Technological Approaches of CAI in Teaching Chemistry for Higher Secondary Students

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Abstract

In determining the effect of Computer Assisted Instruction (CAI) on students' performance, three groups of students had been taken for experimental studies. Each group consisting of 40 students in total 120 students were taken as samples for a period of six months for teaching chemistry in the schools of Tenkasi, Tirunelveli through Computer Assisted Instruction to Experimental group I & II and a Control group. The control group was taught with conventional teaching method and the other two groups with CAI software package with discussion and without discussion. As this was the first attempt in deploying CAI in teaching chemistry concepts in the schools, it was primarily employed as educational means of teaching with CAI. This paper highlights a personal experience and a case study of implementing Computer Assisted Instruction and the effect it has on students' performance in the course. Through hypotheses testing, it is clearly possible that employing Computer Assisted Instruction in educational settings proves to have significant effect on students' performance.

Keywords – Computer, Chemistry, Teaching

Introduction

Computer use by any teacher is a function of his or her computer experience and expertise, availability of hardware and software, and perceived need. An excellent chemistry course may be taught without the use of a computer. However, the careful incorporation of computers into a chemistry course can and does add an important level of enhancement.

Although not as conclusive as one might hope, studies do indicate that computer use in chemistry education can improve learning and positively influence students' attitudes and self-esteem.

The importance of using computers in a chemistry class may not be limited to the ability of Computer Assisted Instruction (CAI) to improve learning. Rather, computer use adds another dimension to the teacher's repertoire of strategies, which may improve overall learning. Another important reason to include student computer use in a chemistry course is that most (if not all) students, especially those planning a career in chemistry, will be required to be computer literate. As students interact with computers in a variety of ways within their chemistry courses, their degree of computer awareness and literacy will increase.

Review of Literature

The following studies found positive effects associated with computer use in science education applications:

Indian Studies

Nirma M. Joseph and Dr. P. Annaraja (2006) conducted a study on teacher trainee's attitude towards information and communication technology.

The major findings were there is no significant difference between male and female teacher trainee in their attitude towards ICT. There is no significant association between attitudes towards ICT.

Bobin Antony (2006) conducted a study on development of CAI package in IX standard computer science and its effectiveness.

The major findings were the experimental groups obtained a higher mean then the control group. The sex wise comparison is insignificant. There is no significant association between the gain score and the hours of study of the control group students and there is no significant association between the gain score and the hours of study of the experimental group students.

Nirmala Sundaraj and Annaraja (2005) conducted a study on effectiveness of power point presentation in teaching zoology for higher secondary students.

The major findings were there was significant difference between the pre-test and the post-test scores of the students. There was significant difference pre-test and post-test scores of the students in attainment of knowledge, understanding and skill objectives. That is experimental group students are better than the control group students.

Subramanian (2006) conducted a study on effectiveness of CAI for teaching triple column cash book at higher secondary level.

The major findings were CAI package significantly improved the performance of students in learning accountancy of higher secondary school. Male students do not differ much from their female counter park in their academic achievements even after exposes to CAI.

Subasri (2006) conducted a study on accessibility of power point presentations among high school and higher secondary school teachers in classroom teaching.

The major findings there is high significant relationship between the fundamental knowledge of computer among the teachers power point accessibility in class room teaching. Urban teachers are found to utilize power point presentations more effectively in class room teaching when compared teachers. There is no significant difference between the high school and higher secondary school teachers in utilizing the power point presentation in class room teaching.

Helen Joy and Shiju (2005) conducted a study on development of CAI teaching material in history at higher secondary level and its effectiveness.

The major findings were there is significance difference between control and experimental group students in there gain score. That is experimental group students are better then the control group students in the gain score. It is noticed that the experimental treatment is effect to the students. It is interesting that the performance of urban students is better than rural students assume importance. It is likely that the rural students are less exposed to computer at school and the home.

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Antony Gracious (2005) conducted a study on development of hypermedia learning package in science for IX standard students and its effectiveness.

The major findings were the experimental groups obtained a higher mean them the control group. The sex wise comparison is insignificant. There is no significant association between the gain score and the hours of study of the control group students and there is no significant association between the gain score and the hours of the experimental group students.

International Studies

Um and Eunjoon Rachel (2008) conducted as study on the effect of positive emotions on cognitive processes in Multi-media based learning.

The result showed that the positive emotions experienced during the learning improved the learner learning performance, motivation, satisfaction and perception toward the learning. It also indicated that positive emotions were generated by the aesthetic design of the learning material. The result of the study supported the facilitation hypothesis of positive emotions in the context of learning. The study implies that positive emotions should be considered as important

factors in instructional design and that emotional design principles should be studied in more detail for better instructional material design.

Kelly and Mary (2008) conducted a study on the use of Multi-media technology to enhance self-determination skill and encourage student leadership in educational goal planning for post-secondary students with asperser syndrome.

The intervention provided students with an opportunity to play a much greater role in planning than many had traditionally played and also provided an engaging medium for team members to learn more about the student an his or her goals. Students were observed engaging in significantly more self-determined behaviors after the intervention but other measures of self-planning were inconclusive therefore it is important for teachers and parents to continue to build on the momentum of the intervention and provide ongoing opportunities to foster newly acquired skills and behaviors. The mixed results may also mean that more long term, multi-component approaches to promote self-determinations skills and participation in educational goal.

Shao and Wei (2006) conducted a study on animating autonomous pedestrians.
The result indicated that the use of a computer-based Multimedia instructional module that integrated mind mapping of foreign culture reading as a treatment has a significant difference is student performance on cultural context knowledge, and had no significant difference in student performance on culture vocabulary knowledge when compared to the traditional instruction.

Chen and Rong - Ji (2006) conducted a study on power and reason: The construction of a mathematics teacher's pedagogical discourse and practices.

The findings of the study can contribute to a better understanding of how a teacher's construction of his pedagogical conceptions and practice is influenced by the social embedded with in a particular network of power relations might be challenged.

Clerk and Danny (2005) conducted a study on the effected of using computer assisted instruction to assist high school geometry students achieve higher levels of success on the Florida Competency Achievement Test (FCAT)

The major findings concluded that the factors associated with having a student centered schools environment incorporating the use of computer technology to evaluate student achievement with the assistance of a collaborative learning environment did play a significant role in the positive increase in academic achievement on standardized test scores.

Lee (2004) conducted a study on the effect of intrinsic and extrinsic load on learning with computer based simulation.

The major findings were high intrinsic / extrinsic group has performed worse than other groups. There was significance difference between interaction effects of the instructional treatment conditions and individual differences.

Koeppen and Andre (2000) conducted a study on Internet as the goal of project linking at laws state University Fulbright-Hays projects abroad program.

This projects the linking established an international dialogue among middle school teachers and students in Moscow, Russia and in the United States. For each of five consecutive years, a new group of twelve as teachers joined a new group of twelve Russian teachers in Moscow to collaborate in developing curricular designed a prepare middle school youth to participate in a global society.

A major problem in evaluating the results of studies designed to measure the value of CAI is the elusive factor of the quality of the software used in the study. The software should be well designed, but there also must be a match between the objectives of the software (or

courseware), the understanding of the teacher as to how to apply it, and the needs or interests of the students.

Use of Computers by Chemistry Teachers

Most of the teachers are willing to incorporate computers into their curriculum when the obstacles are not overwhelming. The desired uses, however, include more than CAI. In fact, a relatively small number of chemistry teachers use computers for CAI in class room teaching and lab applications because there isn't enough hardware and because lab applications require both specialized hardware and software. The most widely used application appears to be word processing. Test and worksheet production takes the lead in this area, and customized laboratory activities are produced as well. Many chemistry teachers employ spreadsheet or customized or commercial grade book programs to record, calculate, and post student grades. Using test item banks to sort and select questions is becoming more popular as software and banks become more available. Finally, a small number of teachers are using computers to produce items such as crossword puzzles, word searches, posters, signs, and diagrams to support instructional activities.

A small but increasing number of chemistry teachers are using computers as a component in selected laboratory activities. CAI employ computers interfaced with commercial or "home-built" transducers. Using the appropriate software allows the computers to measure, record, graph, and analyze a variety of physical quantities: temperature, light, pH, pressure, and electrical and magnetic parameters, to list the most common. Some teachers create their own programs, in a computer language such as BASIC, that allow both students and teachers to evaluate the accuracy of laboratory data and/or calculations.

On the cutting edge of classroom computer applications, interactive videodisks are making their way into many science classrooms. Finally, students are increasingly being

introduced to computer database searching at school. Many high schools subscribe to databases on CD-ROM (compact disk, read-only memory). In addition, modems are used to access university and government databases at remote locations. Such databases range from libraries' online catalogs to scientific data being gathered from spacecraft and satellites.

Constraints of using Computers in Chemistry Classrooms

By far the major factor inhibiting computer use in the chemistry classroom is the insufficient amount of computer hardware and software available due to budgetary constraints. It often takes a chemistry department three to six years to obtain even the minimum number of computers necessary for one teacher to effectively incorporate CAI into the curriculum. Although just one or two computers can be incorporated into classroom activities, this number will support a very limited number of strategies. Moving computers in and out of a classroom is time consuming and significantly inhibits their use. Moving students to a "computer lab" also has several constraints, the two major ones being that the typical computer lab is too small and that teachers must compete for limited lab time.

The Ideal Computer Environment for Chemistry learners

An ideal computer learning environment, possible with current technology, might be an arrangement where each student has access to a "friendly" computer station consisting of high quality Computer Assisted Instruction, touch screen color displays and interactive video. At such a station each student could proceed at his or her own rate. Motivated students of the very highest ability might learn at three to four times the average classroom rate, completing two or three high school science courses a year. Students who seem to learn more slowly could be given extra months to complete a course without failure. The "average" student might elect to proceed at a pace equivalent to the conventional course.

An important feature of the CAI would be the learner's ability to choose whether to proceed or to review when attempting to master course objectives. In addition, students would be encouraged to repeat for themselves demonstrations observed on the interactive videodisk. And, regardless of the degree of computer involvement, there must also be a substantial hands-on laboratory component integrated into each science course. CAI would also play a major role in the labs of the future.

Students in the ideal computer environment would also be encouraged (or required) to participate in cooperative activities as part of the chemistry course, perhaps in the form of problem solving activities that would not require that all students in a group be at the same level of instruction. Indeed, it might be very beneficial to create cooperative problem solving groups composed of students currently studying topics in different areas (i.e. earth science, biology, chemistry, and physics), or at differing levels of an integrated science curriculum.

Our Research Pursuit

After pursuing several studies on CAI, the research scholar (Suresh John Kennedy) chose the title “Technological approach of CAI in teaching Chemistry for higher secondary students” and started to work on it. The use of computer is multi-varied and especially to teach chemistry 10 units were selected and have started to work on it.

At the initial stage for the experimental study to know the level of the students an entry behavior test was conducted, which consisted of 150 items. The researcher has validated the entry behavior test and the discriminative and difficulty level of items were identified. As such, homogeneity was maintained to conduct experimental study through matching technique and the samples were selected. Many researchers have proved that the use of Computer Assisted Instruction would definitely influence the academic achievement of the learners.

The researcher has made an attempt to teach XI standard students through CAI on the topics such as Electronic configuration and quantum numbers, Modern Periodic law, Electronic configuration and periodic table, Atomic and ionic radii, Ionization enthalpy, Electron Affinity, Electron Negativity, Screening constant, Stability, The solid state, Gaseous state, Colligative properties, Basic concepts of organic chemistry, Purification of organic compounds. This research will be very useful for the chemistry teachers to handle the student catering to their individual capabilities. So the researcher has planned to administer the pre-test and post test to the control and experimental group I and II (with discussion and without discussion).

Conclusion

The use of Computer in the Chemistry classroom is still in its infancy. Its overall effectiveness needs to be enhanced by better hardware and software as well as greatly increased availability of each. More research is needed to discover the most effective strategies for their use. The rate at which computers will be used to enhance education in chemistry and in other fields depends mainly upon state and national monetary commitment, followed by the willingness of individual schools to provide good in service programs. This technological approach of CAI in teaching chemistry for higher secondary students fulfill the gaps of students knowledge, understanding, application, skills of knowing chemistry in their day to day activities.

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