

EFFECTS OF COMPUTER ASSISTED INSTRUCTIONS ON THE ACADEMIC ACHIEVEMENT, AND RETENTION OF SECONDARY SCHOOL STUDENTS

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Abstract:

The problem under study was the effect of computer assisted instructions on the academic achievement and interest of secondary school students in physics. The study was experimental in nature. A sample of 146(64 Rural and 82 Urban)Ninth Gradestudents of University Wensam College and St.Helen high School were divided into two equivalent groups on the basis of pre-test. One group (Control) was taught the course contents of physics with the traditional lecture method and the other group (experimental) was taught with the computer assisted instructions. After one month treatment both the groups were exposed to academic achievement tests(Post-test). To check the retention a delayed post-test (retention test) was administered six weeks after the post-test. The results show that in the computer assisted instructions the student's academic achievement and retention was higher as compared to the traditional lecture method. When the Location effects were analyzed the result shows that there was no significant effect of location on the academic achievement, and retention of students.

Keywords: Computer Assisted Instructions, Educational Technology, Academic achievement, Retention, Experimental

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INTRODUCTION:

It is the age of science and technology. In this era our dependency on science and technology has been very much increased. Science is taken from Latin world, 'scientia', which means to know. Science develops the principles, laws, rules and regulations that are based on facts. Scientists always keep on collecting data through observation, and experiments.

Today we are enjoying the benefits of science. Science makes our life very comfortable. Science benefited us in agriculture, transportation, exploration and all other fields of life. Most of the benefits of science are due to physics, which is the most beneficent and ever developing field of science. Physics make our life very easy and comfortable. Physics brought such wonderful changes in the social life of human being that could not be thought in past. Man of today sitting in home watches the changes taking place in different continents of the world through satellite communication. It is due to physics that we are living in the word of electricity, air conditioners, refrigerators, radio, wireless, telephone, telegraph and computers. Which made our life most comfortable. Physics also helped in transportation and due to it man can cover the thousands km distance in minutes and seconds. Physics also helped in the space exploration and astronomy, and that is why man step on moon on one side and the deepest earth of the sea on the other. He has been able to observe the moments of smallest particles of the atom such as electron, proton, and neutron on microscopic level and observes the farthest stars and galaxies with telescope. The energy plays a vital role in the human life. The physics had made possible to achieve energy not only from the coal, petrol etc. but it has also extracted energy from the core of the atom. It is due to physics that developments in the field of energy are being made and new weapons are being developed which put the word in a new era, which is truly called the era of computer and technology (Khatak , 2007. p.4).

Keeping in view the importance of physics, the achievement of the students in the subject is not up to the mark. There may be many reasons for that but the experts suggest that the main reason of it is that the physics is taught with the traditional lecture method and new methods of teaching are totally rejected. Books of physics are translated by the teachers in the school and only memorization is given the importance for the sake of examination. This is not justice with the teaching of physics. This situation calls for a change in the teaching method of physics. The method of teaching in the science curriculum should be such that it compel the students on

thinking, and through their efforts, interests and practical work the student be able to reach the conclusion.

The problem of teaching of physics can be solved by adopting and practicing the computer assisted instructions method of teaching physics. The multimedia slides, presentations and the use of computer programs may be able to motivate students, develop interest in them, and stress them hooked until they may be able to solve the problems in the field of physics. More over there is need to see whether the computer assisted instructions helps the students in retaining these concepts. This study is undertaken to see whether the computer assisted instructions method of teaching physics by using the computer programs, slides, projectors, CD's , and different modes of CAI (Drill and practice, tutorial, problem-solving, Games and simulation and discovery learning) has a positive effect on the academic achievement and retention of the secondary school students.

So the need is to find the comparative effectiveness of teaching physics with the help of traditional lecture method and by using the computer assisted instructions method.

STATEMENT OF THE PROBLEM:

The Problem under study was to know the “Effects of Computer Assisted Instructions on the academic achievement, and retention of secondary school students in Physics”.

OBJECTIVES OF THE STUDY:

The main objectives of the study were to:

1. To know the effects of Computer Assisted Instructions on the academic achievement of students in physics at secondary school level.
2. To know the effects of Computer Assisted Instructions on the Retention of students in physics at secondary school level.

SIGNIFICANCE OF THE STUDY:

Although there are lots of research studies in the area of educational technology but there is a lack of research in this specific area in Pakistan therefore this study specifically focuses the

effectiveness of technology in the educational discipline in the developing countries like Pakistan.

In the absence of research of incorporating educational technology in the educational discipline in Pakistan and specifically on this specific topic of effect of computer technology on the academic achievement and retention in the subject of physics this study will play the role of candle in the real darkness. In the last two decades there are arguments on whether to integrate the technology in the educational discipline and how to integrate it to gain more effective results (Hoyer, 2005)

In developed countries the effectiveness of CAI is established in various fields like mathematics, nursing, science and languages but in developing countries the studies in the field of educational technology can be counted on the finger tips. In developed countries the quality of education is being made by practicing different innovative techniques but in countries like Pakistan this study will encourage educationist for the implementation of CAI in the education discipline.

It is the age of technology and technology has been incorporated in different fields of life to make the effective output. There is also rapid advancement of computer technologies in different parts of the world. This rapid development of computer technologies and software development convinced the educators to change their traditional ways of teaching (Bitter & Pierson, 1999)

To face the challenges of future every nation struggles to improve their system of education so this study which is exploring new dimensions of educational technology is an attempt in this direction.

LIMITATIONS OF THE STUDY:

Due to non-availability of standardized achievement tests in the subject of physics at secondary level, the researcher himself developed and validated the academic achievement tests (pre-test, post-test and delayed post-test) to measure the academic achievement before and after the experiment. These tests were validated by the item analysis using the difficulty level and discrimination index. Also the Reliability of the pre-test and post-test was found to be 0.86 and 0.92 respectively.

REVIEW OF RELATED LITERATURE:

According to Tishna every activity takes place through proper method and technique, therefore a teacher should also teach his lesson through proper method. Teacher should adopt the method of teaching which is according to the mental age and psychology of the students and the students take interest in it. The A.V aids motivate the students and arouse interest of students in the teaching learning process. Therefore A.V aids should be used effectively.

The content is just like the body and the method is just like the soul in the body. The body without soul is of no importance therefore the teaching without the proper method of teaching has zero value. In the lower level grades the drill and practice method is effective and fruitful while at the higher stages the method should be according to the demands of the subject and the interest of the students (Tishna, 1997, p.195).

CAI refers to the use of computers to deliver instructions. CAI has roots in the field of educational psychology and instructional technology. It was 1950, when educational psychologists begin to experiment with programmed instruction. This divided course contents into “frames” which enabled the students to master the content in a specific sequence. Psychologist B.F. Skinner is known as an early champion of programs instruction.

Most of the CAI strategies are computerized version of teaching techniques which are usually performed by persons/teachers. The oldest instructional application of computer is CAI which provides instruction and drill and practice in basic computation and language skill.

In CAI information is presented on computer’s display, students are asked to respond, and there response is evaluated. If response is correct, student moves ahead, if in correct, similar problems are presented till correct response is elicited.

Majority of the studies which are conducted on the effectiveness of Computer Assisted Instructions are in line with the present study. A view of some of the studies is presented here; CAI in its any form provides chances for learning by doing. Learning by doing is more effective than learning by watching the teacher. Also in CAI program, students are more interested (Iqbal, 1999,p.142).Drill and practice promotes the acquisition of knowledge or skill (Digital, 1984.p.23).Discovery learning encourage participation, arouse awareness and interest (Bichler

and Snowman, 1986).When drills are used inappropriately, then often give impression that science is difficult (Woerne-et-al, 1991, p.23)

Motivation and interest of the students play an important role in the teaching learning process. In comparison of computer assisted instructions with the traditional lecture method experts suggest that the lesson becomes interesting with the use of computer assisted instructions, CAI programs motivate the students and arouse their interest in teaching learning process (Iqbal, 1999,p.24).

Time of the class play an important role in the teaching learning process, in the traditional lecture method teaching is teacher centered and most of the time teacher speaks and the students are passive listeners, whereas in the computer assisted instructions the learning time is reduced when compared to regular classes (Ellington and et-al, 1993).The potential advantage of CAI is better and faster learning, learning at the students own pace, and better instruction , eliminating routine drudgery for the teacher, and thereby allowing her more time for “true” teaching (Margolin and Misch, 1970, Gerard1967, Filep, 1967).Alpert and Bitzer (1970), describing their evaluation of the Plato system, state that the interactive capacity of the computer absorbs the attention and encourages the total involvement of students of all ages and grade levels.One of the advantages of using CML is improvement of motivation. Initially children are keen to have their turn and therefore motivation is high. Even after long use of computer, motivation level does not fall. Increased motivation does mean better individual performance (Michael,1989 p.160).

According to Iqbal (2000, p.129) There are two major types of CAI-adjunct (first used by Victor Bunderson) and Primary. Adjunct CAI consists of materials that supplement or enrich the learning situation e.g. short CAI programmes. Primary CAI materials conversely provide instructions of a substitute and of usually longer duration. It is also part of distance learning throughout the world.

Contribution of CAI is made through different teaching strategies: Drill and practice, dialogue, testing, problem solving, games simulations and discovery learning, for detail, each will be discussed with its specific characteristics.

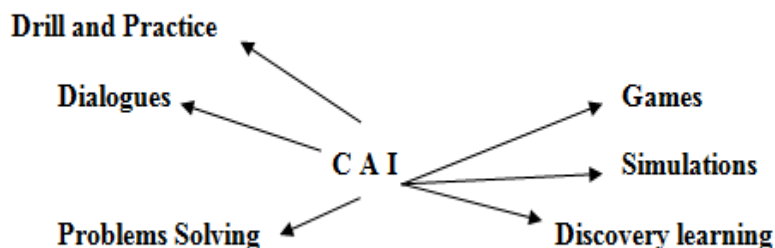
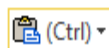


Fig 1: Modes of CAI



Properly used CAI can produce many benefits. But maximum benefits can be made if careful planning precedes implementation. CAI needs subject matter to be analyzed, sequenced with identification of objectives. But it should be seen in the spectrum of communication modes, instructional activities, administrative activities and their interrelationship, so learning may be made more effective(Michael,1989 p.163). Knowledge is hierarchical in its nature, example is Blooms; taxonomy of objectives. Often the best way to have required level of achievement is to identify the pre-requisite skills needed for the current content learning. The computer often fits perfectly into schemes to assess; pre-requisite skills prior to the actual learning. The computer can help either by: 1) performing the assessment: 2) delivering remediation or by doing both. If even computerized diagnosis is not made, computer can make a valuable contribution by helping students to develop pre-requisite skills before beginning the instruction (Aggrawal, 1995, p.352).

The power of computer in the shape of computer assisted Instructions is yet to be utilized but Tinker (1987, P.66) view it “a radical new approach in the schools instruction throughout the entire curriculum. As the hardware and the software technology mature, there are new possibilities for broad-scale, technologically enhanced changes in the mathematics and science curriculum” (Aggrawal, 1995, p.352)

Traditionally, teachers have assumed that students learn science subjects through lectures, assignment reading, problem sets, and lab work. Yet we have all been frustrated by the frequent

failure of our students to learn basic concepts of science. Because of the pace and large enrollment of many science courses, students are often not able to discuss and reflect on difficult materials. Evidence is mounting that these traditional methods are less effective than we once thought in helping our students to develop understanding of the science concepts that we are teaching (Siddiqui, 2005, p.250).

RESEARCH METHODOLOGY:

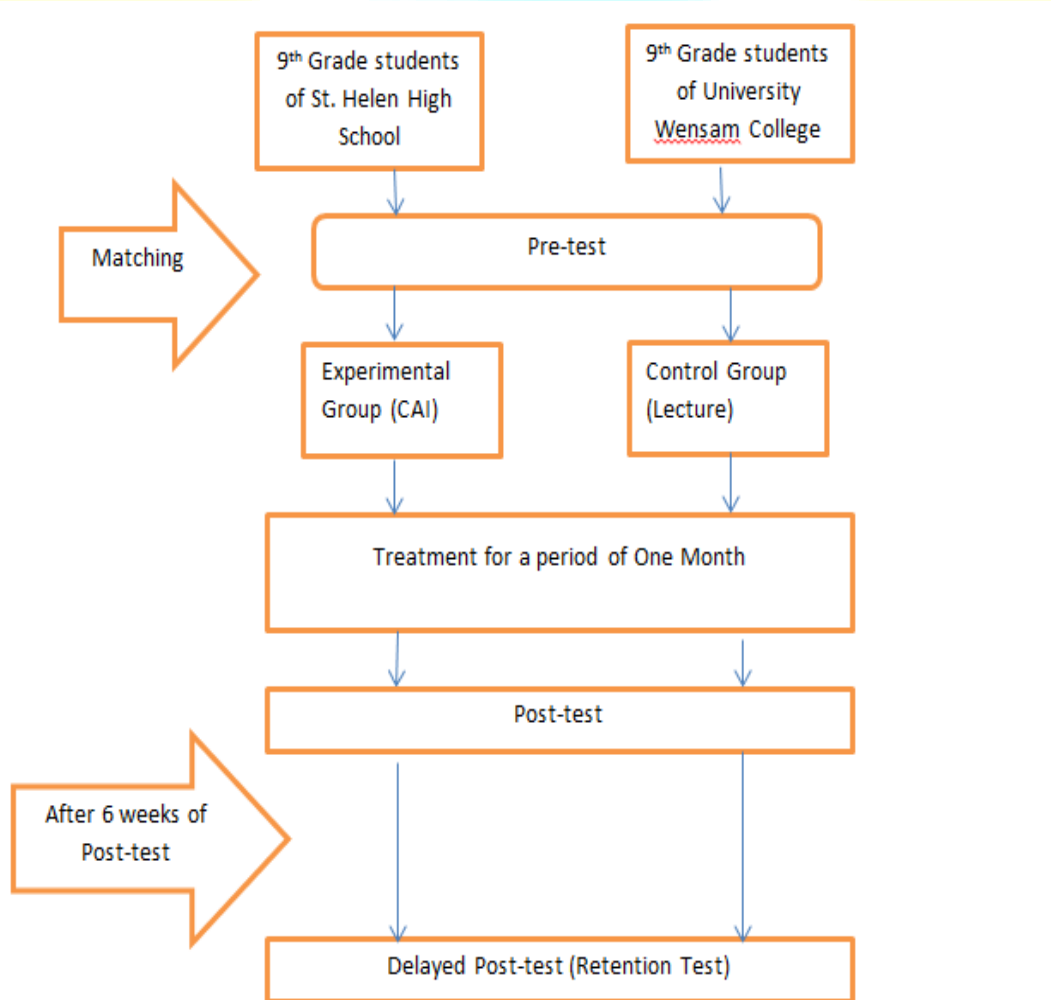


Fig 2: Research Design of the study

POPULATION:

All the 9th grade students of Government High and Higher Secondary Schools of Dera Ismail Khan were taken as the population of the study.

SAMPLE:

In this experimental study, only two schools i.e. University Wensam College, and St.Helen High School of Dera Ismail Khan were selected as the sample out of the six Government High and Higher Secondary Schools of the Dera Ismail Khan city. The schools were selected on random basis using draw method technique. 66 Male students of the two Ninth Grade sections (C and D) of University Wensam College and 80 Female students of St. Helen High School were selected as the sample of the study. Among the overall 146 Students there were 64 Rural and 82 Urban students. These total 146 students were divided into two groups on the basis of pre-test and matched pair sampling. One group was randomly assigned as the experimental group and the other as control group.

Similarly two teachers similar in qualification, teaching experience, age, socio-economic status and their reputation at the school were selected for the teaching purpose. One teacher was randomly assigned as the experimental group teacher and the other as the control group teacher.

HYPOTHESIS:

Following research hypothesis were tested:

Ho1: There is no significant difference in the academic achievement of the students taught physics through computer assisted instructions and through traditional lecture method.

Ho2: There is no significant difference in the Retention of the students taught physics through computer assisted instructions and through traditional lecture method.

Ho3: There is no significant effect of Location on the academic achievement of the students.

Ho4: There is no significant effect of Location on the retention of students.

INSTRUMENT:

Following instruments were used for the study.

1. Teacher made objective type achievement test (pre-test) to divide the sample into two equal groups.
2. Teacher made objective type achievement test (Post-test) to check the achievement of both the experimental and control groups after experiment.
3. Teacher made objective type achievement test for retention (Delayed Post-test) to check the achievement of both the experimental and control groups after experiment.

PROCEDURE:

A sample of 146 students was divided into two equivalent groups on the basis of academic achievement test (Pre-test). One group was called the experimental group and the other as control group. The experimental group was taught using the computer assisted instructions and the control group was taught using the traditional lecture method. The duration of the experiment was one month. After one month period the academic achievement test (post-test) was administered to both the control and experimental groups. The delayed-post test for retention was administered six weeks after the post-test to check the retention of concepts (As shown in the Fig. 2)

The following formula was used to convert the interest inventory scores into average scores.

$$\text{AVERAGE SCORE} = \frac{\text{SA} \times 5 + \text{A} \times 4 + \text{U} \times 3 + \text{D} \times 2 + \text{SD} \times 1}{\text{Total No of responses}}$$

Total No of responses

Where SA = strongly agree

A= agree

U= Undecided

D= Disagree

SD= strongly disagree

RESEARCH STATISTICS

Mean, Standard deviation and the difference between two means independent sample t-statistic was applied (using SPSS 16.0 version) to compare the academic achievement and retention in two different methods of instructions.

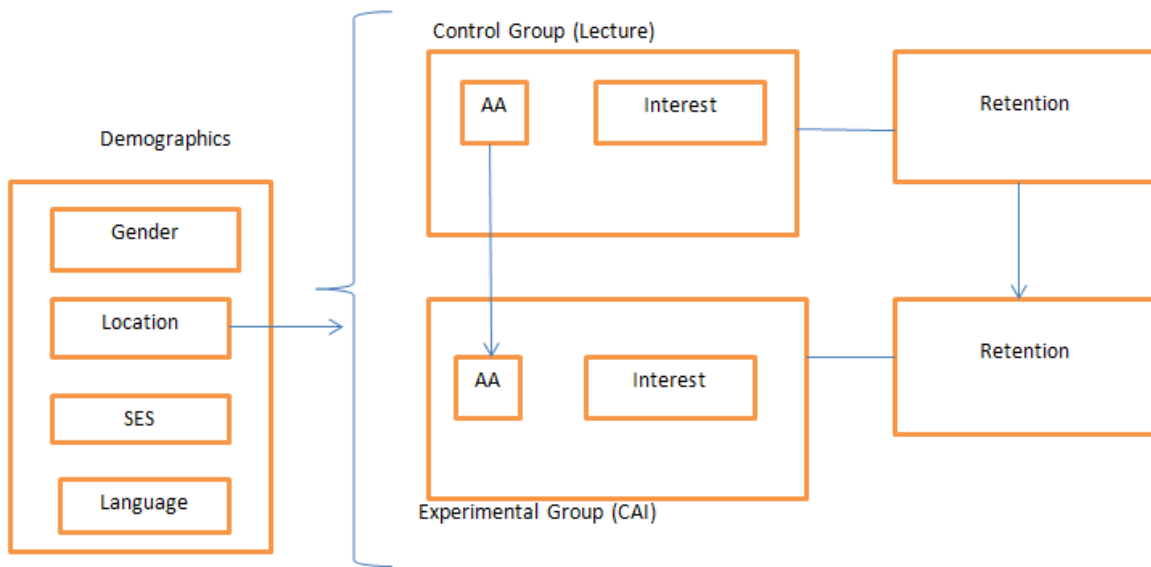


Fig 3: Theoretical Model of the study.

(As this paper is derived from the Ph.D. research work of the researcher,
Therefore In this particular paper only Arrowed Symbols were investigated)

ANALYSIS OF DATA

Table1: Mean Post-test Score (Control and experimental) Groups

Variable	N	Mean	Std.	t	df	p-value
Control Group	73	21	6.9	6.3	144	.000*
Experimental Group	73	28	7.0			

* Significant at 0.05 level

The above table shows the Mean, Standard Deviation, t-value and p-value of both the control and experimental groups. The t-value computed which is 6.3 is > tabulated value 1.976 at the 0.05 level of significance. Also the p value 0.000 is <0.05 which means that the first null hypothesis of no significant difference between academic achievements of students taught through CAI and through Traditional method is rejected.

Table2: Mean Retention-test Score (Control and Experimental) Groups

Variable	N	Mean	SD	t	df	p-value
CG	73	19	6	5.91	144	.000 *
EG	73	25	7			

* Significant at 0.05 level

The above table shows the Mean, Standard Deviation, t-value and p-value of both the control and experimental group. The t-value computed which is 5.91 > tabulated value 1.976 at the 0.05 level of significance. Also the p value 0.000 is <0.05 which means that the second null hypothesis of no significant difference between the retention of students taught through CAI and through Traditional method is rejected.

Table 3: Mean Location(Rural & Urban) difference on academic achievement

Location	N	Mean	SD	t	df	p
Rural	64	23.6	8.73	-1.004	144	.317
Urban	82	24.9	7.46			

The above table shows that the Mean, Standard Deviation, t-value and p-value of both the groups. The p-value .317 is greater than 0.05 (level of significance). Also the t-value calculated which is -1.004 is less than the t-value tabulated (1.976) at 0.05 level of significance. This means that there is no significant difference between the rural and urban students on the academic achievement-

test. Therefore the third null hypothesis that there is no significant effect of Location on the academic achievement of the students is accepted.

Table 4: Mean Location (Rural & Urban) difference on Retention

Location	N	Mean	SD	t	df	p
Rural	64	21.02	7.78	-1.458	144	.147
Urban	82	22.80	7.00			

The above table shows that Mean, Standard deviation, t-value, and p-value of both the groups. The p-value .147 is greater than 0.05 level of significance. Also the t-value calculated which is -1.458 is less than the t-value tabulated 1.976 at 0.05 levels, which clearly means that there is no significant difference between the rural and urban students on the Retention-test. Therefore the fourth null hypothesis that there is no significant effect of Location on the Retention of the students is accepted.

RESULTS AND DISCUSSIONS:

Academic achievement

In table-1: The t-value computed which is 6.3 is > tabulated value 1.976 at the 0.05 level of significance. Also the p value 0.000 is <0.05 which means that the first null hypothesis of no significant difference between academic achievements of students taught through CAI and through Traditional method is rejected.

These results of the present study are supported by number of studies for example Kulik & Kulik (1991) conducted a meta-analysis, result from 254 studies shows that CAI has positive effects on the academic achievement of the students. These studies included all level students from kindergarten to adults. In the average CAI increased the academic achievement by a score of 0.30, standard deviation. The research is also supported by Eng (2005) meta-analysis of ICT in learning, the result are that ICT improve the academic achievement.

Akçay et al., (2006) conducted a research to compare the effects of CAI and traditional method on students achievement in chemistry the result are supporting the present study which shows that CAI was much more effective than the traditional method.

A study was conducted by Kausar et al., (2008) which was aimed to evaluate the effectiveness of CAI vs. Lecture Method in terms of cognitive development. This study was conducted on three colleges of Faisalabad, discovery learning, drill and practice and simulation modes of CAI were used for this study. The results are in line with the present study that the CAI was very effective in cognitive development and researcher recommended that CAI should be used to enhance the quality of teaching.

The study of Serin, (2011) also advocates the present study. Serin conducted a research to investigate the effects of Computer Based instructions on achievement. The sample of the study was 52 science and technology students. The independent group t-test was applied to test the difference between means, the results shows that the experimental group which was taught by computer assisted instructions performed significantly better than those students who were taught by traditional lecture method.

The research studies which are in favors of the present study are in great many numbers which are shortly described as, A Meta-analysis of the computer assisted studies in physics: A sample of Turkey conducted by Yesilyurt (2011) showed that CAI significantly improves the academic achievement of the students in Physics.

The recent study of Muraina et al., (2011) on Computer Assisted Instruction for Teaching /Learning Process and Its Effects On Students' Performance In Tertiary Institutions which shows the significant effects of CAI programs.

Retention:

In Table-2: The t-value computed which is $5.91 >$ tabulated value 1.976 at the 0.05 level of significance. Also the p value 0.000 is <0.05 which means that the second null hypothesis of no significant difference between the retention of students taught through CAI and through Traditional method is rejected.

These retention results of the present study are supported by number of studies. The Kadiravan & Suresh (2003) conducted a research on the impact of computer with peer interaction on learning Physics. The result shows that CAI is effective in enhancing the Retention of learners in the subject of physics.

The Naidr et al., (2004) conducted a study on Long-term retention of knowledge after a distance course in medical informatics at Charles University Prague, the result shows that there was 67% retention of concepts after 12 months using CAI method.

The Akengin (2011) conducted a study on Comparing traditional and computer assisted education in the teaching of color to 6th grade students and determination of its retention. The scores of the retention of education by computer assisted and traditional methods are respectively (Mean= 39.15) and (Mean= 32.40), the difference between the scores of the groups is found to be statistically significant.

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