INTRODUCTION
CHAPTER -1

INTRODUCTION

Section A - Children and Computer - Assisted - Instruction

Human growth and development encompasses many facets of the individual human being, a person, as an integrated functioning organism across the life-span. One may deal with the various facets of development separately, tracing each through the individual life span. But the emphasis must be always on the interrelatedness. A truly developmental approach requires that the subject matter must reflect the interdisciplinary character of Human Development.

In this study the Investigator takes a holistic view of the child development, followed by a specific look at the developing mind during the primary school stage and the developing personality. These areas, the cognitive and psycho-social are given equal weightage in the study because children do not learn only with their minds. For education to be effective, emotions as well as intellect, feelings as well as thoughts should be involved. The principles of growth and development carry wide meaning for children, parents and teachers.

Children vary widely in their "developmental pace ", that is, some children develop in general faster than others. This is particularly, intra and inter-individual variation in developmental level and an important aspect of development in which children differ rather widely.

Knowledge of the principles of growth and development tells us that there are wide individual differences among children with respect to their rate of growth and development. Therefore one must pay attention to their pattern and growth
rate while **planning courses** and **instructional strategies** for their education and development.

This knowledge helps us to know what to expect and when to expect from an individual child with respect to his physical, mental, social development etc, at different stages of development. The correct knowledge of growth trend of a child helps the parents and teachers not to under or over-estimate the future competency or expectancy of their child.

In the context of these reasons mentioned above the investigator proposed to take up this work related to the **interactive aspects** between the **educational system** and the **children** i.e. the **teaching strategies** adopted by the teacher and the **learning styles** and performance patterns of primary school children.

In this regard it is essential to draw upon some clues and cues from the works of early authors who have made significant contributions in the comprehensive field of education as their impressions would provide leverage for chalking out a scheme for experiments to quantitatively assess the "synergy" between the **teaching** and **learning** processes.

Jean Piaget observed the nexus between the twin processes of accommodation and assimilation which are internalized cognitive processes, relevant in designing teaching strategies for children.

One of the principal aims of the teacher will be to present situations to the child which require him to adapt his past experience. The teacher is concerned with facilitating adaptation and assisting the child along the developmental path. The teacher, in this sense, is the organizer of the learning situations in which old experiences can be accommodated to new, and these learning situations are
forward looking. The teachers' aim will be to encourage the child to apply his knowledge to situations hitherto unknown and at the same time to encourage him to use familiar actions in unfamiliar contexts. The school is therefore the place where developmental situations are contrived to the best of the teachers' ability, and is also the place where the child can organize, unconsciously, his own adaptation. It is a place for both structured and unstructured situations.

Vygotsky (1978) a Jewish psychologist has enunciated two areas of development for children.

1. **The area of current development** - includes all that children can be trained to learn to do at that point in time.

2. **The area of proximal development** - wherein children can be allowed to grow to the stature that they can, or can be trained by the adults to reach the highest potential that his personality can permit.

**What does this imply for teaching?** Teaching is effective when it is based on the next stage of the child's development rather than on the current stage of development. The instructor must be knowledgeable about child development in order to predict the learner's development. The instructor must also provide educational materials and content which go beyond the child's capabilities. The teachers' role is not that of simplifying the content, but of providing unfamiliar content and the setting for learners to step from their current level to a higher level of understanding.

Educational psychologists point out that every child is unique and has different curricular needs and readiness levels. A teacher sees a great variety in a single class containing children of the same age. Some children are more intelligent than others, some will be more mature than others. These differences make each child
unique rather than dull carbon copies of others. An understanding of these individual differences is essential for the teacher to match the instruction to the needs of the individual learner.

However, due to the largeness of the class size in the schools today, it is impractical or is not humanly possible for a teacher to tailor lessons to each student. It is commonly seen in any conventional classroom situation some students require additional explanations, while others have already grasped the material and are ready to go on, whereas teaching usually progresses at the average level of the class. Poorer students are left with their doubts uncleared and the brighter students miss exciting challenges. Hence it is important that in a classroom situation, learning of one individual should not be hindered by the abilities or weaknesses of the others. Each student should be allowed to learn at his own pace. There are a variety of possible ways for self-pacing. The techniques for individualizing instructions may be self-study, programmed instruction (PI) and computer-assisted-instruction (CAI).

Hence, **individualization** of instruction is **the need of the hour**, in order to benefit all kinds of students alike.

Why should instruction be individualized? What is wrong with teaching the same lesson to a group of students at the same time and in the same way as it is usually practiced in the conventional classroom method of teaching?

**Conventional method of teacher-instruction (TI) in the classroom:-**

In the conventional method of teacher instruction a single teacher addresses a heterogenous big class (for e.g. 40 to 50 as the case may be). It is very difficult for the teacher to access mentally each and every student. The teacher normally caters to the average class by focusing all her instructions to the level of the average
students. He/she uses the "chalk and talk" method along with one or two teaching-aids (normally a specimen or a chart) to drive home the essential points in her instruction. Conventional method of teacher instruction is not designed to stimulate the below average and the bright child alike, as it is not possible for a single teacher to teach a class without boring some children and leaving others behind.

Educators have become increasingly dissatisfied with the group approach in trying to reach children who may be grouped together in a single class but who are, inevitably on many different levels of achievement.

Different children, in short, have different learning styles and different goals; they learn at different rates. Individualized instruction based on this premise, is designed to stimulate the slow and the bright child alike, to make it possible for a single teacher to teach a class without boring some children and leaving others behind.

The heterogeneity in the background of the students, the largeness of the class and the different levels of comprehension of the students, render the conventional method of classroom instruction somewhat formidable as it is very difficult to cater to this bewildering variety. Hence the following methods can be adopted.

1) **Self study:**
   In this method both the goals of the program and the steps to get there are left to the students' discretion.

2) **Programmed instruction:**
   In most of the programmed instructions both goals and steps are fixed by the teacher, but the student moves at an individually different rate of speed. Programmed instruction is a self-tutoring technique of moving by convenient
and sequentially arranged steps from old knowledge to new knowledge. With programmed instruction the individual can advance in the study of a subject at his own individual optimum rate.

Experimentation has established that programmed techniques can be effective in teaching logic, mathematics and languages; improving the Capacity to recognize distinctions and alternatives; teaching reasons and explanations as well as conditioning for correct responses; providing for student independence in the choice of subject matter and goals as well as in the determination of learning speed; and cultivating high learning motivation in the student.

Properly employed; programmed instruction can free the teacher from much routinized work and can contribute to the conditions necessary for the non-graded school that would overcome the present lock-step method of pupil achievement.

**Computer-assisted-instruction (CAI):**

Computer-assisted-instruction is a way of individualizing instruction by using capabilities of the computer to provide interactive experiences. (Encyclopaedia of Education)

There are two distinctive points of view regard the use of computer in general education. One is that computer-assisted-instruction facilitates instant access to information with infinite patience and accuracy, and it provides an opportunity for systematically organized maximum learning for all learners.

In short C.A.I covers the whole educational spectrum and is gaining more recognition as an important and useful tool in the teaching of various subjects.
Based on the above mentioned methods a plan of action was embarked upon to expatiate on the interactive effects between the teaching strategies and learning styles, the study was conducted in a sequential manner to include design and methods with a focus on the expected outcome.

The present study envisaged the classification of the variable under 3 categories namely **Student-related-variables**, **Computer-related-variables** and **Environment-related-variables**. (Schematic representation-fig. 1 -supra Page No.)

The student-related-variables selected for the study are

a) Age  
b) Sex  
c) Students’ preference for working with the computer,  
d) The personality traits of the students as tested by the Cattell's C.P.Q (14-P.F).

**The Computer-related-variables** selected for the study are

a) **The students' exposure to computers** at home as well as outside sources  
b) The students’ **knowledge about computers** through T.V, Books, Magazines, Newspapers.

**The Environment-related-variables** selected for the study are:

a) Socio-economic-status of the students' family (per-capita income)  
b) Fathers' occupational category and  
c) Mothers' occupational status.

Based on the above the investigator has formulated null hypotheses for verification.
Research Design:
The sample comprised 210 students (116 boys and 94 girls) from Std v from two schools in Chennai. The selected two lessons in Biology were taught to all the students. Suitable commercially available software were used. All the students were taught through C.A.I and T.I. using "Double-Group-Rotational method".

The students were given a teacher-made, paper-pencil, objective type test immediately after the instructional sessions. The performance scores (P score) under both methods of instructions were computed and statistically analysed. Score Differentials of students between the two methods were computed.

For the qualitative aspect, to all the 210 students "Cattell's C.P.Q (14-P.F)" was administered to collect information regarding the personality traits of the students. Besides, general information related to the background of the students such as age, sex. Parental occupation, additional exposure to computer, having a home computer, etc, were gathered by administering an investigator made questionnaire to all the students.

In order to study whether there is any association between the score differential of the students and all the above mentioned factors, the score differential of the students was statistically analysed for it's association with each of the above mentioned factors.

Interactive Sessions were conducted with the chosen 30 students, (15 students who had the highest score differential in favour of CAI and 15 students who had the highest score differential in favour of TI) to incorporate their view points on the CAI method of instruction into the qualitative data.
Focus-Group-Discussion was conducted with the chosen administrators, teachers and parents whose children have undergone CAI to elicit their opinions about the CAI method of instructions and their opinions were incorporated in the analysis of the qualitative data.

Research questions and the conceptual issues:

- Are there indications that students' learn and perform better with computer-assisted-instruction rather than conventional method of teacher instruction in the classrooms?

- How does Computer-assisted-instruction with a 1:1 ratio of one computer to one student compare with the conventional method of teacher instruction in the classroom, which is based on one teacher to a large group of students with regard to students' performance on a teacher made test?.

- Are there any differences among students based on criteria such as Age, Sex, Students' preference for working with the computer (i.e. individually, m pairs, or in groups), personality traits of students, Socio-Economic Status of the family. Fathers' Occupational category, Exposure to computer from sources other than school, who fare differently on computer-assisted-instructions?

These are the research questions the study addresses. The present study aims to study the effect of computer-assisted-instruction (C.A.I) on the performance of primary school students in one science subject viz. Biology, as compared to the conventional method of teacher instruction in the classroom.(T.I) The study dwells on two aspects **Quantitative performance scores** and **Qualitative attributes**.

What are the expected inferences?
The investigator proposes a triangular paradigm for focusing the cross impact among all the three interactive reflective cluster of variables.
The clusters may be individually interactive or the components in each cluster may have synergistic effect on the components of the successive clusters.

All the three clusters placed at the vertices of the triangle would have positive influence on the over-all performance of the students.

This performance parameter would be placed at the centroid of the triangle representing the equilibrating position, which is vital to the growth and development of the students.

**Section B - State of the Art**

Section II of the Introduction deals with the various aspects of CAI and different modes through which CAI operates. CAI systems interface with the social aspects of human interactions. According to Swick (1989) this Human-Computer interface, used in a proper manner can strengthen their playful attributes. Beaty and Tucker, (1987) note that social skills are actually the main benefit of this technology for young children. Various approaches and terminologies related to CAI are discussed in this chapter.

**Origin of CAI:**

The origin of C.A.I could probably be linked with attempts made by some technicians to see if a machine could be programmed to interact with a human being. In the beginning, very simple programmes were tried out on machines, such as printing of pre-stored questions, accepting multiple-choice answers, and
made around 1961 when the University of Illinois produced the programmed Logic for Automatic Teaching Operations (PLATO).

The second landmark in CAT was the development of computer tutorials in arithmetic and reading for elementary school children by Patrick Suppes of Stanford University in the year 1966. At present almost all large universities have installed computers. In India the trend is catching up very fast, in that almost all universities, most of the colleges are using computers in education and gradually a large number of schools are showing interest in exploring the possibilities of using computers.

**CAI in India:**

Realising the importance of computers in Education, the Department of Electronics and Education of the Government of India launched the pilot project "Computer Literacy" and conducted research studies in Schools in July 1984 in 250 schools spread all over India. Now more than 2000 schools have been brought under this project. The CLASS programmes is comprised of about 30 lectures each of one hour duration and 30 practical sessions each of two hour long.

The main objectives of the CLASS project are as follows:

1. Providing students with a broad understanding of computers and their use.

2. Familiarising students with the range of computer applications in all walks of human activities and potentialities of the computer as an information processing tool.
3 Demystifying computers and developing a degree of ease and familiarity with computers which would be conducive to developing individual creativity in identifying and developing applications relevant to the immediate environment of the child.

In the first phase about 250 schools were brought under the project and simultaneous efforts were made in some selected institutions to experiment with Computer-Assisted-Instruction and learning. The implementing agencies included CMC Ltd., Department of Electronics, Ministry of Human Resource Development and NCERT. The proposed future plan envisages coverage of CLASS project for all senior secondary institutions, supply of two to five systems to each school. Switching over to PC compatibilities and resource support to schools through regional and District level resource centres.

Around 30 Jawahar Navodaya Vidyalayas and 20 Kendriya Vidyalayas were covered by the Computer-Aided Project for strengthening of teaching modern Biology and Biotechnology. The major aim was to combine conventional teaching with interactive technology.

**CAI system and its mechanism:** Basically a CAI system is described in terms of its 'hardware' (the machine), its software (the programmes), its communication links (the devices which allow learners to use the hardware and software), and its curriculum (teaching material stored in a computer). The CAI system has been utilised at all levels of education, ranging from the elementary school to the postgraduate study to on-the-job training in almost all the subjects.

In a CAI system in an elementary school, the child sits in front of a tube that resembles a television screen. In front of the tube is a key-board that the child can use to respond to the problems shown on the screen. There is a Mouse which is attached to the computer which the child can use by clicking it, in order to move
on to the next part of the instruction. The hardware of the computer has two drives, A Floppy drive and a CD. Rom drive for inserting either a Floppy or CD. Rom in which the lessons are stored. There are two speakers attached to the Multi-media computer which amplifies the sound. Headphones or Earphones are attached to the computer, which each child can wear in order to hear the soundtrack of the lesson while he is learning. The computer is connected to the main and is 'switched on'. The CD Rom or Floppy is inserted in to the appropriate drive to begin with. The initial commands are given to the computer to select a particular lesson from the software which is to be displayed on the screen. The software is generally "user friendly" so that with a minimum pressing of the keys or with the clicking of the mouse which is placed on a mouse-pad, the child can proceed learning with the lesson, by simultaneously viewing it on the screen and by hearing the soundtrack of the lesson. Teachers can assist children whenever they need help by acting as facilitators. The software provides an option to repeat certain portions of the lesson, in case the child has not understood it thoroughly and would like to repeat learning the same. Each child can proceed with the lesson at his own pace, hence both the bright children as well as the slow learners can benefit equally. A good educational software has a lot of in-built reinforcement for the children to be motivated while learning.

**Multi-media technology:**

"Multimedia is a class of computer-driven interactive communication systems which create, store, transmit and retrieve textual, graphics and auditory networks of information" - Gayeski (1992)

Multi-media refers to transmitting of information to the pupils through more than one medium in a single communication either sequentially or simultaneously. Multimedia instructional technology refers to the instructional strategy Multiich
incorporates a medium of two or more than two media in its instructional process as to enable the pupils to achieve predetermined and desired behavioral objectives.

The Multi-media packages used in the Multi-media instructional strategy provide for considerable visualization of objects and processes which are essential for formulation of concepts. According to Educational psychologists, what impact a visual presentation can do, any amount of verbal exposition cannot do. Moreover, in a fast developing world, where knowledge explosion is taking place in every sphere, it is unreasonable to expect that the spoken or written words alone could convey the volume of relevant information to the learner. Multi-media packages provide unique experience to the learners in the presentation of the content. These Multi-media packages can penetrate more deeply into the minds with an immediate excitement than any other single medium. The dual effect of the audio and video strengthens and enriches the understanding and expedites the mastery of the concept. Realizing the importance of Multi-media, the National Policy on Education (1986) emphasizes that the modern educational technology, in general, should reach out to the most distant areas and most backward sections of beneficiaries. Educational psychologists believe that Multi-media educational strategy caters to individual differences by providing feedback correctives as well as allowing the learners to learn at their own rate without any inhibition unlike as in the case of learning in a traditional classroom setting.

**Modes of instruction:** There are several different modes of instruction. They involve different relationships between students and the system and identify different patterns of interaction. They also differ in other respects. For example, the primary control of an interaction can vary. The author can design an interactive programme so that control rests with student, the teacher, or the system. It is also possible to give the student and the teacher control of the learning experience at different times or for different kinds of decisions.
Problem-solving: One mode of instruction is problem-solving. In problem-solving the control of each experience lies with the student. To use this mode, the student has to learn a computer language in order to feed both his data and the programme into the computer to be processed. In the problem-solving mode the student uses the CAI system to solve problems and supplies the logical analysis of the solution. The teacher's control exercised in assigning problems for which the logic of the solution is a more important educational objective than is the skill of calculation. This mode is used mostly in mathematics and science.

Inquiry Mode: A CAI system can be used to find facts, concepts, or useful information. In this retrieval or inquiry mode the CAI system has stored within it data that can be presented to the student in meaningful and useful segments when he requests it. With the simplest systems he does this by dialing a number or a typing code or abbreviation obtained from a reference source. His entry causes the system to secure and display the information that answers his question. Somewhat more elaborate are systems which permit the student to type his inquiry in his own words. To process these inquiries, the system has to be designed to identify a group of key words as either an ordered or unordered set. It then retrieves the information that has been stored.

Drill and Practice modes: In the Drill and Practice modes, exercises or problems are stored within the system and presented to the student either on his request or as decided by the teacher or author using a contingency rule or set of rules. Both drills and practice materials are structured by the author, and they are designed to produce very specific learning effects, such as no errors or materials primarily in the locus of the decision to begin and to stop working. Drills are system controlled; practice materials are student controlled.
Simulation: Another teaching mode is simulation. In simulation the CAI system puts the student through an experience that resembles a natural experience. For example, the student may experience a CAI simulation of a specific scientific phenomenon, such as the effect of temperature and pressure on the volume of gases. He may do this by entering a new pressure and temperature into a system and receive a reply which tells him the resulting volume for the changes in temperature and pressure inserted. In so far as the system provides an output that conforms to the phenomenon as it is in the real world, the student, through the control of the input, experiences an effect which he could have obtained by other more natural means that frequently take longer to achieve—for example, a laboratory experiment. It is possible to simulate the mixing of chemicals and the laboratory manipulation of gases, falling objects and electric current. Also, the operation of a complex device such as an aeroplane or even a computer can be stimulated. Thus, in a shorter period of time than a real life experience would take and with less risk, the student can test his thinking about relationships or his skill in responding to events. He can learn how complex system develop and work, how to control them, or to manage them in an effective way.

Tutorial mode: In the tutorial mode of interaction, dialogue is used extensively. Sometimes this mode is called the Socratic approach. It is patterned after the procedure used by Socrates in teaching a slave boy in the Meno. The student is taught by being asked questions which are contingent upon his previous replies. The students' answers are interpreted by the CAI system, and branching is used to provide learning experiences. Branching is the selection of an option from a set which depends upon the students' response. A new question or item of information is his next experience, and he responds to it. The tutorial mode of CAI has been
extended so that the Socratic dialogue is no longer a sufficient model.; the tutorial mode includes an interaction in which information is presented to the student and the branching decisions are based not only on his response to parts of the programme but also upon other information. This is a diagnosis-prescription paradigm. With this paradigm, the data for the branching decision may be a particular segment of the student's response to history, his knowledge as determined by tests, or his aptitude, personality, preferences, or areas of interest. In the tutorial mode, programming follows the "if ...then..." form (the contingency pattern), the basis of which can vary from response to response or from a segment to segment. Conditional relationships can be quite elaborate, not only on the "if side but also on the "then" side. A variety of media may be available when CAI is used—for example, audio tapes, films, slides, and printed materials. In addition, the tutorial mode can branch to any of the previously described modes as apart of the students' instructional experience. Consequently, this mode can be thought of as superordinate to those previously described.

Advantages of CAI:

There are several advantages as well as limitations in using CAI method as an integral part of an instructional system. They are as follows:

> CAI method individualizes instruction, i.e. each student is free to learn at his own pace. Hence it benefits the gifted children and the slow learners alike.

> CAI can provide a method of instruction suitable for self-study. Hence, it helps in improving skills or achieving objectives at all difficulty levels.
> CAI enables active participation on the part of students, rather than being a passive observer as in conventional classroom instruction.

> CAI provides immediate feedback correctives. This enables the students to understand the concepts, before proceeding to the next part of the lesson.

> By enabling the students to manipulate concepts directly, and explore the results of such manipulation, it reduces the time taken to comprehend difficult concepts.

> CAI saves time and labour for teachers as well as students, as teachers need not waste their time in arranging same instructional experiences, forming questions for every student, evaluating them at every learning stage.

> CAI provides multi-sensory experiences to the students through audio, animation and graphic effects which make learning more interesting for them.

> CAI is very useful in providing simulations, when a real situation would be time consuming, costly or not available to be brought in to the classroom. In situations where conventional classroom demonstration is not possible, CAI proves to be of tremendous significance.

> CAI could enhance reasoning and decision making abilities.

> Learning could be made fun through CAI for the students.

> CAI reduces fear for the teacher and ridicule by the peers

> CAI could be highly motivating for the students to perform well provided, the software is built with a lot of positive reinforcement.
> Students who use CAI as a learning method could become increasingly self-directed in their learning style. They may become more responsible for learning and less dependent on teachers as they learn to control their own learning situation.

**Limitations of CAI:**

Though CAI has a lot of advantages it has some limitations as well. Some of the limitations of CAI are as follows:

> CAI method cannot become integral part of the educational process unless, the Educational software is prepared based on the Educational objectives.

> CAI method cannot develop manual skills such as handling apparatus, working with a machine etc.

> CAI is an expensive method, since the Hardware and Software investments are heavy on the part of the Educational Institutions. If the staff were to make their own educational packages, in their relative subject areas it would consume a lot of their time and energy.

> If the content covered by the educational package becomes outdated, high costs involved in the development of the package would become a waste.

> CAI method cannot provide the human contact, with care and the warmth, which only a teacher can provide in the conventional classroom method of instruction.

**Problems related to the use of CAI method:**

> Motivating and training teachers to make use of computers in education is a challenging task. They may have fear for this new device. They may be
unwilling to spend extra time for the preparation, selection and use of CAI packages. It may be perceived as a threat to their jobs.

> CAI packages may not fulfill expectations of teachers’ objectives and methods decided by the author and of the teacher may differ.

> There are administrative problems associated with computer installation. The problem particularly relate to the physical location of the computer resources, the cost of hardware maintenance and insurance and time tabling.

> Quality courseware demand a team approach. Expertise required for developmental process is from different fields such as teaching, programming, hardware engineering, subject expertise etc. They may face problems in coming together for a long time.

> The rapid development of hardware makes it difficult to select a system before it becomes obsolete. If a new system is installed by maximum institutions, they may not get courseware required for the system and courseware developed so far may become useless.

To overcome many of the problems related to CAI a lot of educational software has to be developed. A number of such software are being prepared by experts in various fields. For their wider use, they should be validated.

Self-teaching modes: With the self-teaching modes, the computer can allow students different degrees of control. In addition to the problem-solving, where the student is in complete control of the logic used to obtain an answer and inquiry, where he asks questions, a CAI system can be programmed to allow the student
other opportunities. For example, he may want to review material, to explore, or to browse.

**Appropriate use of Computers with Young Children:**

Computers could serve to function as unique parts of a quality early childhood education programme. Beaty and Tucker (1987) point to the following as appropriate instructional functions the computer can meet: manipulation, mastery, and meaning. For example, from the very beginning of the computer experience, children learn to use finer motor skills to manipulate the keyboard, a joystick or a touch-screen in drawing, painting, printing or puzzle activities. Also, as children "play" with even the simplest programmes they quickly master the pattern or mode of the concept presented. This allows them to acquire some perspective on cause-effect relationships and to gain confidence in their problem solving efforts. Finally, as children master the rudiments of the "computer Environment" they initiate their own ideas in relation to creating new and more exciting activities than might exist in the software itself. Swick (1989)

Play is often referred as the "child's work". Yet Brown (1987) notes that play is really a "mindset" that includes a sense of pretend, internal motivation, openness to new experiences, process oriented, and inherently enjoyable. Swick (1989) opines that, used in the proper manner, the computer can become a medium for strengthening children's playful attributes. While the emphasis is often on the cognitive power children can gain from the computer. Recent researches by Sweetnam,(1982); Isenberg,(1984); Beaty and Tucker,(1987) note that social skills are actually the main benefit of this technology for young children.
Social Aspects of Human-Computer Interaction:

According to Lynch (1990) there can be little doubt that there is a social relationship between humans and many of their tools. He claims that people define themselves in terms of their primary tools and often develop intensely personal relationships with them. Consider how adolescents feel about their automobiles, or musicians about their instruments; we assign names to objects, yell at and cajole them, sleep with them, and often allow them to supplant more difficult relationships with other humans. The 'intelligent' roles filled by computers as experts, teachers, knowledge engineers and problem solvers is prima facie evidence that these machines are more than just tools. If we admit that humans and computers do have a social relationships, we must recognize that there is a community of computers and humans which can be constituted and studied as a social group.

The computer is a reflective medium, in some ways similar to other reflective media like films, television, radio, recordings paintings, even books. Reflective in this case means that the medium carries forth certain personal characteristics of the authors, directors, performers and editors responsible for production. Computer hardware and software production is the result of enormous effort on the part of authors, engineers, programmers and even marketing people. A particular computer, it's basic operating system and any software which will work on that computer reflect an individual's, or group's personality, values, believes and life experiences in some combination. Thus, when the user interacts with the computer he/she is interacting with the physical device, to be sure, but more so with the designers of the apparent intelligent behaviour that a machine displays. The designers all have racial, gender, class, economic and philosophical characteristics which are predictably reflected in the work they do and the products they create.
If other communication mediums are reflective, what then is unique about computers such that it elicits powerful responses from its users? Books certainly evoke emotions, elicit responses and convey the personality and experiences of the author, as do television and radio productions. Computers however, represent, the only reflective medium which is also interactive. Books, films, recordings and television are one-way communication devices. While each can elicit a response from the user, none can respond specifically to that user; whereas a computer with appropriate software can respond in innumerable ways to the varying responses of the user. Only living things have similar capabilities and it is precisely this characteristic, this similarity to 'aliveness', which allow the relationship to be established between human and machine.

**The Human-Computer Interface:**

Human-computer interaction not only involves the physical point of contact; it also includes temporal, spatial, cultural and experiential contexts. The human-computer interface is different if one computer is shared by thirty students compared to one computer for each of thirty students. Computers may also only be available at specific times and for specific purposes. Furthermore, the beliefs held about computers, ideas about the roles they should and should not play and the perceived threat or benefit which is offered are also part of the interface. In other words, in addition to the obvious differences in the interface at the physical level, there is a unique dimension to the interface that occurs because individuals encounter it with different backgrounds, attitudes, and believes.

**Group size for Computerized Instruction:**

When students work at the computer, it is assumed that, the ideal situation would be to have each child seated at an individual computer. There is no evidence that
such isolated work is always beneficial. Quite the contrary, for learners at all ages and ability levels there are many instances in which small-group use of the computer is preferable to solitary activity. In addition there are many cases when it is desirable to have an entire class work together with the display on a single computer screen.

Vockell (1989) stated that when students work alone at computers, the following disadvantages are likely to occur: 1) the social isolation involved can create mood states (such as loneliness, boredom, and frustration) that interfere with sustained effort to complete learning tasks; 2) students are denied the opportunity to summarize orally and explain what they are learning; and 3) computers cannot provide social models to be imitated and used for social comparisons. Proper grouping at the computer can help overcome these difficulties.

Students can work in groups in three distinct ways with the computer. Individualistic learning occurs if students in a group simply take turns at the computer, without much concern about the performance of the others in the group. Competitive learning occurs if the students compare their performance with others and strive to do better than others.

Co-operative learning occurs if students work together to try to help one another, do well at the computer. Although all three of these approaches can play a useful role at various times in education, some current research suggests that the co-operative approach is often the most productive.

According to Vockell (1989), the key components of effective co-operative learning are positive interdependence, individual accountability, and shared responsibility for one another's performance. This means that the success of a co-operative group requires that each person must have a role and be accountable for that role and that the individual members must be interested in helping one another.
attain important goals. Closely related to the concept of co-operative learning is that of peer tutoring. Research on this topic (Cohen, Kulik, and Kulik (1982) indicates that when students tutor their peers, both the tutor and the tutee benefit from the process.

**Girls and Computer Technology:**

Conscious or unconscious sex bias does exist in many of the cognitive and affective classroom interactions between teachers and students. Barriers of negative perceptions still exist to a certain extent, among parents and teachers towards girls in terms of their aptitude for mathematics, science and computer technology due to sex role stereotypes. But now girls can no longer be passive recipients of mathematics, science and computer technology instruction. Technology and media exist to meet their different learning styles.

Today the classroom scene is changing globally. Barriers of negative perceptions and lack of training are being removed. More women are teaching mathematics, science and computer technology and are working in business and industry. Girls are building self esteem, are changing their perceptions and are beginning to have new role models. Society is recognising the strength and benefits of a well-trained, diverse workforce.

**Role of Administrators:**

The Administrators as instructional leaders must be supportive of C.A.I programmes. They must be convinced that the change will benefit the students, teachers and the institution as a whole. They should personally make efforts to get empowered with the advancement of technology. The Administrators should encourage staff development efforts through preservice and inservice teacher
framing programmes. They must ensure that the teachers and students should have adequate access to computers through the provision of additional resources.

**Staff Development Efforts:** Successful staff development on technology must restructure our vision of what education can be and help us implement strategies that will make it more relevant to future educational needs. In short, staff development must prepare educators interested in the use of technology tools to be advocates of larger vision that values but at the same time recognizes that technology is only one of the components that need to be restructured. Major curriculum, assessment, and instructional design modifications also must be made before information-rich, more individualized, and self-fulfilling educational supports can be created.

A major consideration about quality technology inservice training is that strategic planning and decision making must be the first step. Strategic planning and decision making requires: 1) Clear examination of the rationale as to why those particular framing opportunities are being offered; 2) The benefits of the inservice training available to participants; 3) The intended benefits to students; 4) An understanding of how these efforts support other long-range goals; and 5) Plans for how the initiatives will integrate into the curriculum and instructional priorities of the schools. Institutions.

Sound staff-development efforts need to be research-based and more focus on specific learner outcomes appropriate for the participants whose needs have been clearly defined.

According to Valdez (1989) there are at least three stages that most people experience when learning to use technology for educational improvement. The first is awareness of what software packages are available in the content or subject
area the teacher is responsible for teaching. This stage is characterized by skepticism/interest about the capability of technology and it's value to students.

The second major stage is concerned with adoption, implementation, and integration. The needs of teachers in this second phase center around curriculum integration, instructional design, research findings, and software/hardware availability.

The third major phase is concerned with refinement, adaptation and new vision. Usually the best resource people for this in service phase are exemplary teachers, instructional designers and visionary people capable of inspiring and stretching participants to go beyond the existing software and exploit their own creativity.

**The Role of Teachers:** With the emergence of Technology in Education, the focus on teacher training becomes inevitable. The success of CAI in Education depends on the teachers' competence in using existing methods and adapting to future developments. Few models of instruction exist to assist in providing delivery system necessary to prepare prospective educators for successfully using technology. Predicting how teachers will use technology in the future and preparing them on using such technology today is a very difficult task. Two fundamental goals in preparing teachers are in the application of products and understanding the processes.

**Products:** The products of technology refers to the teacher's ability to *apply* technical skills to produce a desired result. For example, a classroom teacher must be able to understand how to use a microcomputer and a specific software package. Technical knowledge changes rapidly. Despite the likelihood of technical skills becoming obsolete, the teaching of specific products must remain a goal, since they provide a practical foundation for the understanding of the process of technology in Education.
Processes: A teacher's knowledge about technology must go beyond the application (hands-on-experiences) of products to the understanding of the processes (theoretical investigation). The teaching of the process of educational technology must include not only the technical aspects, but also the conceptual skills required of a teacher in the information age. The conceptual skills, teachers must understand are the limits, extensions, and the future of technology. The processes of Educational technology do not change as rapidly as do the products. Processes are modified with innovations and usually remain a constant within compatible hardware and software. A broad understanding of the processes should enable a teacher to apply technology in a number of specific situations.

The Role of Parents: While schools can foster children's interest in computers, parents hold the key to unlocking the true potential of this learning environment. The essentials of a high-quality early learning setting, such as warm, positive parent-child relations, secure and interesting surroundings, and a safe and healthy context, are irreplaceable and must always be at the centre of children's lives - (Swick, 1989)

It is important that children have a positive attitude towards the computer; parental modeling of the enjoyable aspects of this learning tool sets the stage. A positive guided introduction to the care and use of computer environment promotes many useful self-discipline skills in children and establishes a basis for their viable involvement in later school-based computer learning.

Parents and teachers are "bridge builders" for children. Together, parents and teachers can strengthen the fabric of children's learning mosaic. Using the world of technology as humanizing force, adults can unleash new dimensions of a society committed to both quality and equality. - Swick (1989).
Role of students: Students must understand that their new role of learning from the computer involves additional responsibility of taking control of their learning situation. They should approach the new method of learning without inhibition or fear. They should perceive the teacher as a guide in the learning process. They must evince genuine interest in learning from the computer on their own, at their own pace.

The above state of the art has thrown light on the methodologies, strategies and approaches to be deployed for making judicious experimental investigations both from the technical, technological and psycho-social angles, thereby projecting the relative scenarios of CAI and TI. This study will also reveal whether CAI and TI are complementary or contradictory. The results of the investigation have been expounded in the Results and Discussion Chapter.