A comparative study of the effectiveness of Computer Assisted Instruction (CAI) and conventional method on pupils' achievement in Science

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Abstract: *To make the teaching-learning process effective and for the desired change in learner's behavior, it is very important to use a plan for instructions or presentation. Computer Assisted Instruction (CAI) found to be useful for the purpose. This paper aims to study the effectiveness of Computer Assisted Instruction (CAI) on pupils academic achievement. A total of 80 students were selected and made in two groups (40 each) of nearly equal mental ability. Group A (experimental group) was taught using the lesson plans based on CAI program and Group B (control group) was taught by traditional method. The result revealed that the mean achievement scores of experimental and control group did not differ significantly at pre-test stage but differ significantly after the treatment. The teaching through CAI is better way of imparting and transmitting knowledge to the students in comparasion to the traditional method.*

Key Words: *Computer Assisted Instruction (CAI), concept attainment, effectiveness, achievement.*

1. INTRODUCTION:

The present era is passing through a phase of revolutionary changes in the society imposed by technological and scientific advancements. Education technology has emerged as a new discipline in the field of education. Education is a social concept, philosophically evolved, psychologically developed and socially based. Education is the key to all the processes of development especially human development, which helps the human being to adjust in the society and enables him to become a social being. With education, one is able to develop the desired social skills, habits, social competencies which in return help in recognizing the value of our rich cultural heritage.

One of the most important challenges before education is to make teaching learning process more interesting, exciting and beautiful and this seems to be possible only with the help of advancement in educational technology. The teaching-learning process in all the spheres of school subjects is undoubtedly affected by modern trends of educational technology. The efficiency of teaching-learning process has very close relationship with teacher's teaching style and the student's learning style. Educational technology implies the use of all modern media, methods, practices, theories and principles of maximizing the learning outcomes **(Sharma 1982).** It facilitates learning, by control of environment, media and methods.

Computer is one of the developed technologies, which are dominating every sphere of our life and social system. It has been effectively used for imparting more information and facts to the students and the use of computer in education opens a new area of experimentation and offers a tool that has potential to change some of the existing educational methods. Undoubtedly the teacher is the key to the effective exploration of these resources in the educational system.

Computer Assisted Instruction (CAI) is the use of computers to interact directly with the students for learning and testing purposes. CAI significantly expands the scope of many instructional activities. Students no longer simply write essays but are able to develop presentations that include text and images and other media components. Multimedia softwares are readily available, which can control and edit sound and images from source, CD-ROMs and video discs to develop sophisticated video presentations.

Computer assisted instructions (CAI) is an interactive instructional technique whereby a computer is used to present the instructional material and monitor the learning that takes place. It uses a combination of text, graphics, sound and video in the learning process. CAI refers to the use of the computer as a tool to facilitate and improve instruction. CAI programs use tutorials, drill and practice, simulation and problem solving approaches to present topics and they test the students' understanding. These programs let students progress at their own pace, assisting them in learning. The subject taught through CAI can range from basic math facts to more complex concept in math, history, science, social studies and language arts (**Sharp, 1990**).

Computer Assisted Instruction (CAI) is a narrower term and most often refers to drill and practice, tutorials or simulation activities offered either by themselves or as supplements to traditional, teacher directed instructions. Computer programs are interactive and can illustrate a concept through attractive animation, sound and demonstration. CAI refers to instruction or remediation presented on a computer. It improves the level of understanding, develops the

interests of the pupils, enrich meaningful development of independent study habits and create purposeful development of self-confidence in learning.

According to **lockard, et al, (1997), "**CAI addresses course content in a variety of formats,with or without the direction of a teacher. CAI applications are utilized across many different computer platforms and operating systems."

Cotton (1997), in a review of empirical studies on CAI, concluded that the use of CAI as a supplement to conventional instruction alone, research is inconclusive regarding the comparative effectiveness of conventional instruction alone and CAI alone and that computer –based education produce higher achievement than conventional instruction alone. In addition, students learn instructional contents faster with CAI than with conventional instruction alone and CAI activities appear to be at least as cost effective as and sometimes more cost effective than other instructional methods, such as teacher-directed instruction and tutoring.

Heliya, S. (2004), conducted a study on the topic, "Developmental and implementation of CAL packages for statistics to B.Ed. students". A CAL package was developed through visual basic by the investigator on teaching statistics. 16 B.Ed. students od Department of Education, MSU, Baroda having computer education specialization constituted the sample for the study. Pre-Test treatment, Post test single group pre-experimental design was used for the study. The treatments were found quite effective as evident through the mean gain scores and favorable reactions.

Lawrence and Davis divided computer instruction into two aspects:

1. Pre-tutorial Phase : The main objective of Pre-tutorial Phase is that a particular student can achieve the objectives by using a specific type of instructions.
2. Tutorial Phase : The purpose of tutorial phase is to select appropriate instruction and present it before the learner. It also controls the learner's response.

2. USEFULNESS OF CAI:

- **Learning rate-** in addition to help the students to achieve at higher levels, researchers have also found that CAI enhances learning rate. In some researches , the students learned same amount of material in less time than the traditionally taught students; in other, they learned more material in the same time period. While most researches do not specify how much faster CAI students learn, the work of Capper & Copple (1985) led them to the conclusion that CAI users sometimes learn as much as 40% faster than those receiving traditional, teacher directed instruction.
- **Use for tutorial exercises-** there are computer programs that have the ability to carry out tutorial exercises. A student might undertake a self-imposed exercise. Just as a human tutor corrects the assignments in a tutorial class, the computer can also correct the assignment. The only difference is that the human tutor can take care of sentiments of the students, which the mechanical tutor in computer cannot.
- **Use for drill and practice-** CAI can be effectively used for drill and practice on the concepts taught by the teacher. A formula learnt in the classroom can be drilled at home with the help of a computer. In case of teaching of Area of Triangle in Mathematics, the low achievers benefitted more by CAI then by traditional method (Palniappan 1990). CAI in drill and practice mode was more effective than CAI in tutorial mode in realizing instrumental objectives in Biology teaching (Meera and Balasubramaniam 2000).
- **Retention of learning-** if students receiving CAI learn better and faster thanstudents receiving conventional instruction alone, do they also retain their learning better? The answer, according to researchers who have conducted comparative studies of learning retention, is yes. Thus ,the retention of content using CAI is superior to the retention following traditional instruction alone.
- **Educational softwares-** there are a number of softwares for teaching with the help of computers. Students can use some of the softwares without any type of assistance from the teacher. For eg. Alpha letter drop consists of programs for developing skill in language for practice. There are packages that can facilitate learning of music, composition editing using word processor, development of algebra competencies etc. many syllabus softwares are also available in the market which cover the whole syllabus of the particular class.

3. WHY TO PREFER CAI ?

Bialo and Sivin (1990), Braun (1990), Mokros and Tinkler (1987), Robertson (1987), Wepner (1990) have researched that following is a list of reasons given by students for liking CAI activities and favouring them over traditional learning. These students preferences also contribute to our understanding of why CAI enhances achievement.

Students say they like working with computers, because computers :

- Are infinitely patient
- Never get tired
- Never get angry or frustrated
- Never forget to correct
- Allow students to work privately
- Are self-paced
- Are fun and entertaining

- Are more objective than teachers
- Are excellent for drill and practice
- Help students to improve their spellings
- Help in improving their pronunciation
- Build proficiency in computer use, which will be valuable later in life
- Free teachers for more meaningful contact with students.

4. SIGNIFICANCE OF THE STUDY:

This is an information age and tremendous flow of information is emerging in all fields throughout the world. Educational systems around the world are under increasing pressure to use the new teaching technologies to teach the students, the knowledge and skills they need in the 21st century. The new technologies have potential to transform the nature of education- where and how learning takes place and the roles of teachers and students in the learning process.

In spite of tremendous advancements in the fields, teaching of Science, in the Indian schools generally conforms to the traditional methods and continues to be dull, boring and uninspiring as ever. There is need of conducting in-depth analysis, synthesize research in relation to teaching in the discipline in order to evolve effective modes of teaching. A review of related research literature in CAI has suggested that it had not attracted the attention of researchers so far, to investigate its effectiveness in enhancing achievement in students.

5. STATEMENT OF THE PROBLEM:

"A comparative study of the effectiveness of computer assisted instruction (CAI) and conventional method on pupils achievement in Science at school level."

6. OBJECTIVES:

- To develop a Computer assisted instructional program on the selected content.
- To implement the developed package of CAI.
- To study the effectiveness of CAI on the achievement of students in Science of class VIII.
- To compare the mean scores on the criterion achievement test in Science, of the group of the students to be taught with the use of CAI and Conventional method of teaching, before the experimental treatment.
- To compare the mean scores in the criterion achievement test in Science, of the group of students to be taught Science with the use of CAI and Conventional method of teaching, after the experimental treatment.
- To compare the mean gain scores in the criterion achievement test in Science, of the group of students to be taught Science with the use of CAI and traditional method of teaching, after the experimental treatment.

7. HYPOTHESIS:

- There is no significant difference in the mean scores in the criterion achievement test in Science of the group of the students to be taught with the use of CAI and Conventional method of teaching, before the experimental treatment.
- There is no significant difference between the mean achievement scores of pre-test and post-test of the class VIII Science students of experimental group.
- There is no significant difference in the mean scores in the criterion achievement test in Science, of the group of students to be taught with the use of the CAI and traditional method of teaching, after the experimental treatment.
- There is no significant difference in the mean gain scores in the criterion achievement test in Science, of the group of students to be taught Science with the use of CAI and traditional method of teaching, after the experimental treatment.

8. METHODOLOGY AND PROCEDURE:

Experimental method of research was employed to study the effectiveness of CAI and conventional method of teaching.

8.1 Sample

A total of 80 students were selected and made in two groups (40 each) of nearly equal mental ability.

8.2 Preparation of Multimedia presentation for CAI

When the researcher became well acquainted with the theoretical phase of the program, researcher tried to learn the practical phase. For this the investigator identified a list of instructional objectives for the content of the lesson selected. The Microsoft power point was used to prepare multimedia presentation. Other visuals were also added to it. The topics for the lesson plans were selected from VIII class Science books.

Investigator used three tests-intelligence test, pre and post achievement tests and prepared multimedia presentations for the concepts to be taught. The different steps involved are-

a) Intelligence test:

The investigator conducted the intelligence test to measure the mental ability of the students selected. This test developed by Dr. S. Jalota comprising of a question booklet (100 questions), answer sheet, scoring key and a test manual. It was needed to frame two samples of equal mental ability.

b) Pre test (achievement test):

This test was conducted by the investigator to check the previous knowledge of the students.

c) Post test (achievement test) :

(a) Experimental group (sample1) : this group was taught using the materials based on CAI.

(b) Control group (sample2) : This group was taught by the traditional method.

After the completion of the treatment Experimental group and Control group were given achievement test to test the effectiveness of CAI.

Statistical Analysis : Mean,SD and t-test were used to analyze the data.

Analysis and Interpretation of result

Hypothesis 1 :

8.3 Differences of means at pre- test stage

Group	N	M	S.D.	't' Value	Level of Significance .05	.01
Experimental	40	10.97	2.96	0.6588	*	*
Control	40	10.52	3.14			

** Not significant.

This shows that the achievement shown by both the groups at pre test stage is nearly the same. It indicates that the level of both groups students is equal. These students can be grouped in experimental group and control group to see the effect of CAI on pupils achievement.

Hypothesis 2 :

8.4 Difference of means at pre-test and post-test stage of experimental group

Group	N	M	S.D.	't' Value	Level of Significance .05	.01
Pre-test	40	10.97	2.96	42.73	*	*
Post-test	40	35.42	2.02			

*significant

Scores of students of pre-test stage differs significantly from the post test scores and the difference is attributed to the treatment given to them. Hence the null hypothesis is rejected. It is clear that the study fullfills the objective

" To study the effectiveness of CAI on the achievement of students of class VIII in Science."

Hypothesis 3 :

8.5 Difference of mean scores of experimental and control group at post-test stage

Group	N	M	S.D.	't' Value	Level of Significance .05	.01
Experimental	40	35.42	2.08	23.51	*	*
Control	40	21.02	3.26			

*Significant

This shows that the achievement showed by both the groups at post stage is significantly different, which ultimately may be attributed to the treatment. So the null hypothesis is rejected.

Hypothesis 4 :

8.6 Difference of means gain scores of the experimental and control group

Group	N	M	S.D.	't' Value	Level of Significance .05	.01
Experimental	40	24.52	3.86	14.2212	*	*
Control	40	10.5	4.89			

*Significant

This shows that the achievement shown by both the groups of mean gain scores is different, which may be ultimately attributed to the treatment given to them. Hence the null hypothesis is rejected.

9. FINDINGS AND CONCLUSION:

The results of findings of the current study – the effect of CAI on the achievement of students in Science appears very interesting. The experimental and control group did not differ significantly at pre-test stage but differ significantly after the treatment. The mean scores of the experimental group is significantly higher than the mean scores of control group. Except this the difference in the mean gain scores of the experimental and control groups are also worthy. The difference in the achievement of the experimental and control groups reflects the effectiveness of the treatment. The experimental group was provided higher quality of instructions in the form of the CAI exercises while the instructions given to the control group followed traditional method of teaching.

Hence it is obvious from the above results that the teaching through CAI brings higher achievement as compared to the traditional method of teaching. In other words the teaching through CAI is better way of imparting and transmitting knowledge to the students in comparison to the traditional method.

The conclusion is that there is a significant difference between the mean achievement scores of students taught through CAI (computer assisted instruction) and traditional method.

10. EDUCATIONAL IMPLICATIONS:

The teacher is burdened with the responsibility of imparting knowledgeable education and to encourage the students to adopt the knowledge. The computer is finding an important place in currently being used in variety of ways across discipline in elementary, secondary and higher education. Some of the implications are given below:

1. Computer assisted instructions may be introduced in all standards in the schools. All the teachers may be given orientation about CAI, and its effect on the achievement among the students.
2. The software's or multimedia presentations on topic which are found to make for higher scores compared to traditional method may be distributed to all the school for use in the classroom. In the school library, separate room for viewing multimedia presentation may be arranged, so that the students may spend their leisure time very usefully. The library may lend slides, CD to learn the concepts at home.
3. The use of CAI leads to more positive attitude towards computer. Thus when taught through computer the student feels more involved in studies, which help significantly in raising their achievement.
4. With the help of CAI, the teacher is freed of the administration burden. They thus would be able to devote more time to the task of helping students for which they are trained. Moreover, the students will also enjoy their course of study.
5. Conventional method of teaching if supplemented with CAI can prove to be more effective in enhancing achievement.
6. CAI modes of teaching needs to be introduced for teaching science as they significantly enhance academic achievement of students.
7. Quality computer, which include colorful animation, graphics display from a versatile and effective alternative change in instructional strategy. The careful incorporation of computer for teaching social science course will help the students to grasp the basic concepts of social science.
8. Psycho motor skills can be learnt better through electronic media and communication technologies because they work as a live teacher and guide the learners more effectively.

9. There is need for greater intervention of national and state government to give direction in planning for relevant courses, staff development and student support sources with CAI.
10. CAI should find a permanent place in school time table. If teacher and teacher educator are open minded in the use of computer as a tool for education then the computer machines can be better utilized for education.

REFERENCES:

1. Aggarwal,J.C. Recent Educational Developments in the world, New Delhi: Arya Book Depot, Vol.1,xi,pg.248, 1971.
2. Aggarwal,J.C.Thoughts on Education, New Delhi: Arya Book Depot, pg.288, 1967.
3. Buch, M.B. (ed.) A Survey of Research in Education, Baroda: Centre of Advanced Study in Education, M.S. University, 1974.
4. Buch, M.B. (ed.) Second Survey of Research in Education, New Delhi: Centre of Advanced Study in Education, M.S. University, 1974.
5. Dahiya, S.S. Educational Technology, Shipra Publications Shakarpur,Delhi,2004.
6. Jyoti,K.B.S.Impact of Computer Based learning on students of Chemistry, EDUTRACKS,Vol.6(8),2007.
7. Walia, J.S. Educational Technology, Paul Publishers Jalandhar (Punjab),pg.561,2003.

Journals:

- Indian Educational Abstracts,Jan.1997, NCERT
- Indian Educational Review.
- University News,Jan.2007
- University News,Jan.2008