



Water Education in the Context of Environmental Education. The Views of Private School Teachers

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Abstract

In order to create capable citizens, able to continue and develop culture, environmental education plays an essential role in shaping values, attitudes and education that promote and secure a sustainable future. At the same time, environmental education is based on the promotion of the citizens' responsible behavior towards nature, and on the effective treatment of environmental problems. This paper focuses on critical thinking and holistic problem-solving skills that enable learners to make decisions and act collectively. In the present work, we have created and present innovative teaching approaches to water as the most valuable natural resource of the planet Earth. The ultimate purpose of this project is to realize the necessity, conservation and protection of water resources. An effort is being made to change the environmental behavior of learners through multidisciplinary methods and activities. The holistic approach of the subject includes the necessary theory as well as innovative teaching approaches (teaching forms, conceptual maps and exercises in a playful form). The research population comprises secondary school teachers, specifically from a private high school and lyceum (Aristotle College of Thessaloniki). The quantitative research was performed using questionnaires following the Likert 1 - 5 scale. The data were processed with the SPSS 21.0 statistical program using descriptive statistical analysis techniques, and Cronbach's alpha was tested. The results of this paper have shown that school can be transformed into a space of creative expression and imagination development, with the contribution of experiential activities. Through the innovative teaching approaches, teachers have shown an increased level of satisfaction pupils participate more actively in the classroom processes and show an increased degree of interaction and awareness about environmental issues.

Keywords: *Water Management, Concept Map, Lesson plan, Environmental education;*

1. Introduction

The purpose of this research project was to create an integrated teaching and educational framework for the teacher, as well as the application of alternative methods of approaching the knowledge for the students. The detailed description of the entire teaching approach, with the lesson plans, the conceptual charts, and the necessary methods (brainstorming and project), is the available ready-to-use material.

The material is a valuable tool for any teacher in order to teach the water chemistry, as well as its implications (water management) in secondary education. The cross-thematic and interdisciplinary approach to water knowledge contributes positively to the educational process as it provides students with the opportunity to develop pro-environmental behaviors, to become interested, to acquire awareness and to become alert to a vital environmental issue of the present time. Specifically, Kollmuss & Agyeman [1] define pro-environmental behavior as the kind of behavior that consciously seeks to minimise the negative impact of an individual's actions on the natural and man-made world. Environmental issues are not just about nature, and are not limited to the relationship between man and nature. In this way, the kind of E.E. which is finally promoted can be defined as "environmental management and control training" (Huckle, 1998).

2. Material and Methods

The conceptual map was developed by Novak and Gowin [3], and is a powerful tool for teaching and learning, as well as the active participation of learners in the learning process. The notion of the C.M. is based on the theory and the findings of meaningful learning [4]. At the same time, the findings



of cognitive psychology for the constructive approach to knowledge [5] recognize the conceptual maps as a useful tool so that the learner can combine, associate, assimilate and classify the new knowledge with pre-existing knowledge. The conceptual maps are charts that represent organized knowledge, consisting of concepts and their interrelations in a particular learning object [3].

The process of creating a C.M. is called conceptual mapping. Conceptual mapping is a way of graphically representing knowledge, ideas, concept structures and the mental processes of the students [3]. According to the same researchers, the contribution of conceptual mapping as a cognitive tool is due to the fact that learning is to link new ideas or concepts with already-acquired knowledge in a non-arbitrary way [3]. Conceptual mapping is a technique and a mediating cognitive tool that represents graphically the concepts and their interrelationships in a hierarchical structure, thus reinforcing a critical approach to the content of teaching. It takes into consideration the structure and the representation of knowledge, setting the more general, important and vague concepts at the top of the map, while the more specific and less general concepts are placed at the lower levels [6]. The C.M. is widely used as an assessment technique during the diagnostic or initial assessment, when the teacher uses the C.M. as an exploratory tool for the identification and representation of prior knowledge [7].

The choice of dealing with water, and more specifically with water management, with the contribution of a concept map of Figure 1, stems from the need to emphasize the factors affecting the water reservoirs, as well as the holistic water management at a global level.

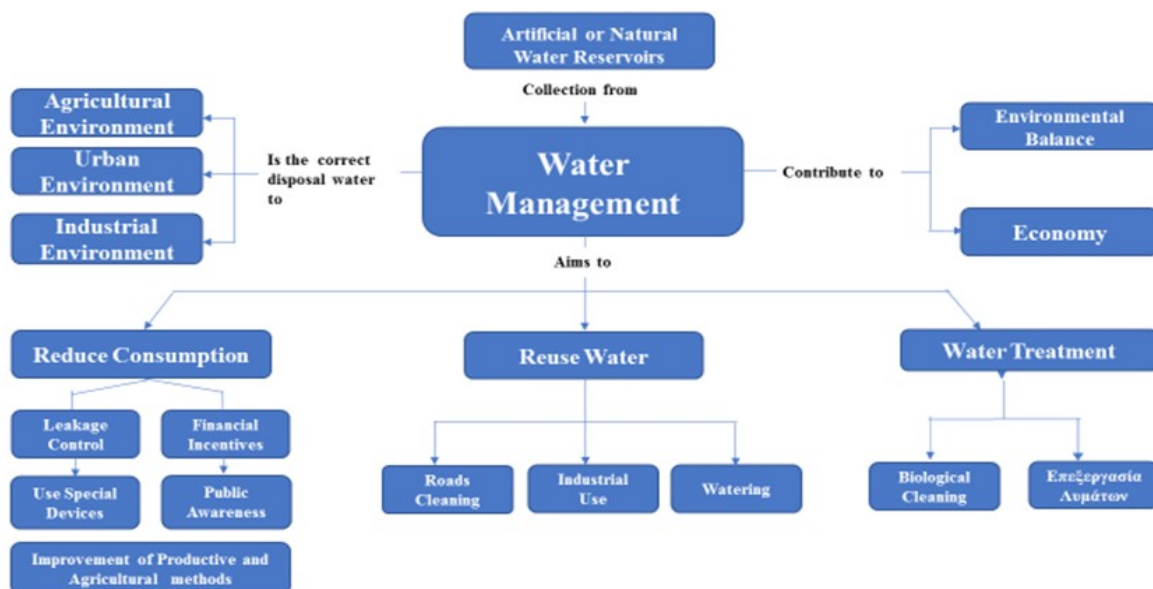


Fig.1. Concept map for water management teaching

The definition of “lesson plan” is a fully structured and effective teaching proposal, in all its parts, that creates an integrated framework in which the teaching will take place. The teacher plans the presentation of a specific module in such a way as to approach the particular subject, taking into account the needs of the learners [8]. The course design is a rational design cycle that includes: a) building learning objectives, b) selecting content, strategies, methods, resources, source materials, activities organization, as well as teaching behaviors, c) implementation, and d) evaluation of the results.

At the stage of educational intervention, the educational environmental program gets planned and implemented. The program’s objectives determine the selection of the appropriate educational methods and teaching techniques, taking into account the trainees’ characteristics, the available space and time, as well as the available infrastructure. In the following illustrations you can see the instructional design document applied to the water management module (Fig. 2-3).



Skills development through the description of specific activities	
Cognitive	Through the recall of previous knowledge, questions and answers, new data, the comment on the figures, the students will get to know the concept of water management. Also, they will clarify the differences among the reduction of consumption, the water reuse and water treatment. They will also learn about the practical ways in which they themselves can contribute to the reduction of the water consumption. In addition, they will be informed about the relationship between water reuse and water treatment.
Affective	Through the dialogue and the presentation of ideas, students will get aware about the importance of water for the people and the environment. The trainees will discover the correlations regarding proper water management and will be actively mobilized to apply simple practices of water consumption reduction in their everyday lives.
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.

Fig. 2. The first page of lesson plan

Fig. 3. The second page of lesson plan

3. Results and Discussion

A questionnaire with 11 questions was set up and administered to secondary school teachers, specifically from a private high school and lyceum (Aristotle College of Thessaloniki). The collection of primary material, using the questionnaire method, took place in the period from September 2018 to November 2018. Closed-type questions were selected in order to make it faster to complete and process its data. All questions were scaled questions with a 5-point rating. The scale chosen for this research was the Likert [9-11]. Also, particular attention was given to clarity. The questions were brief and explicit. Negative questions were avoided as they can lead to misunderstanding, in that the negative word may be overlooked and the respondent gives an answer that is contrary to his/her true opinion [9-11]. The questionnaires (both groups) were tested for their reliability. The results obtained are illustrated in Figures 4, 5.

Environmental Programs	1	Current human water management is effective.
	2	I get informed from environmental programs for rational water management.
Reliability Index Cronbach's Alpha 0.789	3	Developmental plans should take into consideration the quantitative and qualitative conservation of water.
	4	Proper water management should take measures for saving and reusing water.
	5	I am aware about extreme weather conditions management strategies (floods, water scarcity)

Fig.4. Verifying the reliability of questions environmental programs



Educational material	6	The water management training material helped you: to understand the definitions of "sustainable development" and "sustainability".
	7	The educational material for water management helped you: to use water in a rational way.
	8	Based on the water management training material, you consider: Managing interventions in the supply and demand of water are necessary.
Reliability Index Cronbach's Alpha 0,814	9	Based on the water management training material, you estimate that: If water management is applied universally, there will be a progressive improvement in water quality.
	10	Educational material for water management helped you to understand the need for a holistic approach to managing water resources.
	11	Water training materials helped you: To take personal action on water management in your everyday life.

Fig.5. Verifying the reliability of educational material

4. Conclusions

The conclusions drawn through the learning process, the interaction of teachers and students, and the results of the research, indicate that although environmental programs have been integrated into the school activities, teachers rarely implement them. Experiential activities allow the school to become a space of creative expression and imagination development. Also, students' interactions significantly increased, and a meaningful and constructive dialogue emerged. Teachers and students expressed the desire to continue this way of teaching. Their metacognitive abilities improved, as during the stage of the documentation of their views they had to express and to justify their conclusions verbally. The learning asset offered was developed interdisciplinarily thanks to the desired holistic approach to knowledge.

According to the above-mentioned research carried out in the limited context of an educational institution, it can be seen that the EE offers many opportunities to change children's behaviors and attitudes towards modern environmental issues. This is evidenced by the plethora of pedagogical approaches offered by EE depending on the motivation of the pupils, their cognitive, learning and emotional stage, the materials and resources available to each school and, above all, the interest and the resourcefulness of the teacher.

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