Influence of animation-supported project-based instruction method on environmental literacy and self-efficacy in environmental education

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Contents

Abstract

The present study conducted to establish effective environmental education investigated the influence of the project-based environmental education method supported with computer animations and of the traditional environmental education

method on students' environmental literacy and on their self-efficacy beliefs in giving environmental education. For this purpose, an environmental literacy scale and a scale for self-efficacy perception of environmental education were applied to the participating students. In this experimental study, the pretest and posttest model was applied to the experimental and control groups. The study was carried out with 75 second-grade teacher candidates attending the department of Elementary School Teaching at Ziya Gokalp Education Faculty, Dicle University. The results of the statistical analyses revealed that the project-based instruction method supported with computer animations was more influential than the traditional method with respect to the participating students' environmental knowledge. Considering the mean scores, the results were found in favor of the experimental group students in terms of such dimensions of environmental literacy as environmental attitude, environmental perception and environmental behavior. The results also revealed that there was a difference between the students' mean scores regarding their self-efficacy perceptions of environmental education in favor of the experimental group.

Keywords: Environmental Education, Computer Animations, Project-Based Instruction

Introduction

Human beings always failed to recognize the damage they caused to the nature and the environment starting with the very first ages in history. Even after they got aware of it, they ignored this damage for ages. However, today, the damage has increased to such a great extent that it can not be disregarded or ignored. Thus, modern societies have tried hard to make their individuals conscious of environmental protection and of related problems either in written or in oral form. Even if all possible precautions are taken in such areas as technology, law, politics and economy to solve environmental problems, it is a clear fact that environmental problems can never be solved unless a sustainable society is formed and unless important changes occur in people's life styles (Selvi, 2007). Therefore, in the international society in recent years, it has now been approved that it is important to inform people about the environment and about environmental problems via effective, environmental, lifelong education (Atasoy and Ertürk, 2008). In literature, there are a number of definitions of environmental education that will raise individuals' awareness to avoid the environmental problems caused by today's conditions and to have a clearer

environment. UNEP/UNESCO/ OECD Paris (1992) defines environmental education as "a permanent process in which individuals gain awareness of their environment and acquire the knowledge, values, skills, experiences, and also the determination which will enable them to act individually and collectively to solve present and future environmental problems… as well as to meet their needs without compromising those of future generations". Dooms (1995) defines environmental education as the process of developing the attitudes, values, knowledge and skills to understand and protect their environment and their biophysical surroundings.

Environmental education should not only provide related information and form the feeling of responsibility but also influence human behavior. Today, activities for raising environmental consciousness focus on the development of such concepts as environmental literacy and self-efficacy, which are both important factors in making individuals conscious of the environment and in activities related to environmental education. First of all, to define these two important concepts, Mc Beth (1997) refers to environmental literacy as individuals' levels of ability, motivation to use critical thinking skills and take important roles to solve problems about environmental issues. Morrone et. al. (2000) state that one can not be said to be environment literate unless knowledge about the environment is transformed into behavior. This can be achieved by providing individuals with scientific information in environmental education courses. The concept of self-efficacy is defined as individuals' awareness of what they can do when they benefit from their abilities and skills (Pajares, 2002; Senemoglu, 2005). A person with a higher level of self-efficacy will demonstrate a higher level of performance (Gist, 1989). If the goal is to provide future generations with a healthy and clean environment, then it is important to train individuals who are environment literate and who have self-efficacy in environmental education. Therefore, educational institutions should focus on this issue and apply methods and techniques that will positively influence both environmental literacy and self-efficacy in environmental education courses. For this purpose, environmental education studies should be conducted with the help of student-centered and audio-visual materials as required by the current technology era in a way to address students' affective, cognitive and behavioral domains. In this respect, the project-based learning method, which makes students active regarding them as the center of education and which allow learning by doing, has gained great importance in education. Studies conducted revealed that the project-based learning method had positive effects on the development of such affective and cognitive dimensions of students as attitude, achievement and self-efficacy (Yavuz, 2006; Çibik, 2009;

Tertemiz and Sahinkaya, 2010). The project-based learning approach, which supports visual learning, allows the student to take responsibility and to think and places the student in the center of learning, was supported with the current technology. Parallel to this, computer-aided instructional approaches have become fairly widespread in recent years. Computer animation programs used for educational purposes are quite influential in terms of supporting learning visually. Animations are used to present the content of a certain subject to students. According to Akçay et al. (2003), animations can visualize and concretize abstract concepts and thus increase students' attention, and perception and comprehension. In addition, animations make the invisible micro world visible and allow us to see long functional processes in a short time. Rotbain et al. (2008) suggest using computer animations in education that allow rich and appropriate visualizations related to dynamic processes which mostly make it difficult to understand the information via direct instruction. For the methods and techniques used in educational studies, use of current technologies that make the individual active will not only help make permanent the behavioral changes that the individual is expected gain affectively and cognitively but also allow synthesis and application of these changes to other situations. In this respect, the present study investigated the influence of both technology-based and project-based learning approaches to environmental education on teacher candidates' levels of self-efficacy perceptions and environmental literacy regarding environmental education.

Method

Participants

The study was conducted with 82 second-grade students attending the Department of Elementary School Teaching at Ziya Gokalp Education Faculty at Dicle University in 16 weeks in the Fall Term of the academic year of 2010-2011. However, of all the participants, only 75 of them responded as required (36 students from the control group, and 39 from the experimental group). Thus, the research data were collected from 75 participants. In the study, the pretest and posttest experimental design with a control group was applied.

Data Collection Tool

In line with the purpose of the present study, the 'Environmental Literacy Scale' developed by Kisoglu (2009) was used. The scale was made up of four dimensions. The Cronbach alpha value for the sub-dimension of environmental knowledge was calculated as .64, for the sub-dimension of environmental attitude as .77, for the sub-dimension of environmental behavior as .79 and for the sub-dimension of environmental perception as .78. In the study, the 'Environmental Education Self-Efficacy Scale' developed by Aydin (2008) was used. For this study, the Cronbach alpha value of the scale was found to be .76.

Data Analysis

The statistical analyses of the data in the study were conducted with the SPSS/PC (Statistical Package for Social Science for Personal Computers) based on the total scores of the teacher candidates regarding the sub-dimensions of the environmental literacy scale. In order to determine the difference between the teacher candidates' scores regarding the sub-dimensions of the environmental literacy scale and their self-efficacy perceptions pretest and posttest scores, independent samples t-test was applied.

The Process of Teaching the Lessons

First of all, the researcher prepared not only the lesson plans for each course hour to act as a guide the research process but also the learning-teaching situations to execute the experimental processes in the study. In addition, the table of specifications for the gains expected as a result of the present study was prepared. In this phase, the studies in the field were examined, and faculty members from the fields of educational sciences and biology education were asked for their help.

In the study, the project-based instruction method was enriched with computer animations prepared for educational purposes. Before the experimental processes, a guide for students was prepared regarding the animation supported project based learning application to make it adopted and understood better. The student guide included the in-class activities, the studies that the student would carry out in the process, the responsibilities they would undertake and the evaluation criteria. In the first week, in company with the student guide, the students were informed about the method. For the application of the project-based instruction method, the students were divided into groups of four. The projects prepared for the students to research were presented to them for their views, and the projects were shared. The project assignments were made up of two phases. In the first phase, the teacher candidates

were asked to put forward solutions to the problem related to the subject of the project and to discuss these solutions in class. In the second phase, they developed materials for elementary school students regarding the problem they chose. Starting with the 2nd week, the theoretical subjects of the environmental education course (biotic and abiotic factors of the ecosystem, ecological relationships, life zones were taught by the researcher faculty member with the support of animations for 6 weeks. In this way, the students were given time to research the project subjects and to prepare for their presentation. In the week following the end of the theoretical subjects, each group introduced the material they developed to the class. Afterwards, every week, two groups of students started introducing their projects. Following the presentations, the environmental literacy scale and the environmental education self-efficacy scale applied as pretest previously were conducted again as the posttest.

Results

Table I. t-Test Results Regarding the Difference between the Pretest Mean Scores of the Experimental and Control Groups in Terms of the Dimension of Environmental Knowledge

Group	N	$\overline{X}$	SS	Sd	t	p
Experimental	39	11.44	1.85	73	-1.11	0.27
Control	36	10.98	1.78			

$p<0.05$

When Table 1 is examined, it is seen that there was no statistically significant difference between the pretest scores of the experimental and control groups with respect to the dimension of environmental knowledge. It could be stated that before the experimental process, the mean scores of the experimental and control groups were similar in terms of the dimension of environmental knowledge.

Table II. t-Test Results Regarding the Difference between the Posttest Mean Scores of the Experimental and Control Groups in Terms of the Dimension of Environmental Knowledge

Group	N	$\overline{X}$	SS	Sd	t	p
Experimental	39	14.26	1.69	73	-3.86	0.00*
Control	36	11.73	3.50			

$p<0.05$

When Table 2 is examined, it is seen that there was a significant difference between the posttest mean scores of the experimental and control groups in favor of the experimental group with respect to the dimension of environmental knowledge. At the end of the applications, it was found out that the experimental group students, who were taught the lessons with the animation-supported project-based instruction method, were more successful than the control group students, who were taught with traditional methods.

Table III. t-Test Results Regarding the Difference between the Pretest Mean Scores of the Experimental and Control Groups in Terms of the Dimension of Environmental Attitude

Group	N	$\overline{X}$	SS	Sd	t	p
Experimental	39	62.74	7.15	73	-0.45	0.65
Control	36	61.71	12.32			

$p<0.05$

The results presented in Table 3 revealed no statistically significant difference between the pretest mean scores of the experimental and control groups with respect to the dimension of environmental attitude. Before the applications, both groups were found similar in terms of the dimension of environmental attitude.

Table IV. t-Test Results Regarding the Difference between the Posttest Mean Scores of the Experimental and Control Groups in Terms of the Dimension of Environmental Attitude

Group	N	$\overline{X}$	SS	Sd	t	p
Experimental	39	60.68	12.78	73	-0.40	0.69
Control	36	59.50	12.70			

$p<0.05$

When Table 4 is examined, it is seen that there was no statistically significant difference between the posttest mean scores of the experimental and control groups with respect to the dimension of environmental attitude. However, the mean scores revealed that the experimental group students had higher mean scores for the dimension of environmental attitude than the control group students.

Table V. t-Test Results Regarding the Difference between the Pretest Mean Scores of the Experimental and Control Groups in Terms of the Dimension of Environmental Behavior

Group	N	$\overline{X}$	SS	Sd	t	p

Experimental	39	1.89	0.28	73	0.12	0.91
Control	36	1.90	0.30			

p<0.05

According to Table 5, there was no statistically significant difference between the pretest mean scores of the experimental and control groups in terms of the dimension of environmental behavior. Before the applications, it was found out that the experimental and control group students had similar mean scores for the dimension of environmental behavior.

Table VI. t-Test Results Regarding the Difference between the Posttest Mean Scores of the Experimental and Control Groups in Terms of the Dimension of Environmental Behavior

Group	N	$\overline{X}$	SS	Sd	t	p
Experimental	39	2.09	0.31	73	-1.37	0.17
Control	36	2.00	0.26			

p<0.05

When Table 6 is examined, it is seen that there was no statistically significant difference between the posttest mean scores of the experimental and control groups with respect to the dimension of environmental behavior. However, it was found out that the experimental group students had higher mean scores for the dimension of environmental behavior than the control group students.

Table VII. t-Test Results Regarding the Difference between the Pretest Mean Scores of the Experimental and Control Groups in Terms of the Dimension of Environmental Perception

Group	N	$\overline{X}$	SS	Sd	t	p
Experimental	39	3.32	0.63	73	0.72	0.48
Control	36	3.55	0.86			

p<0.05

According to the results presented in Table 7, no statistically significant difference was found between the pretest mean scores of the experimental and control groups in terms of the dimension of environmental perception. Before the applications, the two groups were found similar with respect to the dimension of environmental perception.

Table VIII. t-Test Results Regarding the Difference between the Posttest Mean Scores of the Experimental and Control Groups in Terms of the Dimension of Environmental Perception

Group	N	$\overline{X}$	SS	Sd	t	p
Experimental	39	3.54	0.78	73	-1.35	0.18
Control	36	3.32	0.64			

p<0.05

When Table 8 is examined, it is seen that there was no statistically significant difference between the posttest mean scores of the experimental and control groups with respect to the dimension of environmental perception. However, it was found out that the experimental group students had higher mean scores for the dimension of environmental perception than the control group students.

Table IX. t-Test Results Regarding the Difference between the Self-Efficacy Pretest Mean Scores of the Experimental and Control Groups

Group	N	$\overline{X}$	SS	Sd	t	p
Experimental	39	3.12	0.46	73	0.97	0.33
Control	36	3.23	0.44			

p<0.05

The results presented in Table 9 revealed no statistically significant difference between the pretest mean scores of the experimental and control groups. This result demonstrated that before the experimental study, both groups had similar mean scores regarding their self-efficacy perceptions of environmental education. It was found out that the control group students had higher pretest mean scores regarding self-efficacy perceptions of environmental education than the experimental group students.

Table X. t-Test Results Regarding the Difference between the Self-Efficacy Posttest Mean Scores of the Experimental and Control Groups

Group	N	$\overline{X}$	SS	Sd	t	p
Experimental	39	3.42	0.55	73	-1.81	0.07
Control	36	3.21	0.43			

p<0.05

According to Table 10, there was no statistically significant difference between the posttest mean scores of the experimental and control groups. However, it was found out that the experimental group students, who were taught with the

project-based instruction method supported with computer animations, had higher mean scores than the control group students, who were taught with traditional instruction methods.

Discussion and conclusion

As a result of the study, it was found out that the environmental literacy posttest mean scores of the experimental group students for the dimension of knowledge were statistically significantly higher than those of the control group students. As for their posttest scores for the dimensions of attitude, environmental behavior and environmental perception, there was a difference in favor of the experimental group students, yet it was not found statistically significant. Depending on these findings, the project-based learning approach supported with animations could be said to lead to more success in environmental education courses than do other traditional methods. In the research process, not only did the students learn by doing thanks to the projects but also they were placed in the center of education as the animations addressed their visual worlds. It is reported in several studies that students gain the feeling of awareness more in learning environments that place them in the center of education (Aydede and Matyar, 2009; Kormaz, 2007). In related literature, there is not much research on the influence of the project-based instruction method supported with animations on the dimensions of environmental literacy, yet similar findings to those obtained in the present study have been reported. In one study, Nation (2008) found out that the project-based learning method not only developed the critical thinking and problem-solving skills of students but also taught them how to use these skills in their daily lives. In another study carried out with university students, Kisioglu (2009) organized the educational setting on the basis of student-centered activities. At the end of the study carried out based on the pretest-posttest model, it was found out that there was a significant increase in the students' levels of environmental literacy. Similarly, Wright (2006) investigated the influence of student-centered approaches and of traditional approaches on environmental literacy. The researcher found out that student-centered methods and techniques were more influential on students' environmental literacy than traditional methods. In another study carried out with teachers, Kilinç (2010) reported that project-based learning caused positive changes in teachers' attitudes and thoughts regarding the protection of the environment. The influence of technology in student-centered learning environments should not be ignored. In learning environments, the influence of the computer, one of the most beneficial products of

the technology era, can not be ignored. Various studies have been conducted to examine the influence of computers on environmental literacy. Yakisan, Yel and Mutlu (2009), in their study, used animations in biology teaching. At the end of their study carried out with experimental and control group students, the researchers found out that the experimental group students were more successful than the control group students who were taught via the traditional instruction method. In addition, another study conducted by Ruchter, Klar and Geiger (2010) examined and compared the influence of mobile computers and the traditional method on environmental literacy. At the end of their, the researchers found out that the education given via mobile computers was more influential than the one given via traditional instruction methods. Depending on the results of this study, it could be stated that the project-based learning approach supported with animations developed teacher candidates' feeling of awareness of the environment and helped them raise their consciousness.

One of the important findings of the study obtained at the end of the applications was that the environmental education self-efficacy perception scores of the experimental group students were significantly higher than those of the control group students. Based on the results obtained in the study, it could be stated that thanks to the project-based learning approach supported with animations, the students felt themselves more efficient and confident in environmental education. In this respect, it could be stated that the student-centered methods used in the experimental group were more influential than the traditional methods used in the control group and that the project-based learning approach supported with animations and enriched visually played an effective role in increasing the students' self-confidence. The reason is that projects and visual effects help place students in the center both in affective and cognitive respects. Several other studies also supported the fact that student-centered applications develop self-efficacy beliefs (Korkmaz and Kaptan, 2001; Lucas and Barge, 2010; Tertemiz and Sahinkaya, 2010). Bozgeyikli and Dogan (2010) investigated the influence of computer-aided career group guidance on self-efficacy. At the end of their study, the researchers found out that the computer-aided guidance applications contributed positively to self-efficacy. In order to emphasize the effectiveness of animations in learning environments, Arici and Dalkiliç (2006), in their study, gave related examples to explain the possible contributions of the computer animation technique to the process of "Computer-Aided Instruction" and introduced an application prepared with the animation technique. As a result of their study, the researchers reported that animations contributed positively to the

instruction process. Similarly, in another study carried out by Mat Iskender (2007), it was found out that animations helped develop students' affective skills.

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