# IMPACT OF COMPUTER ASSISTED INSTRUCTION ON ACADEMIC ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS OF BIOLOGICAL SCIENCES: A NORMATIVE STUDY

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*Abstract*

*In the present paper the investigator has tried to investigate the computer effectiveness of computer assisted instruction and conventional teaching method in teaching of biology to secondary school students. A science class of ninth was selected in each of the six randomly selected schools. The pre-test and post-test equivalent quasi experimental design was used. The students in the experimental group learned science concepts on the chosen topic of circulatory system through computer assisted instruction whereas the students in the control group were taught the same concepts and on the same topic by the conventional approach. The conventional approach consisted of teaching, discussions and question and answer teaching methods. The students' pre-test and post-test scores were subjected to statistical techniques of 't' test, analysis of variance. The results indicated that students that were provided instruction by the computer assisted instruction performed better on the post-test than those who are being taught through by the conventional approach. The results also showed that there is a significant impact of type of schools, gender and locality on the academic achievement of secondary school students when they were subjected to teaching through computer assisted instruction method. This instructional approach through computer assisted instruction may also help teachers to organize meaningful teaching learning experiences and thereby motivates them to adopt more innovative methods and approaches in teaching. Computer assisted instruction is a supplementary strategy in effective teaching. In this paper, the author has elaborated the use, utility and importance of computer assisted instruction in teaching and learning so as to create new approaches, techniques and appropriate digital learning environment in education both for present as well as for future generation. In the end of his study, the investigator has made some recommendations which are mainly based on the present study findings and analysis of the results so as to develop relevant computer assisted instruction packages for teaching and learning biology in secondary schools. Further, the results of this study can be applied to the preparation of computer assisted instruction packages in other subjects such as chemistry, physics, agriculture and microbiology, which may help the students studying in higher classes.*

## Introduction

Education should be an individual activity to a much greater content. Not all students should be forced to go through the same steps of learning at the same speed. The high

achievers will move faster in their learning where as the under achievers will need more time. Children have their own ways of learning. Some children may learn better through the use of different learning materials just be merely listening to an inspirational talk by the teacher. The style of learning may also change according to age. They use their reason in acquiring their knowledge. An important feature of education is its use of physical and intellectual tools. Basically, education should reflect the influence of technology. This new technology includes every type of technology that helps to facilitate the process of teaching and learning. There are several new digital technologies such as multimedia technology, computer and video-based technology etc.

The integration of multimedia technology into the communication environment has the potential to transform the students form passive recipients of information to active participants in a media-rich learning process. The introduction of multimedia or any other computer-based information technology is not intended to substitute a presenter. This new technology is intended to provide the presenter with a powerful tool that can greatly enhance communication by delivering a multi-sensory experience. With interactive multimedia technology, a teacher can communicate with the students by means of presentation that becomes more than message—it becomes an active, exciting experience in a multi-sensory environment to create a multi-sensory experience. Thus, this new digital technology demands new interpretations of the instructional process and those changed with educating the next generation must engage in a continual cycle of education and re-evaluation in the light of technological influence at all levels.

**Computer Assisted Instruction (CAI)**

The most exciting innovation in the field of Information and Communication Technology is the Computer Assisted Instruction (CAI). Though it was not the skill developed like other individualized instructional material, the day is not far off when it will revolutionize the whole process of instruction (Taneja 1999).

A computer is programmed with linear or branching programmes. It acts like a super teaching machine catering to the needs of a number of students at the same time. The characteristics aspects of the CAI is its capacity to initiate flexible instructional with the student. In this respect, it is superior to the teaching machine. The computer is able to record and store all the responses of all the students. It can use the information in deciding what information is to be given to the student next. It can branch not just in terms of an answer but

also in terms of a whole series of previous answers. It can also record the time taken to answer a question and the decree of correctness of the student's response. It uses the information in planning to determine which branch or format would be conducive to a learner for effective instruction.

Computer Assisted Instruction is not merely a sophisticated type of programmed instruction but a different kind of instruction altogether. No doubt, data processing, data communication, consents of audio-visual and media theory, communication theory, system theory and learning theory are used in the preparation of the Computer Assisted Instruction material. In contrast to CAI, Computer Managed Instruction (CMI) analyses the relationship between various factors concerned with the learning of a pupil and suggests activities appropriate for individual students.

Different Forms of Computer Assisted Instruction

Computer Assisted Instruction can take any one of the five modes depending on the purpose of the material, which are as following:

**i) Drill and Practice Mode**

**ii) Tutorial Mode**

**iii) Simulation Code**

**iv) Discovery Mode**

**v) Gaming Mode**

**i) Drill and Practice Mode**

The learner is provided with a number of graded examples based on the concepts and principles learnt earlier. The idea is to develop proficiency and fluency through doing all the correct responses which are reinforced and the incorrect responses are diagnosed and corrected.

**ii) Tutorial Mode**

In this mode, the information is presented in small units followed by a question. The student's response is analyzed by the computer and an appropriate feedback is provided. This is similar to programmed instruction. As in programmed instruction, the information may be given in a linear fashion as in branched pathways. The greater the number of alternative paths, the more adaptive the tutorial can be to the individuals.

 iii) Simulation Mode

In this mode information is presented with scheduled down stimulated. Simulations are bearing correspondence with real situation. Simulations are made to avoid risk, save money and conserve time, simulation of an airplane in flight, an experiment on titration, a nuclear reaction, collision of two bodies are good examples of the simulation models in science.

## iv) Discovery Mode

In this mode the individual approach to teaching and learning is followed. The learner is encouraged to proceed through trial and error approach that is by solving a given problem realizing where and how he/she went wrong, trying again and finally solving the complex problem.

## v) Gaming Mode

In this mode, the learner is engaged in playing opposite. The opposite is computer or another learner. The extent of learning depends upon the type of the game. Games on spelling, names of places and general knowledge are some examples of the gaming mode.

## Information Handling

One area where processing and information handling capacity of computer is profitably used is in counseling and guiding the computer stores complete cumulative records and match them against employment needs and potentialities as required for personal and vocational guidance.

## Merits of Computer Assisted Instruction

Computer Assisted Instruction has several advantages over other systems of instructions which are as following:

1, Each student receives instruction at his own pace.

2. Each student receives immediate feedback for his response.

3. Each student responds continuously as he receives instruction.

4. All units of learning are broken down into subunits and elements of learning in accordance with skinner's approach of teaching in small steps.

5. Reinforcement of learning is achieved by personal message.

6. Learning sessions are not manageable by designing the duration between half an hour to one  hour.

7. Students can access the computer from nay place.

8. Students can learn in their own styles and ways.

9. Students can test their own learning at any point of time to an end.

10. Lesson from the theories of learning are taken into account at at any stage of instructional design.

**Review of Related Literature**

In India at present several efforts are being taken up to develop the software fro CAI, for individual instruction and in this regard several studies also have been conducted so as to identify the effectiveness of CAI over the academic achievement of the secondary school students.

Sharma and George (1979) developed a CAI package of mathematics. Their objectives were to study the effectiveness of Mathematics. Their objectives were to study the effectiveness of the CAI for school children and the findings revealed that the CAI packages produced significant result over the academic achievement of the children. Badrinath (1986) conducted a study on developing and validating CAI package for reflection of light at VIIth standard level. He found that experience in CAI program appeared to be an effective method than the conventional method. Nachimuthu (1988) has studied the development of CAI program on "Leaves". He expressed in his thesis about the difficulties in programming a lesson. He also suggested that teaching will be more effective if the researcher himself programmed the lesson than using readymade diskettes. Because when the researcher himself programmes, he can give all the points to be taught, as in conventional method and so the learners also will score marks up to the researchers' expectation. Palaniappan (1989) made a study on computers in education. He found that after introducing computers in schools for teaching the attitude of teachers as well as students have changed. Many dull students have scored more through CAI, than the conventional method. Hemlata (1989) studied on orientation of CAI. She concluded that the computers are commonly used in three main response sensitive strategies in CAI and suggested some levels of comparative involvement in decision making feature. They are drill and practice, tutorial and dialogue. Karpaga Kumaravel, R (1990) in his study on the effectiveness of computer assisted instruction, video assisted instruction and conventional instruction in English language learning found that the academic achievement of video-assisted instruction group is better that the computer assisted instruction and conventional instructional group. P. Jeyamani (1991) pointed out that leanring with computers offers a very powerful tool for educators and all efforts must be made by the learners so as to realize the potential of computers in education. This educational technology

could therefore have a more on comparing the role to play in the developing world. Thus, the simulation model of teaching through computer assisted instruction can readily be used for all types of teaching. Benedicto (1992) developed and validated a CAI packages on pollution for class XIth the standard Biology students. The major findings of his study was learning the unit through CAI was faster for both slow and fast learners when compared with traditional teaching. He also reported that the software developed ensures uniformity of achievement among Biology students. Mathivanan (1994) attempted to develop and validate a CAI package on organisms and environment for IXth standard pupils. His report revealed that the computer assisted instruction package produced more significant effect on the achievement of the pupils. His report revealed that CAI package produced more significant effect on the achievement of the pupils in terms of their knowledge, comprehension, application and analysis level. Dr. P. Annaraja and Smt. Nirmala Sundaraj (2005) made a study on power point presentation in teaching zoology. Pre-post design was used in this and they found that the power point presentation is effective in teaching zoology for higher secondary students. Jayakrusha Choudhary (2005) conducted a study on effect of Computer Assisted Learning using method of enquiry in teaching physics in secondary school. The main objectives of this study was to test the efficiency of computer aided lean ring using method of inquiry in teaching physics at the secondary level on achievement and concept attainment. He found that CAI experimental method is more effective than conventional method of teaching. G. Subnramanian (2006) pointed out major findings were computer assisted instruction significantly improves the performance of students, leanring accountancy at higher secondary level. The combination of the color, text, music and animation of the CAI package was well received by the students and the positive effect of same is perceptible from their achievement scores. Pascual (1993) conducted a two fold study. He applied linguistics approach and empirical study designed to measure the degree of motivation in students leanring English using CAI material and Non CAI material. He found that students belonging to CAI material showed more motivation than their counterparts. Siegle (2000) through his study tired to know that whether exposure to multimedia and the presentation software on laptop computers influenced student achievement in a secondary level anatomy an physiology science course. The study demonstrated that students learned more when they had access to laptop computers, were exposed to multimedia software, and created projects with presentation software.

Vendlinski et al (2002) conducted a quasi-experimental study with 134 first year high school chemistry students using the interactive multimedia exercises computer based learning and assessment tool to solve qualitative chemistry problems. Results of this study show a strong and significant correlation between computer aided measures of student understanding and the teacher's manual evaluation of student understanding using their own rubric.

Susan et al (2003) in his study examined 165 teachers' beliefs about student centered leanring as they implemented Alien Rescue, a computer based programme for middle school science that was designed to create a Student Centered Learning Environment (SCLE) in the classroom. Rabia Tabssum (2004) conducted a study on effect of Computer Assisted Instruction on the secondary school students achievement in science. In her analysis of data, revealed that the class ninth standard students taught through computer Assisted Instruction as supplementary strategy performed significantly better. The CAI was found equally effective for both male and female students. Winters et al (2005) in his study on 62 high school biology students, paired heterogeneously based on prior knowledge, learned about genetics using Gen Scope, a Computer Based Learning Environment(CBLE). The results of this naturalistic study could potentially be used to inform educational practice by highlighting scaffolds that may foster self-regulated learning in a CBLE mediated science inquiry context. Cepni et al (2006) pointed out that the study on effects of Computer Assisted Instruction Material (CAIM) related to photosynthesis topic on student cognitive development misconceptions and attitudes. This study results showed that using CAIM in teaching photosynthesis topic was very effective for students to reach comprehension and application levels of cognitive domain. Mahmood Farhadian (2007) in his research, he studied the co-operative learning. Computer Assisted Instruction and combination of these two methods called Co-operative Computer Assisted Instruction (CCAI). In CCAI method with the use of computer and attractive software, there would be appropriate grounds in instruction and educational achievement of mathematics for students. This method was examined for small group of student in a workshop. He had investigated some hypotheses on the reduction of the students negative beliefs about mathematics, the speed of learning mathematics and its independence from time scheduling. Findings of the study, the difference between pre-test and post-test scores were meaningfully significant.

**Objectives of the Study**

The present study has the following objectives:

1. To provide a broad-based biological knowledge, stimulate a deep interest in the natural world

    through CAI.

2. To develop as CAI package for self-instruction on the unit circulatory system in biological

    science for class ninth standard students.

3. To enable the pupils to utilize effectively the instructional material in learning biology.

4. To verify whether there is any difference in learning level between boys and girls, rural and urban

    school and Government, Government Aided and Unaided secondary schools.

**Hypotheses of the Study**

The hypotheses constructed for the present study are as following:

1. There is no significant difference between the pre-test and post-test scores of government

    secondary school students following the computer assisted instruction.

2. There is no significant difference between the pre-test and post-test scores of aided secondary school students following the computer assisted instruction.

3. There is no significant difference between the pre-test and post-test scores of un-aided secondary school students following the computer assisted instruction.

4. There is no significant difference between the pre-test and post-test mean scores of the

    experimental group following computer assisted instruction.

5. There is no significant difference in post-test performance of computer assisted instruction

    between the different types of secondary school pupils'.

6. There is no significant difference between the post-test performance of secondary school pupils' following computer assisted instruction in relation to locality.

7. There is no significant difference between the post-test mean scores following computer assisted instruction in relation to gender.

**Methodology of the Study**

    Educational software development and validation is a major research and development activity in the field of education. The major area in educational software is occupied by the instructional software development. The nature and the impact of computer and learning were led to its acquiring more significance. In the latest concept of improvement

in the instructional software produced and the role played by educational technologists in the consents and process of software development. The CAI package depends on the electronic device. Further there is a need for the subject-expert, technical expert. Individualized instruction is the one-to-one relationship between learners and the subject to be learnt.

**Sample for the Study**

Sample selection is an important aspect of the research study, violation of a proper sampling method may yield result based information of research and therefore maximum care is necessary for solution of sample. The investigator has selected six schools in Aligarh district which come under the Central Board of Secondary Education. The sample selected was of three hundred (300) students, of which there are one hundred fifty boys and one hundred fifty girls of ninth standard from two government schools, two government aided schools and two unaided schools, both from rural and urban areas. Considering the non-feasibility of formulating randomized groups in school setting; it was decided to have purposive sampling as the method of sampling for this experiment. 150 students of class ninth in each of the three types of schools were taken as CAI experimental group and 150 students of class ninth in different types of rural schools and hundred and fifty students of class ninth in different types of urban schools were taken as the experimental group. Purposive sampling procedure is applied for selecting the sample and so that it is free from any prejudice.

**Sampling Technique**.

For the present study purposive sampling method is used. The purposive sampling is selected by some arbitrary method because it is known to be representative of the total population. It is appropriate in a study which lays special emphasis on the control, of certain specific variables.

**Design of the Study**

The design selected for the study is the pre-test and post-test of two groups.

1. Administering a pre-test measuring the dependent variable at initial stage for elimination of novelty factor.

2. Applying the treatment to the subject, to measure treatment effect.

3. Administering a post-test again for measuring the impact of the dependent variable.

Differences attributed to application of the experimental treatment are then determined by comparing pre-test and post-test scores.

**Development of Instructional Materials**

The subject that is to be converted into CAI package was "*Respiratory System*" in biology for ninth standard students. The content framework of the syllabus was adapted from the prescribed text by the CBSE text book for IXth standard. The teaching points were collected from the text books and other reference books mentioned and sequence according to the designed leanring level of students in the local school. The content prescribed was corrected into a reading material in simple language according to their vocabulary level.

The teaching frames were structured on the leanring materials following the norms and theories set for the preparation of CAI package. The teaching points were structured in small dosage called "Frame". Frames were arranged in proper sequence. In each frame information was presented with simple illustration or examples.

**Description of the Tools Used**

**a) Computer Assisted Instruction Package**

The instructional software package was developed to help learners through a prescribed form of self-instruction manual. In this study biology CAI package was Respiratory system for ninth stranded students. This CAI package contains various stimuli such as showing pictures and animation. This CAI was an effective individualized instructional material.

**b) Performa Sheet**

The investigator himself has developed a Performa sheet to collect necessary information regarding the individuals back ground such as the name, age, sex, name and address of the school, locality, type of school, system of school.

**c) Science Achievement Test**

In this present study the investigator has prepared the achievement test question paper based on the ninth standard State Board Syllabus. The question has been given to ninth students of the selected schools situated in Aligarh district. The test consist of 40 questions and each objective has been provided 04 multiple choice from which the individual is asked to mark the response which he/she feels to be right in their point of view.

**d) Scoring Key**

The answer scripts for the conducted achievement test were collected and scored based ion the scoring key. For scoring the test it was decided to give one mark as weight age

for each correct answer. Thus a maximum of 40 marks were allotted who give correct response for all the items.

**Administration of Tool**

The study was conducted and materials were distributed to the students after taking prior permission from the principal of the selected schools. The investigator personally visited each school and collected data. The purpose and intention of the study were briefly explained. The subjects had been repeatedly assured that they could freely express their opinions without and reservation since the purpose was purely educational research. The co-operation extended by the respondents/students was encouraging remarkably. Each sample was pre-tested with criteria referenced test to measure the entry level. Before the experiment or treatment the students were pre-tested using the test. The test was helpful in assessing the subject knowledge of the students prior to the treatment (pre-test). The same test was administered again after treatment effects (post-test). The individual instruction analysis was carried out by employing 't' test for difference between the Computer Assisted Instruction groups.

**Data Collection**

The pre-test and post-test was planned to achieve the objectives of the study. The sample was selected for conducting the experiment. For conducting the experiment the investigator selected six secondary schools. The investigator selected secondary schools since it would be easy to provide the treatment in the school to the sample.

**Statistical Techniques Used in the Study**

Appropriate statistical techniques were used which included the mean, standard deviation, 't' –test, and analysis of variance..

Analysis and Interpretation of the Data

The collected data was consolidated, tabulated and analyzed statistically by using the following tests.

1. Test of Significance ('t' Test and ANOVA)

2. Mean and standard Deviation

**(1) Test of Significance: 't' Test and ANOVA**

't' test is used to find out the significant level of difference between two groups of population. The values are calculated with the help of the mean scores and standard deviation.

**(2) Mean and Standard Deviation**

Mean and Standard deviations were done using the results of the study to make simple comparisons wherever necessary.

Null Hypothesis 1: There is no significant difference between the pre-test and post-test scores of Government schools pupils following the CAI

**Table 1: Analysis of 'T' test scores of Government Schools Pupils following the CAI**

| S.No. | Source | N | Mean | S.D. | 't' value |
|-------|--------|---|------|------|-----------|
| 1. | Pre-test Score | 50 | 14.30 | 3.2467 | 34.799* |
| 2. | Post test Score | 50 | 32.23 | 3.3030 | |

*Significant at 0.01 level

From the table 1, it can be seen that there is significant difference between the pre-test and post-test mean scores of Government School pupils following Computer Assisted Instruction. Hence the above null hypothesis stands rejected.

**Null Hypothesis 2:** There is no significant difference between the pre-test and post-test scores

of Aided schools pupils following the Computer Assisted Instruction.

**Table 2: Analysis of 'T' test scores of Aided Schools Pupils following the CAI**

| S.No. | Source | N | Mean | S.D. | 't' value |
|-------|--------|---|------|------|-----------|
| 1. | Pre-test Score | 50 | 15.44 | 4.634 | 22.206* |
| 2. | Post test Score | 50 | 29.76 | 4.345 | |

*Significant at 0.01 level

From the table 2, it can be seen that there is significant difference between the pre-test and post-test mean scores of Aided School pupils following Computer Assisted Instruction. Hence the above null hypothesis stands rejected.

Null Hypothesis 3: There is no significant difference between the pre-test and post-test scores of Unaided schools pupils following the Computer Assisted Instruction.

**Table 3: Analysis of 'T' test scores of Unaided Schools Pupils following the CAI**

| S.No. | Source | N | Mean | S.D. | 't' value |
|-------|--------|---|------|------|-----------|
| 1. | Pre-test Score | 50 | 13.16 | 3.604 | 33.969* |
| 2. | Post test Score | 50 | 28.98 | 3.197 | |

*Significant at 0.01 level

From the table 3, it can be observed that there is significant difference between the pre-test and post-test mean scores of Unaided School pupils following Computer Assisted Instruction. Hence the above framed null hypothesis is rejected.

**Null Hypothesis 4:** There is no significant difference between the pre-test and post-test mean scores of the experimental group following Computer Assisted Instruction.

**Table 4: Difference between Pre and Post-Tests Scores of CAI group on total sample**

| S.No. | Source | N | Mean | S.D. | 't' value |
|---|---|---|---|---|---|
| 1. | Pre-test | 150 | 14.30 | 3.959 | 47.644* |
| 2. | Post test | 150 | 30.32 | 3.883 | |

*Significant at 0.01 level

From the table 4, it is revealed that there is significant difference between the pre-test and post-test mean scores of the experimental group following Computer Assisted Instruction. Hence the above hypothesis is rejected.

**Null Hypothesis 5:** There is no significant difference in post-test performance of Computer Assisted Instruction between the different types of schools.

**Table 5: Comparison of Post-test performance of CAI group between the Different types of Schools**

| S.No. | Type of School | N | Mean | S.D. | 'F' value |
|---|---|---|---|---|---|
| 1. | Government School | 50 | 32.22 | 3.303 | |
| 2. | Aided School | 50 | 29.76 | 4.6451 | 12.824* |
| 3. | Unaided School | 50 | 30.32 | 3.1975 | |

*Significant at 0.01level

An ANOVA test was applied and the calculated value of 'F' is 12.824, which is found to be significant at 0.01 percent level. Hence the above framed null hypothesis stands rejected.

Null Hypothesis 6: There is no significant difference between post-test performance of schools pupil in relation to locality following Computer Assisted Instruction.

**Table 6: Comparison of post-test performance of the experimental group following CAI in relation to Locality**

| S.No. | Locality | N | Mean | S.D. | 't' value |
|---|---|---|---|---|---|
| 1. | Urban | 75 | 32.00 | 3.2715 | 5.862* |
| 2. | Rural | 75 | 28.64 | 3.7331 | |

*Significant at 0.01 level

It can be seen from the table 6 that the't' value of 5,862 is significant at 0.01 level and therefore there is significant difference between the post-test performance of school pupils following computer assisted instruction in relation to urban and rural areas. Hence, the above framed null hypothesis is completely rejected.

**Null Hypothesis 7:** There is no significant difference between post-test performance of the schools pupil in relation to gender following CAI

**Table 7: Comparison of post-test performance of the experimental group following CAI in relation to Gender**

| S.No. | Gender | N | Mean | S.D. | 't' value |
|-------|--------|-----|---------|--------|-----------|
| 1. | Boys | 75 | 29.6667 | 4.0415 | 2.084* |
| 2. | Girls | 75 | 30.9733 | 3.6279 | |

*Significant at 0.01 level

From the above table 7, it can be observed that the value of 't' is 2.084 is significant at 0.01 level. Therefore there is significant difference between the post-test performance of school pupils following computer assisted instruction in relation gender. Therefore, the above framed null hypothesis is rejected.

**Findings of the Study**

1. The comparison of scores of pre-test and post-test of Government Schools pupil following computer assisted instruction showed that there is significant difference between the pre-test and post-test scores. The mean post-test score of 32.23 for the Government schools pupil is greater than the pre-test score of 14.30. Thus, it can be inferred that the computer assisted instruction significantly influenced the learning of pupil.

2. The analysis of table 2 shows that the post-test score of 29.79 for the aided schools pupil is greater than pre-test score of 15.44. This indicates that the computer assisted instruction significantly influenced the learning of aided schools pupil.

3. From the analysis of table 3 it can be observed that the mean post-test score of 28.98 for the unaided schools pupil is higher than the mean pre-test score of 13.16. This shows that the computer assisted instruction significantly influenced the learning of unaided schools pupil.

4. From the analysis of table 4, it can be noticed that the comparison of the scores of pre-test and post-test of overall sample in target group following computer assisted instruction shows significant difference. The mean post-test score of 30.32 for overall samples is greater that the mean pre-test score of 14.32. This shows that computer assisted instruction significantly influenced learning of all selected samples following computer assisted instruction.

5. The analysis of table 5, shows that same Government schools pupils are showing better performance, while they received experimental treatment through computer assisted instruction in comparison to unaided schools and aided school respectively and also the mean score of the Government schools is 32.22 which is more than the mean scores of 29.76 and 30.32 of aided and unaided schools respectively in the post test score.

6. Further analysis it can be seen from the table 6, that the post-test scores of urban and rural area in the computer assisted instruction experimental group shows significant difference, as the mean value of this CAI experimental group is 32.00 and 28.64 respectively. Also since the mean value of urban schools pupil is greater than the mean value of rural school pupil, it shows that the urban schools pupil are more influenced through computer assisted instruction in the post-test in comparison to their rural counterparts.

7. From the analysis of table 7, it can be noticed when gender-wise comparison was done then, it was revealed that the girls were more influenced and scored better in comparison to boys when they are given treatment through computer assisted instruction in the post-test. Further, it can be seen that the post-test mean score of girls is 30.97 is greater than the post test mean score of boys which is 29.66 , this shows that there is significant difference between the boys and girls in their academic achievement when they are given computer assisted instruction in their post-test performances.

**Recommendations**

The following are the recommendation given in the context of the present study:

1. Computer Assisted Instruction should be implemented in more number of schools.

2. The Government should allot more funds to provide adequate number of computer and it's related infrastructure for the schools.

3. It is recommended that Government should give concession of purchase of computer.

4. College students who are studying computer science may be asked to do projects in the development of the necessary software for high school syllabus. This can solve the problem of  non-availability of software.

5. Special training shall be given to the teachers through in-service training programme to inculcate instructional materials.

6. Educational institution should have adequate instructional materials.

7. Training shall be given to the teachers to prepare and handle instrument materials.

8. Instruction materials of learning provide scope for self-instructional activities. Here the role of the teacher is limited and maximum activities are prescribed to the learners.

9. Teacher can improve their competence by attending in-service training camps and also by writing research articles in the field of educational technology.

10. The students can learn effectively when they learn on their own. Self-learning develops critical

thinking in handling of study materials on one's own and enhances communication skills and self-reliance.

11. The teachers must motivate the pupils to make more instructional package for self-learning.

**Suggestions**

A research study would be incomplete if it doesn't provide necessary guidelines as well as potential research topics for further exploration. The following suggestions are made for further research in this area:

1. A similar study can be carried out in different types of schools such as the same kind of study can

   be done in private, private aided and private unaided schools in different parts of Aligarh district.

2. In the present study the investigator didn't took students from elementary schools and senior secondary schools and therefore such schools can be taken for further study so as to see the impact of computer assisted instruction on the academic performance of students from schools.

**Conclusion**

The present study is an attempt to do a comparative study on effectiveness of computer assisted instruction and handout on circulatory system for ninth standard students. A sample of 300 pupils studying in ninth standard from six different schools in Aligarh district was selected. One and hundred fifty (150) formed the experimental group of the 300 students following computer assisted instruction. The experimental method was adopted in the study. Achievement test question paper was employed as a tool, at this time the treatment is administered on a small group of the target population. Pre-test and post test were administered prior to starting and after the completion of the treatment respectively. The mean test scores taken to assess the effectiveness of self learning through the computer assisted instruction among the secondary school students.

From the results of the study it was found that the computer assisted instruction improved the academic performance of the secondary schools students'. The computer assisted instruction has provided greater leanring opportunities fro children both theoretical and practical. It use in bringing new kinds of experiences for students is really interesting and meaningful. The investigator therefore would put all his efforts in seeing that more and more number of educational institutes should come forward to make the learning best out of all available instruction materials for learning. Thus, it can be concluded that the students should

learn their curriculum with the support of computer assisted instruction and the teachers should also adopt in their classroom teaching process the computer assisted instruction method; thereby it would make their lecture delivery more beneficial and interesting.

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