Effectiveness of Computer-Assisted Instruction on the Academic Achievement in Mathematics for Secondary School Students

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Abstract:
This experimental study aimed at comparing the effect of Computer Assisted Instructional (CAI) and Lecture Method of teaching on the performance of IX class students in Mathematics. The significance of academic achievement scores for experimental group (using CAI) and control group (using lecture method) were examined in this study. A Pre-test - Post-test control group experimental design was used on forty five students of IX class. The results showed that the experimental group was significantly higher than the control group in academic achievement of students in Mathematics. Findings supported that experimental group (CAI) where students performed better than control group (lecture method) in Mathematics.

Keywords: Computer-Assisted Instruction (CAI), Lecture Method, Academic Achievement.

I. INTRODUCTION
Material world is completely based on the Science and Technology and application of Science and Technology is becoming an integral part of human life. It is making each and every activity very smooth for human being. One of the finest and most important gifts of Science and Technology to the mankind is Computer. It is like a magic box doing miracles in every field of life. And the field of education is not away from its impact. With the use of this technological advancement, we can generate interactive mode in our classroom. The methods like Computer-Assisted Instruction (CAI) can create an interactive environment in classroom and the subject like Mathematics basically demands interaction in the classroom to learn the concepts long lasting and create conceptual understanding of concepts. There is a clear relationship between the Mathematics and the instructions given by the computer.

II. RESEARCH PROBLEM
New Technology is the backbone for Mathematics Teachers where it can make a lot of difference in teaching through use of CAI program, which has the potential to enhance the teaching-learning strategies and achievement of the students. Although lot of work exists pertaining to the use of CAI in teaching-learning process in the developed countries but in developing countries like India, it is at initial stage particularly in the field of Mathematics. CAI has been used as an effective and efficient medium of instruction in the advanced countries for formal and non-formal education at all levels. In CAI, learners can learn at their own pace and spend as much as time as they need. Different studies have been conducted on CAI and Lecture method but the proposed work is different from the studies carried out so far. Researches by Singh, Ahluwalia and Verma (1991), Rose (1992), Jothikani and Thiagarajan (2004), Basturk (2005), Beard (2007), Maheta (2009), Patel (2010), Dhimar and Patel (2013), Devi (2013), Patadia and Ramani (2014) highlighted that the Computer-Assisted Instructional Modules are more effective as compared to lecture method of teaching. Also it was found that there was a dearth of researches in the field of Mathematics for Secondary and Senior Secondary Classes. Keeping this in mind, the researcher selected this research problem where experimental study was conducted to compare the effectiveness of CAI and Lecture method for teaching of Mathematics.

III. RESEARCH OBJECTIVES
The objectives of this study were to:
• To develop and validate the criterion referenced tests in Mathematics to measure the achievement of IX class students.
• To compare the effectiveness of CAI and Lecture method on the academic achievement of IX class students in Mathematics.

HYPOTHESIS
In this study, directional hypothesis was framed.
✓ There exists significant difference in the achievement scores of class IX students who exposed to CAI and Lecture method in Mathematics.

RESEARCH METHODOLOGY
In this experimental study, Pre-test – Post-test control group Experimental research design was used.

SAMPLE
The sample for the present study consisted of forty-five students of class IX of Tarun Niketan Public School from Faridabad District. The sample was selected through Purposive sampling.

TOOLS
Tools are the devices which are used to collect information. In this study, two types of tool were used. These are:-
a) **Instructional Tools**: Instructional tools were developed to impart instructional material to the students. These were Computer-Assisted Instructional (CAI) Modules: The modules for CAI were developed for two Units of Semester-I of Mathematics of IX class which were self-instructional, self-paced and having specific steps ranging from objectives to evaluation. And the material was designed in the form of frames. Each frame is made by using Powerpoint presentations and hyperlinks and each frame is a combination of text and images to create captivating and motivating presentations. **Lesson plans for Lecture method** were prepared for the same two units of Mathematics of IX class. These were prepared by mixing Herbart’s approach and RCEM approach which is followed up now-a-days for developing the lesson plans for lecture method of teaching.

b) **Measuring Tools** were employed to measure the intelligence level of the students. *Raven's Standard Progressive Matrices (2005)* was used to assess the intelligence level of students for making two similar groups before the experiment. Criterion Referenced Tests (CRTs) were used to assess the entry level behavior of the students. These were also used for assessing the achievement level of students after completing each unit.

IV. **PROCEDURE OF FINAL EXPERIMENT**

A sample of 45 students of class IX from Tarun Niketan Public school, Faridabad participated in this study after matching their level of intelligence and Pre-test score. Experimental group had 22 students and control group had 23 students. The experimental group was exposed to CAI and lecture Method was used for control group. After the treatments, both the groups were post-tested. CRT was used for Pre-test stages and Post – test stages. The scores of Pre-test and Post-test were used for checking the effectiveness CAI and lecture Method in Mathematics of 2 units namely Number System and Real Numbers of IX class. Method and Procedure of the experiment is shown below (Fig.2):

V. **STATISTICAL TECHNIQUE USED**

t-test was used to compare the effectiveness of CAI Modules and Lecture Method of teaching in specified two units namely Number System and Real Numbers.

**FINDINGS**: On the basis of analyses and interpretation of data, the following findings have been drawn:

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre-Test</th>
<th>Treatment (Methods)</th>
<th>Post-Test (Achievement level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Intelligence and CRT</td>
<td>Experimental Group using CAI Module</td>
<td>CRT (Achievement test)</td>
</tr>
<tr>
<td>G2</td>
<td>Intelligence and CRT</td>
<td>Control group using Lecture Method</td>
<td>CRT (Achievement test)</td>
</tr>
</tbody>
</table>

**Table 1**

SIGNIFICANCE OF DIFFERENCE BETWEEN THE MEAN SCORE OF EXPERIMENTAL GROUP AND CONTROL GROUP ON PRE-TEST OF UNIT-I AND UNIT-II (NUMBER SYSTEM) & REAL NUMBERS

<table>
<thead>
<tr>
<th>Unit</th>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>SE_d</th>
<th>t-value</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number system</td>
<td>Experimental Group</td>
<td>22</td>
<td>3.18</td>
<td>1.49</td>
<td>0.39</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>Control Group</td>
<td>23</td>
<td>2.74</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real numbers</td>
<td>Experimental Group</td>
<td>22</td>
<td>2.73</td>
<td>1.10</td>
<td>0.69</td>
<td>Not Significant</td>
</tr>
<tr>
<td></td>
<td>Control Group</td>
<td>23</td>
<td>2.50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
It can be observed from the table 1 that the mean score of experimental and control groups on pre-test of unit-I (Number system) are found to be 3.18 and 2.74 with SEd 1.49. The t-value between the two groups come out to be 0.3968. And the mean score of experimental and control groups on post-test of unit-II (Real numbers) are found to be 2.73 and 2.50 with SEd 1.10 . The t-value between the two groups come out to be 0.69. Thus, the difference between the two means was not statistically significant. It indicates that the groups can be treated almost equal for their entry level behavior in unit –I and unit- II.

In order to see the mean achievement scores of experimental and control group and t-value at a glance these results have been given in Figure 3.

### FIGURE: 3
**DIAGRAMATIC REPRESENTATION OF THE SIGNIFICANT DIFFERENCE BETWEEN THE MEAN OF ACHIEVEMENT SCORES OF EXPERIMENTAL GROUP AND CONTROL GROUP ON PRE-TEST OF UNIT-I & UNIT- II (NUMBER SYSTEM) & (REAL NUMBERS)**

Figure 3 shows the mean achievement scores of Unit-I(Number System) and Unit-II (Real Numbers) of experimental and control group on pre-test. Figure 3 also reveals that both the groups were almost equal in their mean scores. It means that CRT helps to find out the similar entry level behavior of the students of experimental group and control group.

**Phase –II :** This phase presents a comparison between the post-test mean achievement scores of experimental group and control group in each unit of Mathematics and is presented in table 2 and Figure 4 is given. This comparison was done to see the effect of CAI and lecture method on achievement scores of IX class students.

The significance of difference between the mean scores of post-tests of experimental group and control group was found by applying t-test and results are shown in table 2 and also in figure 4.

### TABLE: 2
**SIGNIFICANCE OF DIFFERENCE BETWEEN THE MEAN SCORE OF EXPERIMENTAL GROUP AND CONTROL GROUP ON POST-TEST OF UNIT-I (NUMBER SYSTEM) & UNIT-II (REAL NUMBERS)**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>SEd</th>
<th>t-value</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number system</td>
<td>Experimental Group</td>
<td>22</td>
<td>13.77</td>
<td>2.532</td>
<td>3.5629</td>
<td>0.01 Level</td>
</tr>
<tr>
<td></td>
<td>Control Group</td>
<td>23</td>
<td>11.08</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real numbers</td>
<td>Experimental Group</td>
<td>22</td>
<td>13.54</td>
<td>3.6327</td>
<td>3.2680</td>
<td>0.01 Level</td>
</tr>
<tr>
<td></td>
<td>Control Group</td>
<td>23</td>
<td>10.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
It can be observed from the table 2 that the mean achievement score of experimental and control groups on post-tests of unit-I (Number system) are found to be 13.77 and 11.08 with SEd 2.5 respectively. The t-value between the two groups come out to be 3.56. And the mean achievement score of experimental and control groups on post-tests of unit-II (REAL NUMBERS) are found to be 13.54 and 10.00 with SEd 3.63 respectively. The t-value between the two groups come out to be 3.26. It indicates that the students of two groups differ significantly at 0.01 level. The comparison of mean scores further reveals that the mean score of experimental group are higher than that of the control group. Hence, it means that CAI is more effective on total academic achievement scores in comparison to lecture method.

In order to see the mean scores of experimental and control group and t-value at a glance these results have been given in figure 4.

**Figure 4**
DIAGRAMATIC REPRESENTATION OF THE SIGNIFICANT DIFFERENCE BETWEEN THE MEAN OF ACHIEVEMENT SCORES OF EXPERIMENTAL GROUP AND CONTROL GROUP ON POST-TEST OF UNIT-I& UNIT-II

![Diagram](image)

Figure 4 shows the mean achievement scores of experimental and control group on post-test. Students of experimental group were exposed to CAI modules; they learnt the concept with full attention. The reason may be that students learnt the concept at their own pace. But the students of control group were not given chance to learn at their own pace as well as do the practice for concept clarity.

**VI. EDUCATIONAL IMPLICATIONS**

**FOR ADMINISTRATORS**: Experimental Researches should be encouraged by U.G.C. and required facility should be provided to the researchers in true manner so that quality research could take place. Researchers should be motivated to develop effective CAI Modules to improve the quality of research. For this, training should be provided to pre-service as well as in-service teachers for developing CAI modules. It is also required to orient the Mathematics teachers for developing positive attitude for the use of CAI modules for enhancing problem solving in Mathematics.

**FOR TEACHERS**
Teachers should develop and use CAI Modules to meet the challenge of individual differences. With the help of CAI Modules, effective interactive environment can be created in the classroom. Provision of intrinsic reward creates good feeling among the students and they become active learners.

**FOR STUDENTS**
Knowledge through CAI Modules help to inculcate problem solving skills and self confidence among students which are very much essential for enhancing learning Mathematical concepts independently. They become independent thinkers.

**VII. CONCLUSION**
This result shows that computer-assisted instructional (CAI) method is more effective on the students’ mathematics achievements than the lecture method of teaching. So we can say that CAI Modules create interactive learning environment for the learners to learn. These also provide immediate feedback on the performance of the students. These also help to maintain high interest level and sufficient motivation for the learners. These CAI Modules have enriched features such as Self-explanatory, Self-directed, Self-motivating and Self-evaluating which help to cater to the needs of individual differences.

**VIII. REFERENCE**


http://ijesc.org/


