

A Research on the Effects of Computer Assisted Science Teaching

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Abstract: This study aims to prove the effectiveness of computer assisted teaching method over the teacher-centered method (explaining, question-answer, demonstration) together with the academic achievement of science teaching students in the fields of science and technology. In this study, pretest-final test control grouped model was used and 3rd class students of science Teaching department, Education Faculty at Cumhuriyet University in Sivas, in the term fall, 2006-2007 academic year, were involved in it. Both control groups (n=24) and experiments group (n=23) had the same features in terms of being students and totally 47 students participated in our study. The research has lasted for twelve weeks with the pre test, final test and permanent test application periods for both groups. After t-test analysis, data showed that computer assisted teaching was more effective than teacher-centered methods to increase academic achievement and to acquire permanent teaching.

Key words: Science education • Academic achievement • Permanency • Computer

INTRODUCTION

Technology has become very important in human life at the present time. Technology proves to change the less developed characteristics of the countries by changing their cultural and social structures. Therefore, the knowledge which provides appearing and the advance of the technology has been key for development and improvement [1].

The knowledge had changed the human profile by getting importance after it became power in 21st century. Anymore the necessity to people who can reach and use the knowledge and produce, in another words, who can communicate with each other by using knowledge increases from day to day [2].

Science Teaching is also a science which redounds to students to have positive behaviours related to technology. Therefore one of the main aims of the science teaching education is to bring up people who can keep up with the science age which changes and grows up at any moment and can benefit from the latest technological inventions in every fields and to teach the necessity of the science in all technological inventions and developments [3].

In the studies about 3500 related to the science education in the last 20 years it has been fixed that the students were unsuccessful to understand the concepts

in science. The difficulties in understanding is also appeared for successful students. The most important reasons of this event are those the students have some problems in understanding the scientific concepts [4] and the learning of the scientific concepts is frightening for students [5].

To remove this situation, it has been necessary to enter the new technologies which plays the important role in the development of the education process and its quality to education associations. One of the mentioned new technological systems is computer described as a device for the most effective communication and individual education [6]. It has been inevitable to use these new technologies to solve problems in education because of the developing of technology and computer fastly [7].

Computer assisted education is an education method which uses the computers as an environment in which learning occurs, makes strong the education period and student's motivation, can be useful for students due to their learning speeds. This education method is formed by combining computer technology and learning principles by oneself.

First of all, the experiences and savings of teachers about computers is important to benefit from computers in education. Therefore it is thought to benefit for teacher candidates who educate in

education faculties that they must have computer assisted education lesson or study in some lessons as based on computer.

Aim of the study: In this study, it is purposed to put forward the efficiency of the computer assisted education method due to education methods based on teachers (explaining, question-answer and demonstration) with increasing in academic achievements and continuance related to science and technology of the teacher candidates in science teaching. In the direction of the aim stated above the answers of the research questions below are investigated.

1. Due to the computer assisted education method, is there a significant difference between the final test points of the experiment group students who have a scientific and technological education method and the control group students who have a teacher centered education method after experimental process about their academic achievements?
2. Is there a significant difference between pretest points and final test points of the academic achievement in:
 - a) the experiment group?
 - b) the control group?
3. Due to the computer assisted education method, is there a significant difference between the permanence test points of students in the experiment group who have a scientific and technological education method and students in the control group who have a teacher centered education method after experimental process about permanence of the education?
4. Is there a significant difference between final test points and permanence test points related to permanence in :
 - a) the experiment group?
 - b) the control group?
5. How is the distribution of the answers of the "Academic Achievement Test" answered by groups?

MATERIALS AND METHODS

In this research, the model which has the control group who has the pretest – the final test had used. In this model, there are two groups formed by objective

appointment. One of these groups is named as experiment group and the other is named as control group [8]. This study had applied to the students who were in the 3rd class in the department of the science teaching in education faculty of Cumhuriyet University in Sivas in 1st semester of the education period of 2006-2007. Total number of students joined the study were 47. Twenty two (23) students of these were in experiment group and others were in control group. The groups were equal due to the properties of students. While the students in experiment group were studying due to the computer assisted education method, the students in control group were studying due to the teacher centered education method. The research had continued together with pretest, final test and permanence test periods during 12 weeks.

After each student in experiment group had been located at the computers in the computer laboratory, informations about the programs which would use in lessons and performing the lessons. In this study, the education CDs prepared by Sebit Educatin and Information Technologies Incorporated Company, simulations prepared by using Flash Program and Macromedia Authorware 4 software had been used.

Collection of Data: In this study, "Academic Achievement Test (AAT)" developed by Hançer and Uludağ [9] had been used to determine the academic achievement levels of teacher candidates and permanence as pretest, final test and permanence test.

The questions of AAT applied to science teaching teacher candidates are formed by 25 questions. 12 questions are related to principles, strategies, methods and techniques used in education of science and technology and other questions are related to knowledge of science and technology. AAT had been prepared by using science and technology lesson books [10-12], Public Personnel Selection Examination (PPSE) books [13-17] and questions which has been asked before. The test is formed by 25 questions which are multiple choice (four choices). The confidence study of this technique has been done by applying to 113 teacher candidates educating in last class. The confidence study of AAT had been calculated by using KR-20 formulae and the confidence coefficient of test had been found as 0.88. AAT had been applied to experiment and control groups as pretest, final test and permanence test (Permanence test had been applied to groups after 3.5 months) in 30 minutes. Each true and false answers are "1" point and "0" point in tests respectively.

Table 1: t-test analysis results of AAT pretest points of groups for independent groups

Group	N	\bar{x}	SS	sd	t	p
Experiment	23	10.347	4.588	45	0.176	0.861
Control	24	10.583	4.558			

Table 2: t-test analysis results of AAT final test points of experiment and control groups for independent groups

Group	N	\bar{x}	SS	Sd	t	p
Experiment	23	18.260	3.875	45	3.556	0.001
Control	24	14.125	4.089			

Table 3: t-test analysis results of AAT pretest and final test points of experiment group for dependent groups

Group	Measurement	N	\bar{x}	SS	sd	t	p
Experiment	Pretest	23	10.347	4.588	22	14.080	0.000
	Final test		18.260	3.875			

Comparison of AAT pretest results of groups: Before the study, AAT had been applied to each two groups to determine the groups were equal or not? After this process, findings/discoveries found in test had been analyzed by using t test. The comparison of AAT pretest results of groups had been given in Table 1.

When Table 1 is examined, it is seen that the averages of AAT pretest points of experiment and control groups are 10.347 and 10.583, respectively. Any significant difference between averages of points could not been found due to the results of t test ($t_{(45)}=0.146$, $p>0.05$). It can be said that each two groups are equal due to the AAT pretest points.

Before the experimental study, the results of AAT pretests applied to experiment and control groups come to an agreement with the aims of study.

Findings: In this part, data obtained by applying measurement tools to experiment and control groups had been analyzed to determine the effect of computer assisted education. After this, discoveries obtained after analysis by taking account lower-another problems had been tabled and explained.

1. The groups had been compared with each other to test the lower problem due to the AAT final test points. This comparison had been done by using t test analysis for independent groups. Discoveries related to comparison are given in Table 2.

When Table 2 is examined it is seen that there is a difference between the averages of AAT final test points of experiment group's students and control group's students like 4.135 points. A significant difference had been observed between the averages of final test points

Table 4: t-test analysis results of AAT pretest and final test points of control group for dependent groups

Group	Measurement	N	\bar{x}	SS	sd	t	p
Control	Pretest	24	10.583	4.089	23	6.069	0.000
	Final test		14.125	4.558			

of experiment and control groups due to t value calculated by using t test for independent groups at confidence interval of 95 % ($t_{(45)}=3.556$, $p<0.05$). When the average point values are examined it is seen that this difference is in favour of experiment group. This situation shows that computer assisted education is more effective than traditional education methods to increase the academic achievements of teacher candidates.

2. The relation between AAT pretest and final test points had been tried to put forward to test the lower problem for experiment and control groups separately. The results of t test concerning the pretest and final test points of experiment group's students related to their academic achievement levels is given in Table 3. However the results of t test concerning the pretest and final test points of control group's students related to their academic achievement levels is given in Table 4.

When Table 3 is examined it is seen that there is a difference between the averages of AAT pretest points and the final test points of experiment group's students like 7.913 points. A significant difference had been observed between the averages of AAT pretest points and the final test points of experiment group related to their academic achievement levels due to t value calculated by using t test analysis for dependent groups at confidence interval of 95 % ($t_{(22)}=14.080$, $p<0.05$).

When Table 4 is examined it is seen that there is a difference between the averages of pretest points and the final test points of students in control group like 3.542 points. A significant difference had been observed between the pretest and the final test points related to academic achievement due to t value calculated before at confidence interval of 95 % ($t_{(23)}=6.069$, $p<0.05$). If this difference and deviation values are taken into consideration it is seen that this difference is in favour of the final test.

According to this, it is seen that there is an increase in the final test points of teacher candidates in control group who used the traditional education methods. But this increase is significantly lower than the increase rate in the final test points of the students in experiment group like in Table 3.

3. The groups had been compared due to the AAT permanence test points to test the lower problem. This comparison was done by using t test analysis for

Table 5: t-test analysis results of permanence test points of experiment and control groups for dependent groups

Group	N	\bar{x}	SS	sd	t	p
Experiment	23	16.043	2.721	45	4.304	0.000
Control	24	12.750	2.523			

Table 6: t-test analysis results of final test and permanence test points of experiment group for dependent groups

Group	Measurement	N	\bar{x}	SS	Sd	t	P
Experiment	Final test	23	18.260	3.875	22	6.444	0.000
	Permanence testi	23	16.043	2.721			

Table 7: test analysis results of final test and permanence test points of control group for dependent groups

Group	Measurement	N	\bar{x}	SS	sd	t	P
Control	Final test	24	14.125	4.089	23	3.375	0.003
	Permanence testi	24	12.750	2.523			

independent groups. Discoveries related to comparison is given in Table 5.

If Table 5 is examined it is seen that the average of AAT permanence test points of experiment group's students is 16.043 and the standart deviation is 2.721. The average of permanence test points of control group's students. The standart deviations of averages of permanence test points had been cofirmed as 12.750 and 2.523 respectively. A significant difference between the averages of experiment and control group permanence test points due to t value ($t_{(45)}=4.304$, $p<0.05$) calculated by using t test analysis for independent group. If we take into consideration the average and standart deviation values, we can see that this difference is in favour of permanence test points of experiment group. According to this, it can said that computer assisted education is more effective than traditional education methods to increase permanence in academic achievements of teacher candidates.

The relation between AAT final test and permanence test points had been tried to put forward to test the lower problem for experiment and control groups seperately. The results of t test due to the final and permanence test points related to the permanence levels of students in experiment group is shown in Table 6. Furthermore the results of t test due to the final and permanence test points related to the permanence levels of students in control group is shown in Table 7.

If we examine Table 6, we can see that there is a difference between the final test points and permanence test points of students in experiment group like

2.217 points. A significant difference had been observed between the final and permanencet test points of students in experiment group related to the final test due to t value calculated by using t test analysis for dependent group.

When Table 7 is examined it is seen that there is a difference between the averages of the final test points and the permanence test points of students in control group like 1.375 points. This difference is in fovour of the final test points. The difference between the averages of the final test points and the permaanence test points had been found due to t value ($t_{(23)}=3.375$, $p<0.05$) calculated by using t test analysis for dependent groups. This difference was in favour of the final test.

5. AAT had been applied to the science teaching teacher canditates to test the lower problem as pretest, final test and prmanence test. The results obtained from tests is given in Table 8 taking into consideration points related to questions between 1 and 12 concernings with principles, strageties, methods and techniques in science and technology education and questions between 13 and 25 concernings with the knowledge of science and tecnology (Some of questions are given).

When Table 8 is examined an increase like 69.38 % between the pretest points and the final test points of students in experiment group had been for the first 12 questions. For this group, the increase between the pretest points and the permanence test points is 44.41%. The increases between pretest points and final test points and between pretest points and permanence test points are 81% and 61.90% for the questions between 13 and 25 respectively.

The results of the students in control group are those the increase between the pretest points and the final test points is 63.71% for the first 12 questions, the increase between the pretest points and the permanence test points is 41.79%. For the questions between 13 and 25 the increases between the pretest points and the final test points and the pretest pointsand the permanence test points are 13% and 6.06 %respectively.

As it is seen from percentage rates of increase of obtained points, percentage rates of increase of the teacher canditates in experiment group are much more than percentage rates of increase of teacher canditates in control group especially for the questions between 13 and 25 related to science and technology knowledge.

This situation can be explained as computer assisted education is more effective than traditional methods to learn science and technology principles.

Table 8: The average of points obtained from the answers of teacher candidates

Questions	Question Number	Group	X_{pretest}	$X_{\text{final test}}$	$X_{\text{per.test}}$
A teacher will explain the electric circuits in a class which contains students who have different learning levels. If we suppose that the materials are conformable for the subject in school. Which is the education method used by the teacher below?	1-12	Experiment	4.053	6.865	5.853

If we deal with a view in a hot plaj in poles and snowstorm in equator together. What is the kind of this stimulant?					

Which isn't one of the principles of concept education below?		Control	4.269	6.989	6.053

A teacher will explain the subject named "blood groups" by using presentation method. Because of this the teacher gives firstly the knowledges and critical properties related to this principle. Which one has to do by the teacher in later stage?					
How does change the frictional force affected to a moving object depending on properties and situations of object given below?	13-25	Experiment	6.294	11.395	10.190

The specialists state that the packet phones are harmful for the health of heart and brain, specially if they are used near these organs. Which is the most important reason shown as a cause for this harm below					

Which is the most important cause to fall out the leaves in the trees below?		Control	6.314	7.136	6.697

Which statement does state the working principle of the pressure cooker below?					

When the studies which have been done before to determine the effect of the computer assisted education on academic achievement are examined; In instruction of principles like gravity, mass, force and motion to students in 5th class [18], in instruction of "floral plants" subject at 6th class [19], in instruction of the unit named "we discover space" at 6th class [20], in instruction of subject named "Increase and inheritance of alives" at 8th class [21], in instruction of subject about "Digestion and excretion systems" to science teaching teacher candidates [22], in instruction of physics subjects at 8th class [23], in Kingston state in Jamaica, in instruction of subjects about "Reproduction of plants and animals" [24] and about physics and chemistry at 11th class [25-27], in instruction of mathematics [28-32], collaborator learning method [33], significant learning approach [34] and in computer assisted science education applied with the constructive approach theory together [1], besides turkish [35], foreign language [36] and also in instruction of oral lessons as social teaching [37-40]. It is seen that the computer assisted education is more effective than the traditional methods to increase the academic achievements of students. Discoveries obtained in this study have the same results with the results obtained from literature.

RESULTS AND CONCLUSION

The results obtained from discoveries and comments in the study are summarized below.

A significant difference had been found between academic achievement points of experiment group's students who used the computer assisted education method and control group's students who used the traditional education methods after experimental process. This difference was in favour of the final test points of students in experiment group. That is to say, the compute assisted education method is more successful than teacher centered education methods (explaining, question-answer and demonstration) to increase the academic achievements related to science and technology of teacher candidates.

The difference between AAT pretest points and the final test points of teacher candidates in experiment and control groups had been found significantly. But, while the difference between the pretest points and the final test points of students in experiment group was 7.913 points, the difference between the pretest points and the final test points of students in control group was 3.542 points. That is to say, the increase in academic achievement points of students in experiment group is

much more than two times of the increase in academic achievement points of students in control group.

There is a significant difference between AAT permanence test points of teacher candidates in experiment and control groups joined the study. Computer assisted education method had been more effective to increase permanence of academic achievement of teacher candidates related to science and technology.

Significant differences between AAT the final test points and the permanence test points of teacher candidates in experiment and control groups had been found statistically. These differences was in favour of the final test. It had been observed that the points of each two groups related to permanence has been decreased. But, it had been obtained that while the permanence test point of experiment group has been decreased (16.043), it has been bigger than the final test point (14.125) of control group.

Due to the averages of points obtained from the answers of teacher candidates for questions, the principles, strategies, methods and techniques used in instruction of science and technology had been more successful than the traditional methods to teach the principles of science and technology.

Suggestions: As it is seen from the research, computer assisted education method is fairly successful than teacher centered education methods in increasing of academic achievement and permanence in science education.

People who will apply this method are naturally teachers in schools. Therefore, learnings and experiences owned by teachers are very important. Furthermore teacher candidates educating in education faculties have to be people who know using a computer and brought up to have knowledge and skills for performing the computer assisted education. Also, it is thought that in service training which will be given to present teachers will be important to develop positive changes on students.

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