CHAPTER VI

OVERVIEW
OF THE STUDY
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CHAPTER -VI
OVERVIEW OF THE STUDY

INTRODUCTION

The central meaning of education is given as bringing up or leading out of or making manifest the inherent potentialities in a pupil and also it refers to any act or experience that has a formative effect on the personality of an individual. But in a technical point of view, education refers to the process by which society, through its different schools, deliberately transmits its cultural heritage to its young - its accumulated values, knowledge and skills from one generation to another.

John Dewey speaks of education as “that reconstruction or reorganisation of experience which adds to the meaning of experience and which increases ability to direct the course of subsequent experiences”.

The Indian Education Commission (1964 - 66) observed that education must serve as a, “powerful instrument of social, economic and cultural transformation necessary for the realisation of the national goals”. The goal of the education policy was nothing less than the creation of an ethos that would produce young men and women of character and ability committed to national service and development. That we have fallen from short of these goals is evident enough. In the meantime, new learning needs have arisen from the inexorable march of economic and social growth and progress in science and technology.

The aim of education has varied from nation to nation and generation to generation. But the main point of emphasis has always been on the mental and physical growth of the individual. The recent changes in the concept of education resulting from modernisation have also led to the development of newer areas of educational endeavour. Today, it aims at elevating itself to the level of a complete and comprehensive science with broader objectives.

The world of tomorrow, which would usher in an information rich and technology-intensive society, calls for new approaches to learning. Developing the capacity to learn would be more important than what is learnt. Life-long and
recurrent education would be the order of the day. Today, technology is already permeating every sphere of man's activity and even creating the possibility of raising educational aims and modifying learning processes substantially. In technology, particularly media take main and essential part to promote the teaching and learning but also, create interest, interaction, feedback, etc., are the factors that, stimulated the educational aspects.

Today, our nation is facing the challenge of having to fulfil two for middable tasks:- One is providing quality education to every one to develop one's fullest potential and the other one is simultaneously transforming the content and process of education to meet the emerging needs of tomorrow.

Thus the education lights the pupils to acquire knowledge through learning process and then use the knowledge in proper development purpose like improving technology and information fields related to education. From this, the learning processes are improved only by the use of technology and media.

THE ROLE OF PHYSICS IN THE FIELD OF EDUCATION

The Education Commission (1964-66) has emphasized that science education, especially Physics education must become an integral part of school education and ultimately some study of Physics should become a part of all courses in the humanities and social sciences. According to NPE point of view, the objective of science teaching itself should be inclusion of a scientific temper and emphasis should not be on mere acquisition of scientific knowledge but the use of scientific method as a tool for acquiring knowledge.

In the school education, higher secondary stage is crucial one, as after completing this, the students will be entering the highly skilled professional courses. A thorough knowledge of science, especially in Physics, forms as a foundation for further studies like engineering and other technical fields.

The contemporary Physics with all its multifaceted developments should match the learning ability of the students. The learning teaching kits and media have played a vital role in the teaching of Physics.

During the last two decades different kinds of learning modes have been invented and being applied for the effective teaching of Physics.
EDUCATIONAL TECHNOLOGY

Educational Technology can be defined as “the development, application and evaluation of systems, techniques and aids to improve the process of human learning”. It can also be defined as, “a systematic way to designing, implementing and evaluating the total of learning and teaching in terms of their scientific objectives:

Hence, it involves in the improvement of teaching as well as learning. The teachers are to make use of the technology available with them to make the teaching of science interesting and effective.

In the past decades, the method of teaching was teacher oriented as the students had no freedom to interact with teachers. With the change of time, the scenario has changed now and the students are actively participating in classroom activities.

Nowadays the technology devices such as Computer, C.C.T.V., are being used in classroom, which promotes the teaching - learning process. The school curriculum should include the new innovations in software technology so that quality programmes can be developed by teachers to achieve the goal in modern teaching methods.

INSTRUCTIONAL STRATEGIES

Lecture Method

The lecture method has been the earliest known method of instruction. This method is widely used in the classroom now. The students in higher secondary level cannot stand sustained narration, as their span of attraction is limited. This limitation can be overcome by the use of improved projected aids like TV, OHP, CCTV, etc.

Even nowadays science is being taught in the lecture method with the aid of charts, blackboard, etc. With the innovations in science and technology the lecture method can become a lively one by the use of projected aids like TV, CCTV, Computer, etc. This will result in the active involvement by students, resulting better achievements.
Computer-Assisted Instruction

Computer Assisted Instruction can be considered as the most exciting innovation in educational technology. It helps to assess the learners’ present level of knowledge and makes remedial action wherever required.

It is not correct to say that the importance of teacher in the classroom has reduced because of the usage of computer assisted instruction. Now the teachers can concentrate in the areas like evaluation, planning, curriculum, revision, etc.

A Physics teacher with sufficient software knowledge can be of immense use for the students, especially, in rural areas. An appropriately programmed computer is a boon to the learners which can be used to destroy almost all the forms of ignorance such as scientific, technical, humanistic, social, etc.

For better usage of computers, the teachers are to be equipped with various varieties of applications in computer.

DIFFERENT MODES OF CAI AS INSTRUCTIONAL STRATEGIES

Tutorial Mode

This mode aims at satisfying presentation of information and guiding the learners through initial use of the information. Some tutorials do not even guide the learners through information, but only present it. A good tutorial should include both presentation and guidance while extended practice and assessment are the domain of other methodologies. Tutorials are appropriate for presenting factual information, for learning rules and principles or for learning problem-solving strategies (Gagne, Wager & Rajas, 1981). A good tutorial informs the students of the purpose and nature of the lesson followed by presentation of information, evaluating learners’ performance and giving feedback to improve future performance. At the end of each interaction, the programme makes a sequencing decision to determine what information should be treated during the next interaction.
Drill & Practice Mode

Drill & Practice must be preceded instructional methodologies that present the information and guide the student through initial learning. In computer-based instruction, this may mean preceding the drill & practice with appropriate tutorial or simulation. It may also mean preceding the computer-based drill & practice with reading the textbook, a class room interaction or a group discussion. The function of drill & practice is to provide practice, applicable to all types of learning assuming that initial presentation of guidance have already occurred. Drill & Practice may be applied to simple paired-associate learning to complex problem-solving.

In this mode the computer presents a controlled sequence of events designed to reinforce the concepts and skills taught earlier. A Physics teacher with access to a computer would find a wide assortment of programmes that would be used by students to learn simple facts or statements of concepts.

Simulation Mode

Simulation is a powerful technique that teaches about some aspects of the world by imitating or replicating it. Simulations but also learn by interacting with them in a manner similar to the way they would react in real situations do not only motivate learners. Simulation also simplifies the reality by omitting or changing details. Thus, simulation helps the learner, built useful mental model of part of the world and to provide an opportunity to test it safely and efficiently. In the simulation, the student learns by actually performing the activities to be learned in a context that is similar to the real world. Simulation may serve for initial presentation, for guiding the learner, for practice, for assessing learning or for any combination of these phases. Simulation that assesses learning usually does not incorporate any of the other phases, but when the other phases are present they are usually in combination. Simulation may be of four categories viz. physical, procedural, situational and process.
NEED FOR THE STUDY

A substantial body of embrace studies shows that computer mediation as significant advantages in achieving traditional goals of instruction. Evaluations of CAI applications report consistently positive and on the whole moderately high achievement gains at all educational levels. Instructional management applications appear to be effective only at the secondary school and college levels. But computer programming and illustrative simulation software do not appear to have any effect on examination achievement except at the college level. Research designs, however, have not been sufficiently elaborate to allow robust multivariate examination of the mechanisms. Computer mediation has been found to improve student attention and computer mediation allows the same materials to be presented and learned in a shorter time-span. The impact of CAI on achievement outcomes varies with certain implementation contingencies. CAI applications in lower educational levels and with lower achieving students are more effective than in counter-part population sub-groups. At lower educational levels, CAI Drill & Practice applications, which reinforce instruction, are much more effective than tutorial applications, which substitute for human instruction. The course content in CAI implementation also makes a difference. At lower educational levels, CAI applications in mathematics appear most successful. In contrast, at the college level applications in more open-ended, fields of study are more effective. There is a strong presumption that technology improvements result in more effective applications. This receives some support form a moderate correlation between the data of implementations and magnitude of discovered effects. Hence, it is imperative to find out the relative effectiveness among different modes of computer-based instruction. It is also equally imperative to establish whether the personality of the learner has any influence in determining the media effectiveness in realizing the instructional objectives.
STATEMENT OF THE PROBLEM

The instructional process includes the instructor presenting the information to students, the instructor guiding the student’s first interaction with the material, the student practicing the material to enhance fluency and retention and the instructor testing students to determine what they should do next. The same principles apply to computer-based instruction also. That is not to say that the computer must always fulfil all the phases of instruction. Computers are but one element of instructional environment, along with the teachers and other media. Thus the computer may serve any combination of the four phases. It may present initial information, after which the student receives guidance from an instructor and practices using a work - book. The student may learn initial information from a lecture, after which the computer is used to practice some parts of the material to fluency. The computer may be used for the first three phases, with testing being done in the traditional way by the instructor. In all cases, the four parts of the instruction should be present, although they may be embodied in any combination of different media.

When the computer is responsible for total instruction, it is important that all four phases included. It is not typical for computer programs intended for drill & practice to be expected to carry the load of total instruction. When this is done, students may fail to learn what is desired.

Tutorial are programs that engage in the first two phases of instruction. They take the role of the instructor by presenting information and guiding the learner in initial acquisition.

Drill & Practice engages in the third phase, requiring the student to practice for fluency and retention tests almost always present the last phase, assessing the level of learning.

Simulations are more complicated, for they are frequently used to provide any combination of four phases of instruction in the same lesson. A simulation may be used to present information and guide the learner, to guide and give drill, to do all three, or to test the student’s knowledge. However, it is rare for a single lesson of any methodology to provide all the four phases of instruction. This
implies that most instructional computer-programs must be used in conjunction with other programs or media to provide complete and successful instruction.

Though CAI has been proved effective in realising the instructional objectives, there is dearth of studies in establishing the relative effectiveness among different modes of computer-based instruction. Studies have also proved that the effectiveness of different media changes with respect to individual differences among learners. Under these circumstances, it is imperative to establish whether the personality of learners has any influence in determining the media effectiveness. Hence, an attempt was made to take up a study on “RELATIVE EFFECTIVENESS AMONG SELECTED MODES OF CAI IN PHYSICS IN RELATION TO LEARNERS’ PERSONALITY”.

SCOPE OF THE STUDY

Research on computer assisted instruction would help the decision-makers in the field of Education to face the new challenges arising from the increasing use of computers in educational institutions. The present study besides establishing the relative effectiveness among different modes of computer-based instruction in realising the instructional objectives in Physics at Std. XII. Compares the effectiveness of instruction between conventional lecture method and different modes of computer-based instruction. In conjunction with other process-product studies, this study also contributes to the knowledge of instructional media particularly to CAI. Moreover, the software packages developed in different modes of CAI in Physics particularly the areas which poses difficulty to students would be immensely helpful to the practicing teacher in realising the instructional objectives among the learners. The knowledge with respect to personality influence on media effectiveness would be immensely helpful to the designers of CAI packages meant for the learners with varied learning abilities.
OBJECTIVES OF THE STUDY

The objectives of the study are stated as follows:

1. To find out whether there is any significant difference between the lecture method and computer-based instructions in terms of their effectiveness in realising the instructional objectives.

2. To establish the relative effectiveness among different modes of computer-based instruction viz. Tutorial, Drill & Practice and Simulation in realising the instructional objectives.

3. To find out whether there is any significant difference between the lecture method and computer-based instructions in terms of their effectiveness in enhancing the retention of what have already learnt as revealed by the learners’ performance in the retention test.

4. To find out the relative effectiveness among different modes of computer-based instruction in terms of their effectiveness in enhancing the retention of what have already learnt as revealed by the learners’ performance in the retention test.

5. To establish whether the effectiveness of different instructional strategies viz. Lecture Method and Computer Assisted Instruction in different modes, viz. Tutorial, Drill & Practice and Simulation in realising the instructional objectives is influenced by the learners’ personality types.

6. To find out the relative effectiveness among different modes of computer-based instruction, viz. Tutorial, Drill & Practice and Simulation is realising the instructional objectives in the context of the learners with various levels of personality types.

7. To develop and validate computer-based instructional packages in three different modes viz. Tutorial, Drill & Practice and Simulation for the selected content areas in the prescribed Physics syllabus at Std XII.

8. To develop a Criterion Referenced Test (CRT) in the content areas planned to instruct the subjects of control and experimental groups.

9. To assess the personality of the subjects of the control and experimental groups using Myers-Briggs Type Indicator.
HYPOTHESES OF THE STUDY

The hypotheses of the study are stated as follows:-

1. There is significant difference between the Lecture Method and different modes of computer-based instruction, viz. Tutorial, Drill & Practice and Simulation in terms of their effectiveness in realising the instructional objectives in Physics at STD XII.

2. There is significant difference among different modes of computer-based instruction, viz. Tutorial, Drill & Practice and Simulation in realizing the instructional objectives in Physics at Std XII.

3. The learners' personality types influence the effectiveness of different instructional strategies, viz. Lecture Method and computer-based instruction in different modes, viz. Tutorial, Drill & Practice and Simulation in realising the instructional objectives.

4. There is significant difference between the Lecture Method and different modes of computer-based instruction, viz. Tutorial, Drill & Practice and Simulation in terms of their effectiveness in realizing the instructional objectives in relation to learners' personality types and also in the context of the varying levels of learners' personality types.

5. There is significant difference among different modes of computer-based instruction, viz. Tutorial, Drill & Practice and Simulation in terms of their effectiveness realising the instructional objectives in relation to learners' personality types and also in the context of varying levels of learners' personality types.

6. There is significant difference between the Lecture Method and different modes of computer-based instruction, viz. Tutorial, Drill & Practice and Simulation in terms of their effectiveness in enhancing the retention of what have already learnt as measured by the learners' performance in the retention test.

7. There is significant difference among different modes of computer-based instruction, viz. Tutorial, Drill & Practice and Simulation in terms of their effectiveness in enhancing the retention of what have already learnt as measured by the learners' performance in the retention test.
TOOLS USED IN THE STUDY

The tools used for the study are as follows:-

1. Syllabus-based software packages were developed in selected modes of CAI viz. Tutorial, Drill & Practice and Simulation, for five prescribed topics in Std XII Physics which included 1. Discharge Tube, 2. Properties of Cathode Rays, 3. Properties of Canal Rays, 4. Radio Broadcasting and 5. Radio Reception. In toto there were fifteen instructional packages comprising five in each mode. All these packages were validated using three different standardized evaluations pro forma.

2. Two syllabus-based Criterion Referenced Tests were developed as pretest in atomic physics and electronics prescribed at Std. X and XI and posttest in five prescribed topics at Std. XII as stated earlier and

3. Myers-Briggs Type Indicator (MBTI) was developed and standardized by Jung (1971).

METHODOLOGY IN BRIEF

In order to test the formulated hypotheses, "the Pretest Posttest Nonequivalent - Groups Design" was adopted in the study. Four identical groups each of 35 students studying at Std XI in four different schools were formed. The homogeneity among these groups in terms of their achievement in Physics as measured by the pretest was established using ANOVA. One of the groups was identified as control groups while the other three groups were treated as experimental groups. Lecture Method was adopted in the control group while CAI in different modes, viz. Tutorial, Drill & Practice and Simulation were introduced as experimental intervention in the other three groups. Syllabus-based software packages were developed in selected modes of CAI viz. Tutorial, Drill & Practice and Simulation, for five prescribed topics in Std XII Physics which included 1. Discharge Tube, 2. Properties of Cathode Rays, 3. Properties of Canal Rays, 4. Radio Broadcasting and 5. Radio Reception. In toto there were fifteen instructional packages comprising five in each mode. All these packages were validated using three different standardized evaluation pro forma.
Instruction in the said content areas was given to the control group adopting lecture method while the experimental groups were given instruction in the same five topics using the specially developed CAI packages in different modes viz. Tutorial, Drill & Practice and Simulation respectively. As soon as the instruction in the particular topic was over, the posttest in the said topic was administered to the control and experimental groups. The MBTI was administered to the control and experimental groups immediately after the posttest had been administered in order to assess the learners' personality types. The same test administered as posttest was administered to the control and experimental groups as retention test one month after the experimentation was over.

The responses made by the learners to the posttest, retention test and the personality test were scored, tabulated and analysed using appropriate statistical techniques.

**DELIMINATIONS OF THE STUDY**

The delimitation of the study is as follows:-

1. The homogeneity among the control and experimental groups was established based on the scores of the pretest alone. But at the same time, the intervening variables such as anxiety, fatigue, motivation, attitude, personality and intelligence were not taken into consideration in doing so.

2. Only five selected topics in two content areas in Physics syllabus prescribed for Std XII. Were considered for the development of CAI packages in the study due to the vastness of the syllabus.

3. Considering financial and time constrains, it was decided to include only 140 students studying at Std XI in four different schools situated in Erode in the present study.

**MAJOR CONCLUSIONS OF THE STUDY**

The major conclusions of the study are stated as follows :-

1. There is significant difference between the Lecture Method and different modes of computer - based instruction viz. Tutorial, Drill & Practice and Simulation in terms of their effectiveness in realising the instructional objectives
in Physics at Std XII. Lecture Method is less effective when compared to the
different modes of CAI Packages in this respect.

2. There is significant difference among different modes of
computer - based instruction in realising the instructional objectives in Physics at
Std XII. Among the different modes of computer - based instruction, Simulation
is the most effective one while Tutorial is the least effective one in realizing the
instructional objectives in Physics. However, the Drill & Practice stands between
the Tutorial and Simulation in terms of its effectiveness in this respect.

3. The effectiveness of different instructional strategies in realizing the
instructional objectives is not influenced by the different levels of learners’
personality types.

4. The media effectiveness in realizing the instructional objectives is
independent of the personality types of the learners.

5. Irrespective of the learners’ personality types and levels of personality
types, Lecture Method is less effective when compared to different modes of
computer - based instruction in realising the instructional objectives.

6. Irrespective of the learners’ personality types and levels of personality
types, Simulation is most effective while Tutorial is least effective in realizing the
instructional objectives. But at the same time, Drill & Practice stands between
Tutorial & Simulation in terms of the media effectiveness.

7. There is significant difference between the Lecture Method and different
modes of computer based instruction in terms of their effectiveness in enhancing
the retention of what have already learnt. Lecture Method is less effective when
compared to the different modes of the CAI packages in this respect.

8. There is significant difference among the different modes of computer -
based instruction in enhancing retention of what have already learnt. Among the
different modes of computer - based instruction, Simulation is the most effective
one while Tutorial is the least effective one in enhancing the retention of what
have already learnt. However the Drill & Practice stands between the Tutorial and
Simulation in terms of its effectiveness in this respect.
DISCUSSION

The amount of learning could be enhanced if the knowledge to be learnt were broken into small pieces and each piece presented so clearly that the pupil could not make mistakes. At very slight immediate reinforcement at every correct response would have a tremendous effect on controlling behaviour. The arrangement of tiny bits of knowledge into a logical sequence is called the programme. The process is called programmed learning. Programmed instruction is a kind of game in which the learner can hardly lose. The more he wins the more he wants to win and the more he wants to learn.

Instruction leading to learning may be in groups or individualised. Individualised programmes consists of learning experiences specifically designed for the individual learner on the basis of diagnostic procedures employed to determine individual interests and needs. Individual differences which may concern ‘personality variables’ like traits and temperament, ‘cognitive variables’ such as I.Q. and specific abilities, inquiry variables like curiosity, experimental attitude etc., and sequencing variables involving random or logical sequencing of instructional information, demand individualisation of learning.

Computers have a major impact on how learners learn and teachers teach and also they provide direct interaction between learner and the subject-matter to be learned. Unlike earlier educational techniques most of which are washing out, computers are taking hold in the education because they are already transforming society itself (Bhatt 1998). Current studies in computer supported learning indicates that it engenders several positive outcomes which enhance learning (Jegede 1998). Any system, such as the school computer which provides a simulating alternative to the teacher may be perceived as a worth while and satisfactory substitute.

In education, computer takes a different role in instruction. In CAI, the role of the computer is mainly to provide many direct instructions in different modes to the learners. The CAI starts by identifying the way a learner seems to learn best. It reviews his past history of learning and then presents a programme built on his strength. Therefore CAI is not merely a sophisticated type of
programmed instruction but a different kind of instruction altogether. Learners’ learning rate is faster with CAI than with conventional instruction and also the retention of content learning using CAI is superior to retention following traditional instruction alone (Capper & Copple, 1985; Kulik, Bangert & Williams, 1983 and Kathleen Cotton, 1997).

The results of the study indicates that among the four instructional strategies viz. Lecture method and CAI in Tutorial mode, Drill & Practice mode & Simulation mode, the CAI in Simulation mode is most the effective strategy in realising the instructional objectives in Physics at Higher Secondary level. CAI is more effective when compared to the lecture method. CAI in Simulation mode is the most effective one in enhancing the achievement of the learners in Physics at all levels of cognition viz. Knowledge, Understanding and Application. The same trend is found also in enhancing the retention of the learners in Physics. These findings support the existing studies stated earlier (Capper & Copple, 1985, Kulik, Bangert & Williams, 1983 and Kathleen Cotton, 1997)

It is found that there is no personality influence in enhancing the achievement of the learners in Physics at all levels of cognition viz. Knowledge, Understanding and Application. It is evident from the studies conducted by Elsberry Jefrey Brain, 1995; Rangaraj, 1995 and Webb, Evelyn E.J., 1997. Hence the result of this study that the enhancement of achievement in Physics is only due to the media effectiveness. Therefore, it is evident that CAI can better be introduced in education at all levels for the successful realization of the instructional objectives.

RECOMMENDATIONS

With a rapidly changing educational and technological scenario in the modern world, the role of the teachers and teaching is changing fast wherein he/she is enshrined with the responsibility of promoting fruitful learning and stimulating the students by adopting appropriate strategies. Thus the present study has several recommendations to those who are interested in keeping pace with the scientific innovations and those who do not want to lag behind in this technologically developing world.
1. Among the four different instructional strategies viz. Lecture Method, Tutorial, Drill & Practice and Simulation, the last one viz. Simulation is found to be most effective in modifying the cognition of the students in Physics at std XI. It is also found that the three CAI strategies viz. Tutorial, Drill & Practice and Simulation are equally effective in modifying the cognition at knowledge level. The Drill & Practice is found to be the most effective one in modifying the cognition at application level of the contents. Where as the tutorial is found to be the effective one at all the levels of cognition. Hence, it is evident that CAI as a modern technology can be exploited for achieving different instructional objectives. Conventional lecture method is found to be inadequate in catering to the needs of all kinds of students due to individual differences among them. Hence, CAI in its different modes can be used as an individualized instructional strategy in the classroom for modifying the cognition of students in physics.

2. As the application of the different CAI modes viz. Tutorial Drill & Practice & Simulation is very effective one in the teaching-learning process, it is recommended that syllabus based computer software packages in physics be developed more in number.

3. It is recommended that the instructional software packages may be developed with the computer managed testing for the reason that it enhances the teaching-learning process with proper feed back to the learners at appropriate times. Further, it is recommended to introduce individualized examination and evaluation system by the way of introducing computerised test administration.

4. There has been increasing tendency among CAI experts to criticize other CAI materials on grounds of style. Criticism should be based primarily on education quality, not matters of style.

5. A wide range of important teaching applications may be fulfilled with relatively simple CAI systems so that further developments in this system may not deter us from the practical implementation of what is now affordable and feasible.

6. CAI materials may be developed keeping the teacher in mind and how he appreciates the role he has to play in bringing the programmes to life.
SUGGESTIONS FOR FURTHER RESEARCH

The present study has opened up many directions for future studies in the area of CAI, a few of which are given as follows:-

1. The study may be replicated for various standards and for different content areas in physics and other subjects to confirm the generalisability of the result and conclusions of the study.

2. Researches need to be conducted to study the feasibility in terms of cultural milieu, teacher acceptance, social status, sex, etc. of different information processing CAI modes of teaching as well as learning so that with certain modification they can be effectively used.

3. The effectiveness of the application of different CAI modes of teaching to various disadvantaged groups, handicapped, the gifted and the like may be studied.

4. Researches may also be undertaken to study the effectiveness of various CAI modes viz. Problem solving, Instructional games, Testing, etc.

5. Students' interest and willingness to study through the different CAI modes viz. Tutorial, Drill & Practice and Simulation and their effect on their motivation may also be studied in a longitudinal manner.

6. Researches may also be conducted to ascertain whether the use of audio input, output devices would change further educational application of computers.

7. The realization of higher level instructional objectives in teaching and learning of physics at higher secondary stage may also be studied in relation to different CAI modes.

8. The students' behaviour while learning through different modes of CAI may be studied with reference to the transcripts of the lessons transacted through the said media.

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