

## Issues of environmental risk management in the Greek schools(\*).

Theodore Antoniou,

*TVE Teacher, Doctoral Student at the Department for Primary Education, The University of Crete, antoniou@edc.uoc.gr*

P. G. Michaelides,

*Professor, Department for Primary Education, The University of Crete, michail@edc.uoc.gr*

*(\*)This work has been partially funded by the European Commission (project OIKOS, Contract 2004 - I/04/B/F/PP-154025). Neither the Commission nor the authors of this work may be held responsible for any use of the information provided here*

**Abstract.** *Environmental issues, especially these involving environmental hazards show an ever-increasing concern in our modern and technology dependant societies. Some of these hazards may be attributed mainly to natural causes (for example earthquakes, flood ...) while others are due to human activity (for example water pollution, leaks from chemical factories ...). Due to the high population concentrations observed these days and the intense environmental exploitation, an otherwise environmental disaster may lead to catastrophic effects. Consequently, there is a need for environmental risk management including measures of prevention, of anticipation, of deterrence etc. In all these aspects, the active cooperation of the public may be proved very useful if the people involved are literate to the subject, an issue where school education may be proved appropriate. In this work, we present how environmental risk management and related issues are considered within the formal school curricula in Greece.*

**Keywords.** Risk management, environmental risk.

### 1. Introduction

1. Environmental education became a priority issue in the Greek schools since the early '80's [1]. By now the environmental education component of the Greek schools' curricula is more extent than in many other countries [2]. Environmental education in the Greek schools takes 3 distinct forms:

➤ As formal education included in the school curricula. There is a specific subject, 'Study of the Environment', for the first 4 classes (ages 6 to 10 in the primary school) where topics from the natural and the human

(social) environment are discussed. Specific topics are also included in all other subjects of the primary and the secondary education school curricula. In addition, in all the school subjects there is as an explicit objective the development of environmental conscious behaviour [3].

➤ As optional activities involving the study of specific environmental issues, usually from the school (natural or social) environment. These activities are on a voluntary basis and outside the compulsory school program. They have the form of long term (e.g. projects) or short term (e.g. environmental 'sightseeing') organized studies with the central or the local government support. Long term activities (usually from 5<sup>th</sup> grade – age 10) are effected through the formation of environmental groups where team of students under the supervision of one or more teachers undertake to study in depth a specific topic [4].

➤ As informal activities that reflect the culture of every specific school and its school environment [5].

2. An ever-increasing concern in our modern and technology dependant societies involves environmental hazards. Some of these hazards may be attributed mainly to natural causes (for example earthquakes, flood ...) while others are due to human activity (for example water pollution, leaks from chemical factories ...). Due to the high population concentrations observed these days and the intense environmental exploitation, an otherwise environmental disaster may lead to catastrophic effects. Consequently, there is a need [6] for environmental risk management including measures of prevention, of anticipation, of deterrence etc. In all these aspects, the active

cooperation of the public may be proved very useful if the people involved are literate to the subject, an issue where school education may be proved appropriate. In this work, we present how environmental risk management and related issues are considered within the schools in Greece.

3. 'Risk' is potential (future) events that have an impact (positive or, as conceived usually, negative) on an asset or a (human) value. Risk management includes processes of assessing (measuring or estimating) the risk and actions of developing measures to avoid or reduce its negative consequences. In this work, the following environmental risk management aspects were searched for in the curricula of Greek schools:
  - a. Processes of assessing an environmental risk,
  - b. Measures of avoiding an environmental risk,
  - c. Anticipation measures to confront a risk once happened,
  - d. Reduction measures to reduce negative impacts of an environmental risk,
  - e. Conditions under which the (negative) impacts of an environmental risk may be considered acceptable (retention).

## 2. Methodology

4. For this work the following resources were used:
  - The official school course curricula and textbooks were studied to locate issues related to environmental risk management either in the course outline or in its objectives. These resources covered the formal environmental education.
  - To cover the optional environmental education form, a search of the literature on the issues discussed within the optional environmental education activities was made. This search was limited because of the scarcity of relevant published works and time constraints. To a great extent we used our own results from relevant studies. Guidelines and circulars from the central and local education authorities were also used.
  - Our experience with school environmental education issues is the only resource for the informal environmental education activities.
5. As stated earlier, all courses in primary and secondary education schools in Greece have a significant environmental component. According to the relevant course objectives, environmental education should be taught in

a holistic interdisciplinary way. However, this is not reflected in the textbooks. In general, the topics related to environmental education are discussed isolated. The required systematic interdisciplinary approach, relating aspects of the social and of the natural environment, is missing. In the humanities' courses the approach is mainly towards the human environment with the (explicit or implicit) objective focused mainly to the appreciation of the local culture. In the Science courses (Physics and Chemistry in particular) there is a more systematic approach with the emphasis being towards the knowledge of the natural environment. Only in the 'Study of the Environment' course of the first 4 grades (ages 6-10) of primary school an interdisciplinary approach may be traced.

6. For the formal environmental education the content of the courses 'Study of the Environment', 'Chemistry' and 'Physics' were analysed to locate aspects of environmental risk and of risk management (see in 3 above). In the secondary education schools (Gymnasium, Lyceum and Technical Vocational schools) the course on 'Geography' (natural and human) could also be used but, surprisingly, its syllabus does not include any topics or related to environmental risk and risk management. The same is true for the course 'Biology' where only an incidental mentioning to genetic engineering is mentioned. In order to have an indication of the extent these aspects cover the course we used the (rather naïve) approach of the pages in the textbook [7].
7. The topics related to environmental risk and risk management that were located are presented in the next sections.

## 3. Results.

8. **Primary school.** The course analysed was 'Study of the environment taught in the first 4 grades (ages 6-10years) of the primary school. The objectives of the course are focused mainly to understand and appreciate the (natural and the human) environment and the interrelations between its constituents. There is no specific provision for environmental risk and risk management topics which, with the exception of earthquakes (see later) occur only incidentally. However, in many of the topics

discussed, the suggested teaching provides to the teacher the opportunity to discuss aspects of risk and of risk management. These topics cover about 15% of the textbook pages in total, starting from almost 10% for the 1<sup>st</sup> grade (age 6) and increasing to about 20% in the 4<sup>th</sup> grade. The situation is similar with the course 'Science' for the 5<sup>th</sup> and 6<sup>th</sup> grade [8]. Of this 15% the majority (80% in the 1<sup>st</sup> grade to 50% in the last) are associated with water, water management and related risks (e.g. pollution, flooding). Other topics include Food chain [9], Fires, Energy, Landscape forming, Thunder- and Wind-Storms (all with two instances) and Ecosystems (with 7 instances). In all the cases mentioned, the specific risk aspect favoured falls within the risk assessment. Only a few exceptions on reduction (treatment of household wastes, alternate energy sources) and anticipation (e.g. river bed or coast line shaping to anticipate flooding).

9. **Gymnasium.** In the low secondary education (middle school – grades 7<sup>th</sup> to 9<sup>th</sup>, ages 12-15) the relevant courses examined are Chemistry and Physics. They are taught in the 2<sup>nd</sup> (8<sup>th</sup> grade) and 3<sup>rd</sup> (9<sup>th</sup> grade) years. The topics for which the suggested teaching may provide the teacher the opportunity to discuss aspects of risk appear in 27 instances and cover (only) 3% of the total textbooks of Chemistry and Physics. The split is: Chemistry 9% and 5% for the 2<sup>nd</sup> and 3<sup>rd</sup> year respectively, Physics 1% and 1% for the 2<sup>nd</sup> and 3<sup>rd</sup> year respectively. The presentation suggested however is plainer towards risk aspects, mainly on assessment [10]. Of these 27 instances 19 (70%) relate again to water but there is a wider diversity on the viewpoint adopted extending into pollution (including detergents, fertilizers, quality of drinkable water and eutrophication), management, dams, hydroelectrics, acid rain, waste, drought ... . A wider diversity is also observed into the rest of the topics that include volcanoes, European and Greek legislation, the Rio [11] and Kyoto [12] conventions, the sustainable development, the greenhouse effect ..., all with one 'en passant' instance (see also note [10]).
10. **Lyceum.** In the upper secondary education (high school – grades 10<sup>th</sup> to 12<sup>th</sup>, ages 16-18) the relevant courses examined are

(general) Chemistry and Physics taught in all the 3 years of Lyceum and 'specialty' Chemistry and Physics taught in the 2<sup>nd</sup> and 3<sup>rd</sup> years [13]. The topics whose the suggested teaching may provide the teacher the opportunity to discuss aspects of risk appear in 26 instances, mostly within the general courses, and cover (only) 2% of the total textbooks of Chemistry and Physics (4% in the 1<sup>st</sup> year shared as 8% for chemistry and 2.5% for Physics). The topics, always within the contexts described for the primary school and the gymnasium, show a wider variety and include the green house effect, acid rain, nuclear wastes, radioactivity, nuclear explosions, industrial wastes, emission of chlorofluoro compounds and ozone hole, explosives, earth waves and antiseismic measures, sea waves and tsunami, volcanoes...

11. **TVE.** Only 3 instances were found covering about 7% of the textbooks. The three instances were waves with a rather extensive (8 pages) presentation on seismic waves and protective measures, acid rain and air pollution. The result is rather expected due to the technical vocational orientation of the schools [14].
12. **Optional activities.** Optional environmental activities operate in primary and secondary (general) education schools with the largest number of activities in the middle school. They have no definite syllabus. Instead, every activity is planned beforehand by the environmental group. The environmental groups consist of the teacher or teachers who supervise the group and a number of students who decide on the topic to study. Although, most of the topics are from the immediate vicinity of the school quite a few are of a more general nature. This is especially true for the long term project activities [15]. To check if these activities include environmental risk or risk management issues we searched the (limited) literature on the subject. The information here is from specific studies on the reports from these project activities [4], [16], [17]. There are no centrally kept records for the optional environmental education activities. However, for the long term project activities, in order to gain financial support from the state or local education authorities, the environmental group must make an application with their project's description.

We used these files to examine the type (as it appeared in the title of the application) of the activity undertaken and classify its contents. Incidental evidence from other studies indicates no significant variations on the kind of topics studied between long and short term activities [18]. Out of the 193 projects analyzed in [4], the 89 (46%) refer to the natural environment and 104 (54%) refer to the human environment. Of these 104, 13 (~7%) included also elements from the natural environment. About 15% of the students participate on these activities per year. Consequently, during the whole of the compulsory education period (9 years, 6 in primary school and 3 in Gymnasium) the majority of the students have participate in at least one such activity (about 15% of the students participate to more than 1 activity). The majority of the projects provide opportunities to discuss aspects of environmental risk and management. However, as the focus is on the environmental education aspects of risk are discussed incidentally (see note [10]).

13. **Informal activities.** There are no records on these activities. From ongoing studies (see [5]) it seems that these activities, although not systematic, are numerous. The subjects refer to pollution, treatment on wastes, landfills, road traffic safety. The focus is to form a clean and safe school environment. Again only incidentally issues of environmental risk and management are discussed.
14. **Earthquakes.** Due to the high seismic potential of Greece [20], special measures have been taken. These include special actions in all levels of school education, especially in the compulsory education. Apart from the specific cases mentioned previously for the formal environmental education there are supplementary actions, such as:
  - Anticipation measures including guidelines on what to have ready before an earthquake, how to behave during an earthquake, what to do afterwards,
  - Drills (at least once per year) to apply the guidelines,
  - Specific courses on the necessity to observe the antiseismic measures regulations,

#### 4. Comments

Despite its significance, environmental risk and environmental risk management in the Greek schools is only incidentally discussed within the broader context of environmental education. As a result important environmental risks either they are discussed superficially (e.g. landslides) or not at all (e.g. extreme weather conditions, nuclear power plant accidents).

This is a common situation in other countries also. It could be attributed to the still existing from the past attitude that risk issues are not of such an extent that could justify special actions within the school program. Similar attitudes were present a couple of decades ago on environmental education. Such an attitude could be justified in the past where environmental intervention was rather limited and, in order to be noticeable, required long time. With the advance of technology this is not any more the case – the importance now associated to (the protection of the) environment is very indicative.

Environmental education should be enhanced to include in a systematic way issues of environmental risk and of environmental risk management. Towards this end there is a need for appropriate (education) material and means.

The OIKOS project [21], financed by the European Commission under the Leonardo program includes in its objectives the production of such material and means that could be used within the formal or the optional education in schools.

#### 5. References and Notes

- [1] See a summary in P. G. Michaelides, 'Environmental Education in the Greek Schools' in G. Flouris, M. Kassotakis (editors) Honorary Volume of Professor B. Masialas, Rethimno, 2005.
- [2] Result obtained in the context of an Erasmus project (ICP-89-0026/05).
- [3] A. Athanassakis "Environmental education and teachers' tendencies", Department for Primary Teachers' education of The University of Crete, Ph.Ed. dissertation, 1992 (in Greek).
- [4] Michaelides P., Kimionis G. "Fifteen Years of Environmental Education in the Prefecture of Rethimno - First assessment, conclusions and perspectives" proceedings of the conference on "Optional Education programs in Schools", University of Patras,

- 28-30 May 1999, pp 350-358 published by Mpagakis G (ed.) Athens 2000, Metechmio publishers (in Greek)
- [5] see a brief expose in Theodore Antoniou, 'Environmental Issues on the Newspapers of HERAKLION – CRETE', 2<sup>nd</sup> International Conference on Hands on Science Hsci2005 – Science in a Changing Education, July 13-16, 2005 – Greece, The University of Crete campus at Rethimno (<http://www.clab.edc.uoc.gr/2nd/>).
- [6] A simple web search on June 30, 2006 with the keyword 'Environmental Risk Management' produced about 2 million hits, the majority being web sites of organizations and commercial companies, most of which having this keyword as their name. This high return is an indicator of the concern.
- [7] For all courses in the official school curriculum of the Greek school a textbook is provided free of charge to all the students. This textbook is accompanied by a guideline book for the teacher. Our experience from previous studies shows that the vast majority of the teachers follow very closely the material as it is presented in the textbook although the guidelines stress that this is to be used only indicatively. There is also a (rather direct) relation between the time planned for the different topics and their coverage in the textbook. Consequently, we believe that we may rely on our 'naïve' index.
- [8] 'Science' is a unified course for the 5<sup>th</sup> and 6<sup>th</sup> grades (ages 11-12) of the primary school with elements from Physics, Chemistry, Biology ....
- [9] Only as Food chain. Food webs (or networks) are totally ignored with the consequence of raising many misconceptions (for example 'elimination of a prey leads to the elimination of all its predators').
- [10] It must be stressed however, that the presentation's viewpoint is on the acquisition of knowledge without specific planning on risk. So, even on the assessment aspect, the relation to risk is only by providing the different parameters (e.g. relations between the various factors present in a phenomenon) without any attempt to estimate (assess) the risk involved or even the relative importance of these different factors.
- [11] See more at the United Nations web site on 'The Convention on Biological Diversity' <http://www.biodiv.org/default.shtml> (visited on June 30, 2006).
- [12] See at <http://www.unece.org/trade/kyoto/ky-01-e0.htm>, a web maintained by UNECE - the United Nations Economic Commission for Europe (visited on June 30, 2006).
- [13] In 2<sup>nd</sup> and 3<sup>rd</sup> years the Lyceum is in 3 study paths; Humanities, Science and Mathematics, Technology. 'Specialty' Chemistry and Physics are advanced courses for the last two study paths (counting somewhat more than the 2/3 of the students). Due to the highly competitive entrance to higher education examinations, students' attention is directed almost exclusively towards the courses relevant to their examinations.
- [14] However, depending on the specialty study path followed, specific courses on job environment and safety exist. These were not analysed as they were considered specialist's education.
- [15] Long term (project) activities have a duration of a semester (at least) or a whole school year. The environmental group selects a topic to study in depth. At the end of the school year a school fair with the results from all the environmental groups of the school (or of the schools in the region) is organized. Short term optional environmental activities have a duration of less than a semester. They may be only of one day (environmental visits –sightseeing) as environmental awareness activities.
- [16] Theodore Antoniou, P. G. Michaelides, 'Optional environmental education in the Greek schools' paper to be presented at the HSci 2006 - 3rd International Conference on Hands on Science 4th - 9th September, 2006, University of Minho, Braga, Portugal.
- [17] Georgios Kimionis, P. G. Michaelides, 'Environmental Education in Greek Schools: The Viewpoint of the Local Coordinators', proceedings of the 2nd International Conference on Hands on Science: Science in a Changing Education, July 13-16, 2005 – Greece, The University of Crete campus at Rethimno pp 196-200 (<http://www.clab.edc.uoc.gr/2nd/>).
- [18] Michaelides P., Kimionis G., Charalambidou F., "The Participation of Pupils in Environmental Awareness Activities", in "3rd Pan-Hellenic Congress in Didactics of Natural Sciences and Application of New Technologies in the

Education” Rethymno 9-11/5/2002”, pp 108  
(in Greek).

- [20] An earthquake of the order 4 in the Richter scale occurs almost once per week. Antiseismic measures for the construction of (new) buildings in Greece are quite strict and in some areas the measures are for constructions to withstand (at least) earthquakes of a magnitude of 7.5 in the Richter scale. As a result, the cost of buildings is quite high.
- [21] Leonardo da Vinci project OIKOS, Contract number 2004 - I/04/B/F/PP-154025. Web site <http://151.8.193.227/oikos/> or [www.e-oikos.net](http://www.e-oikos.net)