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The Effect of Computer Assisted Instruction on the Achievement of Students on the Instruction of Physics Topic of 7th Grade Science Course at a Primary School

İzzet Kara and Özkan Kahraman

Faculty of Education, Pamukkale Universtiy, 20017 Denizli, Turkey

Abstract: The aim of this study is to determine the effect of Computer Assisted Instruction on the academic achievement of the students on the instruction of Physics subjects of 7th grade science lesson. This study includes Force and Pressure topics of 7th grade Science lesson. Two hundred and fifty three students joined in this study as control and experiment groups. Control group took only traditional instruction; experiment group took traditional instruction supported by teacher controlled computer assisted instruction. For both groups, Science subject test was applied as a pre-test before the instruction. It was seen a difference between the control and experiment groups' average scores at Science subject test at a significant level.

Key words: Computer assisted instruction, science teaching, academic achievement, force, pressure

INTRODUCTION

Improving technology has brought great easiness together in every field from military to industry, from health to education. Especially the development and prevalence of Computer Technology and usability for multi purpose aims provide not only speed and economy but also visual and sound opportunity. Computer technology, which started with abacus and now has come to core duo processors, is made be a great need even at home from now on (Demirci, 2006).

These technological developments and technological products being brought with them forced Traditional Education (TI) systems to be changed and add new ones to means and tools used (Anonim, 1997). It is possible to follow and keep up with the time if only raising the effect of educational system. Because our time is technology time, it is needed to add technological opportunities into it and to use technology. Educational materials as assistant materials are among the tools to make instruction more beneficial, lasting and pleasurable. Computers and instructional materials being used as both tool and method are effective for students on increasing the concentration on the course, understanding lesson, synthesizing and improving positive thoughts for the course. Instructional Materials make the topic clearer and more lasting by making the abstract topics concrete (Çepni *et al.*, 2004; Demirel, 2004). So especially for teaching abstract concepts like in the Science Education course, it is very important to use visual materials for students to understand the lesson better and improving positive attitude towards the lesson.

In these days, it is seen that visual materials are being used in every field and students are mostly in the effect of technological tools like computer and television. As a result of supporting instructional materials with different sounds, images and simulations, more lasting, pleasurable and effective learning occurs. The learning outcomes is the result of seeing with 83%, hearing with 11%, smelling with 3, 5%, touching with 1, 5% and tasting with 1% (Demirel, 2004; Demirel and Yağcı, 2006). People's learning is resulted from seeing with 75%, hearing with 13%, smelling with 6%, touching with 3% and tasting with 3% (Küçükahmet, 2001).

Experimental evidences are found that verbal-only method isn't always working so well. Increasing visual content makes instruction lasting and effective when principles of how people learn are taken in to account (Mayer, 2003).

According to Çilenti and Kinder, learning is a result of reading with 10%, hearing with 20%, seeing with 30%, both seeing and hearing with 50%, talking about with 70% and both doing and talking about with 90% for a fixed time (Şimşek, 2002; Demirel, 2004; Yalın, 2006). This shows that instructional materials supported by sound and animations are more effective on the students' learning, perception and synthesizing.

The most feelings which are included in the instructional activity does mean the fastest and best learning. Learning becomes so lasting. The best learning is learning by doing and living by himself or herself (Küçükahmet, 2001; Demirel, 2004; Yiğit, 2004).

Therefore we have to develop Science Lessons as to be the lessons getting students' interest and in this way

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providing permanent learning, emphasizing the nature of Science and being supported by visual instructional materials and sound to accelerate learning.

The basic aim of the instructional research is to find how to form instructional environment providing upper level and permanent learning in a short time and with a less expense and endeavour (Yiğit and Akdeniz, 2003). The usage of computers in classrooms is one of the popular topics recently and the ratio of Computer Assisted Instruction (CAI) and the usage of computers in classroom have been rising. At the same time, completed researches haven't been able to show consistent results about If CAI is beneficial or not (Bayraktar, 2001).

Living styles of the people not only affect the learning styles and but also determine how they will be and improve them. Therefore educational and instructional materials offering more visual content as instructional opportunity are needed as to be presented in order to teach today's people having been bombarded with visual information and always living visually (Çepni *et al.*, 2004).

Today's students are growing with visual tools like television, video, computer and internet. It is not possible to get these students' interest by TI methods used in the past. Technological developments have resulted in a big gap between the ways of teaching methods at school and of getting information in society in the last quarter of 20th century. Because most of the students get the information via visual content sources like computers and televisions, which are used in daily life very much, it is made difficult to teach something to students by traditional methods (Çepni *et al.*, 2004; London, 2005).

Nowadays, it has been seen that visual materials are used everywhere and students are in the effect of technological tools like television and computers. As a result of supporting instructional materials with different voice, image and animations, more permanent, pleasurable and effective learning occurs (Demirel, 2004; Demirel and Yağcı, 2006).

Young children are more influenced by visual stimulus than auditory ones (Halis, 2002). This situation makes it more difficult to get children's interest and to give permanent knowledge at school without using visual or auditory content. CAI is a usable way to make instruction more interesting and to make the learnt knowledge permanent.

In the World and in Turkey, a lot of researches have been done about CAI. These researches resulted in very different results. Some of the researches found CAI as useful for students' development (Cotton, 1991; Morse, 1991; Child, 1995; Brophy, 1999; Çekbaş *et al.*, 2003; Yenice, 2003; Carter, 2004; Moodly, 2004;

Preciado, 2004; Brooks, 2005; Bryan, 2006; Çepni *et al.*, 2006; Wilder, 2006; Liao, 2007). Some other researches found no significant difference between CAI and TI (Alacapınar, 2003).

Research findings show that the use of computers in Science and Math courses as a tool towards application makes the lessons more interesting and encouraging and so makes the more complex Science concepts be learnt permanently and in an effective way (Halis, 2002).

If it is taken into account that students especially at the ages of primary school have difficulty in learning abstract concepts, it is important to make these concepts concrete and to present them sprightly. For this, educational technologies, especially computers, play an important role (Akpınar *et al.*, 2005).

The developments in the technology bring new learning and teaching opportunities with itself. Today, computers proved their position for education and instruction in developed countries. Now and on people are not searching If the computers are effective for educational and instructional activities, but searching how to use computers more effectively (Yakar, 2005).

There is still no agreement on effectiveness of the computers and virtual environments on instructional activities, but research finding showed that virtual classes have 20% higher scores than traditional classes (Schutte, 1996).

Humans have always observed environment from its existence up to now and questioned about both their beings and occurrence of events around with the questions like what, why and how (Çepni *et al.*, 2004). One of the objectives of Science Education is to make students be aware of concepts related to natural events and of relationships between concepts (Ünal and Ergin, 2006).

Science lesson is a natural science. It is an area that provides people interpretation and understanding about environment in which they live. Science Education gives students creative thinking ability. It helps them know and love the environment. Creative power of students increases. Our era is technology age. Science Education makes students obtain positive attitude towards technology (Hançer *et al.*, 2003).

It is very important that gaining positive attitude and behaviors towards science which was appeared as a result of observations of nature and natural realities and teaching it effectively and consciously (Bozdoğan and Yalçın, 2005).

CAI is the use of computers in educational and instructional activities. Computers, which are described as the most effective and personal learning tool, are used in order to keep in with technology and to be in time with the today's standards (Yenice, 2003).

The first use of computers in Educational area started with the use of MARK and ENIAC in 1940s. First computers were used as a problem solving machine especially for science and engineering (Carter, 2004).

The main purpose of the educational researches is to find how to form instructional environments which provide permanent and upper level learning with less expense and endeavor in a short time (Yiğit and Akdeniz, 2003).

The purpose of this study is to expose the effect of instructing Force and Pressure topics, which are ones of physics topics in 7th grade Science Lesson, in a computer supported way on the academic science scores.

In this study, pre-test and post-test of subject test including Force and Pressure topics were applied to 7th grade students.

MATERIALS AND METHODS

This research is a quantitative and experimental study with the real experiment model in the form of controlled pre-test and post-test model. In this research, there are two groups as experiment group, which follow the lesson with CAI and control group, which follow the lesson with Traditional Instruction (TI).

The universe of this study is 7th grade students in the 2nd central region of Denizli in 2006-2007 Academic year. The sample of this research is 253 students at Atatürk Primary school in Central Denizli.

Classes which will follow the course with CAI are chosen as four classes according to suitability of the course times with the course schedule of Science laboratory having a computer. Here it is assumed that science teachers are distributed to classes randomly.

In this study, science lesson is taught by classes' own science teacher in order not to make researcher's prejudice effect the study. Another assumption here is that the effect, which is originating from personal properties of teachers on students' achievement, is not so great to affect our study.

A data questionnaire is developed in order to get information about students' educational and instructional conditions outside the school, about their computer possibilities and about their computer using levels and to provide balance between groups. This questionnaire about Students' personal data and family states is applied with the post test.

In this research, a test is developed by picking up suitable multiple choice questions according to course content from different kinds of resources in order to measure the students' subject knowledge level. This test is prepared as 25 questions after being undergone item

and reliability analysis. This improved science subject test is applied to both groups as pre-test and post-test applications.

In this research, 3 different programs prepared for CAI are used. These are Mobides CAI system, Vitamin Educational program and an educational program developed by MS FrontPage program.

Students' personal and family data are investigated in order to balance the groups. After balancing them, paired and unpaired groups t tests are done in order to determine If there is a difference in pre-test and post-test applications between and in groups which are defined as Experiment and Control groups.

Used methodology in this research is to compare CAI and TI on the students' academic achievement for 7th grade Science lesson. In this study, the groups in which students following the course are our independent variables. Students' academic achievement is our dependent variables based on our independent ones.

A lot of researches have been done in Turkey and abroad in order to investigate the efficacy of CAI with different student groups with different ability and number. CAI both increases motivations towards learning and develops the academic achievement at the courses according to general opinion which is the result of these researches. According to research findings in this area, CAI is more effective in some researches but it has the same efficacy for some others and is less effective for some others.

RESULTS AND DISCUSSION

In this study there are 129 girl students with 51% and 124 boy students with 49%. Control group consists of 74 girl students with 53% and 65 boy students with 47%. Experiment group consists of 55 girl students with 48% and 59 boy students with 52%.

Table 1 shows the pre-test application of science subject test. At the beginning, control and experiment groups have the same achievement scores. In order to understand If the difference between the scores of the groups is significant or not, unpaired t-test for 2 unpaired group is performed and p-value is found as 0.20.

When we look into t-test results of experiment and control groups' subject test scores for the means of unpaired samples, there is no statistically significant difference between group scores of subject test at 0.05 significance level. That means, at the beginning of the course, control and experiment groups students are nearly almost the same with each other.

According to this result (Table 2), control and experiment groups do not have the same science subject

Table 1: Pre-test scores of science subject test

Groups	N (f)	Mean	Standard deviation	p-value
Experiment	114	6.29	3.44	0.20
Control	139	5.76	3.03	

Table 2: Post-test scores of science subject test

Groups	N (f)	Mean	Standard deviation	p-value
Experiment	114	15.19	4.29	0.00
Control	139	10.45	3.84	

Table 3: Difference scores of pre-test and post-test scores of science subject test

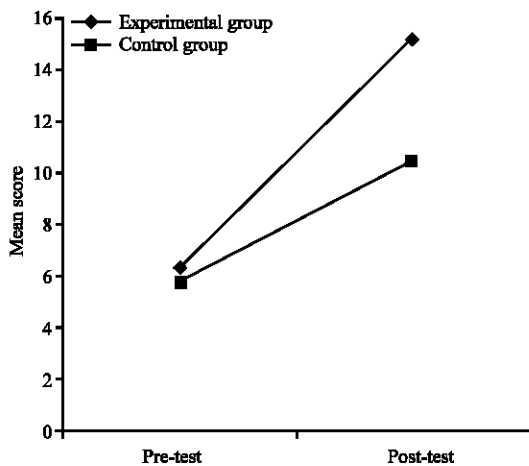| Groups	N (f)	Mean	Standard deviation	p-value
Experiment	114	8.90	5.01	0.00
Control	139	4.69	4.52	

Fig. 1: Pre-test and post-test scores of science subject test

test scores at the end of the course. In order to understand whether the difference between the group scores is significant or not, unpaired t-test between 2 different groups is performed and p-value is found as 0.00.

When experiment and control groups' subject test scores are looked into for unpaired sampled t-test, there is a statistically significant difference between group scores of subject test at 0.05 significance level. That means, at the end of the lesson, control and experiment group students' achievement levels are different from each other.

Table 3 show that at the end of the application experiment and control groups do not the same gain level. In order to investigate the significance of these difference scores between the groups, unpaired t-test for 2 independent groups means is performed and p-value is found as 0.00.

According to Fig. 1, slope of the gain level of experiment group scores is higher than control ones. Figure 1 show that experiment group's gain level is greater than control group's gain level.

Unpaired t-test for independent groups' means is performed with the difference of pre-test and post-test scores taken by control and experiment groups from the subject test. The significance level of the gain level difference of the groups shows that the gain levels aren't the same with each other with the significance of 0.00 at the significance level of 0.05 and that there is a significant difference in the favor of experiment group. That means, after the course the achievement levels of the student groups separated as control and experiment are different from each other in the favor of experiment group.

Findings have been gotten as a result of research is in accordance with a lot of research finding which were performed before (Demircioğlu and Geban, 1996; Akçay *et al.*, 2003; Carter, 2004; Karamustafaoğlu *et al.*, 2005; Çepni *et al.*, 2006; Wilder, 2006).

CONCLUSIONS

The finding from the study shows a significant difference between pre-test and post-test scores at Science Subject Test for both control and experiment groups. This shows that both TI and CAI are effective on the academic achievement of students at Science Lesson.

Another result from this study is, there were no significant difference between groups for the pre-test application scores but there is a significant difference between post-test scores of the groups in favor of experiment one. Also it is shown that there is a significant difference between the difference scores of both groups' pre-test and post-test scores for experiment group. So CAI is more effective than TI on the academic achievement levels. When we compare the groups' average scores, difference between the gain levels is almost nearly two times higher for experiment group.

CAI will be effective for eliminating the misconceptions by technological material with well prepared pedagogical and scientific content. According to Ivowi (1984), the main causes of misconceptions in students can be traced to teachers and some available textbooks.

As a result;

- CAI affects the students' knowledge level in a positive way. Increasing the CAI opportunities in the classrooms will increase the academic achievement of students.
- An informative education should be given to teachers about the properties of CAI, computers and the use of computer in order to make use of CAI well. It is not possible to make CAI successful with teachers not having plentiful knowledge about computers and CAI.

- It is possible to show the dangerous Science experiments easily and a jillion times with CAI. It should be used a software developed for experiments.
- It must be teamwork to prepare Instructional Software. Only one researcher can develop software alone but this software will be lack with some properties. If the characteristics of intellect are taken in to account, a researcher develops software which is convenient to own intellect.
- Simulations are the most effective and interesting CAI programs. It is possible to make application more economically and effectively with simulations for both laboratory and course.
- Suitability of the programs to students' feature, visual properties of the programs and the ability of giving motivations to students must be taken in to account while CAI tools and materials are being chosen.

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