THE EFFECTS OF INTERACTIVE LEARNING ENVIRONMENTS ON COOPERATIVE LEARNING ACHIEVEMENT AND STUDENT ANXIETY IN ENVIRONMENTAL EDUCATION

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ABSTRACT

All events in the world are caused by chemical events and reactions. One of the most important aims of life chemistry is bringing up individuals who have sensitivity towards the environment and environmental awareness; could apply their learnt knowledge to daily issues and problems; have the ability to comment and adopt their knowledge into different situations. In order to achieve these aims, it is of great importance to train students of all levels and create awareness in the society. Therefore, life chemistry has been emphasized together with what could be done about it and how it could be integrated into the curriculum including which applications should be done at which level. This study aimed to investigate the effect of distance education and technology assisted cooperative learning projects on students' achievement and attitude in "Chemistry events and concepts in our life". In the light of this aim, student achievement scores as outcomes of student cooperative learning projects were evaluated together with technology attitude scale.

Keywords: **Distance education, Interactive learning environment, Cooperative learning, Student achievement, Attitude, Life chemistry.**

INTRODUCTION

Life chemistry is one of the most important and required topics in the world. The utilization of clean energy and environmental protection is emphasized all around the world and studies are conducted on how resources could be utilized more efficiently. All events in the world are caused by chemical events and reactions. These chemical events and reactions are all involved in chemistry. One of the most important aims of life chemistry is bringing up individuals who have sensitivity towards the environment and environmental awareness; could apply their learnt knowledge to daily issues and problems; have the ability to comment and adopt their knowledge into different situations. In order to achieve these aims, it is of great importance to train students of all levels and create awareness in the society. Therefore, life chemistry has been emphasized together with what could be done about it and how it could be integrated into the curriculum including which applications should be done at which level. The factors affecting students' environmental knowledge, attitude, awareness and behaviors are investigated at all levels of education by scientists, beginning in kindergarten.

According to the results, educational models and curriculum suggestions are prepared. As an example we can cite the studies of Gillespie & deHaals (1979) and deHaals & Gillespie (1979) that relate to planning environmental change and measuring environmental awareness.

Palmer (1995) studied the effect of early childhood experiences, family and education on environmental conception and behaviors. Howe & Disinger (1988) investigated the variables in improving the responsible environmental behaviors. Musser & Diamond (1999), in their study on the environmental awareness of kindergarten students, examined the factors affecting the improvement of environmental knowledge and awareness.

They found that the behaviors of the students were not related to the private applications that the parents actualize at home. Ballantyne (1998) examined the improvement of the students' environmental knowledge through interactive study recordings.

Musser & Malkus (1994) developed a scale to assess the attitudes of school children towards the environment. Ballantyne (1996) designed an environmental concept improvement model in co-operation with environmental knowledge, attitude and behaviors. Ballantyne et al. (2001) developed environmental education programs focusing on the students' knowledge and attitudes related to the environment and their environmental activities. Similarly, Thomas (1989-1990), Hites (2001) discussed the context of environmental education curriculum, educational techniques, educational tools and how to improve student motivation.

Wenzel & Austin (2001) evaluated an introductory chemistry course that had an environmental awareness prior to 2001 in the field of environmental chemistry in the undergraduate laboratory. They suggested that the students needed to address sensitive issues more carefully. Randall (1997) recommends that environmental education should be supported with activities that could be done within the natural environment. Lee (1974), Davis (1974), Chrotowski (1985) and Stearns (1988) prepared sample lesson plans on various suggestions and applications of environmental chemistry in high school curriculum. Carlson (1993) describes a three-week intensive course in a general chemistry class, which consisted of two distinct phases: a one-week introduction to environmental chemistry and a two-week project involving a particular environmental program. In his research related to science, technology and society, Uri Zoller emphasized the global environmental issues and importance of environmental chemistry in this context (Zoller, 2000; Zoller, 2001; Tal, Dori, Keiny, Zoller, 2001).

Students of Georgia Southern University, Departments of Geology, Chemistry, Biology and Physics have been taking the environment class. This policy has been applied since 1999 and has been supported by National Science Association. Its aim is to increase the level of scientific literacy and awareness (Jenkins, et. al, 2004).

The utilization of clean energy resources that prevent environmental pollution could also be included within his concept besides the various researches on environment and environmental protection. Wenig (1981) prepared 25 class modules on renewable energy among these clean energy resources. The prepared modules involved social effects of energy, evaluation of alternative renewable energy resources, economical aspects of energy resources, utilization of renewable alternatives and decreasing the usage of energy at home. Moreover, Mumma et. al. (1996), Rowland (1985), Crelinsen (1983), Theiss (1982) and Sarvis (1980) ran studies on energy to be included in the curriculum and studied on activity and lesson plans about renewable energy. Apart from these, there are many project studies on renewable energy.

Newson (1997) organized a project, which aimed to acknowledge students on renewable energy. Nicholson (1996) integrated the utilization of technology in education into the topic of renewable energy, and designed a project where students built websites on renewable energy through using computers at the Internet class. A company called Resources for the Future designed a project work on the protection and improvement of natural resources within their study on environmental improvement. In a project done in local technical schools, there were applications on environmental administration and protection where 4 educational courses were organized in order to explain the utilization of solar energy. The project designed at Missouri State Fair High School, renewable energy resources was integrated into the field of agriculture.

THE UTILIZATION OF INTERACTIVE ENVIRONMENTS IN CHEMISTRY EDUCATION

Interactive environments are utilized in chemistry education through various ways. Computer Based Education can be described as activities in which students interact with a programmed lecture on a computer. Computers may be used as an educational strategy to improve overall learning and computer literacy in students. Many science teachers are currently using computers to produce tests and worksheets; record, calculate, and post student grades; develop tests and worksheets; and produce supplementary items such as crossword puzzles, posters, and diagrams to support instructional activities The major factor inhibiting computer use is budgetary constraints (Morse, 1991).

Recently the Internet has become the most important development in the chemistry field (Holmes, 1996). The Internet holds important educational promise for engendering active and experiential learning, encouraging reflection and the application and fostering of collaboration and individualized construction of meaning in learning communities that extend beyond the boundaries of the traditional classroom or campus (Eastmond, 1998).

According to CAST, the center for Applied Special Technology in Massachusetts reports that the Internet offers a strong potential to break down the barriers and inequities encountered by students of different socioeconomic, linguistic and disability backgrounds (Bayha, 1998). Internet usage is a method that provides the correct information within a short period. Internet supported learning provides learners with interactive and collaborative environments. Tools such as chat rooms, discussion groups, and video-sound conference and e-mail groups provide students with an opportunity to share and discuss their ideas and opinions (Holmes, 1996). This learning that takes part in a united atmosphere is an element of successful science education (Penhale, 1994).

The recent introduction of the Internet into classrooms provides an opportunity for learners to access a wide range of digital resources on the World Wide Web (Hoffman, 1997). For teachers, students, and parents this means access to information that is not in textbooks or the local library (Haury, 1996).

The Internet also enables teachers and students to quickly access primary sources. Introducing and using primary sources in the classroom leads to active learning and to the development of critical thinking and the enhancement of learning processes by allowing students to construct their own understandings (Shiroma, 2000).

The teaching methods of online chemical database research must be presented to chemistry teachers to encourage them to integrate online searching into their

chemistry programs (Carr, 1989). Students must be encouraged to execute the computer based interactive research through various databases (Cooke, 1991). What a database is and how to use it, and the types of databases must be described. By creating and using databases, students develop research and organization skills. By searching through databases, they learn to identify information needs, make problem statements, retrieve and sort information, and design strategies for organizing data (Parisi, 1985).

Information about Internet usage also must be provided to teachers in order to enhance learning (De Dicco, 1998). Over the past decades education has traditionally meant bringing students to sources of knowledge, but the time has come to bring sources of knowledge to the students (Barley, 1999).

Web technology is only one alternative among the wide range of available media for helping people learn (Boisvert, 2000). According to Sabry & Baldwin, (2003), increasingly, web technology is used for learning interaction and is becoming commonplace in educational institutions (Nielsen.NetRatings, 2002; McGraw-Hill, 2002; Collis et al, 2000).

Web-based learning is a method of computer supported teaching. It is a learning model that supports individual learning. In a Web-Based Learning Model the teacher and student are in different places.
It prevents the difficulties which appear from individual differences. It does not contribute to the social development of students because it prevents student-student, student-teacher communication. Web-based learning is available to anyone who wishes. There are no limitations on how many students can be accommodated. Neither students nor trainers incur costs and time to travel to and attend a training class. Difficulties of finding a training site in a geographical area are eliminated. Training can be scheduled whenever and wherever a student wishes and for as long as desired. Web-based learning technology allows the testing and tracking of students' progress (Hawkins, 1997).

Traditionally, students have been asked to demonstrate their knowledge by either writing papers or taking tests. But in project-based learning (PBL), the view of the types of work able to be used is expanded as to how learners can demonstrate their understanding (McGrath, 2003).

According to Moursund, (1999) the project-based learning model is a basis teaching model of computer based education applications that emphasizes technology usage as a tool. It accepts a project as an underside element. In the project-based learning model students prepare a project that is relevant to their selected topic. Students determine the schedule of a project. Generally, a project is prepared as a group. The presentation of a project is made with PowerPoint. According to McGrath, (2003), the important thing is that the tool must involve students in constructing their own knowledge about important subject matter and the transformation of that knowledge as it is refined and revised (Thomas, 2000). The project tool should be explicit and observable, something that the learners can discuss. It might help if you think of knowledge itself as a design, something people devise (Perkins, 1986).

Also, the PBL tool is the product of an extended investigation that is collaborative (McGrath, 2003).

THE PURPOSE OF THE STUDY

This study aimed to investigate the effect of distance education and technology assisted cooperative learning projects on students' achievement and attitude in "Chemistry events and concepts in our life". In the light of this aim, student achievement scores as outcomes of student cooperative learning projects were evaluated together with technology attitude scale in this research.

METHOD

Sample

The samplings of the study were 31 3rd year students from Zonguldak Karaelmas University, Faculty of Education, Department of Primary School Education. In this course, the students were instructed to teach about "life chemistry" through course content that was prepared by considering distance education approach and through interactive projects that were prepared for cooperative learning activity.

Data Collection Tools

Life Chemistry Knowledge Test

The "Life Chemistry Knowledge Test" of 20 multiple-choice questions, which was developed by the researcher in order to determine students' knowledge levels attained through cooperative learning projects on "Chemistry events and concepts in our life", was administered to the samplings as pre and posttests.

Technology Attitude Scale

In the study, the technology attitude scale, which was developed by Yavuz (2005) in order to evaluate student attitude towards technology was used.

The scale that is 5-point likert type includes 5 factors and 19 items; 13 of them are positive and the rest is negative. The factors can be ordered as the follows; "Not Using Technological Tools In Education", "Using Technological Tools In Education", "The Effects Of Technology In Educational Life", "Teaching How To Use Technological Tools" and "Evaluating Technological Tools". The reliability of the scale was found as 0,87 by using Cronbach Alpha coefficient. The total correlations of 19 items for item differentiation index and item difficulty ranged from 0,24 to 0,68.

In the scale, the choices and points for each item were determined as "Strongly Agree" (5), "Agree" (4), "Undecided" (3), "Disagree" (2) and "Strongly Disagree" (1). The coding process was carried out by giving points to choices of items that ranged from 5 to 1.

The maximum score on the scale is 71 that refer the highest positive attitude and the minimum score on the scale is 43 that refer to the highest negative attitude toward technology.

Application Procedure

Students were initially administered the "Life Chemistry Knowledge Test" in order to assess their knowledge related to the chemistry events in our life in addition to the technology attitude scale as pretests.

The students were asked to prepare a project on their own topic about "Chemistry events and concepts in our life" by constructing 3-4 students group.

In Zonguldak Karaelmas University, Faculty of Education has been providing support to the students by adding interactive course contents and materials the students will be able to use, in order to strengthen their the ordinary courses by distance education activities.

In this system, the students are able to reach course contents about their ordinary semester courses by using their passwords and user names.

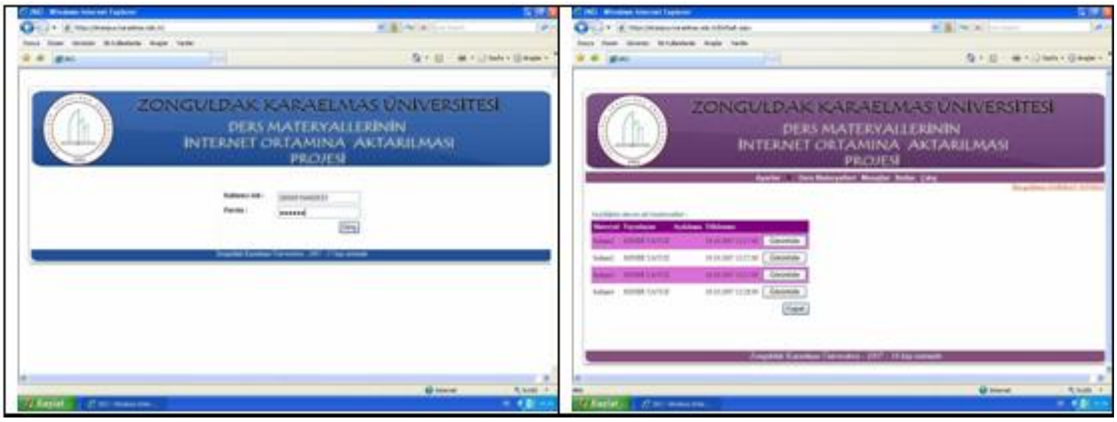
In addition, the lecturers can present additional materials via internet and can do connection with the students. In the following figure (Figure: 1), an example of interactive learning material and steps for reaching it by the students is presented.

The projects were prepared in the light of the knowledge attained with the help of distance education materials and interactive environments in 1 month.

Students acquired various information related to their projects through their searches on the Internet.

They organized the acquired information within their group and eliminated the useful ones to be used in their projects.

After the projects were prepared and presented, the "Life Chemistry Knowledge Test" was administered as the posttest together with technology attitude scale.



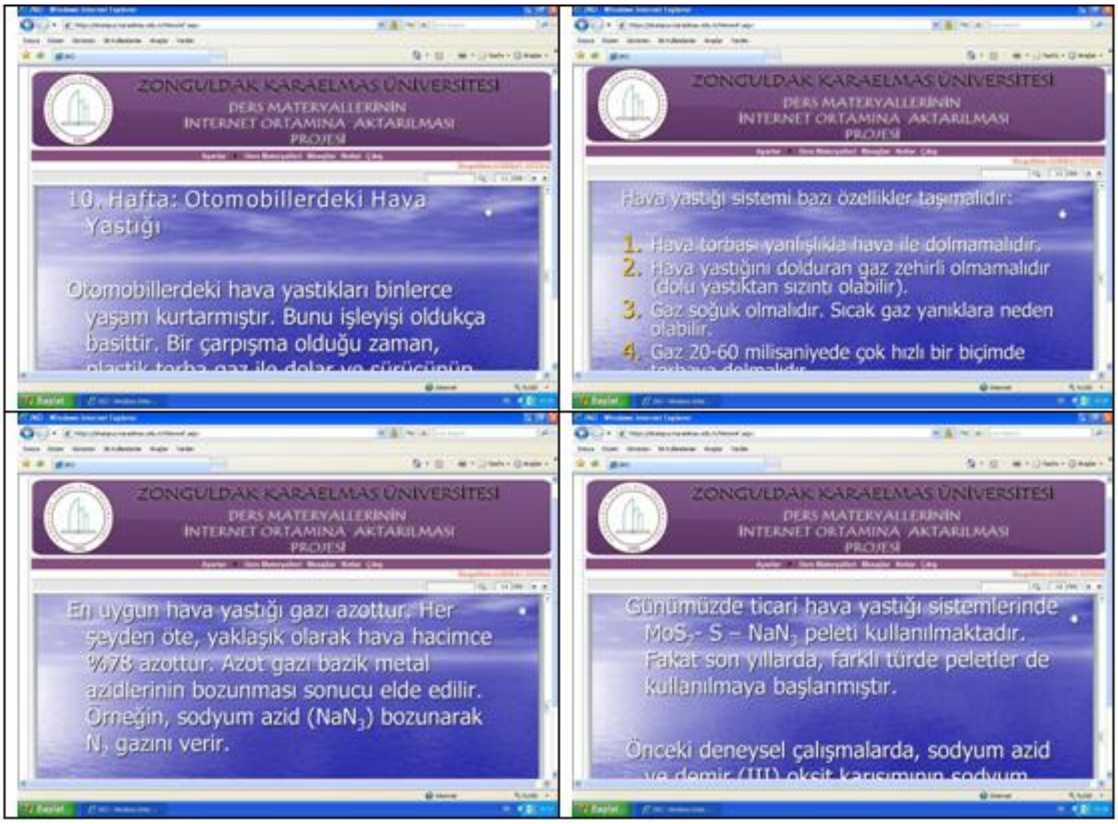


Figure: 1
Steps for using the system and example material for "Life chemistry"

FINDINGS

Findings Related to the Life Chemistry Knowledge Test

The paired-samples t-test analysis was done in order to determine a possible significant difference between the Life Chemistry Knowledge pre and posttest scores.

Table: 1
The paired samples t-test results of students' life chemistry knowledge test scores before and after the applications

	$\bar{X}$	n	s	t	p
Pretest	49,38	31	5,23	-8,746	0,000
Posttest	78,42				

$p<0,05$

The analysis results revealed that there was a significant increase in students' knowledge levels of life chemistry as a result of the cooperative learning projects in distance education assisted interactive environments ($t_{(31)}$= -8,746, $p<0,05$).

Before the cooperative learning projects, students' average in the life chemistry knowledge test results was found to be $\bar{X}_{pre}$=49,38, whereas the value increased up to $\bar{X}_{post}$= 78,42 after the application.

This finding shows that cooperative learning projects in interactive environments have important effects on increasing students' knowledge levels about life chemistry.

Findings Related to the Technology Attitude Scale

Table: 2
The paired samples t-test results of students' technology attitude scale scores before and after the applications

	$\bar{X}$	n	s	t	p
pretest	48,37	31	7,62	-4,91	0,000
posttest	65,86				

p<0,05

The analysis results displayed a significant increase in the technology attitude levels of students as a result of the cooperative learning project application in distance education assisted interactive learning environment ($t_{(31)}$=-4,91, p<0,05). Before the cooperative learning projects application, the average of students' technology attitude results was $\bar{X}_{pre}$= 48,37, whereas this value increased up to $\bar{X}_{post}$= 65,86 after the application.

This finding indicates that cooperative learning projects in distance education assisted interactive learning environments have an important effect on increasing students' technology attitude levels.

CONCLUSIONS

All applications throughout the study concluded that cooperative learning projects, which are assisted by interactive environments, led to an important increase in students knowledge levels related to life chemistry. This increase in the achievement levels was determined through the difference between students' pre and posttest results favoring the posttest.

Moreover, the difference between students' technology attitude scale pre and posttest results favoring the posttest revealed that distance education assisted interactive environments affected students' technology attitude positively.

These results are in coherence with the results of the study by Litteral (1998), Ctrnactova (2001), Serapuu & Adojaan (1999), Blume et.all (2001) where the increasing effect of interactive education on student achievement and course efficiency was determined.

SUGGESTIONS

Interactive learning environments cannot be effective and thrive without considering students' needs and preferences. Obtaining student feedback about the interactive learning environment is crucial point for the successful design and implementation.

Consequently it is important to determine attitude and learning achievement for education will continue to have an impact on teaching and learning. Real life examples related to student experiences in an interactive learning environment contributes to student achievement that will increase student attitude and learning.

Interactive learning environments should be carefully designed to students' attitude with these environments. Distance education instructors should consider the characteristics of an interactive learning environment to develop successful distance courses and to meet the expectations of their students. It is clear that other factors may also contribute to distance education. Next research may include other characteristics, such as computer and internet ownership, which may influence students' anxiety toward interactive learning environments.

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