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Evaluation of an Environmental Education Program as a form of Non-Formal Education in Secondary Education

Georgios Giannoukos*, Vasilios Hioctour, Ioannis Stergiou and Sotiria Kallianta

Second Chance School, Greece

Research Article

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***For Correspondence**

Georgios Giannoukos, Second Chance School, Greece

E-mail: g.giannoukos@gmail.com

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ABSTRACT

Modern environmental problems are largely because of the waste of non-renewable energy sources and environmental pollution. New generations should be educated on environmental protection in order to become more environmentally friendly. Therefore environmental programs are of major importance and should be evaluated as to whether they are effective.

In this paper we present the results of an empirical quantitative research that aims to investigate whether the participation of high school students in the prefecture of Fthiotida on environmental non-formal education programs, influences their attitude and perceptions about recycling and energy saving. The research took place from February 20 to March 7, 2015 in the prefecture of Fthiotida, Greece and the sample consisted of 30 high school students, 10 from each of the grades A, B and C. This research, which was based on closed-ended questionnaires, shows that such programs can help to change the student's attitude and perceptions.

INTRODUCTION

According to article 111 of Law 1892 / 90 in Greece, the purpose of environmental programs in the secondary education is to help students to realize the relationship between man and nature, to raise awareness about the problems associated with it and to operate, with the help of these programs, so that they can contribute to cope with those problems. Such problems are global warming, the depletion of natural resources, climate change, air pollution, acid rain, the ozone hole, etc.

Overproduction of carbon dioxide from the ever increasing number of internal combustion engines has resulted in the accumulation of this gas into the atmosphere. Carbon dioxide functions as a semi-permeable filter that allows solar radiation to penetrate into the earth's atmosphere but stops the reflected radiation from leaving the atmosphere. This results in an increase of the earths and the atmosphere's temperature and the phenomenon is called the greenhouse effect [1]. Other gases which contribute to this phenomenon are methane, chlorofluorocarbons and nitrous oxide (they are also called greenhouse gases). According to the 3rd National Report of the Convention Framework of the United Nations Climate Change Ministry of Environment, Planning and Public Works (2002), the total increase of the three main gases namely carbon dioxide, methane and nitrous oxide in Greece from 1990 to 2000 was 23%. Fossil fuels contain sulfur dioxide, which when burned release this gas that accumulates in the atmosphere. Also during the operation of an internal combustion engine, nitrogen oxides are generated inside it and they are then released in the atmosphere. These oxides react with atmospheric moisture resulting in the formation of sulfuric acid and nitric acid, which fall on the earth during a rainfall or a snowfall. The effects of acid rain are the destruction of valuable soil components, resulting in forests and crops devastation, the acidification of lakes with all that this entails for aquatic organisms living inside them and also the erosion of monuments and buildings. Ozone (a three atom form of oxygen) is located in the stratosphere (an upper layer of the atmosphere) and acts as a protective shield for the earth against the harmful infrared radiation that the sun sends us. There are gaseous substances that deplete the ozone layer such as the CFCs. Sources of such substances are the refrigerants of refrigerators and air conditioners, some industrial cleaners, propellant gas in spray cans as well as some extinguishing agents. By the term 'ozone hole' we mean the destruction of the ozone layer in the stratosphere [2].

Environmental education is addressed to all future citizens who are experiencing environmental problems and gives them the required knowledge and moral values, attitude and skills that will serve to protect the environment. The teacher - trainer of environmental education does not have the classic role, meaning the source of knowledge, but is cooperative, trying to guide his students in order to discover knowledge on their own and then gives them the opportunity to propose which environmental issue they will work on. At this point it should be noted that the accession of a student in the environmental education group is not compulsory but voluntary. According to the newsletter C2 / 3594/91 of the Greek Ministry of Education it becomes clear that environmental education is an educational process, not an extra lesson. It is also specified that these programs can be done either during school hours or after. The non-formal Environmental education programs are based on the " learning of free choice " and are organized in inside and outside school environments in order to awaken the students on environmental issues and problems, while they are not based on a specific curriculum, but arising from the environmental concerns of the students. Through this process and the student's needs, much knowledge, skills and changed attitude towards the environment will eventually emerge. The issue of environmental education concerns every organized society and its population must be trained in order to acquire knowledge, values, attitude and skills so that they can solve environmental problems. Taking into account that the non-formal education includes any organized educational activity and has a specific educational audience and defined learning objectives, it is concluded that environmental education in the primary and secondary level belongs to the non-formal education [3]. The objective of this research is: "Evaluation of an environmental education program as a form of non-formal education in order to investigate how the attitudes and perceptions of the high school students of the Fthiotida prefecture have changed, towards the environment and in particular concerning recycling and energy saving."

LITERATURE REVIEW

• Parents as factors affecting the environmental perceptions of children and their contribution to environmental activities such as recycling and energy saving

Family is the primary factor that equips children with a behavior and attitude value system, meaning that children's behavior is a result of social and family influences. Vasiloudis I. (2007) conducted a survey from October to December 2006 which referred to the registration of parents' attitude and behaviors related to actions within and outside their homes in order for their children to develop friendly attitude and behaviors towards the environment. In this research the 435 families that took part had a child who was studying in the sixth grade of primary school in areas of 2nd Directorate of Primary Education of Athens. The results of this investigation show that the knowledge of students about pollution and energy consumption may be of a low level in contrast to students who have more educated parents and this is because these children had a greater effect on environmental activities such as participation in household recycling, energy saving of household appliances, reuse of paper etc.

• Systemic thinking and students' attitude about energy saving.

Anagnostakis S. (2006), made a survey with 30 students aged 16-18 years on environmental knowledge of students about energy use issues and its impact on the environment, taking into account their relative learning background [4]. According to the survey, students behave positively in terms of protecting the environment on issues related to energy use and its impact on the environment.

• Effective training in energy conservation.

In a research which was conducted in Crete, in which 321 students of various educational levels took part and in particular of the last five grades of elementary school, of all three classes of high school and of the first two classes of lyceum, and which was held in the school year of 2006-2007 by Zografakis, Menegaki & Tsagarakis (2008), the results of an educational program related to energy saving are depicted. This survey shows that the energy behavior of students following their participation in the program has changed and has become more efficient [5]. Therefore the conclusion is that such programs should be more frequent in schools so that the students may develop an environmental conscience.

• Willingness and actions like energy saving and use of renewable energy sources by secondary school students to combat global warming as.

A similar research took place abroad. According to Rodriquez, Boyes & Stanisstreet (2010), on a survey conducted in Spain with 1460 students, the largest proportion of them declared that they were willing to recycle materials and plant trees. Approximately half of the students agree with the option of buying energy saving electrical devices, so as to save money spend on electrical power and use renewable energy sources in order to insulate their houses.

• Environmental knowledge, awareness and concern of students.

In the US and particularly in New York a research was conducted with 3200 students aged 16-17 years, related to their environmental knowledge, awareness and concern. The vast majority of those students (74%) believe that there is an environmental crisis and that household garbage is an environmental problem [6] [7]. About half of the students (56%) responded positively to the question whether they would choose a school lesson relevant to the environment and stated that they want more environmental discussions in their classes.

Research Question

Our research is concerned with how students perceive recycling and energy issues, whether their participation in the environmental program changed their attitude towards the environment and what caused this change of attitude in a non-formal educational program.

The research questions are:

First research question:

What are the attitudes of high school students of the prefecture of Fthiotida concerning recycling and energy conservation issues after their participation in a program of environmental education as a form of non-formal education?

Second research question:

Do the high school students of the prefecture of Fthiotida believe that a change of their attitude was achieved after their participation in the environmental program of non-formal education and which were the program factors that caused this change?

Third research question:

Do the high school students of the prefecture of Fthiotida believe that this change has affected their attitude in their ordinary life and how?

Methodology

a) *Research process*

In the survey we conducted, we had to take into account some existing limitations. The target population of our study was high school students of the prefecture of Fthiotida. The approach was through the science teachers of these schools, which helped to carry out the research [4] [8] [9]. Considering that there was not enough time to carry out interviews, but only a little time, during science lessons, could be made available by teachers so that students could answer questions, our data collection necessarily confined to questionnaires. Also, the fact that the investigator could not be present during the distribution and collection of the questionnaires, which was performed by the teacher during his lesson; we decided that these questionnaires should be consisted of closed-ended questions. Therefore the methodology followed in this study is quantitative.

b) *Participants (sample, assembly process)*

Once the type of research was chosen, we then had to ensure access to the target group in order to carry out the data collection. The target group of our research was 30 high school students in the prefecture of Fthiotida, namely 10 students attending the first grade, 10 in second and 10 in the third grade of high school. On our part there was a time constraint on the conduction of the research, which had to begin as soon as possible, but due to a time delay by the Ministry of Education on the authorization of this procedure, we had to resort to another solution. Through our social and professional network we tried to ensure a guaranteed access at times that was convenient [10] [11]. So, using our acquaintance with science teachers, who worked in various schools, access to students was ensured. This is called "convenient" sampling. Students were selected so as to have an equal representation of both genders. 10 students were selected from each grade of the high school, to ensure better and an equal age distribution. Each teacher of Natural Sciences was also asked to choose, as far as possible, students with different school performances. In this way, although the sample was "convenient", an attempt was made to stratificate the sample, so as to obtain a better result [12]. After contacting the school teachers we were assured that they could inform their students about this survey and then give away our improvised questionnaire prepared for the students of each class, giving them the little time they needed to complete it during their course time. It should be noted here that students were ensured that the questionnaires were anonymous. We made sure that they would then collect the questionnaires so that we could take them for further processing.

c) *Data collection tool*

The data collection tool that was selected was the closed-ended questionnaire, for all the reasons mentioned above. The structure of the improvised questionnaire was designed according to the research questions and it is consisted of four subunits with a total of 13 questions. The first includes two demographic questions about the gender and the student's class level (questions 1 and 2 respectively of the questionnaire). These two demographic questions were selected because we were interested in the views of both sexes and also the equal distribution of the questionnaire on each of the three classes of high school. The second subsection includes five 'stance' questions, related to recycling and energy saving issues, after the students' participation in the environmental education program. Questions are based on the five-point Likert scale [2] [13]. Specifically they were asked whether they believe that their participation in the environmental education program influenced them to buy notebooks from recycled paper, if they recycle more often, if they care not to leave the light on when leaving a room, if they close the TV rather than letting it in standby, if they unplug the charger when it is no longer needed [7]. The third subsection consists of four questions related to students' perceptions on whether they achieved a change in their attitude after participating in the environmental program and what factors caused this change. In this subsection, the five-point Likert scale was also used and the students were asked if they thought that the outdoor activities of the environmental program was a major factor in changing their attitude towards recycling,

whether the photos and/or the videos they watched during the project influenced them to change their attitude towards recycling and if their participation in the environmental program contributed to better understanding of the relation between energy saving – the greenhouse effect and the relation between recycling – confronting the environmental pollution [14]. Finally, the fourth subsection consists of two questions also based on the Likert scale and related to the perceptions of the students as to whether these changes have influenced their attitude in their ordinary lives. Specifically they were asked whether the outdoor environmental activities of the program affected them so as not to throw garbage anywhere, to help keep the environment clean and how a better understanding of the problem of environmental pollution has affected them to choose to commute with a bicycle (or walking) instead of using the car. To ensure that the questionnaire was understood by the students and that it did not contain errors and omissions, a pilot control was conducted, more specifically the questionnaire was originally given to five students and then taking into account their comments, some corrections and additions were made, relevant to the formulation and fuller explanation on how to fill it out. Our ultimate goal was to collect 30 completed questionnaires, but taking into account that there was the possibility of refusal to fill it out by some students and even more that some of them could fill it out incorrectly, for all these reasons 50 questionnaires were distributed so that at the end of the process we would have collected 30 completed questionnaires. The questionnaires were distributed during April 2015 and with the supervision and assistance of the science teachers of the schools, 30 completed questionnaires were eventually collected.

RESULTS OF DATA ANALYSIS

The method used for the analysis of this survey's data was percentages (%). This means that the answers for each question of the 30 completed questionnaires were collected with the help of tables and then a deduction of the responses to a one hundred scale was made to represent the percentage of each answer to each question. Then, the percentages were gathered in tables and with the help of the excel software program, pie charts were made to present them.

From the completed questionnaires we can see that 50% of the participants were boys and the other 50% were girls. Moreover the participation of students was 33.34% from each year of studies that is the A, B and C year of high school, respectively.

Regarding the first research question, namely the attitude of the high school students of Fthiotida about recycling and energy conservation issues, after their participation in a program of environmental education as a form of non-formal education, the survey results showed that in question 3 of the questionnaire which refers to whether participation in the program influenced them to buy notebooks from recycled paper, the majority of the students (40%) chose " Somewhat affected " as their answer, while "very much affected " was chosen by the 20%, " Somewhat unaffected " by the 17% and "neutral" by the 23%. We also see that 40% of the students chose 'Somewhat affected' to question 4 that refers to whether they were affected by the program to recycle more often. "Very much affected" was chosen by the 33% and "Neutral" by the 27% **(Table 1 and Figure 1).** At this point it is apparent that the program affected all students positively to recycle more often.

Table 1. The percentage of the students that were affected by the environmental program to recycle more often.

	Very much unaffected	Somewhat unaffected	Neutral	Somewhat affected	Very much affected
Answers:	0	0	8	12	10
Percentage:	0%	0%	27%	40%	33%

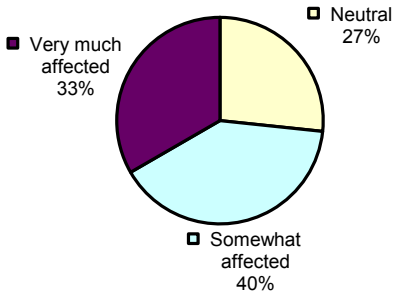

Figure 1. The percentage of the students that were affected by the environmental program to recycle more often.

A small percentage of 7% chose the answer "Somewhat unaffected" to question 5, which asks them if their program has affected them so as not to leave the light on when leaving the room. The largest percentage (66%) chose "Somewhat affected", while 27% chose "Very much affected". In this question too, it is obvious that the total environmental program affected the students positively, so that they now make sure to turn the lights off when leaving a room. In question 6 of the questionnaire, one can observe that the highest percentage (47%) chose the answer "Somewhat unaffected " as to if they were affected by the program to turn off the TV and not to leave it on standby, while 23% chose "Very much unaffected" and 30 % were "Neutral" **(Table 2 and Figure 2).** In this question the conclusion is that the program did not affect them much in respect to this action.

Table 2. Percentage of students affected by the environmental program so as not to let the TV on standby.

	Very much unaffected	Somewhat unaffected	Neutral	Somewhat affected	Very much affected
Answers:	7	14	9	0	0
Percentage:	23%	47%	30%	0%	0%

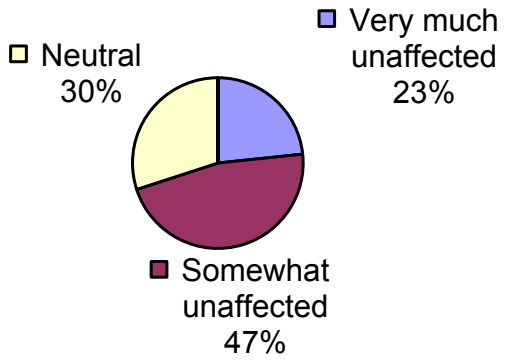

Figure 2. Percentage of students affected by the environmental program so as not to let the TV on standby.

The last question of the first research question is whether the participation of students in the program affected them as to unplug the charger of the mobile phone when it is no longer needed and the results showed that all students were positively influenced in this direction. Specifically, 13% chose the answer "neutral", 67% chose "Somewhat affected" and 20% chose "Very much affected".

Equally positive were the results of the questions of the second research question which are relative to the thoughts of the high school students of Fthiotida on whether a change of attitude was achieved after their participation in the environmental program of non-formal education and which of the program factors were responsible for that change. In question 8 students are asked whether the outdoor activities of the program influenced them to change their attitude towards recycling. The majority of students (50%) chose the answer "Very much affected" followed by the percentages of "Somewhat affected" and "Neutral" with 27% and 23% respectively. Next question 9 is about the photographs/videos referring to environmental problems that students attended during the program, affected them to change their stance towards recycling. The majority of students believe that they were affected positively, 33% chose "Very much affected" and 60% "somewhat affected" while a small percentage of 7% chose "somewhat unaffected" The next question (question 10) refers to whether the participation of students in the program helped them have a better understanding of the relation between energy saving – cope with the greenhouse effect, we observe that the vast majority of students (60%) chose the answer "Very much affected" and the remaining 40% chose "Somewhat affected"

Similar results were obtained from question 11, which is about whether their participation in the program helped them have a better understanding of the relation between recycling – cope with the environmental pollution. The largest percentage (67%) chose "Very much affected" while the remaining 33% chose "Somewhat affected"

Finally, positive were the results of the questions of the third research question which was related to perceptions of high school students in the prefecture of Fthiotida on whether this change has affected their attitude in their everyday life and how. In question 12 about whether the outdoor activities of the program affected students as not to throw trash outside the bins, most students (60%) chose "very much affected" and the rest (40%) chose "somewhat affected" **(Table 3 and Figure 3).** In the last question of the questionnaire, which was about whether students were affected by their participation in the program so that in small movements to choose their bike or walking instead of a car, 50% chose the answer "neutral" and 20% chose "somewhat unaffected "and 30%" somewhat affected **(Table 4 and Figure 4).**

CONCLUSIONS

The aim of our research was to examine whether the past participation of high school students in the prefecture of Fthiotida

Table 3. Percentage of students that think their participation in the program helped them have a better understanding of the relation between energy saving – cope with the greenhouse effect.

	Very much unaffected	Somewhat unaffected	Neutral	Somewhat affected	Very much affected
Answers: Percentage:	0 0%	0 0%	0 0%	12 40%	18 60%

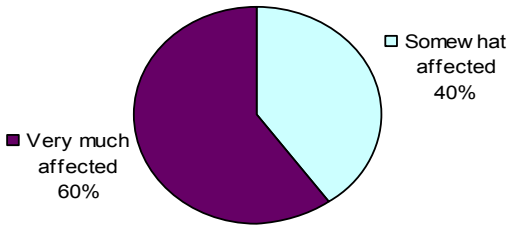

Figure 3. Percentage of students that think their participation in the program helped them have a better understanding of the relation between energy saving – cope with the greenhouse effect.

Table 4. Percentage of students who believe that their participation in the program has affected them as to choose their bike or walking for short distance movement instead of the car.

	Very much unaffected	Somewhat unaffected	Neutral	Somewhat affected	Very much affected
Answers:	0	6	15	9	0
Percentage:	0%	20%	50%	30%	0%

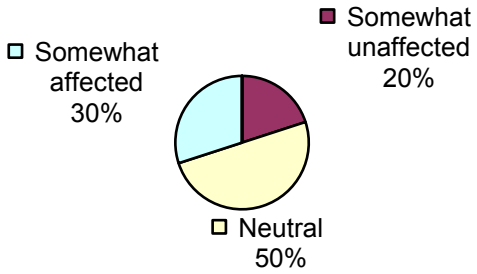

Figure 4. Percentage of students who believe that their participation in the program has affected them as to choose their bike or walking for short distance movement instead of the car.

in the environmental program of non-formal education, influenced them in changing their attitude towards recycling and energy saving. The research took place from February 20 to March 7, 2015 and had as target population 30 high school students in the prefecture of Fthiotida, Greece, namely 10 students from each grade A, B and C respectively. The survey showed that in general the higher percentages of students were positively influenced in a change of attitude towards both recycling and energy saving. The results on question 3 and 4 (40% chose "somewhat affected" on each of these questions), which were about whether they put more attention to buy notebooks from recycled paper and whether they recycle more frequently, leads us to believe that the students were affected by the environmental program and became more sensitive towards environmental problems. This is also confirmed by the questions 5 and 7, in which the largest proportion chose "somewhat affected" (66% and 67% respectively), which were about whether the students were affected by the program to turn off the lights when leaving their room and unplugging the mobile charger from the outlet when not using it. On the other hand, they appear to be determined to let the TV on standby rather than turn it off (Question 6 - the largest percentage was 47%, those who chose "somewhat unaffected") and this is probably because students are not convinced that this action is necessary. But most of the students agree that the outdoor environmental activities of the program (question 8) and the photos/videos about environmental problems (question 9) they watched (50% chose "very much affected" and 60% "somewhat affected" respectively) affected them positively towards changing their attitude towards recycling and gave them a better understanding of the relation between energy saving – greenhouse effect and recycling - environmental pollution (in question 10: 60% selected "very much affected" and in question 11: 67% choose ”very much affected", respectively).

These results suggest that the outdoor activities as well as viewing photos and videos is a useful and effective method to help students understand the environmental problems and consequently to change their attitude towards them. Also one can observe that the environmental program affected students in their daily lives. 60% (in question 12) chose "very much affected" in not throwing trash outside the bins. We observe that the choice 'neutral' has the largest percentage in question 13 which is about whether they would choose to use a bike/walking instead of a car, in small distance transitions, here one may conclude that they were not very much influenced by their participation in the program as to choose more certainly the bike/walking option.

There is also a convergence of our results with the research conducted by Zografakis et al. [14] which is referred in the literature review. In both surveys (ours and the latter) it is obvious that the participation of students in environmental programs has resulted in positive changes in their attitude towards energy conservation. There is also a convergence between the results of our research and the research of Rodriquez, Boyes & Stanisstreet (2010). In both studies it appears that the majority of students are willing to recycle materials.

According to Fernandez et al. [8] "Environmental attitudes provide a good understanding of the set of beliefs, interests, or rules that influence environmentalism or pro environmental action". This assumes that if positive values and attitudes towards the environment are instilled in pupils they are more likely to become actively involved in environmental conservation.

Further study of the results of this research might be useful as well as a comparison of how the environmental program affected each age group and gender.

In conclusion we may say that our research has shown that the participation of students in the environmental program of non-formal education has, in general, affected the majority of students to change their attitude towards recycling and energy saving. This confirms previous research that environmental programs are of major importance and indeed positively affect learners in addressing environmental problems.

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