The Effect of Computer Assisted Instruction Material as Teaching Aid on Chemistry Learning of High School Students

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Abstract

Today's tech savvy generation easily approves the use of computer applications in teaching field. We are interested to compare the potential of Computer Assisted Instruction Material as teaching aid with traditional lecture method and thereby know contribution to improve the learning process. Two groups of 15 students were set for the study of chemistry. One group was set for lecture method while other was for CAI (Computer Assisted Instruction) material method. Pre, post and additional tests are apllyed to quantify the achievement of students . Pre and post test are planned to know understanding level while additional test was designed to know understanding and application level, of the subject. Statistical analysis of data obtained implies that use of CAI material has more potential than lecture method. In the additional test, use of CAI material has shown progressive effect but at the same time improvement in the performance of control group is noticeable. Blending of lecture and CAI method will surely help for betterment of learning process at all the three levels viz. information, understanding and application.

Keywords: chemistry education; chemistry knowledge; chemistry awareness; computer-assisted education

I. Introduction

Teaching the science concepts meaningfully and make students aware of how these concepts can be used in their daily lives is the aim of science education. Concepts are not materials, events or creatures but they are units of thought assembled into certain groups. They exist in ideas and only the examples of the concepts are found in the real world (C. epni, S., Ayas, A., Johnson, D., & Turgut, M. F. 1997). In this process, learning the basic concepts during the primary and secondary education is very crucial, in terms of learning the advanced concepts. It was argued that if new concepts were compatible with previous concepts, the meaningful learning would occur (Ausubel, D. 1968). It is important to know that, what prior knowledge students bring to a learning environment in order to help them construct new knowledge (Tsai, C.-C. 2000, p285).

From historical period till today, maximum number of teachers prefers the lecture method, in which the teacher transmits knowledge to the students and listen without active involvement. Question and answer activity up to some extent avoid the boredom caused by lectures and to provide a more efficient learning environment. On the other hand, case studies allow the students to face the problems that occur in real life. They help to fill the gap between theory and practice through putting the previously learnt concepts and principles into use. The best part of this method is that it enables the students to apply what they have learnt to what they

are living through (Sönmez V. 1986, p287). A useful part of instructions in science is performing of experiments. In this method teacher actively demonstrates the experiments.

During past decades, personalized (i.e. individual) instruction by experiment or even fully autonomous learning has been developed for teaching in all areas (Boland R.G.A. 1977, p233) Beneficial feature claimed for student-centered methods is that they allow more time to be spent by the teacher tutoring individual or very small groups of students. This has been claimed, in particular, by the advocates of computer-assisted instruction learning (Hinchliffe P.R., 1982, p 588).

Flexibility in using computers as per convenience of time, place and availability of hardware and software is chief advantage of Computer-Assisted Instruction (CAI). Computer programs can be used for practice, revision, one-to-one instruction, problem solving, or simulations during the applications (Brooks, D.W., Lui, D., & Walter, J.L. 1997). With CAI, there is a form of one-to-one instruction (or two students together at each computer), plus the opportunity for the students to proceed at their own pace, repeating parts of the exercise as they wish. None of these features are easily available in a didactic classroom situation. In addition, there is added variety and, perhaps, novelty in CAI, along with the potential to use vivid and animated graphics, enabling three dimensional aspects, and other features to be viewed more realistically. Of course, not all computer programs have these features, but the potential is certainly there. However, computers lack the human dimension and the ability to provoke thought by spontaneous questions and answers. A good teacher can respond to the way a class is reacting to a lesson by the skillful use of such spontaneous questions and answers. This flexibility is not easy to develop in a computer program and the style of presentation will depend on the ingenuity of the program developer and his/her own understandings of the subject matter (Inci M, Soner Y, Ozge O.O. and Secil A 2004, p52)

II. Purpose of the Study

Looking at the need of hour Government of Maharashtra has introduced Information Communication Technology (ICT) as a regular subject for IX and X class students. In this context it becomes important to understand how CAI affects teaching and learning process. Chemistry is a one of the fundamental science subject and therefore selected for present study. It also has dimensions of environmental and biological sciences. As mentioned above, there are mixed responses to the use of traditional (lecture) method and computer assisted instruction method. To identify the appropriate method of teaching, these two methods were compared by using pre and post test designs (Jackman, L. & Moellenberg, W. 1987. P 794). This method of analysis is proved to be appropriate in many studies.

III. Experimental Details

A. The Subjects
The experiment was carried out in Lokmanya Tilak High school, Pune (one of the school affiliated to S.S.C. Board, Maharashtra). Students of IX class were selected randomly. Two groups; control and experimental, each consisting of 15 students, were formed. It has been taken care, that student could handle computers satisfactorily.

B. Subject Knowledge Test

The Subject Knowledge test is the source of statistical data for the present work. The test consisted of 20 questions each in pre and post tests. The questions were designed after discussion with experts of the subjects. Inclusion of information, understanding and application based questions is as per Bloom's taxonomy. The questions asked were open ended so that students would express themselves satisfactorily. In post test also same pattern was implemented. Along with post test, one additional test also implemented. This additional test was designed to know the understanding of the subject and enhancement in other skills like presentation of thoughts.

C. Application of instructions

Two groups were formed which were control group (CG) and experimental group (EG). Control group was set for lecture method. Experimental group was set for computer assisted instruction method. CAI includes video clips, animations, documentaries and self explanatory slide shows. Reinforcement of instructions of both the groups was achieved by daily sessions of one and half hour. Apart from instructions, students of both the groups were allowed to use other information sources like family, teachers and library. For experimental group, CAI material was made available through CDs also, so that they could view them as per their convenience other than session schedule. For CG, the lecturer has gone through the CAI material and same was delivered effectively by regular chalk and blackboard (lecture) method along with participation of students through discussion.

D. Test Procedure

The Subject Knowledge Test was applied two times i.e. pre and post test. Along with this one additional test in post session was also applied. Between pre and post test there was period of 15 days for reinforcement of knowledge.

The answer papers were evaluated and the marks were compiled. The averages (Avg.), standard deviations (sd.) and differences in marks were calculated. The graphs representing their performance changes in terms of marks were plotted. This data is compiled below.

IV. Results

Pre test performances of CG and EG are comparable but not same as sample was selected randomly. Standard deviations indicate appreciable variations in control group (5.08) as compared to the experimental group (2.76). Difference in pre and post test performances, for both the groups is positive (12.33 for CG and 25.43 for EG). This implies that students can learn the subject by both the methods i.e. lecture and CAI material but at the same time effectiveness of the method also clearly emphasized.

Experimental Group change

Control Group change

Pre test performance
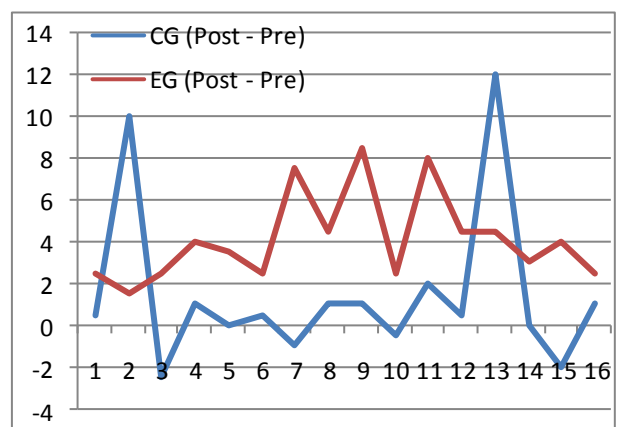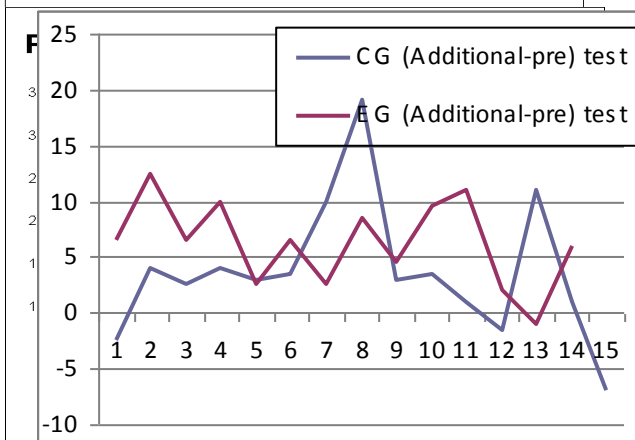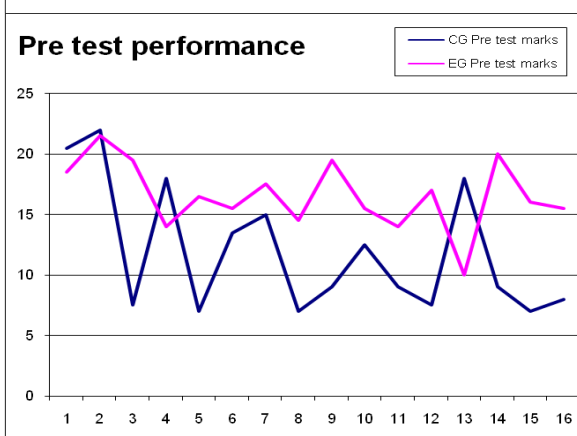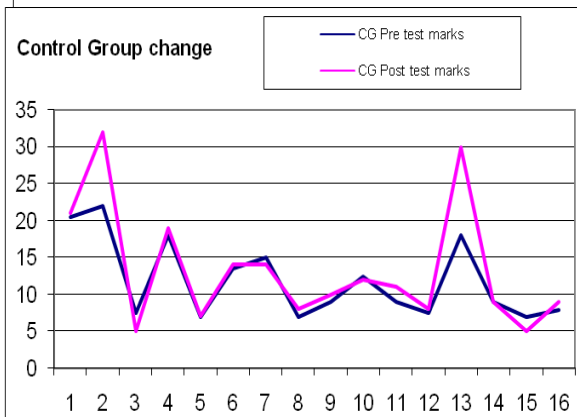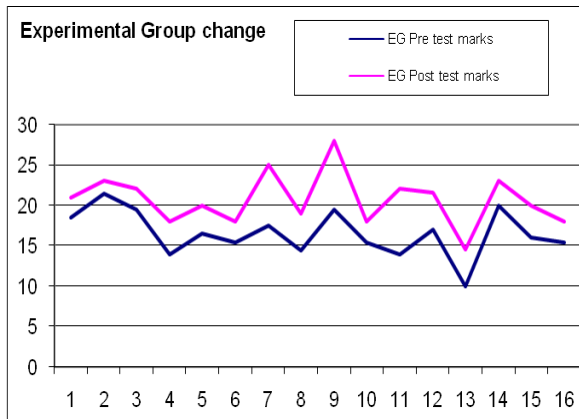
Additional test performance is found to be significant to know enhancement in various skills. The questions for this test were based on understanding of concepts and application of the knowledge. In this test, performances of both the groups are positive. Here too, the role of instruction method is momentous. But standard deviations indicate that there is appreciable variation of performances of students of experimental group as compared to control group.

V. Conclusion

Through the evaluation of statistical data obtained from subject knowledge pre-post and additional tests interpretations were made which are listed below. Also through discussions with students after post test some of their responses could be interpreted more accurately.

1. Students can understand and visualize the concepts because of various tools used in CAI which is the strength of CAI material.
2. Both groups show improvement in learning and performance and between CG and EG, EG found to be better than CG.
3. Comparatively CAI material was found to have more potential than lecture
4. Effectiveness of lecture method depends on the competency of a teacher to deliver the knowledge. But at the same time, lecture method is live and can be made interactive so that students can be made to take initiative in learning process.
5. Comparing the change (12.33% for CG and 25.43% for EG) observed for (post-pre) test performance with change (29.93% for CG and 37.82% for EG) observed for (additional – pre) test, the progressive development is found in later.
6. Better performance in additional test unearthed the refinement of some important skills viz. precise expression of thoughts, application of knowledge and its implementation in day to day life.
7. Achievement in pre, post and additional tests of two students of control group was comparable with average performance of experimental group. This suggests that different opinion. Such bright students can do well if they are exposed to CAI material method along with lecture method.
8. CAI material increases the information level of students but there is no increase in the ability of application of subject knowledge. Hybrid method comprising of use of CAI material and lecture method is therefore expected to give maximum results.
9. Present study is confined to chemistry. But the field is open for such experiments for other science subjects and different age group students.
10. The larger value of standard deviation observed in the control group can be attributed to the two sample elements much above normal. The small values of sd for experimental group indicates their similar response patterns. The authors are confident that if the number of sample is greatly increased such minor inconsistencies would get ironed out.
11. In spite of this , the performance changes are quite consistent

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