Environmental Education and Innovative Teaching Approaches, Case Study: "Saving of Water"

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Abstract

The goal of environmental education is not protecting the natural environment or coping with environmental problems through simple solutions. It addresses people and social groups of all ages and aims at developing free and responsible citizens who participate effectively in social acts. It tries to convey meanings which seem to be elusive or ambiguous and open to multiple interpretations. In this way, societies will be able to act collectively in order to discover, probe and set their priorities. It is considered to be a progressive type of education, which is not stable in time. Actually, it discerns and assimilates all the social, financial, technological and cultural changes.
In this particular paper, innovative teaching approaches concerning water and more particularly its saving are presented. In the past few decades, the creation of a new mentality on saving water and on proper use of water resources appears to be an imperative need. This effort aims mainly at addressing the constantly increasing needs of modern society as well as ensuring the preservation of all types of ecosystems locally or globally.
The subjects of the survey were students at the department of chemistry of Aristotle University of Thessaloniki. The data was processed with the SPSS 21.0 programme and techniques of descriptive statistical analysis were used.
The conclusions of the present paper revealed that the implementation of alternative methods of approaching knowledge as well as the analytical description of the whole teaching approach based on lesson plans, concept maps, brainstorming and projects contribute to viable water resources to a great extent. Moreover, they facilitate in altering the mentality on how to consume water (proper use), how to economize on water (waste elimination, reduced consumption, improvement works) through suitable techniques and how to perceive that water is an invaluable commodity (information, education, sensitization).

Keywords: Environmental Education; teaching; water.

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1. Introduction

Environmental Education (E.E.), trying to contribute to the solution of complex environmental problems and at the same time to face difficulties in the field of education, has assumed a multiple role: environmental, social, economic, cultural and at the same time educational, didactic, educational as well as pedagogical. The environmental issues faced by societies are significant, multidimensional, interconnected and interacting at an alarming rate. Both the anthropogenic environment and the natural environment are not independent and isolated from one another, but they constitute a wider environment on which the future of the planet is depending. The degradation of natural ecosystems, the depletion of natural resources, the increase of the earth's population, the air pollution, the water and soil pollution, the extinction of animals and plants, the climate change, the reduction of the ozone layer and the increase of the earth's temperature, are just some of the world's environmental

problems. Human choices and interventions in the environment cause global, regional and local problems, resulting in the disappearance of forest areas and wetlands, the desertification of vast cultivated lands, over-fishing and over-pumping of water. All the aforementioned cause extensive pollution in both soil and water and in the air at micro-macro-scale [1, 2].

The up to date senseless water consumption, as well as the undue burden on the ecosystems, demonstrate the irresponsible way of managing water resources. The consumption of huge amounts of water to irrigate water-hungry crops, the dramatic decrease of freshwater resources, the global climate changes, the rapidly increasing need for water, as well as the water pollution, are issues of high importance to modern societies. The phenomena of drought, water scarcity and serious water shortages occur in many parts of the world, and the future looks ominous. The worldwide available water is mostly used in agriculture, industry and for urban consumption. The supply of water to these three activities depends to a large extent on the type of development of the country, as well as on the climate conditions of each region.

The need for research and study in the field of environmental education at secondary school students through theoretical and pedagogical approaches was the main motivation for conducting the research work. The contribution of all the involved parties (consumers, managers, institutional bodies) is required in order to jointly cope with the challenges of the future. Changing water behavior (rational usage), application of appropriate technical interventions aimed at saving water (eliminating overconsumption, reducing consumption, ameliorative projects) and the awareness that water is a valuable commodity (information, education, awareness) are the basic model approaches towards the sustainability of water resources.

2. Material and method

An integral and fully structured course design follows successive steps of systematic design, in the spirit of technical rationality, and includes:

✓ The exact wording of the aim and objectives in a way that allows the quantifiable control of their achievement. The teaching objectives of the module are analytically detailed in terms of knowledge, understanding, application, analysis, synthesis and evaluation [3].
✓ The teaching activities and teaching materials (texts, images, slides, worksheets), the method (or the set of approaches), the learning experiences to be selected for covering the subject and achieving the goals. These are combined into activities and tasks consistent with the method adopted. The design is broken down into segments that set the time for each activity.

✓ The evaluation process, in order to be able to evaluate the approaches and activities in relation to the objectives.
✓ Finally, the evaluation techniques to be applied to determine whether and to what degree have the teaching objectives been achieved.

For the creation and management of a C.M. a number of steps should be followed, as suggested by [4]:

1. Creating a starting point or query. The original concept is considered critical.
2. Adding related nodes and identifying the relationships between them.
3. Adding new groups of nodes with their own nodes - starting points and identification of the relationships between them.
4. Adding individual nodes. These can constitute a new group when the necessary relationships will be created.
5. Creating relationships between existing individual and group nodes.
6. Delete non-related nodes and/or relationships.
7. Standardization of nodes through icons in order to refer to hierarchical levels or type of information.
8. Placing individual or group nodes in order to refer to hierarchical levels or types of concepts.

3. Results and discussion

In the context of this study, educational material (lesson plan and concept map) was created (Table 1, Fig.1) with the appropriate and necessary theory that each trainee should know so as to decode complex scientific concepts and then games and exercises, which raise awareness about environmental issues in a playful and interactive way [5 - 8].

Table 1. Teaching Form – Course Plan of Water Saving

Module	Water Saving		
Module Concepts (Keywords)	• Water saving • Reuse of household wastes • Ways to reduce water consumption • Suitable agricultural methods • Rainwater collection • Gray water recycling		
Teaching Goals	• Define ways to save water. • Describe water saving techniques. • Apply water-saving methods to school • Draw conclusions from the recycling of gray water. • To create C.M. determining which are the appropriate agricultural methods for saving water.		
Teaching Method - Course description with corresponding technique and means at each step.			
Teaching method: Method of concept attainment			
	Course	**Course**	**Course**
1	**Preparation of a teaching framework** Recall relevant knowledge from students. Lesson Objectives Notification.	Questions and Answers Dialogue	PC Projective Software Power Point Transparencies

2	**Students deals with main question:** What do you know about water management?	Brainstorming	PC Projective Software Power Point Transparencies
3	**Application – Concept map construction** An application form is distributed to the students in which a conceptual map should be created according to the ideas listed in the table. The teacher splits the students into 4 teams and gives them 5 to 7 minutes to create the concept map, followed by a two minutes presentation of each group's conceptual map. Finally, there is a 5 to 7 minutes team discussion in which everyone can give an opinion as to create a complete and comprehensive conceptual map for water saving.	Concept map construction	PC Projective Software Power Point Transparencies
4	**Evaluation** An evaluation testing form is distributed to the students asking them to complete and expand the concept map. Emphasis is placed on the correlation between water consumption and the reuse of water.	Evaluation testing form	PC Projective Software PowerPoint Transparencies
5	**Recap** **S**ummarization of the key points which mentioned in the group presentations as well as an exchange of views from the formation of the C.M.	Dialogue	PC Projective Software PowerPoint Transparencies
6	An individual homework activity is assigned to the students (homework assignment) in which they should create a concept map about water savings in the school.	Assignment form for homework	PC Projective Software PowerPoint Transparencies

Evaluation: Description of the evaluation techniques applied.
Students are given an evaluation testing form in which they are asked to complete actions that can be applied in their home area to save one cubic meter of water over a one-month period.

Skills development through the description of specific activities
Cognitive
Though the recall of previous knowledge, quizzes, new data and annotation of the pictures, the trainees will learn some ways of saving water. Also, they will also clarify the differences between recycling and reuse of water. In addition, they will be informed about rainwater harvesting as well as about the appropriate methods of agricultural cultivation.
Affective
Through dialogue and presentation of ideas, the trainees will be made aware of the importance of water to human and the environment. Trainees will demonstrate ways to save water and ways to use water properly. Trainees will realize the value of a precious commodity crucial to preserving life on the planet.
Social
Group participation develops the students' socialization, the effective co-operation and the respect for their colleagues. The discussion and the brainstorming of ideas motivate the learner to become interested and actively participate in the educational process.
Metacognitive
Through the questionnaires, the trainees will understand the concepts taught and more specifically the correlations between them. They will find out that their own actions can affect the overall water management.
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Fig 1. Concept map on Water Saving.

4. Conclusions

The proposed teaching approach to water and its implications, which was applied in this paper, with the contribution of experiential learning, was the most appropriate combination that brought awareness and motivation of the students' interest. For its more effective implementation, all activities were systematized and integrated into an appropriate learner-centered pedagogical framework. Advanced learning games have effectively matched the formation of students' attitudes, the
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development of critical thinking, the development of problem-solving skills, and the design of holistic approaches. They set the students as protagonists, while at the same time they developed communication and socialization skills in the group.

The further enrichment of the teaching process with modern methods such as ICT and polymorphic applications, has enhanced the student interest through interaction. The contribution of the ICTs, combined with the playful learning conditions, contributed to the achievement of the goals of the Environmental Education. The conduct of the educational activities with experiential character, as well as the interdisciplinary approach of these subjects, not only by educators but also by specialists of the EE, has produced positive results. A positive sign has contributed to this research in the application by central actors of researches on the pedagogical science and the EE, in a context of continuous updating and implementation of research results. The ultimate goal was to educate teachers, as well as to prioritize environmental issues according to the updated scientific data.

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