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Physical science teaching through Computer Assisted Instruction (CAI) and traditional lecture method at secondary level: A comparative study

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Abstract
In order to compare the effectiveness through Computer Assisted Instruction (CAI) and Traditional Lecture Method for teaching Physical Science, an experimental research was conducted on the students of class X studying under West Bengal Board of Secondary Education in Kolkata District in West Bengal. A two group (Experimental and Control group each containing 9 students) randomized matched posttest Equivalent Design was taken. A unit on Lens was taught with the two groups separately and the same posttest was applied on both the groups to test the hypotheses. Lesson plan and achievement were designed by Investigator himself. The mean scores of the students taught through CAI significantly better than the Traditional Lecture Method as found by one tailed test. This study revealed that CAI is more effective than the Traditional one.

Keywords: physical science teaching, CAI, traditional method, experimental and control groups

1. Introduction

Today, the world is becoming more and more technologically oriented. Thus, the industrial age gave way to the information age because this has brought changes to society, business, education and our lives. Moreover, due to information explosion the objectives of education have become multidimensional. It is difficult to achieve these objectives of teaching by using simple Lecture Method only. There is need of some innovative methods of teaching. Using technology in education system we can achieve these objectives. Computer Assisted Instruction (CAI) is one of the useful methods which provide individualized and self-paced instruction to the learners in the real classroom situations [1-3].

The use of computer-based teaching in Physical Science provides number of alternatives to students such as visualization of abstract concepts that will foster student understanding. These alternatives would be complementary to traditional teaching. Computer assisted instructional materials are more effective in developing favorable attitude, and in capturing interest towards learning of Physical Science. The computer simulations and animations prepared to be used in teaching activities are able to create a teaching atmosphere like laboratories where students are active. A variety of visual representations of concepts in the computer simulations make concepts visible that are otherwise invisible to students [4].

Many studies have been carried out to find the effectiveness of CAI at different levels. Some of these are Dalton and Hannafin (1986), Richardson (1986) [5], Price (1989), Roberts and Madhere (1990), Rha and Bedell (1998), Hsiao (2001) and Raninga (2010) [6] carried out the studies to find out the effectiveness of CAI in teaching learning of Mathematics at different levels. They found a good increase in scores of the learners by using CAI. It was found that secondary students exposed to CAI showed higher academic achievement than the students exposed to traditional instructions. Annan (2009) [7] conducted a study on improving junior secondary school students' understanding of mathematics through the use of CAI. They noticed that students in the experimental group had higher learning levels, exhibited positive attitudes towards the learning of Mathematics, progressed through the topics at different rates, did collaborative work and studied Mathematics with excitement and broke loose from their fear of the subject. Singh (2005) [8] conducted a study on the effectiveness of Computer-Assisted Instruction (CAI) for teaching Biology and found that both the methods (lecture and CAI) were effective in enhancing the learning about cell and tissues. Lecture method was more effective than CAI for teaching cell whereas CAI was more effective than lecture method for teaching tissues.

2. Materials and Methods

The use of computer technology to supplement traditional instruction to develop concept of Physical Science among students is a recent development. Some researchers think that CAI has great potential for improving concepts in science education. Others contend, however, that science students need personal interaction with an instructor and other students. At this stage science students are able to choose different professional courses through various entrance examination which requires a sound conception and thinking of Physical Science. Does computer-assisted instruction enhance the learning of Physical Science or is traditional instruction more effective for these students? Do students be able to form consistent conceptual understanding in Physical Science?

3. Objectives of the study

Objectives of the study are:

i) To develop the CAI package on the unit 'Lens'.

ii) To compare the effectiveness of Computer Assisted Instruction and traditional lecture method on the students of class X.
iii) To measure differences of performance of students in traditional and modern CAI approaches.
iv) To develop skills of the learners in Physical Science.

4. Hypotheses of the study

Keeping in view of the objectives of the study, the following hypotheses have been formulated:

i) Learning through CAI will be effective than the conventional method.
ii) There will a significant difference between the posttest scores of achievement of control group and experimental group.

5. Delimitations

i) A secondary school under West Bengal Board of Secondary Education is selected for the research work.
ii) The subjects of the study are limited to secondary level Physical Science only.
iii) The sample includes only boys of average age of 15-17 years, of different ethnic backgrounds of government secondary schools in Kolkata.
iv) Learners use Urdu/English as medium of instruction.

6. Methodology

The details about sample, sampling technique and data collecting tools to be used to carry out the study are mentioned below.

6.1 Research Design

The research is true- experimental in nature because the equivalence of the control and experimental groups are provided by random assignment of subjects to experimental and control treatments. The research design followed by researcher is the two group randomized Post-test Equivalent groups Deign.

6.2 Population

All Students of Physical Science of Class X who are studying in different Government Schools Kolkata under West Bengal Board of Secondary Education (WBBSE).

6.3 Sample

the researcher has taken the student from one school (namely Karaya Government School) especially class X students under West Bengal Board of Secondary Education as the sample of the study i.e. total 18 students are selected through randomized matching technique based on the available achievement scores in Physical Science for the said study.

6.4 Sources of data

22 students of class XI from the science stream attended the classes conducted by the investigator in the Physics Laboratory of the school.

6.5 Tools used for data collection

An achievement tests is administered by the investigator in the classroom on the 18 students.

6.6 Methods used for data collection

The investigator appealed to the head of the institution for conducting classroom activity and administering achievement test. Two groups randomized matched post-test only design is implemented to test the hypotheses. The randomized matching has been done on the basis of available achievement scores of all students of class X in Physical Science. This design involves two groups namely Group A (Experimental) and Group B (Control). The investigator has taught the students of Group A (Experimental) Lens following the Computer Assisted Instruction. On the other hand, the students of Group B (Control Group) have got teaching the same lesson by the same investigator followed the lecture method.

Questions are framed on the basis of Knowledge, Understanding, Application and Skill. After the teaching the achievement test is administered on the students of both groups with the same set of questions of 20

7. Results

The following findings are obtained from the study-

i) The result of the present study clearly point out the significant increase in the mean scores that has been found in the posttest scores of the experimental group.
ii) Significant differences have been found between the control and experimental group on posttest scores.
iii) The experimental group, taught through CAI, acquired better learning.
iv) It is evident that the CAI is an effective media of instruction of teaching Physical Science than traditional method at secondary level.

Table 1: Experimental and control group results of post-test only

Group	N	Mean	S.D.	t – value	Level of Significance
Experimental group	9	15.556	2.4037	5.077	Significant
Control group	9	10.000	2.2361		

The calculated value of t is 5.077 which is more than the table value for both at 1% and 5% level. So the difference between the two Means is significant. Therefore, the hypothesis is retained.

8. Discussions

Recently, S. Banik *et al.* [9] conducted a study on the effectiveness of teaching Physics through computer assisted instruction and traditional method at higher secondary level and they have developed computer assisted instructional package on the topics namely Newton laws of Motion and Scalars and Vectors of Physics curriculum. However, these chapters do not have the abstract concepts of Physics, so these units are not very much suitable for teaching using CAI. Study of Maheswari U. *et al.* [10] on the effectiveness of CAI package on in Physics of IX standard students of Tamil Nadu state Board confined to poor achievement test administered on the students on work power and energy unit. Morover, this chapter can be taught better way by activity method rather than by CAI. In the present study, Lens unit from class X have been selected for CAI package, as it provides number of alternatives to students such as visualization of abstract concepts of the said unit (Lens) such as ray diagrams, dispersion of light, primary and secondary colours etc. that will foster students' understanding. These alternatives would be complementary to traditional teaching.

9. Implications

Using CAI understanding of the subject matters, development of skills, interest, motivation, interaction among the students and interaction between the teachers can be done**.**

10. Limitations

1. Girls could not be included for paucity of time.
2. The students were divided into two groups (Experimental group and control group) on the basis of pre-test.

11. Suggestions for further development

- Sample size should be increased.
- Rural area should be considered.
- Boys and girls should be taken into consideration separately.
- Teachers should be encourages to prepare and implement CAI packages in the classroom teaching-learning.

12. Conclusion

After analyzing and interpretation of data the investigator has found the following:

- There is significant difference between the performance of Experimental and Control group students
- The learners interact with the teacher more in CAI method.
- CAI strategies were superior to the traditional method of instruction, and CAI with Teacher Support System (TSS) was more effective than CAI without TSS for underachievers.
- Computer Simulated Experiment (CSE) is an effective tool to capture the interest of the learner toward the learning of Physical Science.
- Although the CSE provides favorable outcomes in the realm of Sconce education, there is no significant to claim that the CSE is more effective than the traditional method. However the CSE can be one best alternative in teaching the subject in the most modern way using high-tech scheme of academic instruction.
- CAI method also helping to develop scientific attitude within the learners.

Hence CAI is an effective method for teaching–learning of Physical Science. However, it is not commonly is the institutions due to the lack of infrastructure, shortage of experienced teachers. Thus, teachers should be oriented in the mass scale during in-service and pre-service via training programmers.

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