THE EFFECT OF INQUIRY BASED LEARNING ENVIRONMENT IN SCIENCE AND TECHNOLOGY COURSE ON THE STUDENTS' ACADEMIC ACHIEVEMENTS*

ªSimge AKPULLUKÇU & ᵇF. Yasemin GÜNAY

ªDokuz Eylül University MSc, simge_akpullukcu@hotmail.com
ᵇDokuz Eylül University Assist. Prof. Dr , yasemin.gunay@deu.edu.tr

Abstract

Especially, it has been investigated how to upgrade the retention level for academic achievement and science concepts and how to improve positive attitudes towards science. Quasi-experimental design has been used in the study. In order to seek the effect of inquiry based learning approach, two of the classes constituted by the school management, except for random distribution, have been defined as experiment and control group. 72 students, studying at a state school in the city of Aydın, have formed the working group of the research. In the study, "Academic Achievement Test" prepared by the researcher, has been used to determine the developments in the academic achievements of the students. According to the findings of the study; the academic achievements of the students towards science and technology, who have been in the experiment group studying in inquiry based learning environment has displayed a difference in a significant way compared to those in control group studying in the environment to which 2005 Science and Technology curriculum has been applied. As a result of interpreting the findings obtained from the research, it has been considered that using of the technics practiced in inquiry based learning environment in science and technology can be profitable for the academic achievements of the students towards the course.
Key Words: Science and Technology Teaching, Inquiry Based Learning, Academic Achievement

INTRODUCTION

In recent years, it has been put forth that at the second stage of the elementary school there exists significant decreases of the students' attitudes and interests towards science in most of the studies on science education (Osborne, 2003) and dwelled upon the importance of training the students as scientifically literate individuals in order to adapt them to an era equipped with science and technology (NRC, 2000). In parallel with these developments, the ministry of national education has eliminated lesson plans and programs allowing the traditional learning environment going into the process of restructuring primary school curriculum. Instead, the ministry of national education has dealt with new methods and processes which allow the scientific concepts to be built as meaningful complements in mind and in which the students are active in learning environment. Among these processes, inquiry based science environments appear as an issue on which is frequently studied, recently.

* This study is a part of master thesis which name is "The Effect of Inquiry Based Learning Environment in Science and Technology Course on The Students' Academic Achievements, Attitudes and Retention Level"

Inquiry based science environment consists of active learning processes such as problem based learning, learning by discovery, project based learning. Moreover it can be defined as an environment in which the students are confronted with questions, problems and tasks and they can learn the scientific notions by discovery (Hammer, 1997**).**

The steps which are followed in the exploration process at the learning atmosphere constructs the basics of learning. In a research making process, following the steps and obeying the rules of the learning as told before is accepted as the indicator of a research scientism (Çepni, 2009).

According to Harmanlı (2000), strategies of learning is a behavior and thought that has an aim to effect and make the students learning easy, permanent and help the coding process in the research period. The context of science and technology lessons has qualifications to imply the inquiry based learning easier. Science and technology lessons use events, concepts, principles, laws and hypothesis to clarify nature and natural events (Çepni, 2006). The inquiry based learning occasion contains all the specifications like; discovery based learning, project based learning, cooperative based learning, constructivism, active learning and problem based learning. Concordantly, if we concentrate to the activities which appears in the inquiry based learning process; we will especially see that hypothesis and problem solving techniques are one step in front then the others. In the inquiry based learning environment students implements; feeling and limiting the problem, defining the problem, making researches about the problem, defining causality relations, establishing a hypothesis and planning an experiment for testing the hypothesis, developing proofs based on obtained data's and presents and reports the research with a group and without a teacher. In all these knowledge developing process, the specifications of the learning atmosphere effects learning significantly.

There are different types of learning styles based on inquiry. Inquiry is accepted when students generated a question and processed an inspection based on student centered or "opened". Opened inquiry provides students the highest point of independent study. Students clarify on specifying expressive questions themselves, developing a design for research, analyzing datas and explaining diagnosis without a teacher direction at this progress. Teacher-guided inquiry is an applied type of research in which the teacher chooses the question and both the student and the teacher decide how to outline the research and carry it. Windschitl (2003), defines teacher-guided inquiry as an environment in which the researchers are able to independently on what the appropriate methods and techniques that will be used in the research. When the teacher selects the question and then carries the research out in a way of lecturing directly or exemplifying, this indicates to the teacher-centered inquiry type (NRC, 2000).

The features and the advantages of inquiry based science environment have been stated by many educational institutions and science education researchers and it is advised to take part and to apply in curriculum (Boyer Commission, 1998; NRC, 1996). Studies in which learning and teaching activities will be designed related to inquiry based science education environments are needed in our country, as well.
In this study, it is investigated how to raise the students' level of academic achievement on the basis of the strategy moving on from guided through open in inquiry based science environment.

Problem Statement

Is there a significant difference between the academic achievements (pretest-posttest scores) of the students towards science and technology, who have been in the experiment group studying in inquiry based learning environment and in control group studying in the environment to which 2005 Science and Technology curriculum has been applied?

The Effect of Inquiry Based Learning Environment in Science and Technology Course on The Students' Academic Achievements

2011

METHOD

The framework of the study

In this study, quasi-experimental design was used. In order to seek the effect of inquiry based science environment, two of the classes which were previously formed by the school management except for random distribution have been assigned as the experimental group and the control group, respectively.

Participants

The study group consists of 72 students at 7th grade who attend a state school in Aydın. 18 of 38 students in the experimental group are girls, 20 students are boys. 18 of 34 students in the control group are girls and 16 students are boys. It can be said that the students in the experimental and control groups resemble each other according to gender distribution.

The instruments of data collection

Among the units in the 7th grade science and technology curriculum, the unit "light" was handled to get the data of the research. "Academic achievement test" was carried out to measure the level of academic achievement which the students have for the unit "light". The instrument was prepared by the researcher for the purpose of defining the students' achievement levels which they have for the subjects (absorption of light, is white light really white?) in the unit "light". Different resources (science and technology course book, preparatory test books, the questions in previous exams) were benefited to construct the test. The test was prepared as a multiple choice test with 4 options.

Firstly, achievement test with 42 questions was presented to expert opinion to test the content validity. After receiving the expert opinion, 1 question was removed from the test; the choices of 2 questions were edited. Finally, the achievement test consisting of 41 questions was applied to 167 students from 2 different schools in pilot study. The item analysis in this study was made by using Test Analysis Program (TAP). After eliminating the items with low distinctiveness, KR reliability coefficient of the test was obtained 0.860. As a result of the analysis, 12 items were removed from the achievement test consisting of 41 questions. Finally the test was reduced to 29 items.

Experimental Process Path

Two classes as the experimental group and control group were assigned in order to investigate the effect of inquiry based science environment on academic achievement. Pre-tests which consist of achievement tests were applied to both two groups before the operation. During the operation in the experimental group, the courses were performed in inquiry based science environment. Inquiry based learning practices which were organized in the experimental group were executed by taking the operation steps of 7E Teaching Model into account. The practices in the control group were performed with the help of the instructions in teacher's guidebook of 2010-2011 academic year science and technology lessons as indicated in 2005 science and technology curriculum.

The analysis of the data and the used statistical techniques

In the research, KR20 and KR21 statistics which are of the methods based on item variance were carried out for the reliability analysis of the achievement test which was prepared for the unit "light" in science and technology. Items were analyzed using TAP and SPSS.

FINDINGS

In this study the research problem is expressed as "Is there a significant difference between the academic achievements (pretest-posttest scores) of the students towards science and technology, who have been in the experiment group studying in inquiry based learning environment and in control group studying in the environment to which 2005 Science and Technology curriculum has been applied.

Table 1.1: Achievement Test Scores Pretest Posttest Descriptive Statistics for the Comparison of Groups

Dependent variables	Experiment Group ($n = 38$)				Control Group ($n = 34$)			
	Pretest		Posttest		Pretest		Posttest	
	M	SD	M	SD	M	SD	M	SD
Achievement	13.26	4.82	24.11	3.07	5.25	2.81	9.50	4.22

As can be seen on the Table 1.1, before the application, the students' academic achievements test mean score who have been in the experiment group and studying in inquiry based learning environment is 13,26. After the application this value is becoming to 24,11.

A similar way, before the application, the students' academic achievements test mean score who have been in the control group studying in the environment to which 2005 Science and Technology curriculum has been applied is respectively 11,41 and 19,35.According to these findings we can say that both of the groups have an increase about the level of academic achievements in themselves.

The results of two way ANOVA which the students are confronted with the experimental results of two separate processing, can be seen on Table 1.2.

Table 1.2: Two Way ANOVA Results of Each Group's Academic Achievements Test Scores

source	SS	df	MS	F	Sig.	η2
Process	3165,5	1	3165,5	512,4	0,000	0,88
Group	391,3	1	391,3	16,3	0,000	0,19
Process x Group	75,5	1	75,5	12,2	0,001*	0,15
Error	432,5	70	6,2			

p<.05

The results of two way ANOVA are shown in the table 1.2 .The test statistic is the F value of 12.22. Using an α of .05, the p-value for 12.22 is .001, so the test statistic is significant at that level. It means that after the application there is a (statistically) significant difference among the group means [F (1, 70) = 12,22, p< .05].

The Effect of Inquiry Based Learning Environment in Science and Technology Course on The Students' Academic Achievements

2011

The findings shows that, being in the experiment group studying in inquiry based learning environment and control group studying in the environment to which 2005 Science and Technology curriculum has been applied, has different impacts on increasing the academic achievements level.

It is understood that, inquiry based learning environment which has more success score in process, is more effective on increasing the achievements level than the environment to which 2005 Science and Technology curriculum has been applied

DISCUSSION and COMMENTS

It is seen that (Table 1.1), the average pre-operational academic success points of the students studying in the inquiry based learning environment and the average academic points of the students studying in the learning environment in which 2005 Science and Technology teaching program is applied are close to each other. This situation shows that experiment and control group's pre-test academic success levels are nearly similar to each other. According to these data, to define the effect of the inquiry based learning method on academic success, it can be said that two groups of which academic success levels are not different from each other takes place in the research.

It is concluded that, there is a (statistically) significant difference in favour of the experiment group (Table 1.2) between mean scores of the students studying in the inquiry based learning environment and the students studying in the learning environment in which 2005 Science and Technology teaching program has been applied. It can be said that using inquiry based learning method in science and technology teaching is more effective to raise the academic success level of students than using only 2005 Science and Technology teaching program.

RESULTS and SUGGESTIONS

It is seen in lots of study that the learning environment in which inquiry-based learning methods are applied in science and technology courses is an effective way of raising the academic success (McPhedran, 2006; Tatar, 2006; Ortakuz, 2006; Arslan, 2007; and Çalışkan, 2008).
From this point of view, using inquiry-based learning environment in different disciplines can be provided.
Also in this research 7E learning model is used. Inquiry-based learning environments can be designed directed to using different learning models.
This study is applied on 'Absorption of Light' and 'Is White Light Actually White?' subjects of Science and Technology lessons can be dealt in different Science and Technology subjects.

REFERENCES

American Association for the Advancement of Science (AAAS), (1998). Blueprints for Science Literacy. New York: Oxford University Pres

Arslan, A. (2007). "Fen Eğitiminde Araştırmaya Dayalı Öğretim Yönteminin Kavramsal Öğrenmeye Etkisi". Yayınlanmamış Yüksek Lisans Tezi, İstanbul Marmara Üniversitesi Eğitim Bilimleri Enstitüsü.

Ayas, A. P., Çepni, S., Akdeniz, A. R., Özmen, H., Yiğit, N., Ayvacı, Ş. H., (2006). "Kuramdan Uygulamaya Fen ve Teknoloji Öğretimi". Pegem A Yayınları, Ankara

Boyer Commission (1998). "Reinventing Undergraduate Education: A Blueprint for America's Research Universities". Boyer Commission on Educating Undergraduates in the Research University.

Çalışkan, H. (2008). "İlköğretim 7. Sınıf Sosyal Bilgiler Dersinde Araştırmaya Dayalı Öğrenme Yaklaşımının Derse Yönelik Tutuma, Akademik Başarıya Ve Kalıcılık Düzeyine Etkisi" Yayınlanmamış doktora tezi, Ankara Gazi Üniversitesi Eğitim Bilimleri Enstitüsü.

Çepni, S. (2009). "Araştırma ve Proje Çalışmalarına Giriş". (4.Baskı). Trabzon: Celepler Matbaacılık.

Çepni, S., Bayrakçeken, S., Büyüköztürk, Ş., Yılmaz, A., Yücel, C., Koç, G., Korkmaz, İ., Tok, Ş., Tok, T., (2006). Öğretimde Planlama ve Değerlendirme. Pegem A Yayıncılık Ankara.

Ditzler, M.A., & Ricci, R.W., (1994). "Discovery Chemistry: Balancing Creativity and Structures". Journal of Chemical Education, 71(8), 685-688.

Hammer, D. (1997). "Inquiry Learning and Discovery Teaching. Cognition and Instruction", 15(4), 485-529.

Harmanlı, Z. (2000). "Öğrenme Stratejileri (Etkili Öğrenme Eğitimi)", İzmir Dokuz Eylül Üniversitesi, Buca Eğitim Fakültesi.

International Association for The Evaluation of Educational Achievement (2005). TIMSS Special Initiative in Problem Solving and Inquiry. Http://Tımss.Bc.Edu/Tımss2003ı/Psı.Html.

Keys, C. W. & Bryan, L. A. (2001). "Co-Constructing Inquiry-Based Science with Teachers: Essential Research for Lasting Reform". Journal of Research in Science Teaching, 38, 631-645.

Mcphedran, J. L. (2006) "An Investigation of Inquiry Based Teaching and Its Influence on Boy's Motivation in Science" Unpublished master's thesis. University of Toronto.

MEB, (2005). İlköğretim Fen ve Teknoloji Dersi Öğretim Programı, Taslak Baskısı. Ankara: Devlet Kitapları Müdürlüğü Basım Evi.

MEB, (2005). PISA 2003 Projesi Ulusal Nihai Rapor, MEB, Ankara

National Research Council. (1996). National Science Education Standards. Washington, DC: National Academy of Sciences.

National Research Council. (2000). "Inquiry and The National Science Education Standards: A Guide for Teaching and Learning". Washington, DC: National Academy of Sciences.

Ortakuz, Y. (2006). " Araştırmaya Dayalı Öğrenmenin Öğrencilerin Fen-Teknoloji-Toplum-Çevre İlişkisini Kurmasına Etkisi". Yayınlanmamış yüksek lisans tezi, İstanbul Marmara Üniversitesi Eğitim Bilimleri Enstitüsü.

Osborne, R., (2003). "Learning in Science: The Implications of Children's Science". Auckland, New Zealand: Heinemann Education.

Sönmez, V., (2008). "Öğretim İlke ve Yöntemleri". Anı yayıncılık Ankara

Tatar, N. (2006). "İlköğretim Fen Eğitiminde Araştırmaya Dayalı Öğrenme Yaklaşımının Bilimsel Süreç Becerilerine, Akademik Başarıya ve Tutuma Etkisi". Yayınlanmamış yüksek lisans tezi, Ankara Gazi Üniversitesi Eğitim Bilimleri Enstitüsü.

TIMSS 2003 Special Initiative in Problem Solving and Inquiry. (International Association for the Evaluation of Educational Achievement, 2005)

Windschitl, M. (2003). "Supporting The Development of Science Inquiry Skills With Special Classes of Software". Educational Technology, Research and Development, 48(2), 81–95.