SUMMARY

INTRODUCTION

Biology occupies a unique position in the school curriculum and is central to many Science related courses such as Medicine, Pharmacy, Agriculture, Nursing, Biochemistry and so on. It is obvious that no student intending to study these disciplines can do without Biology. In spite of the importance and popularity of Biology, Science enrolment at post compulsory (plus two) level has been declining in India (Garg & Gupta, 2003). Science survey (Shukla, 2005) has shown that interest in Science as well as satisfaction with quality of Science teaching declined as the age of the student increase. Poor performance of the students in Science has been attributed to a number of factors including poor quality of Science teachers, overcrowded classrooms, inappropriate teaching methods, and lack of suitable and adequate Science equipment etc. (Bajah, 1979; Kareem, 2003). When traditional methods are used in teaching Science subjects, student understand subject at knowledge level only and they usually memorize the concepts without understanding the real meaning resulting in poor performance. It in the long run results on the decline in enrolment in this subject. It is obvious that to improve the student’s performance in Science and to increase their interest in Science, alternate teaching approaches like illustrative tools such as graphs, animation, sound and video-clips in one machine (Orion, Dubowski & Dodik (2000). To increase the effectiveness of teaching and learning computer can be a good alternate tool in the classroom environment.

These days, no doubt, computers are being used for a plethora of applications, from engineering to music and yoga, and from law to microsurgery and space technology etc., however it was
only in the recent past that they have foraged into the territory of education which hitherto was the sole purview of teachers only – be it in a school teaching tiny tots alphabets or elementary mathematics or in a college and university setup. While many teachers find the intervention of computer in education distasteful and dehumanizing, others are hailing computers as “virtual” teachers and tools of immense educational possibilities (Lancaster, 1985; Bhatt & Prakash, 1994). However, one thing is certain: since education is in one way or other concerned with information, there is bound to be a wide scope of any tool like computer which can help in fast and accurate processing of information.

The main features of computers which make it a tool with tremendous potential for education are its interactive operations, speed, accuracy & reliability and information retrieval.

COMPUTER ASSISTED INSTRUCTION – A BRIEF OVERVIEW

MEANING

CAI is a method of instruction in which the computer is used to instruct the student and where the computer contains the instruction which is designed to teach, guide and test the student until a desired level of proficiency is attained.

ADVANTAGES OF CAI

- Individualization of instruction.
- Learning occurs at learner’s own pace and time frame.
- It enhances learning and retention rate of the students;
- It motivates and develops sense of efficacy.
- CAI makes learning more convenient, comfortable and enjoyable for the students.

Meta-analysis of sixty five studies conducted by Kuchler (1998) revealed that CAI has a positive effect on retention of mathematical
concepts and skills of secondary school students; it improves student’s attitude towards several aspects of schooling and learning.

**RATIONALE OF THE STUDY**

According to Akour, (2006) Computer Assisted Instruction (CAI) as a supplement to traditional instruction produces higher achievement than the use of traditional instruction alone. CAI has been found to enhance students’ performance better than the traditional instructional method in counselor education (Karper, Robinson, & Casado-Kehoe, 2005). According to Mills (2001), CAI is as effective as classroom instruction for fact based learning, but not as effective for topics requiring critical thinking or mathematical problem solving. Jenk & Springer (2002) opined that how CAI is delivered can affect its effectiveness, and new studies are needed to clarify the effect of CAI in contemporary student environment. Research is inconclusive regarding the comparative effectiveness of the use of traditional method alone and CAI alone, and that computer based education (CAI and other computer applications) produce higher achievement than traditional instruction alone (Yusuf & Afolabi, 2010). Based on the review of the results several studies, the present study was proposed to investigate the effect of individualized form of CAI on the achievement of VII grade students in Science.

Gender issues too have been linked with performance of students in academic tasks in several studies but without any definite conclusion. But there is a general conclusion as per the findings of many investigations that imbalance exists in computer use, access and attitude. Some studies revealed that male students perform better than the female in Physics, Chemistry and Biology (Okeke & Ochuba, 1986; Novak & Mosunda, 1991; Danmole, 1998). Studies such as those of Wonzencreaft (1963); Kelly (1978) revealed that
female students perform better off than males where as Bello, (1990); Spence (2004); Yusuf & Afolabi, (2010) found that gender has no influence on the Achievement in Science when instructions are delivered through computer. Keeping in view the variability in findings regarding interrelationship between Achievement, computers and gender, the present study was proposed with an objective to study the effect of CAI on the Achievement in Science in relation to the gender of the student.

Cognitive learning style of the student has been found to have potential and great implications for the educational process (Sternberg & Grigorenko, 1997) and is described as a model in which students approach, acquire, organize and process the information. According to Witkin, et al. (1971) and Witkin & Goodenough (1981), cognitive learning styles are the consistent manner in which an individual perceives and carries out intellectual activities, memorizes and retrieves information. Though, CAI has been found to be effective in individualized tutorial form and also as supplement to the conventional teaching but unfortunately many CAI programmes have neglected cognitive learning style and the processes of how student learn.

Understanding of students’ attitude is important in supporting their Achievement and interest Towards a particular discipline however, earlier research studies focused mainly on Science in general (Dawson, 2000) and less attention was paid to specific branches like Biology, Physics or Chemistry (Salta & Tzougraki, 2004).

Thus, in the light of the observations made above, the objective of the present study was to make an investigation of the effect of CAI on the academic Achievement and Attitude Towards Science of field dependent and field independent students.

**STATEMENT OF THE PROBLEM**
EFFECT OF COMPUTER ASSISTED INSTRUCTION (CAI) ON ACHIEVEMENT AND ATTITUDE TOWARDS SCIENCE IN RELATION TO COGNITIVE STYLE AT ELEMENTARY SCHOOL LEVEL

OPERATIONAL DEFINITIONS OF THE TERMS USED

• COMPUTER ASSISTED INSTRUCTION (CAI)

CAI is the method of instruction in which the computer is used to instruct the student and where the computer contains the instruction which is designed to teach, guide and test the student until the desired level of proficiency is attained. In the present study, CAI was used in tutorial mode in which computer was used to deliver the entire instructional sequence similar to teacher’s classroom instruction on the topic.

• COGNITIVE STYLE

Cognitive style is a term used to describe the way an individual thinks, perceives and remember information or their preferred approach to using such information to solve problems. In the present study, cognitive style is classified as Field Dependent (FD) and Field Independent (FI) as measured by Group Embedded Figure Test (GEFT) developed by Witkin et al. (1971).

• ACHIEVEMENT

Achievement refers to academic proficiency or performance in a given skill or body of knowledge. In the present study Achievement was assessed on the basis of difference between the scores obtained by the student in pre-test and posttest on an Achievement test developed by the investigator.
• **SCIENCE**

Science refers to the subject “general Science” which is a combination of Physics, Chemistry and Biology as prescribed by CBSE for elementary school level. In the present study, the investigator considered Biology (theory) part of the syllabi of grade VII only.

• **ATTITUDE**

An attitude is a particular feeling about any object, event or person. In the present study, attitude of the students Towards Science was assessed as any change in the liking of Science by the student. It was measured through a Biology attitude scale developed by Russell & Hollander (1975).

**OBJECTIVES OF THE STUDY**

The present study proposed to achieve the following objectives.

1. To develop a package for Computer Assisted Instruction (CAI) in the content area (Biology) for elementary level (VII class).
2. To determine the effect of CAI on students’ Achievement and compare it to Traditional Instructions (TI).
3. To determine the effect of CAI on students’ Achievement in relation to their cognitive style and gender.
4. To find out the effect of CAI on students’ Attitude towards Science.

**RESEARCH QUESTIONS**

Following research questions were framed to achieve the above given objectives:

17. Is there a statistically significant difference in the Mean Score on Achievement test in Biology of the group of students taught through TI and the group of students taught through CAI?
18. Is there a statistically significant difference in the Mean Score on Achievement test in Biology of the group of students of Field Independent cognitive style taught through TI and the group of students of Field Independent cognitive style, taught through CAI?
19. Is there a statistically significant difference in the Mean Score on Achievement test in Biology of the group of students of Field Dependent cognitive style taught through TI and the group of students of Field Dependent cognitive style taught through CAI?
20. Is there a statistically significant difference in the Mean Score on Achievement test in Biology of boys taught through TI and boys taught through CAI?
21. Is there a statistically significant difference in the Mean Score on Achievement test in Biology of girls taught through TI and girls taught through CAI?
22. Is there a statistically significant difference in the Mean Score on Achievement test in Biology of boys of Field Independent cognitive style taught through TI and boys of Field Independent cognitive style taught through CAI?
23. Is there a statistically significant difference in the Mean Score on Achievement test in Biology of girls of Field Independent cognitive style taught through TI and girls of Field Independent cognitive style taught through CAI?
24. Is there a statistically significant difference in the Mean Score on Achievement test in Biology of boys of Field Dependent cognitive style taught through TI and boys of Field Dependent cognitive style taught through CAI?
25. Is there a statistically significant difference in the Mean Score on Achievement test in Biology of girls of Field Dependent cognitive style taught through TI and girls of Field Dependent cognitive style taught through CAI?
cognitive style taught through TI and girls of Field Dependent
cognitive style taught through CAI?
26. Is there a statistically significant change in Attitude towards
Science of students of experimental group after their exposure
to CAI?
27. Is there a statistically significant change in the Attitude towards
Science of Field Independent students of the Experimental
group after their exposure to CAI?
28. Is there a statistically significant change in the Attitude towards
Science of Field Dependent students of the Experimental
group after their exposure to CAI?
29. Is there a statistically significant change in the Attitude towards
Science of Field Independent boys of the Experimental group
after their exposure to CAI?
30. Is there a statistically significant change in the Attitude towards
Science of Field Independent girls of the experimental group
after their exposure to CAI?
31. Is there a statistically significant change in the Attitude towards
Science of Field Dependent boys of the experimental group
after their exposure to CAI?
32. Is there a statistically significant change in the Attitude towards
Science of Field Dependent girls of the experimental group
after their exposure to CAI?

RESEARCH DESIGN AND METHODOLOGY

The study was conducted in two phases i.e.

- Development of computer assisted instruction (CAI).
- Administration of CAI to determine effectiveness in terms of
  student’s Achievement and Attitude towards Science vis-à-vis TI.
DEVELOPMENT OF CAI PACKAGE

The Computer Assisted Instruction (CAI) package was developed in Biology chapters of class VII and presented to the students in its interactive tutorial mode using “Visual Basic” computer software. The text material of the three chapters of Biology (Organisation of the living world; Sustenance of the individual; and Reproduction) from the Science textbook for 7th class was transformed into CAI package. To transform this text material into CAI package it was divided into segments suitable for a tutorial. Unfamiliar terms and concepts in the text were explained through hyperlinks and images. Multiple-choice test items based on the text were constructed to assess student’s learning. Text material in the CAI programme was drawn from several books of Science for 7th class to make it more worthwhile effective and interactive.

DESIGN OF THE STUDY

The present study is aimed at finding the effectiveness of CAI on Achievement and Attitude towards Science in relation to gender and cognitive style. For this purpose, pre-test, post-test three way (2x2x2) factorial design was employed. Effectiveness of CAI vis-à-vis TI was studied with respect to gender and cognitive style (field independence and field dependence). The two variables i.e., gender and cognitive styles were used for classification purpose. The variable of gender was classified at two levels i.e., Male and Female whereas cognitive style was also studied at two levels i.e., Field Dependent (FD) and Field Independent (FI) on the basis of scores on GEFT.

TEACHING STRATEGIES EMPLOYED

• Self learning through Computer Assisted Instructions (CAI) and
• Traditional Instructions (TI).
The teaching strategies were the independent variables whereas learning outcome as measured by the scores obtained in standardized Achievement test and Attitude towards Science were the dependent variables. To find the relative effect of the above said strategies of teaching, the data was collected in two parts.

- In the first part, data was collected in order to match the students of the experimental and control group. Marks obtained by each student in Science in the 6th class exam were taken from the school record to match the groups. To ascertain student’s cognitive style, Group Embedded Figure Test (Witkin et al., 1971) was employed.
- In the second part, the data was collected to evaluate the student’s Achievement (difference between the scores of post-test and pre-test) and on student’s Attitude towards Science.

SAMPLE SELECTION

The sample of the study comprise of the 7th class students of a co-educational English medium school affiliated to Central Board of Secondary Education (CBSE) for the academic session 2010 – 2011. 236 students (149 girls and 87 boys) of class VII were taken as the sample population for the study. The school was selected purposely for the following reasons:

1. Well equipped computer lab and sufficient number of computer
2. Students have basic knowledge of computer
3. Comparable strength of boys and girls

PROCEDURE FOR COLLECTION OF SAMPLE

The Group Embedded Figure Test (GEFT) (Witkin et al., 1971) was administered to all the 236 students to segregate them on the basis of their cognitive style of learning. Students were categorized
as field independent, field dependent on the basis of scores on GEFT. The final research sample consisted of 40 Field Independent students (20 boys and girls each) and 40 field dependent students (20 boys and girls each). Rests of the students were eliminated from the study to make the sample homogenous on the basis of their scores in previous class. The finally selected 80 students were divided into experimental and the control group.

**TOOLS APPLIED**

In the present study following measuring tools were used by the investigator

1. Group Embedded Figure Test (GEFT) to measure cognitive style, (Witkin et al., 1971)
2. Achievement test in Science in the form of Multiple Choice Questions (MCQ) developed by the researcher.

**ACHIEVEMENT TEST IN SCIENCE**

Achievement test based on MCQ from three chapters of Biology was developed by the investigator. This test was administered as pre-test and posttest to measure the initial and terminal achievement of the students. The investigator followed the techniques of Achievement test construction i.e. planning the test, item development field testing for item analysis, selecting the final items, finding the validity and reliability.

**ATTITUDE TOWARDS SCIENCE**

Biology Attitude Scale developed by Russell & Hollander (1975) was used for the present study. This 14 item likert-type scale was used because:
1. The instrument is not intended to measure absolute attitude Towards Biology; rather, it is designed to detect and measure changes in attitude generally from the beginning and to the end of a course.

2. It had been validated for Indian sample and reliability of the scale was 0.91 which is quite high.

3. It suits to the objective of the study.

EXPERIMENTAL PROCEDURE

It consisted of three stages:

1. Pre-testing to assess previous knowledge and pupil’s Attitude Towards Science

2. Experimental treatment and

3. Post-testing to assess gain in knowledge and change in pupil’s Attitude Towards Science

EXPERIMENTAL TREATMENT

After pre-testing, the experimental treatment of teaching Science (Biology) to class VII students was started. The control group was taught by the investigator herself, through conventional chalk and talk method where as the experimental group was provided with the CAI on the computer to learn at their own pace. Any quarries of the experimental group were also answered by the investigator herself. After the completion of the treatment, the students were given posttest.

STATISTICAL ANALYSIS

The data obtained was subjected to Multivariate ANOVA and Paired sample t-test.
DELIMITATIONS OF THE STUDY

The present research study was delimited to:

- The instructional material both for CAI as well as TI was developed for some specific units of Science related to Biology of 7th class only.
- The computer Assisted Instructional programme was developed for one-to-one interaction in Visual Basic language.
- The instructional material both for CAI as well as TI was developed in English language only. Therefore the experiment was confined to English medium students of 7th grade only.
- The school with adequate computer facilities was selected for experimentation.

MAIN FINDINGS

- Tutorial mode of CAI has significantly positive effect on the Achievement of the students at VII grade of schooling.
- Field independent students of the experimental group scored significantly high as compared to the field independent students of the control group.
- Field dependent students learn better in the traditional teacher oriented class than by self learning tutorial mode of CAI.
- Gender of the student does not interfere with the learning of the student when taught through CAI.
- The Mean Score of field independent boys of experimental group was significantly higher than their counterpart in the control.
- Field dependent boys performed better in the teacher oriented classroom teaching than the field dependent boys taught through the CAI based self learning method.
• Difference in the Mean Score of the field independent girls of experimental and control group was statistically significant in favour of the experimental group.

• Difference in the Mean Score of the field independent girls of experimental and control group was statistically insignificant. Hence, it can be said that girl students of field dependent cognitive style performed equally well, both in the teacher oriented classroom teaching and the CAI based self learning method.

• The difference in the Mean Score on the Biology Attitude Scale before exposure to CAI and after experimentation was statistically significant. Thus CAI had positive effect on the students’ Attitude towards Science.

• It was found that Field Independent student showed significantly positive change in Attitude towards Science whereas the change in attitude in the field dependent students was insignificant.

• Both the genders of field independent cognitive style had a significant positive change in their Attitude towards Science after exposure to CAI.

• The difference in the Mean Scores at two occasions of both the genders was found to be statistically insignificant. CAI does not induce any change in Attitude towards Science in the field dependent student of both the genders.

CONCLUSION AND SUGGESTIONS

The study showed that the use of individualized CAI just like any other new technologies improved the academic performance of students in the teaching and learning of Science, and that gender has no effect in the use of CAI among the students. However, cognitive style of the student does interfere with their
performance. Where field independent students can learn independently through CAI, field dependent students need help of the teacher/mentor and perform better in conventional classroom teaching. CAI brings positive change in students’ Attitude towards Science hence develops students’ interest in subject.

Based on these findings the following recommendations were made:

1. Since this study showed that individualized form of CAI enhance the academic performance of the student, so, CAI should be utilized to improve quality of education at school level.

2. When instruction is administered in accordance to the cognitive style of the learner, their academic Achievement can be enhanced.

3. Presence in the Science classes can be increase by proper utilization of CAI in student centered approach.

4. Teachers should be trained to properly integrate computers in their daily classroom processes.

5. The Government and non-government agencies should equip both urban and rural schools with computers and new technologies for easy access by both teacher and student.

6. There should be a provision of regular supply of electricity to schools at all times.

7. Teachers in schools should be given free and compulsory computer training to enable them use these new technologies when supplied to them.

8. Teachers should be motivated to prepare CAI of their own keeping in view the requirements of the students/classroom.

9. There is a need to conduct more studies on Computer Assisted Instructional techniques over large student sample for an extended period in different subjects and stages of schooling.
Further, studies need to be done from rural and urban areas, different socio-economic status and ability groups.

10. There is ample scope of incorporating recent technologies to include animations, simulations and interactive technologies to improve the effectiveness of the CAI technique.

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