

Teachers' Attitudes towards the Environment and Environmental Education: An Empirical Study

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ABSTRACT

The aim of this study is to explore teachers' attitudes towards environmental education (EE), and the relation of these attitudes with other socio-demographic factors, such as area of residence and local environmental conditions. We focus on the case of Viotia prefecture. Our results indicate that the teachers' attitudes towards EE are strongly related to their attitudes towards the environment and environmental problems in their areas of residence, while knowledge and information on environmental issues are strongly related to the positive attitudes towards EE. The results of this study indicate possible factors involved in the formation of the attitudes of EE teachers and also possible aspects to be considered for the design of effective policies for EE teacher training.

KEYWORDS

Environment, Environmental Education, Teachers' Attitudes, environmental problems, Greece

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Introduction

The aim of this study was to identify factors relevant to the formation of the attitudes of teachers towards Environmental Education (EE). Although a large body of research has focused on factors relevant to the attitudes towards the environment and environmental problems (Van Liere & Dunlap, 1980; Samdahl & Robertson, 1989; Jones & Dunlap, 1992; Foster & McBeth, 1994; Schultz, 2000; Raudsepp, 2001; Brody, 2004; Harris, 2006; Berenguer, 2007;) and on the dynamics of EE, emphasizing the role of the teacher (Chawla & Cushing, 2007; Hwang, 2009; Waktola, 2009; Shephard et al, 2009), research specifically on the attitudes of the teachers towards EE is still limited.

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The teacher, particularly in secondary education, plays a critical role for the quality and effectiveness of EE, and consequently the shaping of students' attitudes and behaviour towards the environment (see also Esa, 2010). Students' participation in EE programs seems to be a critical factor positively affecting their knowledge and ideas on environmental issues, as suggested by Liarakou et al. (2011). Effective EE could be the key for the development of environmental awareness and ecological consciousness with further positive implications for the quality of the local and global environmental conditions. Our goal in this study was to explore the matrix of factors involved in the development of the teachers' attitudes towards the environment and environmental education.

In fact, this is a global problem that consists of small pieces of the same problem, more or less like a puzzle. If we control the problem in a national (local) level, the control of the global problem will be straightforward (Nannos, Bersimis, Georgakellos 2013). This is why studies focusing on one single country or region are still of special interest.

We focused on secondary education teachers in the Viotia prefecture in Greece and we considered factors such as the teachers' socio-demographic information, their work experience, the environmental conditions and problems of their area of residence or the location of the school, the attitudes of their social and family circle towards the environment, the teachers' resources of information and their EE practices at school. We collected data through a survey and examined the relations among these factors. We further propose a framework of the factors involved in the formation of the teachers' attitudes towards EE. The proposed framework may contribute to the research on the implications of attitudes, beliefs and environmental and social conditions on EE and it could also provide valuable insights to educators and policy-makers for the design of customized, relevant and effective EE curricula and programs.

Theoretical and Conceptual Framework

Environment, Environmental Quality and Environmental Education

In this study, we viewed the concept of the *Environment* as a set of natural and anthropogenic elements that interact and influence the ecological balance, the quality of life, the residents' well-being, the historical and cultural tradition and the aesthetic values (Beder, 2006). We considered the term *Environmental Quality (EQ)* as the characteristics of the environment that comply with the human needs (see also the model EN ISO 8402 Quality Management and Quality Ensuring Glossary) (Megalofonos, 2001). We focused on the degradation of EQ as a transformation of the characteristics of the environment and the change of its initial composition through human interventions (e.g. high concentration of substances, noise, radiation) resulting to negative implications on the well-being of the population, the economy, and the cultural activity (Zachariou, 2008).

We further viewed *EE* as an agent of awareness and mobilization of people. Such awareness and mobilization at all levels of society (e.g. organized and active citizens and state organizations) towards the environmental problems is considered essential for the preservation of EQ (Connell et al., 1998). EE is defined as the process of identifying values and clarifying ideas in order to develop, within individuals and social groups, the necessary and essential skills

as well as attitudes for understanding and appreciating the interrelation between Man, Civilization and Natural Environment (Huckle, 1999). Although EE is not directly involved in the solution of the environmental problems, it nevertheless aims at the formation of environmental morals by introducing new attitudes, behaviors, values, knowledge and skills -such as the concept of sustainable development- to the students, the general public, the citizens and social groups (Hungerford et al., 1990; Palmer, 1998;).

Environmental Education and the Greek Curriculum

The concept of EE evolved and developed during the 60's, as a response to increasing concerns about ecology, the environmental problems and the protection of nature, and was eventually established on a global scale during the first world meeting on EE in Nevada, USA, in 1970 (Huckle, 1999; Orr, 2004).

In Greece, the concept of EE was introduced in 1976 and was first implemented in secondary education in the form of an "Optional Educational Innovation" program in the school year 1980-81. Since 1990 it constitutes part of the school curriculum. It aims at raising the students' awareness regarding the inter-relation between people and their natural and social environment, at informing the students about relevant problems, and at mobilizing them to get involved in environment protection activities. EE is approached interdisciplinary and inter-thematically, and emphasis is given to the sustainable management and development of the environment, to the concern for the future of the planet, and involvement -at a local and global level- in activities relevant to the rational use of natural resources and the "appropriate usage" of technology (Trikaliti, 1995; Papadopoulos, 2005). Even though EE is closely related to other disciplines, and it connects school knowledge with the local cultural and social environment, it is still an optional subject.

Research Questions

As previously discussed, although research on the impact of socioeconomic and demographic variables on the attitudes and perceptions in relation to the environment has advanced our understanding of how people view, think about, and are aware of the natural environment (Samdahl & Robertson, 1989, Brody, 2004), research specifically on the formation of attitudes towards EE is still limited. The main research question of this study was the examination of the relation between the *teachers' attitudes towards EE* (Construct A) and the *attitudes towards the environment* (Construct B). We examined this relation also considering the interaction between the cognitive aspect (knowledge) and the emotions for the formation of attitudes and beliefs, as discussed in section 2.3. This perspective may further provide more in-depth insights on the possible relation between EE and EQ.

Our secondary research questions addressed the relation of the *teachers' sources of information* (e.g. official or unofficial sources, attitudes of social and family circle) (Construct C), and of the *intensity of environmental problems* in their place of residence or of the school in which they are employed (Construct D), with the teachers' attitudes towards EE. These four constructs (A, B, C and D) constitute the main axes of our survey, as will be discussed in the Research Methods section. For a schematic representation of the features of these concepts see Figure 1.

Research Method

Viotia prefecture and Education

For our study, we selected Viotia prefecture mainly because of its social, industrial and geographic heterogeneity (it is one of the most heterogeneous geographic areas in Greece) (Zachariou, 2008). Viotia is part of Central Greece. 22% of the total area is mountainous, 38% semi-mountainous, 40% plains and cultivable land, with two costal zones -one in the North (Gulf of Evia) and one in the South (Gulf of Corinth). In Viotia there are also areas of varying population density (i.e. large cities, small towns and villages, almost uninhabited areas). The main economic activities of the area are agriculture, tourism, and the industry.

Particularly in relation to the industry, Viotia hosts a significant number of large, medium-sized or smaller industrial units. These are mainly located in the three industrial zones: one in the eastern part of the prefecture (Inofyta, Schematari), one in the central part (Thiva) and one in the southwestern part of the prefecture (Thisvi). Part of Viotia is heavily industrialized making it one of Greece's most industrialized prefectures, following Attica and Thessaloniki. This heavy industrialization could possibly be linked to the significant pollution problems of the area. Particularly during the time of our survey, an important issue of surface water and groundwater pollution with hexavalent chromium in Eastern Viotia was drawing a lot of media attention (Zachariou, 2008).

In Viotia prefecture, there are 64 schools of secondary education (high schools, general senior schools and technical schools), 1,527 (N_{total}) teachers of all specializations and various teacher-school work relations (permanent, supply teachers, hourly paid etc.) and 7,177 students. The environmental actions of the schools of the prefecture are supported by the Office of Environmental Education at the Head Office of the Secondary Education of Viotia.

Sampling

The target population of this study was the total number of teachers (N_{total}) of all the specialties of secondary education public schools in Viotia prefecture. Our sampling unit was the teacher and our sampling frame was the official records of the teachers in these schools. Stratified sampling (with proportional allocation) was chosen as a sampling method (Cochran, 1977; Kiss, 1995). The strata were based on the level of urbanization of the area each school was located. Specifically, we defined 3 stratas and inside in each strata we sampled the appropriate number of teachers ($n_{strata} = n_{total} \cdot N_{strata} / N_{total}$). The sampling fraction was set to 20%. The sample size (number of participants) was $n_{total} = 262$ from 53 different schools (82.8% of 64 total number of schools in the prefecture). Also, the stratified sampling process considered the samples of the different teachers' specialties. These specialists were: Sciences (e.g. mathematics, physics), Language (e.g. literature, history), Foreign Languages (e.g. English, French), Social Sciences (e.g. Theology, Sociology), Economy, Health and Sports Sciences (e.g. gymnastics, medicine), Technology (e.g. information technology, engineering), Technical and Other Laboratory Specialties (e.g. mechanics, hairdressing) Questionnaire

Data instruments and data collection

Data was collected through questionnaires. The questionnaire included a section for the demographic information of the participants (gender, age, area of residence, work relation with the school, level of education) and four groups of questions corresponding to the constructs of our study, as described in section 2.4: the first group of questions (Group A) included questions on the exploration of the teachers' attitude towards the environment (relevant to Construct B). Group B included questions on the quality of the environment and the environmental problems in their area of residence or work (relevant to Construct D). For this group of questions the aim was not to identify the most important environmental problems, but rather the educators' attitudes towards some of the most important local environmental problems. Questions in Group C referred to the sources of information on environmental issues, e.g. family, friends, mass media, internet, or official institutions (relevant to Construct C). Finally, Group D of questions aimed at exploring the teachers' attitudes on EE and the environmental programs they implement at school (relevant to Construct A). Responses to the questions were given by the participants in a seven-grade scale, where "1" indicated strong disagreement and "7" strong agreement. We initially conducted a pilot survey which allowed us to verify the reliability and validity of the questionnaire.

Data Analysis

For the analysis of the data, we applied descriptive and inferential statistics (Tsantas et al., 1999). We further applied the multivariate analysis technique of "Factor Analysis" (Bartholomew et al., 2008). Factor analysis was appropriate for our data since it applies to psychometrics, and behavioral and social sciences and it can also deal with correlated data of large sizes. We employed factor analysis for describing variability among observed, correlated variables and for summarizing them into unobserved, uncorrelated variables (factors). Cronbach's alpha coefficient of reliability was used in order to measure the internal consistency of each group of questions. The Cronbach's alpha coefficient of each group will be described in the next sections. For the statistical analysis, the statistical program SPSS (version 18) was used.

Descriptive and Exploratory Data Analysis

Personal Characteristics and Demographics

There was an approximately equal representation of men and women in our sample (54.2% and 45.8% respectively). The majority of them had not attended any supplementary training or postgraduate studies (52.3%), most of them held a permanent position in the school (53.1%), and had less than 5 years of work experience as teachers (41.6%). The majority was 35-45 years old (42.3%) and resided at Viotia (70.3%).

Exploration of Teachers' Attitudes: Question Groups Results

In this section we present the results and analysis of the participants' answers in the four question groups. We consider the rate "4" as the mean score of the 7-point Likert scale we employed, and we discuss the possible divergences from this rate. The survey items, results and descriptive statistics of each question group are presented in Tables 1- 4 in the appendix. Also, we give the

corresponding 95% confidence intervals for the mean of each item denoting the lower bound (LB) and the upper bound (UB).

Teachers' attitudes towards the environment

The attitudes of the teachers towards the environment (Construct B) were explored through Questions Group A. The relevant descriptive statistics are presented in Table 1 of the appendix.

Our results indicate that the teachers are not satisfied by the measures for the protection of the environment (mean=2.649, SD=1.422) and they do not believe that society is sensitive towards the environment (mean=3.080, SD=1.258). At the same time, the majority of the respondents (71% of responses were from 1 to 4 in the Likert scale) are also not satisfied with the quality of the environment in which they live (mean=3.565, SD=1.569), but is not willing to change their place of residence seeking a place with better environmental quality (mean=3.855, SD=1.922). The majority (in total 58% rated the item with 5-7) believes that they are aware of the environmental problems in their region (mean=4.668, SD=1.379). They also tend to consider themselves less responsible for the environmental quality of their place of residence (mean=4.256, SD=1.536). The responsibility for the environmental problems of their place of residence seems to also be attributed more to others (mean=5.054, SD=1.383). Furthermore, respondents seem to consider themselves sensitive towards the environment (mean=5.156, SD=1.149) and they report that they are willing to change their way of life in order to improve the environmental quality of their place of residence (mean= 5.412, SD=1.368). Finally, the majority of the respondents seems to be familiar with the concept of "*environmental education*" (mean=5.447, SD=1.317).

It seems encouraging that, as indicated by our results, teachers seem to have a positive attitude, be sensitive towards the environment, and recognise the importance of efficient measures for the protection of the environment. They tend, though, to separate themselves from the source of the problem; the majority does not seem to assume responsibility for the environmental quality, but rather emphasise more the responsibility on external factors.

In order to analyse the data in depth we proceeded to the application of exploratory factor analysis (FA). The linear combinations that are formed, by applying FA, substantially interpret the structure of the data. The method used for performing FA is Principal Components and as a rotation method we used varimax with 99 iterations. The internal consistency of the questions Group A was acceptable (Cronbach's alpha=0.673). Four significant factors were extracted by FA (Total Variance Explained 66%). These factors were conceptually meaningful. More specifically in Table II.

Teachers' attitudes on the environmental problems

Through Questions Group B we aimed to explore the perceptions of the teachers in relation to the impact of different human activities on the environment and the possible damage these entail. Descriptive statistics of this group of questions are presented in Table 2 of the appendix.

Analysis of the data indicated that Aeolic and photovoltaic parks are not considered by the majority of the respondents as damaging to the environment

(mean=2.729, SD=1.807). Touristic activities were also rated low as factors negative for the environment (mean=3.508, SD=1.810). Tourism in Viotia is localized around the mountainous area of Parnassus and is mainly seasonal (winter tourism). It also relies on the traditional architecture and the natural habitat of the area. The construction of underground infrastructure networks for water or energy supply were also assessed as less damaging factors; they were mainly considered to cause temporary problems during their construction (mean=3.615, SD=1.677). Finally, a neutral position with a number very close to the average (mean=3.908, SD=1.768) seems to be held by those who responded that the environment is being damaged due to various infrastructure constructs (e.g. roads, ports, airports). The transport network in Viotia consists of the national road, which does not traverse inhabited areas, while the rest of the network is rural. There is no significant port infrastructure on the coasts, except of small-sized fishing shelters, and the existing airports in the area are now rarely used.

Respondents rated higher, as factors damaging the environment, the aerial transport networks of energy, information etc. (mean=4.527, SD=1.697) and the road advertising boards (mean=4.561, SD=1.738). The highest rated environmental problems were, according to the respondents, the television and radio broadcasting towers (mean=4.966, SD=1.638), the illegal constructions (mean=5.218, SD=1.718), the telecommunication towers of mobile telephony companies (mean=5.408, SD=1.627) and the industrial sites (mean=5.710, SD=1.595).

Such factors are often put in focus in discussions on environmental degradation. Furthermore, these infrastructures (e.g. transport networks, telecommunication towers of mobile companies, road advertising boards) are often found within eye-range and are more obvious to the public (e.g. telecommunication towers are installed even in inhabited areas). The industrial sites as an environmental problem, however, were not as highly rated as we expected. Industrial sites are concentrated in specific regions. This localization aggravates the environmental problems of the area, but also makes them easy to ignore or disregard as an environmental issue to people not familiar with the specific area. 12.21% of the respondents rated the industries from 1 (less important) to 3 as a factor of environmental problems. This could also be an indication of the mitigation of environmental problems and quality in favor of a modern model for consumerism.

The internal consistency of this question group was satisfactory (Cronbach's alpha=0.770). The application of factor analysis to Group B of questions (Table 2) resulted in two main factors (Total Variance Explained 57%). The factors are described in Table II.

Teachers' attitudes on their sources of information on environmental issues

The third group of questions (Group C) refers to the extent to which teachers consider that the level of the information provided to them on environmental issues is satisfactory. The relevant survey items referred to information coming from family (e.g. spouse, siblings, parents), friends, the mass media, the printed press, the internet, local authorities, the Ministry of Education, the school (i.e. school authorities or channels of communication),

scientific organizations, and environmental organizations (e.g. non-profit organizations for the protection of the environment). The relevant items, descriptive statistics and percentages of responses are presented in Table 3 in the appendix. Most teachers responded that they are not satisfied by the information on environmental issues that is provided by the relevant ministries (64.88% of the responses were in the 1-3 range of the Likert scale) (mean=2.924, SD=1.476) and by the local authorities (mean=3.111, SD=1.543). The responses to the questions regarding their satisfaction from the information provided by their family, friends, the media, the press, the internet, school, scientific institutions and environmental organizations are near the average. This discontent regarding the information provided by government authorities could probably be linked to a general perception, prevalent among the Greek population, that the state is unreliable and inadequate (The Greek Ombudsman annual report: "State-Citizen Relations", Athens 2000).

The application of factor analysis to this group of questions (see also Table 3) produced three factors (Total Variance Explained 70%). Factors' are described in Table II.

Teachers' attitudes regarding the EE programs in secondary education

The fourth group of questions (Group D) is relevant to the environmental education programs that are implemented in secondary education schools. Relevant items, descriptive statistics and percentages of responses are presented in Table 4 of the appendix. Analysis of the accumulated data indicated that teachers seem to believe that environmental programs should be included in the current school curriculum (mean=5.153, SD=1.894). They also seem to believe that the students' and teachers' participation in such programs should be compulsory in secondary education (mean=5.160, SD=1.739). To a relatively high degree, they consider the implementation of such programs to be necessary (mean=5.832, SD=1.379) and they believe that this institution should be extended to the whole of society (mean=5.992, SD=1.428).

Factor analysis of this group (Cronbach's alpha= 0.863) produced three main factors (see also Table 4) and the total variance explained was found to be equal to 70%. The three factors that emerged are described in Table II.

Exploration of the Relations among Factors and Variables

Correlation of Teachers' Attitudes towards the Environment with their Attitudes towards Environmental Education

Having identified the different factors involved, through the factor analyses described, we further attempted to explore the correlations among these factors. For the analysis we used the correlation coefficient of Spearman (non-parametric correlation coefficient) in order to identify the correlation structure among factors revealed by different groups of questions.

It seems that the "Degree of Participation of Teachers and Students in EE" factor (D.I) is positively related to the factors "Degree of dissatisfaction from Information coming from official sources" (C. II) (R=0.373, p-value<0,001), "Degree of Pollution Due to Other Infrastructures, Wind Parks and Touristic Activities" (B.II) (R=0.144, p-value=0.038), "Degree of understanding of EE and teacher's environmental awareness" (A.I) (R=0.129, p-value=0.020), and "Degree

of Satisfaction from Information coming from Unofficial Sources” (C.I) ($R=0.128$, $p\text{-value}=0.039$). These links were rather expected; the teachers’ higher awareness and knowledge of EE, discussions and information exchange on environmental issues in the social and family circle, the demand for further and more in-depth information by the official sources and the awareness of the sources of environmental pollution seem to be linked to the active participation of teachers and students in EE programs.

The “Need for Implementation and Increase in Application” factor (D.II) is positively related with the factors “Degree of Dissatisfaction from Information coming from Official Sources” (C.II) ($R=0.300$, $p\text{-value}<0,001$), “Degree of understanding of EE and teacher’s environmental Awareness” (A.I) ($R=0.281$, $p\text{-value}<0,001$), “Degree of Conscientiousness and Openness” (A.III) ($R=0.223$, $p\text{-value}<0,001$), “Tendency to Escape for Environmental Reasons” (A.IV) ($R=0.177$, $p\text{-value}=0.004$), and “Degree of Pollution Due to Technology, Energy and Industry” (B.I) ($R=0.172$, $p\text{-value}=0.005$). As previously discussed, increased environmental awareness and knowledge of EE is positively related to positive attitudes towards EE and the requirement for further implementation of EE in the compulsory curriculum and extension to the broader community, to more citizens and youngsters, so that they can contribute to the improvement and protection of the environment. The positive correlation between the “Tendency to Escape for Environmental Reasons” (A.IV) and the “Need for Implementation and Increase in Application” (D.II) factor should also be highlighted. Dissatisfaction with the quality of the environment in the area of residence and the perception of the environmental problems as a cause of relocation seem to stress the importance of the “Need for Implementation and Increase in Application” (D.II) of EE.

Factor D.II is also negatively correlated to the “Degree of society’s environmental Awareness” (AII) factor ($R=-0.225$, $p\text{-value}=0.001$). This correlation could possibly indicate that the lower the sensitivity of the society towards the environment is perceived to be, the higher the requirement by the teachers for further implementation of EE is.

The positive correlation between the “Degree of Teachers’ Knowledge in EE programs” factor (D.III) and the “Degree of understanding of EE and teacher’s environmental awareness” (A.I) factor ($R=0.245$, $p\text{-value}<0,001$) seems to confirm the link between the teachers’ knowledge, and information on environmental issues with the sensitivity of the teachers and the active participation of the students in EE programs. This indicates that knowledge and information may lead to higher teachers’ sensitivity, and to the participation of the students and future citizens in actions that will give them the means to improve their attitude towards the environment.

Some critical relations which have to be, again, highlighted, are the strong relations of the factors “Degree of Dissatisfaction from Information coming from official sources” (C. II) and “Degree of understanding of EE and teacher’s environmental awareness” (A.I) with both the factors “Degree of Participation of Teachers and Students in EE” (D.I) and “Need for Implementation and Increase in Application” (D.II). The factor “Degree of understanding of EE and teacher’s environmental awareness” (A.I) is also related to the “Degree of Teachers’ Knowledge in EE programs” (D.III). These relations seem to stress the

importance of knowledge and information by official sources as the basis for the further development of EE.

Socio-demographic characteristics and the Teachers' Attitudes

In this section we discuss the relation of the factors described in the previous sections with the socioeconomic and demographic characteristics of the teachers. Statistical tests such as t-tests and non-parametric equivalents of t-test were used for comparing mean scores of the factors with respect to the teachers' differences in years of work experience, work position, and area of residence.

Teachers' gender does not affect teachers' attitudes toward environment. The analysis of all factors presented in Tables 1-4 are not differ due to gender. Work experience, Work Position and Factors Relevant to EE

The work experience and the position of the teacher seem to be related to the knowledge of and the participation of the teacher to EE programs.

More specifically, the "*Degree of Participation of Teachers and Students in EE*" (D.I) factor is negatively related to the years of working experience (as well as to the teacher's age). Teachers with less than 5 years of work experience rated their participation and the participation of the students in EE programs' higher than teachers with work experience of more than 5 years. This could possibly be attributed to the enthusiasm and impulse of teachers in the beginning of their career path, who tend to participate in actions supplementary to their compulsory working hours and without other direct benefits. The decline of this participation after 5 or more years of work could possibly be attributed to the age of the teachers, to the information they have access to, or to factors relevant to in-school or psychological processes. It would, nevertheless, be an interesting question for further research, possibly via a longitudinal study.

Although the participation of teachers and students in EE programs was rated higher by teachers with less work experience, it was interesting that the teachers with less than 5 years of experience rated their knowledge of EE programs lower than those with more than 5 years of experience. The factor "*Degree of Teachers' Knowledge in EE programs*" (D.III) was negatively related to the years of work experience and particularly to the less-than-5 years of working experience variable. This factor was also related with the work relation of the teacher. Responses of the teachers in a permanent position were close to the average, while the responses of the temporary teachers (supply teachers, hourly paid) were below the average. It seems that temporary teachers have not yet become familiar with EE programs, possibly because of lack of time available for non-compulsory or voluntary activities.

Finally, the "*Need for implementation and increase in application*" factor (D.II) was not related to any demographic characteristic.

Relation of the area of residence with other factors

Although the area of residence does not seem to have a direct relation with the factors relevant to EE, there may be an indirect relation since there are differences on the scores of the factors "*Tendency to escape for environmental reasons*" (A.IV), "*Degree of Pollution due to Technology, Energy and Industry*" (B.I), "*Degree of Pollution due to Other Infrastructures, Wind Parks and*

Touristic Activities” (B.II) and “*Degree of Satisfaction from Information coming from Family and Friends*” (C.III) in different areas. Although the area of residences does not present a relation with these factors, it is related to factors that are related to them, as described in the previous subsection.

The results of the analysis are presented on geographical maps (see Figures 2.a, 2.b, 2.c and 2.d in Appendix) after the factor scores were discretised for obtaining a clearer view of the phenomena emerging. It should be noted that the parts of the maps with the “No Data” indication are mountainous or agricultural areas that are not inhabited or are sparsely inhabited and therefore teachers do not live there.

The results of the relation of the area of residence with the “*Tendency to escape for environmental reasons*” factor (A.IV) are presented in Figure 2.a. As indicated on map, there is a high level of tendency to escape (rates above the average) in areas without serious environmental problems. In this case, the tendency to escape could be attributed to the inaccessibility of the area; furthermore it is usually newly hired, temporary teachers who are assigned in these areas. The high tendency to relocate from such areas can therefore be attributed not to any environmental problems, but rather to social or personal reasons. On the other hand, in the areas indicated on the maps with darker shades, tendency to leave is lower (below average). In this case, it has to be considered that it is mainly teachers with permanent positions and more years of working experience that live in these areas; tendency to relocate is, therefore, limited. It seems that tendency to leave the area of residence is a complex issue involving not only environmental factors but also social, personal or professional factors.

The results of the relation of the place of residence on the “*Degree of Pollution due to Technology, Energy and Industry*” factor (B.I) are presented in Figure 2.b. It seems that rates are higher (above average) in rural and mountainous areas and in areas with major industrial development. In the latter case, the residents are directly confronted with the impact of technology, energy and industry in their area of residence. In the former case, the sensitivity of the teachers living in rural areas towards the impact of technology, energy and industry on the environment could be relevant to the fragility of such areas with respect to human intervention: any intervention is immediately visible, as for example the installation of mobile companies’ telecommunication towers.

In Figure 2.c the results of the relation of the place of residence with the “*Degree of Pollution due to Other Infrastructures, Wind Parks and Touristic Activities*” factor (B.II) are presented. It was interesting that areas with rates above average, on this factor, were the areas with industrial zones, recently installed aeolic and photovoltaic parks, and developed touristic activities. The areas with rates under average are rural, non-inhabited farmlands or areas covered with forests or barren lands where no substantial intervention has been made by man. It seems that this type of human intervention on the environment (i.e. infrastructure, wind parks, touristic activities) had a greater impact on teachers living in areas where such interventions were directly apparent.

The results of the relations of the place of residence on the “*Degree of Satisfaction from Information coming from Family and Friends*” factor (C.III) are presented in Figure 2.d. The areas with rates above average were the highly

urbanized areas, including the two largest cities of the prefecture (Leivadia and Thiva), the highly touristic region of Arachova and the heavily industrialized area near Schimatari. It seems that information exchange in the family and social circles was higher in urban and industrial areas. This could possibly be attributed to social or environmental factors such as frequency or type of communication with friends and family, the presence and impact of environmental problems, and easier access to information sources by the respondents and their social and family circle.

Conclusions and Discussion

The main focus of this study was the exploration of the teachers' attitudes towards environmental education and their relation to their attitudes towards the environment, and also other socio-demographic factors. Our results indicate that teachers' attitudes towards the environment, their family and social circles, and the importance of environmental pollution problems in their place of residence are highly related to their attitudes towards environmental education, similarly to Esa's study (2010) which showed a correlation between environmental knowledge, attitude and practices of pre-service teachers. Knowledge and understanding of environmental issues are linked to the development of positive attitudes towards environmental education. A requirement of the teachers also emerged for the need to support the institution of EE, mainly addressed to young people who will potentially be the main agents of the management of the environment and should therefore become more informed and sensitive towards it. It is also worth noting that knowledge and understanding affect the attitudes towards environmental education. There seems to be a two-way dynamic relationship between these two parameters since information enriches knowledge and the enrichment of knowledge stimulates curiosity and the need for further knowledge.

Moreover, the findings of this study show that teachers consider the implementation and expansion of the application of EE programs to the wider public necessary, as, in the majority, they observed lack of social awareness and social responsibility of the public. The teachers also seem to require more information and more training on EE from Official Sources. This need is bigger in the most polluted areas (industrial areas) of the prefecture. Environmental Educational programs, conferences and seminars seem to be necessary for keeping the teachers up-to-date with the latest developments, research and policies. A similar study conducted by Liarakou et al. (2009) also highlighted the lack of in-depth knowledge of educators on specific environmental issues (renewable energy sources) stressing the importance of information and training. An interesting trend also emerged indicating that demographic characteristics such as years of working experience may have a negative relation with the involvement of the teachers in EE programs at school.

Furthermore, it seems that the teachers are aware of the environmental problems, they seem to be concerned and show interest for the effects of human activities on the environment. There are, however, differences mainly in regional schools with non-permanent teaching staff and even staff who reside in large urban centres and has a different perspective, and experiences things differently. Most differences were found in schools on the east side of the prefecture which faces the most environmental problems and has the largest

percentage of migrant education staff who have a permanent place of residence in the neighbouring prefecture of Attica, where environmental problems are more severe.

We also noticed a tendency of denial of personal responsibility for the existing situation and attribution of responsibility to others as well as a cautious attitude towards the state, while we noticed a positive attitude towards activities within the school which contribute to strengthening the sense of responsibility of the students and future citizens towards the environment.

Following these results, suggestions may be made for the reinforcement and improvement of the institution of environmental education and the teachers' attitude towards it: constant and up-to-date teachers' training on environmental issues, with parallel reinforcement by events such as conferences, meetings, and work-shops, the creation of high-quality and scientifically accurate educational material (e.g. handouts, audiovisual material, software) for environmental education purposes aiming both at teachers and their students, the improvement of the schools' infrastructure (e.g. environmental educational material in the libraries, scientific tools and instruments on environmental education, and environmental laboratories), guiding and informing teachers and school units on networking and corporate environmental issues, and incorporation of the institution in the form of activities within the compulsory curriculum of secondary education school and the extension of its implementation in life-long learning institutions. In a similar vein, a study conducted with Swedish secondary school teachers (Borg et al., 2012), identified the lack of inspiring examples of effective implementation of Sustainable Development (SD) in their teaching and the lack of the necessary expertise about SD as the main barriers in SD education. The study also concluded that more channels of communication and collaboration among teachers have to be developed and further training is required.

This matrix of factors involved in the formation of the teachers' attitudes towards the environment is schematically represented in figure 3 in the appendix, and constitutes our proposed framework for further research in this area. Based on these results and our proposed framework, further research seems to be necessary mainly focusing on the attitudes of the students and parents so as to extract conclusions on the main pillars of the educational process (students-parents-teachers). The exploration of the relations among the attitudes of these three groups could also provide interesting insights. The results of a nation-wide study, possibly by a central institution such as the Ministry of Education, could be further used for the sensitization of the educational community towards better environmental quality. We would further suggest a longitudinal study on the possible shifts of the attitudes of students', teachers' and parents', following specific environmental education interventions.

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Appendix

Characteristic	Values	Frequencies	Relative Frequencies
Gender	Males	120	45.8%
	Females	142	54.2%
Educational Level	High School	133	50.8%
	Senior High School (General)	95	36.3%
	Senior High School (Technical)	25	9.5%
	Technical School	9	3.4%
Supplementary Education	No supplementary training	137	52.3%
	Other training	87	33.2%
	MSc	36	13.7%
	PhD	2	0.8%
Employment Status	Permanent	139	53.1%
	Temporal	92	35.1%
	Detachment	31	11.8%
Teachers' Experience	<5 years	109	41.6%
	5-10	55	21%
	10-20	64	24.4%
	>20	34	13%
Age	<35	81	31.2%
	35-45	110	42.3%
	45-55	55	21.2%
	>55	14	5.4%
Place of Residence	Viotia	212	70.3%
	Attica	47	18.1%

Table I: Main descriptive Statistics of the Sample

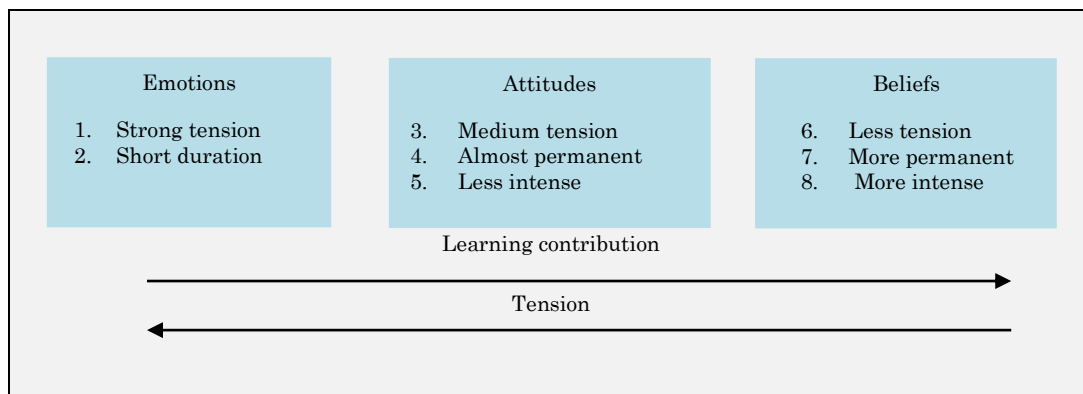


Figure 1: Interaction between emotions, attitudes and beliefs (Filippou et al. 2001).

Question	Frequencies for Level of Compliance							Summary Statistics				95% Confidence Interval		Factors			
	(1) Lowest Level	(2)	(3)	(4)	(5)	(6)	(7) Highest Level	N	Mean	Mode	Std. Deviation	LB	UBs	A.I (20.6%)	A.II (17.7%)	A.III (16.3%)	A.IV (11.5%)
A.1. ... understand the term “Environmental Education”	1.15%	1.53%	5.34%	14.12%	22.52%	32.06%	23.28%	262	5.447	6	1.317	5.287	5.606	0.817			
A.2. ... consider themselves sensitive towards the environment.	0.38%	2.29%	3.05%	20.61%	34.73%	27.10%	11.83%	262	5.156	5	1.149	5.017	5.296	0.801			
A.3. ... consider society to be sensitive towards the environment	7.25%	27.86%	32.06%	20.99%	8.40%	1.15%	2.29%	262	3.080	3	1.258	2.928	3.233		0.779		
A.4. ... are satisfied with the quality of the environment in which they live	9.92%	17.94%	21.37%	21.76%	19.08%	5.34%	4.58%	262	3.565	4	1.569	3.375	3.755		0.545		-0.520
A.5 ... consider themselves to be responsible for the quality of the environment they live in	4.20%	8.78%	18.70%	24.81%	19.47%	17.18%	6.87%	262	4.256	4	1.536	4.070	4.442			0.784	
A.6. ... consider the others responsible for the quality of the environment the live in	0.38%	4.23%	10.00%	17.69%	26.15%	25.77%	15.77%	260	5.054	5	1.383	4.886	5.222			0.799	

A.7. ... are aware of the environmental problems of their area	1.91%	5.73%	11.07%	23.28%	27.86%	23.28%	6.87%	262	4.668	5	1.379	4.501	4.835	0.671		
A.8. ... consider the measures taken for the protection of the environment to be satisfactory	22.52%	31.68%	21.76%	12.98%	5.73%	4.20%	1.15%	262	2.649	2	1.422	2.477	2.821		0.795	
A.9 ... are willing to change their way of life so that the quality of the environment is improved	1.15%	2.69%	5.38%	15.38%	17.31%	36.15%	21.92%	260	5.412	6	1.368	5.245	5.578			0.481
A.10. ... are willing to change their place of residence in search of better environmental quality	12.98%	17,94%	14,12%	16,03%	14.50%	13.36%	11.07%	262	3.855	2	1.922	3.622	4.088			0.900

Table 1: Frequencies and Descriptive Statistics for the first group of questions (Group A).

Question	Frequencies for Level of Compliance							Summary Statistics				95% Confidence Interval		B.I (32.6%)	B.II (24.6%)
	(1) Lowest Level	(2)	(3)	(4)	(5)	(6)	(7) Highest Level	N	Mean	Mode	Std. Deviation	LB	UBs		
B.1. ... telecommunication towers of mobile companies pollute the environment	4.20%	3.05%	5.73%	10.31%	20.23%	24.43%	32.06%	262	5.408	7	1.627	5.210	5.606	0.868	



B.2. ... television and radio broadcasting towers pollute the environment	3.82%	5.73%	8.78%	16.41%	22.52%	22.52%	20.23%	262	4.966	5	1.638	4.766	5.165	0.816	
B.3. ... road advertising boards pollute the environment	5.73%	9.54%	9.92%	22.52%	17.56%	19.47%	15.27%	262	4.561	4	1.738	4.350	4.773	0.698	
B.4. ... air networks of transmission of energy, information etc. pollute the environment	6.11%	7.25%	12.21%	22.52%	20.61%	16.79%	14.50%	262	4.527	4	1.697	4.320	4.733	0.702	
B.5. ... underground networks of transmission of energy, water etc. pollute the environment	11.45%	18.70%	16.79%	22.90%	15.65%	9.16%	5.34%	262	3.615	4	1.677	3.410	3.819		0.614
B.6. ... wind parks (wind turbines) and the parks of photovoltaic elements pollute the environment	34.73%	24.05%	8.02%	14.12%	9.16%	5.73%	4.20%	262	2.729	1	1.807	2.509	2.949		0.720
B.7. ... industrial sites pollute the environment	2.67%	3.05%	6.49%	8.78%	9.54%	26.34%	43.13%	262	5.710	7	1.595	5.516	5.904	0.531	
B.8. ... various infrastructures (roads, ports, airports....) pollute the environment	12.21%	13.36%	12.60%	22.52%	19.08%	12.98%	7.25%	262	3.908	4	1.768	3.693	4.123		0.783
B.9. ... touristic activities pollute the environment	18.70%	14.89%	16.41%	19.08%	13.36%	12.98%	4.58%	262	3.508	4	1.810	3.287	3.728		0.660

B.10. ... uncontrolled construction building pollutes the environment	2.29%	9.54%	5.73%	13.36%	12.60%	28.63%	27.86%	262	5.218	6	1.718	5.009	5.427	0.539	
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Table 2: Frequencies and Descriptive Statistics for the second group of questions (Group B).

Question Degree of satisfaction with the information on environmental issues ...	Frequencies for Level of Compliance							Summary Statistics				95% Confidence Interval		Factors		
	(1) Lowest Level	(2)	(3)	(4)	(5)	(6)	(7) Highest Level	N	Mean	Mode	Std. Deviation	LB	UBs	C.I (25.3%)	C.II (23.9%)	C.III (20.3%)
C.1. ...that is provided by the family	16.03%	19.47%	12.21%	27.10%	16.79%	6.87%	1.53%	262	3.359	4	1.588	3.166	3.552			0.569
C.2. ...that is provided by friends	7.25%	15.65%	21.76%	29.01%	15.65%	9.54%	1.15%	262	3.634	4	1.418	3.461	3.806			0.560
C.3. ... that is provided by the media (tv, radio etc.)	3.05%	9.16%	17.94%	25.19%	25.95%	16.03%	2.67%	262	4.206	5	1.388	4.037	4.375	0.785		
C.4. ... that is provided by the press (newspapers, magazines etc.)	3.44%	4.58%	16.41%	25.95%	23.28%	20.61%	5.73%	262	4.458	4	1.424	4.285	4.631	0.731		
C.5. ... that is provided though the internet	5.73%	5.34%	12.60%	18.70%	20.61%	23.66%	13.36%	262	4.676	6	1.663	4.473	4.878	0.630		
C.6. ...that is provided by the local authorities (prefectures, counties	18.32%	19.85%	23.28%	17.94%	13.74%	5.34%	1.53%	262	3.111	3	1.543	2.923	3.298		-0.527	



etc.)																
C.7. ...that is provided by the competent ministries	19.08%	25.57%	20.23%	21.76%	6.87%	5.34%	1.15%	262	2.924	2	1.476	2.744	3.103			-0.565
C.8. ...that is provided by school	5.00%	11.92%	18.08%	25.00%	20.38%	12.31%	7.31%	260	4.100	4	1.569	3.908	4.292			
C.9. ...that is provided by scientific organizations	4.58%	14.89%	14.89%	22.90%	17.18%	15.65%	9.92%	262	4.198	4	1.679	3.994	4.403	0.736		
C.10. ... that is provided by environmental organizations	5.34%	3.82%	13.74%	14.50%	17.94%	24.05%	20.61%	262	4.905	6	1.721	4.695	5.114	0.582		-0.580

Table 3: Frequencies and Descriptive Statistics for the third group of questions (Group C).

Question	Frequencies for Level of Compliance							Summary Statistics				95% Confidence Interval		Factors		
	(1) Lowest Level	(2)	(3)	(4)	(5)	(6)	(7) Highest Level	N	Mean	Mode	Std. Deviation	LB	UBs	D.I (28.43%)	D.II (26.0%)	D.III (15.3%)
D.1 ... that they know the content of environmental programs implemented	4.58%	7.63%	14.12%	20.99%	14.12%	22.52%	16.03%	262	4.641	6	1.716	4.433	4.850			0.941

D.2. ... the implemented environmental programs in schools are considered necessary	1.15%	1.91%	3.82%	9.54%	16.79%	22.90%	43.89%	262	5.832	7	1.379	5.664	6.000		0.691	
D.3 ... that environmental programs are implemented in their schools	2.29%	9.92%	11.83%	17.56%	20.61%	20.61%	17.18%	262	4.748	5	1.658	4.546	4.950	0.533		
D.4. ... the participation of students and teachers in the environmental programs that are implemented in schools should be obligatory	6.11%	3.44%	6.87%	16.03%	12.60%	29.39%	25.57%	262	5.160	6	1.739	4.949	5.372		0.698	
D.5. ... that the participation of the teacher in the environmental programs that are implemented in schools is considered satisfactory	15.65%	17.94%	11.45%	15.65%	13.74%	18.32%	7.25%	262	3.779	6	1.931	3.544	4.014	0.599		0.581
D.6 ... that the participation of students in the environmental programs that are implemented in schools is considered satisfactory	3.44%	11.07%	17.56%	19.85%	20.61%	15.27%	12.21%	262	4.378	5	1.647	4.178	4.578	0.898		
D.7. ... that the participation of teachers in the environmental programs that are implemented in schools is considered satisfactory	5.34%	12.21%	17.56%	21.37%	19.08%	14.89%	9.54%	262	4.195	4	1.662	3.992	4.397	0.891		
D.8. ... that the environmental programs that are implemented in schools achieve their aims	3.82%	10.31%	15.27%	28.24%	20.61%	17.94%	3.82%	262	4.206	4	1.463	4.028	4.384	0.579		

D.9. ... that the environmental programs should be part of the school curriculum in the form of obligatory modules	8.02%	4.20%	9.54%	8.40%	12.21%	27.86%	29.77%	262	5.153	7	1.894	4.922	5.383		0.790	
D.10. ... that the institution of programs regarding the environment should be expanded to the whole of society	0.76%	4.20%	3.05%	6.87%	9.54%	23.28%	52.29%	262	5.992	7	1.428	5.819	6.166		0.834	

Table 4: Frequencies and Descriptive Statistics for the fourth group of questions (Group D).

Factor name	Item	Description
Factor A.I	Questions A.1, A.2 and A.7 presented higher loadings in factor A.I. This factor seems to refer to the <i>“Degree of understanding of EE and teacher’s environmental awareness”</i> .	The emergence of this factor implies that information and awareness is positively linked to the sensitivity towards the environment.
Factor A.II	Questions A.3, A.4 and A.8 were grouped under Factor A.II. This factor seems to refer to the <i>“Degree of society’s environmental awareness”</i> .	This factor indicates a relation between the discontent for the environmental conditions and the awareness of people.
Factor A.III:	Questions A.5, A.6 and A.9 had higher loadings in factor A.III. This factor seems to be relevant to the <i>“Degree of Conscientiousness and Openness”</i> .	The factor indicates the feeling of responsibility concerning the environmental conditions as well as a tendency to change the way of life in order to improve environmental quality.
Factor A.IV	Questions A.4 and A.10 were grouped under Factor A.IV which is relevant to the <i>“Tendency to Escape for Environmental Reasons”</i> .	The emergence of this factor reveals a negative relation between satisfaction with the area of residence and willingness to abandon the area in search for a better location. The more the respondents reported that they were satisfied by the environment in which they lived, the less willing they were to move in search of a better place.
Factor B.I	Questions B.1, B.2, B.3, B.4, B.7 and B.10 and is relevant to the <i>“Degree of Pollution Due to Technology, Energy and Industry”</i> .	

Factor B.II	Questions B.5, B.6, B.8 and B.9 are included and seems to refer to the <i>“Degree of Pollution Due to Other Infrastructures, Wind Parks and Touristic Activities”</i> .	
Factor C.I	Questions C.3, C.4, C.5, C.9 and C.10 included and referred to the <i>“Degree of Satisfaction from Information coming from Unofficial Sources”</i> .	
Factor C.II	Questions C.6, C.7 and C.8 and seemed to refer to the <i>“Degree of Dissatisfaction from Information coming from Official Sources”</i> .	In this case, the relevant ministries and the local government authorities seemed to attract the highest degree of dissatisfaction and schools as sources of information the lowest. This finding adds to the issue of the discontent towards the state discussed earlier, while low dissatisfaction with the role of the school in the distribution of information could be attributed to the voluntary participation in EE, according to the existing curriculum.
Factor C.III	Questions C.1 and C.2 (as well as C.10 with a negative factor loading) involved and referred to the <i>“Degree of Satisfaction from Information coming from Family and Friends”</i> .	Both parameters seem to participate almost equally and on a relatively high level; this indicates that at least on a conversational basis among family or friends, information and opinions that concern the environment are exchanged. This tendency seems to confirm the increased sensitivity towards the environment as was previously analysed. The negative sign of C.10 indicates the contrast of information by family and friends and of information by environmental organizations.
Factor D.I	Seemed to refer to the <i>“Degree of Participation of Teachers and Students in EE”</i> and involved the questions D.3, D.5, D.6, D.7 and D.8.	The items relevant to the implementation of EE programs in the school, the participation of the teacher and the achievement of the objectives presented lower loadings in this factor, whereas the participation of students and teachers in general had a higher loading. This could possibly be explained by the fact that teachers take part in these programs with the additional motivation to reach their total working-hours objective and the students for being introduced to an alternative educational approach.
Factor D.II	The factor refers to the <i>“Need for Implementation and Increase in Application”</i> and groups the questions D.2, D.4, D.9 and D.10.	It has to be highlighted that the necessity for the incorporation of the programs in the compulsory curriculum was particularly stressed. Furthermore, the extension of their implementation in a



		wider range of the society was also highly rated by the participants as a means for the best possible results in the protection and improvement of the environmental quality.
Factor D.III	The factor included items D.1 and D.5 and referred to the <i>“Degree of Teachers’ Knowledge in EE Programs”</i> .	This indicates a link between the teachers’ awareness and knowledge of EE programs and their involvement in such programs.

Table II: Factors’ description.



Figure 2.a: Mean Scores of the factor “Tendency to escape for environmental reasons” (A.IV) in each municipality of Viotia.



Figure 2.b: Mean Scores of the factor “Degree of Pollution due to Technology, Energy and Industry” (B.I) in each municipality of Viotia.



Figure 2.c: Mean Scores of the factor “Degree of Pollution due to Other Infrastructures, Wind Parks and Touristic Activities” (B.II) in each municipality of Viotia.

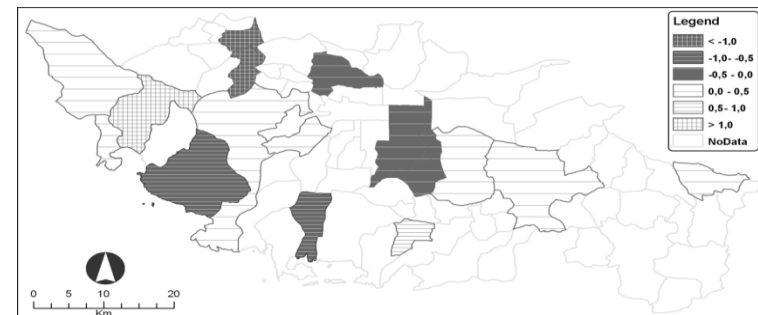


Figure 2.d: Mean Scores of the factor “Degree of Teachers’ Knowledge in EE programs” (C.III) in each municipality of Viotia.

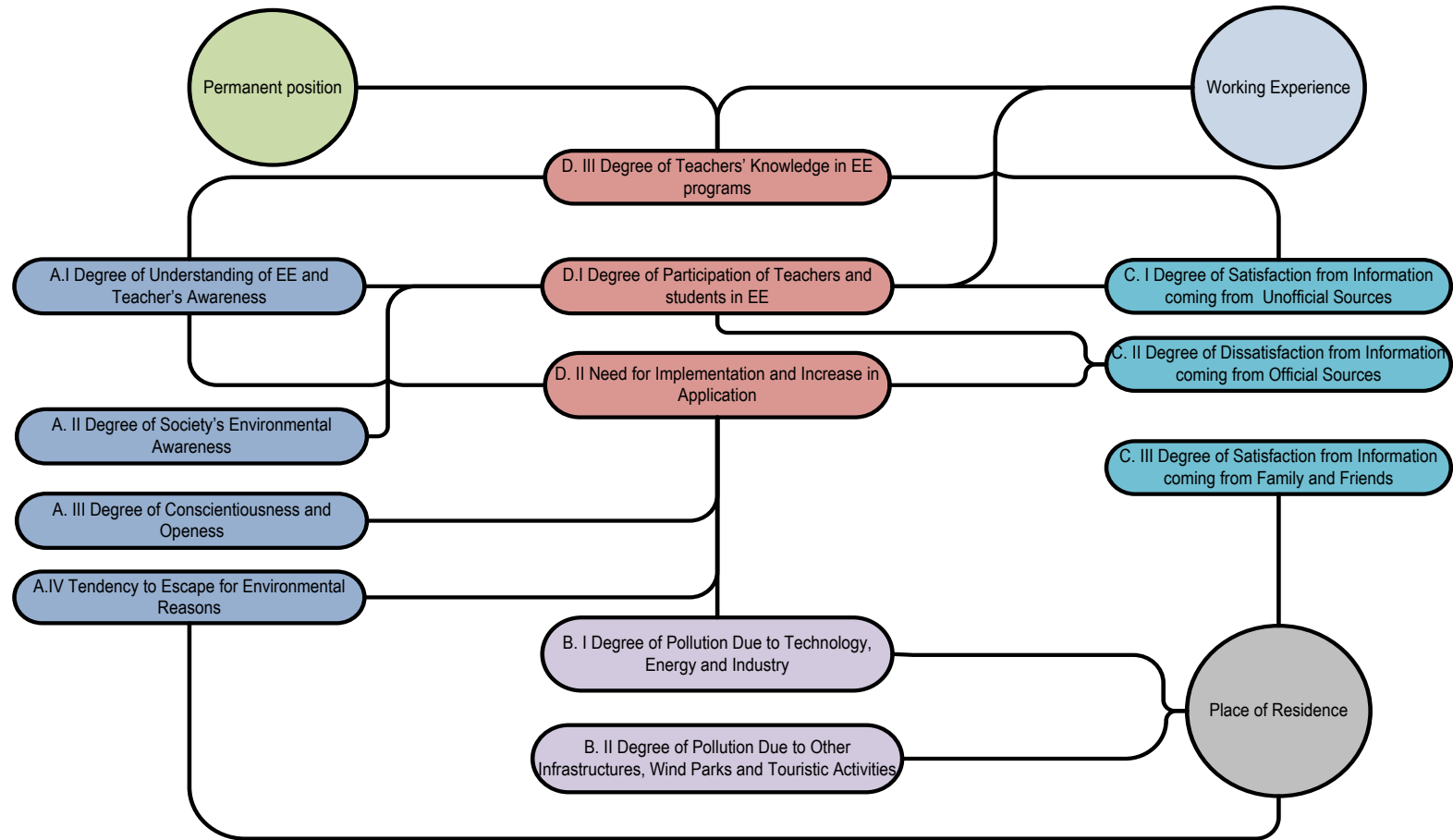


Figure 3: The framework of attitudes relations that was identified