches as a starting point. Brymer and Davids's 2013a and 2013b articles only explains the theoretical framework of this model and it is needed experimental application studies about EDM.

Table 1.

The Comparison of properties of EOEE and EDM

EOEE		EDM	
Interdisciplinary perspective			
Community in practice	Social context	Environment	Social environment
	Ecological context		Physical environment
Ontological perspective		Individual learning	
Activities	Place-based	Task	
	Problem-based		

### Literature review

Guler (2009) managed an outdoor education projects intended for teachers in 2008. There were 24 in-service teachers at the project which was only 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 got 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, Varnaci-Uzun (2010) managed an outdoor education projects intended for 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 the quantitative approach. The scales were applied as pre/post/postpost test (after 3 months). As a result, they found 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 education projects intended for in-service teachers in 2009. The project was 10 days, and there were totally 40 in-service teachers at the project. The participatory action research was used. The aim of the project was to determine tendency of the participants to take active role in solving any environmental problem. As a result, the researchers found that the participants were very enthusiastic in order to take active role to solve any environmental problem. However the researchers emphasized that they could not follow up the participants. This was the big limitation of the research.

Okur-Berberoglu, Yalcin-Ozdilek, Eryaman, Uygun, and Cetinkaya-Edizer (2013), applied an outdoor education projects intended for in-service teachers in 2009. The project was designed as two periods. Every period is 10 days, and 20 in-service teachers attended to the each period. There were totally 40 in-service teachers at the project. The aim of the project was to determine the short term effectiveness of an outdoor education program on environmental awareness. They found that awareness levels of the participants were increased.

Yalcin and Okur (2014) carried out an experiential education about electromagnetic area (EMA) within an outdoor environmental education project in 2010. The project was ecopedagogy-based and for 10 days. There were 24 in-service teachers as participants at the project. The triangulation mixed methodology was used within case study. The participants were followed up after six months. The data was collected by the electromagnetic field awareness scale, diaries of the participants, interview documents and 6th month following up data. They found that the participants' awareness was

developed throughout the education and they tended to be careful about using of electrical devices at their daily life.

As seen above, there researches did not mention EDM or ecological behavior changes. I think that EOEE might be a kind of adaptation of EDM to education. The aim of this research is to evaluate whether EOEE, which is based on EDM, is successful in order to achieve ecological behavioral changes within in-service teachers.

## **Method**

Data for the study was retrieved from the project which's name was 'Ecology in Dardanelles (Gallipoli) and its nearby towns, 2011.' The education program was designed within eco-pedagogic approach, interdisciplinary perspective, and the objectives of the science-society projects of TUBITAK (The Scientific and Technological Research Council of Turkey, Invitation Paper, 2010). TUBITAK financed this project and wanted the project to explain ecological knowledge via actual speech and with activities in natural environment.

### *Education program*

The EOEE program of the research was based on ecology so the researchers determine four themes related to ecology: Physical environment, Population and community ecology, Ecosystem ecology, Human ecology (HE) (Molles, 2008). (App. 1)

EOEE was also designed according to Kolb's Experiential Learning Theory. There are 4 stages in Kolb's theory: Concrete experience (experiencing), reflective observation (reflecting), abstract conceptualisation (thinking), active experiment (doing) (Kolb, 1984; Kolb, Boyatzis & Mainemelis, 2000). The educator gave some example/ case study/ photograph related to subject in concrete experience. A discussion happened in reflective observation, and it was expected the participant to reflect own opinions. The educator lectured related to the subject in abstract conceptualisation, and participants did activity in active experiment. The educators taught the subjects via outdoor experiential activities. For example 'Compost production from home waste' and 'Stream Ecology' activities.

The participants carried out the compost process during the program. 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 organic waste and dry grass. They also set up an oxygen motor into the container and measured the temperature of the container every day. At the end of the program the participants evaluated the last form of the compost and temperature changing with the lecturer. The lecturer especially emphasized local and global effects of compost and waste management, and daily life effects of them.

The stream ecology activity was carried out at the upper side of Karamenderes (Scamander) Stream (39° 58'24"N, 26° 10' 41"E) on the Ida Mountain. The participants were divided into five groups. Each group filtered the stream water via a milk strainer and tried to find macrovertebrates. They tried to determine the macrovertebrates via an identification key and measured some physical and chemical properties of the water. The aim of this activity was to realize that 'every species does not live randomly in a place and has specific life condition.'

There were 19 different activities in the project and correspondingly, 19 lecturers (App 2) within interdisciplinary perspective. Every activity was managed by a lecturer who had PhD related subject. The program was applied sequentially. In other words knowledge, which was mentioned in each activity, was repeated and connected to the other activities. (Yalcin-Ozdilek, Ozdilek, Okur & Eryaman, 2011)

### *Data collection and analysis*

Case study was used in order to understand behavioural change development of in-service teachers via qualitative approach. The case study is useful in order to collect enough data (Yildirim&Simsek, 2006), to have descriptive and explanatory result (Forces & Richer, 1973: in Zanovello, 1999) about people or events. It is also very reliable to collect data by triangulation methods in the social science (Yildirim& Simsek, 2006). Non-participant observation, open-ended questions (Zanovello, 1999; Bas&Akturan, 2008), and psychodrama were also used for the triangulation. Psychodrama has been beginning to use in education within the last decade because it helps to increase awareness of people and self-reflection of feelings/ opinions (Bona, 2003; Gershoni, 2003). A psychologist who is specialist about psychodrama worked during the education process (App 2). At the end of the program in every evening, psychodrama expert carried out an activity like 'group therapy, every tree has an animal, the plant in your soil, the emotion which you do not want to lose, etc' and helped participants to reflect own feelings and opinions.

I also observed participants either in lessons/ activities or in psychodrama activities, and took notes. The psychologist and I discussed and evaluated the reflection of participants within content analysis. We especially mentioned and focused on the importance of actively taking part to solve an environmental problem. All the activities were recorded by a camera. I also followed the participants up after 6 months in order to determine behavioural changes. I asked them after 6 months this question: "Did you take part in actively in order to solve an environmental problem?" The participants wrote an essay about what they did last 6 months and sent me the essays and some photographs by e-mail.

### *Content analysis*

Content analysis was used in this research. Some literatures (Harkness, Long, Brembach, Patterson, Jordan & Kahn, 2005; Tesch, 1990) point out every essay includes an opinion or knowledge. According to this perspective every observation notes, camera records and 6th months follow up essays were analysed one by one.

It is so hard to observe behavioural changes in 10 days. Hence I tried to consider the inclination of participants by observation notes and camera records in short term within behavioural changes. The follow-up essays were evaluated within indirect action, direct action, and behavioural changes. I considered and focused on what the participants did in order to solve a real environmental problem.

### *Participant selection*

Participants in the project were in-service teachers because of the criteria of TUBITAK projects. Teachers may share their environmental knowledge and experience with students and own families. Students may also share acquisition with own families. By this way successive sharing may happen. (TUBITAK Invitation Paper, 2010)

A web-site ([www.canakkaleekoloji.net](http://www.canakkaleekoloji.net)) was designed in order to solicit participants. The advertisement of the project was posted to Google search engine and all primary and secondary schools' e-mails. It was asked to participants why they would like to join this project, and the participants were selected according to these answers. The other criterion of participants' selection was about 'not to join any TUBITAK outdoor environmental education project.' This was a special institutional policy of TUBITAK. Teachers could join only once to this kind of projects.

There were 24 participants in the group; 12 of them were male, 12 of them were female. The project was carried out between 15.07.2011- 24.07.2011 (App. 2). The teachers who attended to the program were from 13 different disciplines. These were primary school, science, chemistry, biology, social science, music, physics, philosophy, sport, preschool, geography, computer/ information, and mathematic.

## **Results**

I evaluated the data at 3 stages: indirect action, direct action and behavioural changes and determined indirect actions with 11 participants at the end of the program (Table 2). In other words participants shared their knowledge and experience with the students and friends in 6 months.

Table 2.

Frequency and per cent value of participants' expressions related to behavioural change.

	Participants number/24	
	f	%
Indirect action	11	45.8
Direct action	6	25
Individually behavioural change	20	83.3

### **Indirect action**

One participant, who was 25 years old and female primary school teacher, explained her indirect action as:

“I behave responsive about compost and recycling. I taught compost with application to my students and we searched little living things among grass and in water accumulation. I explained acquisitions of this project to my social and school friends. I shared damage of thermal and hydroelectric power stations to natural environment. I prepared a power point presentation to my students and shared same knowledge with them. We prepared recycling container for batteries and papers in the school. We collected second-hand clothes and handed out who needs them.”

This participant shared knowledge and experiences with other people but there was no direct action. She especially mentioned ‘Compost production from home waste’ and ‘Stream Ecology’ activities. Both applications triggered indirect action.

The participants took photos during the activities. I thought that it was very easy for them to prepare a power point presentation or to show their photos in order to share their acquisitions with the students and the friends. The other point was activities might be interesting for them. For example I realized that the participants amazed when they found and saw the macrovertebrates and their importance for the natural environment. The waste management was a part of human life; certainly every person caused waste in anyway. It might be very meaningful to mention daily life process, waste production, and what happened to them.

### **Direct action**

On the other hand the most important outcome for me was to achieve direct action. Six participants mention direct action (Table 2). For example one participant, who was 34 years old and physical education teacher, said:

“I trailed the recycling project of city council as individual. People who live in our apartment separated their waste according to recycling content but I saw that waste car

of city council did not collect the wastes according to the content. I chased this car and reported to the city council. After one week, the waste was collected according to contents with different cars.

- I shared my knowledge and experiences with my students, friends, and family.
- Natural gas is common nowadays in our city so I moved into another home which has natural gas heating.
- I separated the waste as I have learnt in the project, and encouraged my neighbour in order to join me. Now we store some of the waste and put the other waste according to content in front of the apartment
- I started to use water, which is used in order to wash vegetables and fruits in the kitchen, in order to irrigate the flowers.
- I am using energy saving lamps in my home but I encourage my friend in order to use same lamp.
- I am shopping from local bazaar and production firms.
- I also visited solid waste facility of city council with my students; had knowledge about process system of facility, and saw how they produce electrical energy.
- I walked in natural environment with my students in order to become aware of nature.”

Another participant, who was 27 years old and female primary school mathematics teacher, said:

“Firstly I shared my knowledge with my parent. I thought what I could do? We did not separate our home waste, it was like drudgery for us but I have learnt that Bolu city council collected the waste according to content so we started to separate our home waste. I especially separated organic waste in order to give my neighbour’s goat. Bolu is not a sunny city but we had solar power system on our home. It was old and not useful for us. After returning the project we renewed our solar power system, it is now very productive.

We also planned a recycling project which was evaluated inapplicable in the school. There was a recycling commission in the school. I enrolled there. I and one of my friends collected waste papers from students and teachers during one week. A private firm sent us their truck in order to collect these papers. This firm pay money to our school because of papers. Everybody was very glad.”

Another participant, who was 26 years old and male primary school teacher, said:

“I cared about not to use unnecessary plastic bag and package because I think that the most harmful behaviour for environment is unconscious consumption. I applied compost activity with my students in the village school and shared my knowledge with my students and family. I directed my students to sport activity in order to protect environment. I arranged basketball and volleyball area for students in order to be in natural environment.

I did pruning and irrigation activity for village trees and they grew up better. We also collected dry grass in environment and used them in order to warm up. I used overflowed water from water storage in order to irrigate the trees. I also shared my knowledge about electromagnetic area (EMA) and its damages on human health.”

Yet another participant, who was 24 years old and female science teacher, said:

“We are living in an apartment building with 32 flats. We applied to city council in order to put recycling container in front of the building. People who live there do not put their waste randomly; they started to separate them according to contents.”

Participants determined some environmental problems and tried to find a solution individually. They also had either direct or indirect action. The most common subject for participants was recycling. Recycling was the common subject in direct action, indirect action, and individual behaviour change. This subject is related to real life. The waste management is a real big problem for the municipalities and everybody can do something in order to reduce the waste. Some living places in Turkey are very close to waste storage areas; the explosions and casualties also happened at those places in past years. Recently recycling is also very popular in Turkey. Even European Union has financed some municipalities in order to find and set up new and modern waste storage areas or reclaim the old ones. There are many more recycling boxes on the streets recently but most of the people do not know what to do with their wastes. Maybe these reasons might cause the participants to pay attention to the recycling because this subject is very popular and close to the life.

### **Behavioural change**

However 20 of the participants have individually changed behaviour in their personal life (Table 2). For instance one participant, who was 29 years old and female information technologies teacher, said:

“\* I separate the waste according to contents.

- I collect the papers in order to deliver recycling container in the school.
- I do not leave electric outlet on the plug.
- I try to be careful not to use plastic bag and not to take unnecessary plastic bags from markets.
- I try to be careful not to buy more clothes or dresses.“

Another participant, who was 36 years old and male geography teacher, said:

“I drive car with gas; live in a home with insulation, shop from local production firms. I try not to piss away anything and struggle to unlimited consumption. I share my knowledge with my students in my lessons.”

Another participant, who was 33 years old and male primary school teacher, said:

“I realized that real environmental protection can be obtained by not to pollute so I decreased usage of plastic bag, unnecessary water and encourage other people about this subject. For instance I put weight in the water resource of WC. I arranged this weight by full water bottles.

I take out the electrical plug when I do not use. I share my knowledge related EMA and its damage for human health with other people.”

Another participant, who was 27 years old and male primary school teacher, said:



“Now I educate 4<sup>th</sup> grade. There is a unit ‘Let’s know the matter’ in science syllabus. I used photos that I took ‘Can Thermic Power Station’ visiting when I teach this unit. My students were very confused because when somebody says something about ore bed they think somewhere like a cave.

I did not use hair dryer since project and explained its damage for us. I take out TV’s plug when I do not watch. Now my students’ sensitivity to EMA has increased.

I talked to school director in order to have recycling container for our school. We contacted prefecture and wanted recycling container. They sent us 6 recycling container.”

Individual behaviour changes were related to EMA, recycling, and ecological footprints. These results were very typical because these subjects affected people’s lives directly. The lecturers also gave actual examples related to subjects and daily life. For instance in EMA activity participants measured EMA level of some daily life devices (cell phone, computer, kettle, hair dryer etc) cables of wind stations, and cables of the classroom by gaussmeter. People install electrical cables in a room or under soil. We do not see these cables but EMA spreads out over soil or the wall. We have to use electrical devices in our daily lives but also learn how to protect ourselves or minimize the negative effects of EMA. It is so clear that people are very impressed when they are exposed to some negative effects directly. The participants were very impressed because they could directly see an invisible effect by gaussmeter.

The ecological footprints lesson was a general perspective to our daily life. The lecturer gave examples and calculations related to one person’s consumption and their effects on Earth. For instance, Turkey is a poor country about water resources and annual water usage per person is 1615 m<sup>3</sup>. It is generally accepted that if annual water usage per person is more than 5000 m<sup>3</sup> then this country is rich about water. Turkey needs extra water in order to satisfy the demand (Mekonnen & Hoekstra, 2011). Turkey has to be very careful about water usage. Water scarcity will affect all participants’ daily lives so they need to be careful and sensitivity. Some condition is valid for petrol usage of Turkey and participants also mentioned this subject. They started to shop from local places and producers; in this way they tried to reduce their ecological footprints.

## **Discussion**

I think that EOEE and EDM are successful on changing ecological behavioral at the end of this study but this result should be confirmed/tested with other studies. Experimental and experiential researches related to EDM are insufficient. I hope that this study can point out researchers’ attention to this subject.

The participants especially mention EMA, recycling and ecological footprints subjects. Three of them are related to human ecology (Molles, 2008). Our EOEE program has ecology subjects and four themes (Molles, 2008).

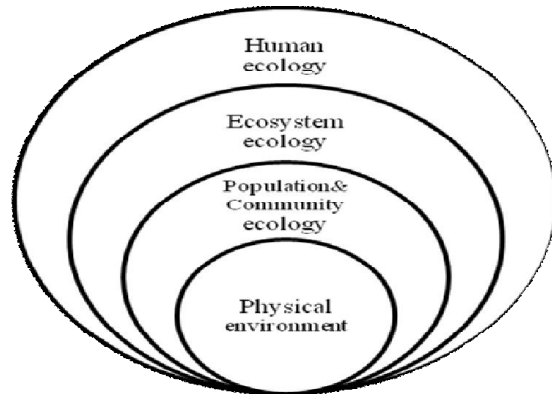


Figure 1. Ecological subjects of EOEE programs

Human ecology covers the other themes (Figure 1). It is meant if somebody mentions human ecology, at the same time s/he mentions also the other themes. Human ecology affects daily life directly so people can care about subjects which affect them directly.

Rickinson (2001) points out that environmental education programs cause different outputs but it is not known how or why these outputs appear. In this study I used Kolb's Experiential Learning Theory. I can say that this theory is effective in order to change ecological behaviour but there are other models such as 'The development of physical skills: Instruction in the psychomotor domain (Romiszowski, 1999) or Learning by Doing (Schanck, Berman, & Macpherson, 1999)'. These models should be also checked over in terms of EDM.

EDM also mentions individual outputs (Brymer & Davids, 2013a, 2013b) rather than program outputs. Every person has a different social or cultural background so outputs will be varied. As seen in the results, participants may have similar or different outputs. Similar outputs are related to program outputs (one size fits all). For instance four participants declare that they decrease usage of plastic bags because I especially emphasize negative effects of plastic usage during EOEE. Different outputs are related to personal situation and perception. For instance one participant reports the waste truck because of not to do own duty; another participant renews solar power station; and yet another participant put weight in the flush tank of the water closet for water saving. All of these activities are personal selection of these participants so either individual or program outputs are very valuable for me. Brymer and Davids (2013a, 2013b) do not ignore the importance of social interaction for individual outputs. One participant expresses that he learned the putting weight by water bottles in the flush tank of the water closet from another participant. Recently the flush tanks are double staggered; in this way the half or full of the tank can be used for water saving. Unfortunately most of the flush tanks in Turkey do not have double staggered so the participants try to reduce water using by the full bottles. I did not mention this bottle method during the education but they have learnt each other. It supports that people can learn something by social interaction (Kollmuss & Agyeman, 2002). Brymer and Davids (2013a, 2013b) identify also the importance of social interaction under social environment.

The other part of the environment according to EDM is physical environment. This point is very coherent with EOEE because the program of EOEE should be developed placed-based (Brookes 2004; Emmons 1997; Lugg & Slattery 2003; Harrison 2010; Irwin 2010; Piller 2002). This research's program is based on Canakkale (Gallipoli). Other researchers may develop different programs or activities according to their own places and check them over.

Similarly activities can be changed according to places and age groups. Joyce, Weil and Calhoun (2004) explain that age, gender, ethnicity, socioeconomic backgrounds are important in terms of teaching and outputs.

I conducted this research with in-service and there are studies with in-service teachers (Eryaman et al, 2010; Guler, 2009; Okur-Berberoglu et al., 2013; Yalcin & Okur, 2014), pre-service teachers (Greaves & Stiles, 2002; Keles, Uzun, & Varnaci- Uzun, 2010) or children (Ozdemir, 2010; Piller, 2002; Yardimci, 2009) within outdoor environmental education. These researches have favourable outputs but they do not mention ecological behaviour change, EOEE or EDM whereas all these studies' outputs and activities may be evaluated within EOEE and EDM. I tried to evaluate a whole education program. Each activity might also be evaluated one by one via different researches. Yalcin and Okur (2014) especially focused on EMA education within on EOEE. My findings and their findings are very coherent because I think that activities which are related to daily life affect people behaviour. I have to also mention the other themes outputs because of program evaluation in this research but each ecological theme or subject might be evaluated separately and have more detailed results. For example, the effectiveness of recycling or stream ecology activity which participants mentioned mostly might be evaluated in specific studies. I did not only evaluate the outputs of this research in terms of Turkey because the data related to EDM is very limited according to literature review. On the other hand I tried to evaluate the outputs in terms of outdoor environmental education and give suggestion within Turkey because the education program was designed as placed based. It might be a bit difficult to evaluate the findings because of not to have experimental and experiential studies related to EDM and EOEE so this study's findings should be confirm/test via another studies.

This research's result is similar to Keles et al. (2010) and they used quantitative approach. We use the qualitative approach in this study. Qualitative or quantitative approaches can also be used in other studies. Both approaches have advantages and disadvantages. Creswell (2005) states that mixed methodology may be used in order to eliminate disadvantages of both approaches. Different and unforeseen outputs might be determined by mixed methodology.

On the other hand quantitative approach may be used in terms of mathematical modelling. There are some models (US linear model; sociological models; altruism, empathy, prosocial behaviour models, model of pro-environmental behaviour, ecological dynamics model etc) to achieve behavioural change (Brymer & Davids, 2013a, 2013b; Burgess, Harrison & Filius, 1998; Eisenberg & Miller, 1987; Kollmuss & Agyeman, 2002). These models are theoretical and they might be checked over by experimental studies.

Last decade structural equation modelling is used commonly in environmental education research in order to develop scales (Barr& Gilg, 2007; Bogner& Wiseman, 2006; Fernandez-Manzanal, Rodriguez-Barreiro, & Carrasquer, 2007, Meyerhoff, 2006; Okur& Yalcin-Ozdilek, 2012; Okur- Berberoglu & Uygun (2012). One of the most remarkable researches belongs to Okur-Berberoglu and Uygun (2012). These researchers examined between environmental awareness and environmental attitude. They find the effect size of environmental awareness on environmental attitude is 0.81. This means that increasing environmental awareness highly affects environmental attitude. However this correlation is linear. There are more than one ways in order to deliver behavioural changes within models, but mathematical modelling should be started somewhere. Ecological behavioural models can be checked over by putting linear or nonlinear ways among environmental knowledge, environmental awareness, environmental attitude, holistic perspective, individual background, behavioural change etc.

Education is a long-term process. Every program, every activity, every output, every person who attends an education program should be evaluated one by one. This study is a summative research. We also need formative evaluation in order to get meta-analysis and more researches in order to apply formative evaluation. United Nations Agenda 21 (UN, 1992) report states that researchers should ‘exchange of experience concerning training and program (36.24 coded title, p.328)’ and this title is the trigger point and main scope of this research.

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## **Appendix**

### 1. Theme of education programs

<b>Theme</b>	<b>Activities</b>
Physical environment	Astrophysics Climatology- ecosystem relationship Geography of Canakkale
Population and community ecology	Endemic plants of Canakkale  Marine algae Vertebrates of Canakkale Marine ecosystem Forest ecosystem Biologic combat
Ecosystem ecology	Stream ecology Energy production Efficient usage of water
Human ecology	Compost Ecotourism Plant improvement& Organic cultivation Electromagnetic Area by Human Green designs Deep ecology Ecologic footprints



## 2. EOOE program

<b>Date</b>	<b>Hours</b>	<b>Name of activity</b>	<b>Place of activity</b>
15.07.2011	12:00-13:00	Entrance Speech	Dardanelle Campus (DC)
	13:00-14:00	Introduction Psychodrama	DC
	14:00-16:00	Taking of project expectations of participants	DC
	16:30-19:00	Compost application	Garden of DC
16.07.2011	20:00-22:30	Astrophysics	University Observatory
	9:00-12:00	Geography of Canakkale (Theory)	DC
	13:00-16:00	Geography of Canakkale (Application)	The road of Ayvacık-
	16:30-18:00	Climatology- ecosystem relationship	Canakkale
	18:30-20:00	Stream ecology (Theory)	Ayvacık
17.07.2011	21:00-22:00	Psychodrama	DC
	9:00-12:00	Endemic plant of Canakkale	Ayazma-Ida Mountain
	13:00-16:00	Forest ecosystem	
	16:30-19:00	Stream ecology (Application)	
18.07.2011	20:30-21:30	Psychodrama	Garden of DC
	9:00-12:00	Vertebrates of Canakkale	Coastal area of D DC
	13:00-16:00	Energy production	Can Coral Basin
	16:30-19:00	Efficient water usage	Atikhisar Dam
19.07.2011	20:30-21:30	Psychodrama	Garden of DC
	10:00-15:00	Marine ecosystem	Bozcada Island (BI)
	10:00-15:00	Marine algae	
	10:00-15:00	Diving with tube	
	16:00-18:00	Ecotourism	
20.07.2011	19:00-20:30	Psychodrama	Costal area of DC
	9:00-12:00	Plant improvement& Organic cultivation	Garden of DC
	13:00-16:00	Biologic combat	
21.07.2011	17:00-18:30	Psychodrama	
	9:00-12:00	Electromagnetic Area by Human	Wind Tribunes
	13:00-16:00	Green designs	Sample from World
	17:00-19:00	Ecological footprints	DC
22.07.2011	20:00-21:30	Psychodrama	Garden of DC
	9:00-18:00	Gallipoli National Park	Gallipoli National Park
	20:00-21:30	Psychodrama	DC
23.07.2011	9:00-12:00	Deep ecology	DC
	13:00-16:00	Compost (Evaluation)	Garden of DC
	17:00-18:30	Psychodrama	DC
24.07.2011	9:00-12:00	Project evaluation	DC