GREEK STUDENTS' PERCEPTIONS OF WATER MANAGEMENT

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ABSTRACT

Environmental education in Greece is not part of the statutory curriculum. Many teachers and their students take part in environmental education projects voluntarily. This study examines the influence of an environmental education project, "The River" on students' geographical and environmental knowledge. Results show that the project had a positive influence on the students' knowledge. The results are discussed and future research is *suggested.*

KEY WORDS: Environment,Environmental Education,School Geography,Sustainable management,Water resources,Water conservation,Project work

Discussion about appropriate, effective and productive strategies for the incorporation of environmental education into the Greek education system is ongoing. The 'infusion', 'interdisciplinary' and 'holistic' models have all been suggested as possible approaches (Hungerford and Peyton, 1986, Flogaiti, 1993, Georgopoulos & Tsaliki, 1993). Incorporating environmental education into the education system is one of the most important issues in Greek education (Flogaiti, 1993).

The study reported here involved the design, implementation and evaluation of a geographical-environmental education project. The study was designed to look at the inter-relationship between environmental studies and geography. The majority of the data collection involved a questionnaire that assessed specific aspects of geographical and environmental knowledge.

School geography and environmental studies have many objectives in common (Kelly, 1984; Goodson, 1996; Kimmel, 1996). Some might argue that environmental studies and geography education are inseparable. Field trips and fieldwork are regarded as effective educational tools in some countries (Farmer and Wott, 1995; Falk and Baling, 1982) and serve to enhance school geography. However, in Greece, there are no specialist geography teachers.

The question that this study was designed to answer was 'Can a project that combines aspects of school geography with environmental education projects, as they are implemented in Greece (i.e. involving class work and fieldwork) raise students' knowledge of specific aspects of geography and their environmental consciousness (Ramsey and Rickson, 1976; Day, 1995; Hungerford & Volk, 1990)?' The research reported here is part of a wider study. In this article, students' knowledge of water resource management is examined, specifically the issues of water conservation.

THE INTERVENTION

The co-ordinators in the Experimental Group schools were told, at a preliminary meeting, about the general goals and objectives of environmental education (as agreed at the UNESCO conferences in Belgrade (1975), Tbilisi (1977) and Moscow (1987). They were also informed about the geography content of the Greek National Curriculum. The project's educational and environmental objectives were described in detail, taking into consideration the cognitive development of students (abstract thinking) according to Bloom (Bloom & Krathwohl, 1986), the content of the geography textbooks (OEDB, 1994a and 1994b) and the goals and objectives of environmental education.

At the same meeting, the co-ordinators were taught the basic elements of the project methodology (Frey, 1986) and they were given background information and a draft structure of the project. Fieldwork was explained as being an integral part of the whole project although teachers were left to teach the project as they wished. No other intervention was made to the work of the teachers until the end of the project.

It is usual in Greece for teachers and students to engage in environmental education projects and activities voluntarily. They receive limited guidance from qualified instructors and little other support, so they implement their projects depending, primarily, on their own knowledge, imagination and creativity.

Previous studies involving interventions fieldwork have either shown very significant changes (Vasala, 1994; Wang, Haertel and Walberg, 1993), or little significant influence on the knowledge of students (Leeming et al, 1997). The difference between the previous studies and the one reported here is that in the present study, the co-ordinators (teachers) were given the freedom to choose their teaching methods and implementation strategies once they had been given general guidelines. In the other studies, the researchers did the teaching themselves.

METHOD

The research was planned as a classic intervention study involving a Pre/Post-test design (Bennet, 1984 & 1989). The study lasted for six months and involved third-grade students (aged 14-15) in secondary schools.

The participating schools were all located a short distance from their nearest river. The Experimental Group, which took part in "The River" project, consisted of 226 students from 11 volunteer schools, from different parts of Greece. The Control Group consisted of 242 students from 10 schools which were similar (in terms of size, student attainment, etc.) to those in the Experimental Group.

The Control Group followed the normal school curriculum. The project co-ordinators in the Experimental Group schools were teachers of a range of subjects (e.g. literature, science, physical education, biology, geology). As was stated above, none of the teachers was a 'geography' teacher, as in Greece, there are no qualified teachers of geography.

Students in the Experimental and Control Group schools completed a questionnaire at the beginning of the project (November 1995) and at the end (May 1996). The questionnaire was designed to assess aspects of the students' cognitive domain (Bloom and Krathwohl, 1986). Each of the multiple-choice questions had four possible responses one of which was the correct, and a "Don't know" response. When the questionnaires were marked (by the first author) they were scored either '0' - incorrect and 'Don't know', or '1' - correct.

DATA ANALYSIS

The Statistical Package for the Social Sciences (SPSS) was used to analyze the questionnaire data. In this article only the results of the T-tests and Paired T-tests are presented. These statistical analyses were chosen in order to illuminate what happened to the Experimental and Control Groups before and after the intervention.

DATA PRESENTATION

This study focuses on the six questions, which dealt with water conservation and sustainable management of river water (which constituted one section in the questionnaire). These six questions test knowledge relevant to the "water conservation and sustainable management of water resources" aspect of the project.

Question 1:

Which of the following activities contributes to saving water?

Among methods suggested for reducing the large quantities of water used for irrigation, some experts on water management propose replacement of water-thirsty crops with dry-land crops (Enger et al, 1983; OECD, 1983; Morgan et al., 1993).

Table 1. Means for question 1. Experimental and Control Groups.		
	Mean	
	Before	After
EG	0.16	0.17
CG	0.15	0.15

Table 1. Means for question 1

Question 2:
Which of the following uses consumes larger quantities of water in Greece?

According to OECD and other researchers (OECD, 1983; Kousouris, 1997; Morgan et al, 1993), irrigation absorbs most of the freshwater consumed. In Greece, this exceeds 80%, a rate consistent with other countries (Morgan et al, 1993). This issue should be part of a student's basic knowledge.

Table 2. Means for question 2. Experimental and Control Groups.		
	Mean	
	Before	After
EG	0.27	0.41
CG	0.26	0.22

Table 2. Means for question 2

Question 3: A procedure which serves to reduce waste in the use of water is:

Researchers and water management experts agree that recycling of water will increase in the future as a response to increasing demand and to the need for sustainable management of water resources (Enger et al., 1983; Morgan et al., 1993). The correct answer was 'recycling of water'.

Table 3. Means for question 3. Experimental and Control Groups.		
	Mean	
	Before	After
E.G.	0,42	0,57
C. G.	0,39	0,44

Table 3. Means for question 3

Question 4 Drainage works help by ...:

Drainage works are only mentioned positively in Greek geography textbooks, for example, "Drainage works give land that is cultivated intensively" (OEDB, 1994b). In the past, Greek people attempted to drain wetlands in order to gain land for cultivation (Kousouris, 1997).

Table 4. Means for question 4. Experimental and Control Groups		
	Mean	
	Before	After
E. G.	0,69	0,83
C. G.	0,69	0,70

Table 4. Means for question 4

Question 5
River discharge can be reduced because of ...:

Using river water for irrigation is mentioned in both the second and third grade geography textbooks (OEDB, 1994a, 1994b). The discharge of

Greek rivers in Greece has decreased in recent years and the major cause for this, is the intensive use of water for irrigation (Skoulikidis, 1996, 1997).

Table 5. Means for Question 5		
	Mean	
	Before	After
E. G.	0,32	0,45
C. G.	0,31	0,39

Table 5. Means for question 5

Question 6

Which of the following statements indicates an activity causing problems to the environment?

It has been shown that urban runoff and sewage both enrich river water with phosphates (Akrivos, 1989). Untreated home and industry sewage is still discharged into Greek rivers (Skoulidikis, 1997)

Table 6. Means for Question 6. Experimental and Control Groups		
	Mean	
	Before	After
E. G.	0,58	0,73
C. G.	0,50	0,47

Table 6. Means for question 6

T-Test Groups, for Experimental and Control Groups

T-test was used to examine the statistical significance of differences in the mean scores between the Experimental and the Control Group.

Table 7. T- Test Groups /K1= before / K1-2= after EG= Experimental Group/ CG= Control Group

Variables		Mean	Sig. 2-tailed
K1 Water Conservation	CG	0.15	
	EG	0.16	0.657
K1-2 Water conservation	CG	0.15	
	EG	0.17	0.567
K2 Usage/ excessive consumption	CG	0.26	
	EG	0.27	0.894
K2-2 Usage/ excessive consumption	CG	0.22	
	EG	0.41	0.000
K3 Reduce of waste	CG	0.39	
	EG	0.42	0.542
K3-2 Reduce of waste	CG	0.44	
	EG	0.57	0.007
K4 Drainage works help:	CG	0.69	
	EG	0.69	0.998
K4-2 Drainage works help	CG	0.70	
	EG	0.83	0.001
K5 River discharge	CG	0.31	
	EG	0.32	0.836
K5-2 River discharge	CG	0.39	
	EG	0.45	0.199
K6 Worsening activity	CG	0.50	
	EG	0.58	0,124
K6-2 Worsening activity	CG	0.47	
	EG	0.73	0.000

$p < .05$

Initially (pre-test), only question 6 shows a significantly different difference between the Experimental and the Control Group mean scores. In general, both groups scored poorly on the questions. After the intervention (post-test), three questions showed statistically significant differences between the means score of the two groups (table 7), one of which again is question 6. The other questions do not show statistically significant difference before and after the intervention. As question 6 shows a significant difference initially, it is likely that the intervention has made little difference.

Paired T-Test Experimental Group

Paired T-tests were used to compare the mean score of the Experimental Group before and after the intervention. They revealed the influence of the environmental education project on student knowledge.

Table 8. Paired T- test for Experimental Group

Variables	Mean differences	Sig. 2-tailed
K1/K1-2 Water Conservation.	-0.004	0.879
K2/K2-2 Usage/ excessive consumption.	-0.11	0.005
K3/K3-2 Reduce of waste.	-0. 33	0.003
K4/K4-2 Drainage works	-0.13	0.003
K5/K5-2 River discharge	-0.15	0.000
K6/K6-2 Worsening activity	-0.15	0.000

p< .05

It would appear that the notion of water conservation has not been well understood by the students. The other concepts: the high consumption of river water for irrigation; the need to avoid excessive consumption of water for irrigation (by growing dry-land crops); the elimination of river discharge (because of excessive irrigation); the pollution caused by effluent discharged into the river and the implications of drainage works for wetlands all seem to be reasonably well understood by the students of the Experimental Group.

However, it is evident that although statistically significant differences are shown between the pre-test and the post-test for the Experimental Group, the performance remains relatively low for four of the six questions.

Paired T-Test Control Group

Table 9. Paired T-Test for Control Group

Variables	Mean difference	Sig. 2-tailed
K1/K1-2 Water Conservation	0.0455	0.601
K2/K2-2 Usage/ excessive consumption.	-0.0702	0.467
K3/K3-2 Reduce of waste.	-0.0868	0.443
K4/K4-2 Drainage works	-0.078	0.034
K5/K5-2 River discharge	0.033	0.384
K6/K6-2 Worsening activity	-0.016	0.638

p< .05

The Control Group shows only one question (K.4) with a statistically significant difference between pre- and post-tests. These results are as expected as the group received the traditional school curriculum.

RESULTS AND DISCUSSION

The results of this study should be interpreted with care, because the sample was not selected at random - the schools participated voluntarily. The voluntary nature of the project implies that teachers were committed to the project and may have been motivated to teach well. This does not mean that all the teachers performed identically, as performance depends on many different and complex factors, such as knowledge, understanding, awareness, enthusiasm and personal practice (Reid, Scott and Oulton, 1997, Monroe and Kaplan, 1988).

Research suggests that teachers use the available educational resources unevenly (Simmons, 1994). The differential performance of teachers affects students' learning. It is reasonable to assume that differences in the local environment, perceptions, values and practices, led to different responses of students to the questionnaire, since a significant part of the project took place in the local environment.

As was mentioned earlier, in Greece, environmental education projects are implemented outside the school curriculum, usually during weekends, school excursions, late afternoons or school holidays. A significant number of the students live in villages some way from the schools and go home immediately after school finishes. For these students, it was difficult to participate in the whole project, which may have affected their participation and performance.

Another factor that might have affected student performance is the size of each participating group. Most of the Experimental Groups consisted of about 20 students. This number sometimes causes problems of co-ordination, control and transportation in the field (Simmons, 1998).

Teachers were expected to organize lessons in the classroom or out-of-school and field work on topics including: river features; irrigation methods; water management practices; water quality assessments, etc. The results indicate that the students' knowledge of water conservation did not develop significantly as a result of taking part in the project. This may be because the prior knowledge was so low that it would have taken a much more significant intervention to raise the students' knowledge.

Although most of the participating schools come from the Greek countryside, a significant proportion of the students seem to ignore the link between changes in cultivation methods and the need for water conservation. Dry-land crops can help in conserving water and this knowledge should be imparted to students. Irrigation, which accounts for about 80% of water demand in Greece and elsewhere (O.E.C.D. 1983, Morgan et al, 1983), requires judicious conservation. Although demand for irrigation water in Greece has inspired a vast project for the diversion of water from the River Acheloos to the plains of Thessaly, this knowledge seems to be unknown by a good portion of the students. Teachers need to give the opportunity to the students to investigate, confirm and combat practices that increase excessive consumption of water.

The question that was answered satisfactorily concerns recycling of water. Although the mean score is not very high, students seem to understand the role of recycling water for water conservation, possibly because recycling is very often mentioned in television programs and in various environmental projects (Gillilan, et al, 1996).

The decrease in river discharge seems to gain a good score, leading us to assume that the project had a positive influence on the students' knowledge. The same can be said of the questions regarding human activities that pollute river water with sewage and agricultural runoff. In general, the geographical-environmental education project "The River"

has had a positive influence on student knowledge of the key concepts of water conservation and sustainable management and of water use.

Given that most of the concepts taught through the project are novel and not well established in the curricula and that most of them are not implemented in a large scale in Greece (existing mainly at a theoretical framework (Agelidou, 1995)), one may be generally satisfied with the results. The environmental and geographical education project has led to better understanding and transfer of knowledge to students, as the basis for the formation of well-informed, aware and conscious citizens.

Water conservation has to play a key role in sustaining water resources on the planet and modifications must be made to irrigation and cultivation practices in Greece. These notions have to be imparted to students and further research must be undertaken to explore knowledge, attitudes and beliefs of students on these key issues.

CONCLUSIONS

The results of the study indicate a positive influence on student knowledge of geographical and environmental issues as a result of taking part in the project "The River". A combination of geography teaching in the classroom and environmental education projects that were especially designed for implementation in the classroom and outdoors, might give better opportunities to students to learn, incorporate and understand issues, related to the exploitation of water resources and river water management.

Further research is needed on the relevance between knowledge, awareness and environmental friendly behavior, as well as on the different perceptions of river water conservation of students from urban and rural settings.

BIBLIOGRAPHY

[1]AGELIDOU, E., 1995, Formation of Information, Doctoral Dissertation, Athens, p.178

[2]AKRIVOS, G., 1989, Quality of surface water in Kopaida plain of Viotia, (in the Proceedings of Hellenic Conference" Environmental Protection and Agricultural Production", GEOTEE, Athens), pp. 139-156

[3]BENET, D. B. 1984. Evaluating Environmental Education in Schools. A practical guide for teachers. (In UNESCO -UNEP International Environmental Education Programme, Environmental Education Series No. 12, reprint 1989) pp. 11-68

[4]BENNET, D. B. 1989. Four steps to Evaluating Environmental Education Learning Experiences. *The Journal of Environmental Education*, 20 (2), p.14-21

[5]BLOOM, B.S. and KRATHWOHL, D.R. 1986. Taxonomy of educational objectives. (Ed. Kodex, Thessaloniki) pp. 86-100

DAY, A. 1995. Geography: Challenges for its Next Century, Teaching Geography, April 1995, pp. 90-99

[6]ENGER, E., KORMELINK, R., SMITH, B., SMITH, R., 1983. Environmental Science, (W.C. Brown Publishers), pp 476-485

[7]GEORGOPOULOS, A. and TSALIKI, E. 1993. Environmental Education, (ed. Gutenberg, Thessaloniki), pp. 57-63

[8]GILLILAN, S., WERNER, C.,OLSON, L. and ADAMS, D., 1996. Teaching the Concept of Recycling: A Campaign and Evaluation. *The Journal of Environmental Education,* Vol. 28, No. 1, pp. 11-18

[9]GOODSON, I. 1996. Curriculum Contests: Environmental Studies versus Geography. *Environmental Education Research*, Vol. 2, No. 1, , pp. 71-87

[10]FALK, H. J. and BALING, D.J., 1982. The Filed Trip Milieu: Learning and Behavior as a Function of Contextual Events. *Journal of Educational Research*, Vol. 76 (No. 1), pp. 22-27

[11]FARMER, A. and WOTT, J. 1995. Field trips and Follow Up Activities: Fourth Graders in a Public Garden. *The Journal of Environmental Education*, , vol. 27, No. 1, pp. 33-35
[12]FLOGAITI, E. 1993. Environmental Education, (Greek University Editions, Athens). pp. 211-213
[13]FREY, K. 1986. The project method (Kyriakidis Publications Thessaloniki).pp. 16-84
[14]HUNGERFORD, R. and PEYTON, P. 1986. Procedures for Developing an Environmental Education Curriculum (UNESCO SERIES NO 22). pp. 11-23
HUNGERFORD, H. R. and VOLK, T. L. 1990. Changing learner behaviour through environmental Education. *The Journal of Environmental Education*, 21 (3), p. 8-21
[15]KELLY, V. 1984. Geography and Environmental Education in Schools, Geography, vol. 69, No. 303, part 2. pp. 1-3
[16]KIMMEL, J. 1996, Using the National Geography Standards and Your Local River to Teach About Environmental Issues. *The Journal of Geography*, vol. 95 (2), pp. 66-71
[17]KOUSOURIS, T. 1997. About lakes, lagoons, rivers and other wetlands of Greece, (in Sustainable Development with Environmental Education, Athens). pp. 101-163
[18]LEEMING, F., PORTER, B., DWYER, W., COBERN, M., OLIVER, D. 1997. Effects of Participation in Class Activities on Children's Environmental Attitudes and Knowledge. *The Journal of Environmental Education*, , Vol. 28, pp 33-42
[19]MONROE, M. and KAPLAN, S. 1988, When words speak louder than actions: Environmental problem solving in the classroom" *Journal of Environmental Education*. 19 (3), p. 38-41
[20]MORGAN, M., MORAN, J., WIERSMA, J., 1993. Environmental Science, (W. C. Brown Publishers). p.272
[21]O.E.D.B. 1994a Geography of Continents (Textbook for the first-grade Secondary Education Schools, Athens , Ministry of Education, Athens), p.60
[22]O.E.D.B. 1994b Geography of Europe, Textbook for the second -grade Secondary Education Schools, Ministry of Education, Athens, p. 46
[23]OECD 1983. Environmental Policies in Greece, *(OECD), pp. 75-93*
[24]RAMSEY, C. and RICKSON, R. 1976. Environmental Knowledge and Attitudes, *The Journal of Environmental Education*. Vol. 8, No. 1, pp. 10-18
[25]REID, A., SCOTT, B. and OULTON, C. 1997. The Contribution of Geography Teaching to Students' environmental Education: Methodological Considerations and Issues for researching teachers' Thinking about Practice. *Research in Geographical and Environmental Education*, Vol. 6 (3). pp. 33-38
[26]SIMMONS, D. 1994, Where is EE taught? Urban teachers' experiences. In R. .Mrazek (Ed), Pathways to partnerships: Coalitions for environmental education. Troy, OH: NAAEE., PP. 123-129
[27]SIMMONS, D., 1998, Using Natural Settings for Environmental Education: Perceived benefits and Barriers, *The Journal of Environmental Education*, Vol. 29, No. 3, pp. 23-31
[28]SKOULIKIDIS N. 1996. Impact of desertification processes on Greek river systems. (International Conference on Mediterranean Desertification Proceedings), pp 76-78
[29]SKOULIKIDIS, N., 1997, Environmental condition of Greek Rivers (in "Sustainable Development with Environmental Education", Local Government, Mesologgi) pp. 58-99
[30]VASALA, P. 1994. Soil Erosion as an example in Environmental Education. (Doctoral Dissertation, Athens). pp. 210-213
[31]WANG, M., HAERTEL, G., WALBERG, H., 1993. What influences Learning? A content analysis of review literature. *Journal of Educational Research*, Vol. 84 (No 51). pp. 30-38