CHAPTER I

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1.0 INTRODUCTION

The present educational set-up has been challenged by the technological advancements. On the one side, there is a rapid growth in science and technology but on the other side there is snail pace development in educational applications. New avenues of knowledge are opened up almost daily. With the new millennium being an era of ever growing InfoTech with sophisticated tools for learning, there is indeed a hope to revamp the system of education at all levels of teaching.

"In general education is now undergoing a revolutionary transformation based on the application of scientific technology to instruction"( KULIK and BANGERT, 1984).

Innovations in pedagogy and educational technology, would certainly balance the gap in learning that arises due to physical, economical and social factors.

The phenomenon of learning, that is the act of acquisition of knowledge, skills and aptitude, are fundamental to a person’s development. Learning is self responsibility of an individual to learn. It takes place with one’s own motivation and interest. One may learn by oneself through reading, writing, observing, listening and discussing, through video, computers and other technological
devices. Different persons learn at different rates with different stimuli and in different environments.

The present educational system stresses on memorizing facts rather than understanding "why". The learning has, therefore, to be shifted to in-depth exploration of concepts to enable "learning to know" to result in "learning to learn". Once "learning to learn" is acquired, the purpose of education is fulfilled.

Teachers often make the assumption that learning is automatically taking place when they teach. Teaching is often confused with the teaching-learning process, which should ideally be happening in every classroom across the globe. In the vast majority, learning is assumed to be a passive process of knowledge acquisition with predictable and measurable outcomes.

Education Commission (1968), states that the destiny of India is shaped in the classrooms. Children of today are the leaders of tomorrow. The investment in education in Human Resource Development (HRD) is the basis for all other developments. In this responsible process of teaching and learning - in other words - instruction - plays a vital role. We have just entered a new era of Cyberage. Challenges facing education force the system to look into alternate strategies. With the scientific and technological advancements taking place by leaps and bounds, changes are inevitable in every field, including education. With the advancement of modern techniques in instruction such as computer network, Internet, television, and cell phone, acquisition and processing of information have
acquired new, stunning and varied dimensions. Hence classroom instruction has to compete with mass communication media for the dissemination of knowledge. Therefore teachers are compelled to change their time honoured methods of instruction so as to educate students on a wide spectrum of access of knowledge. This, in turn, raises an important question, whether in the long run technology will replace a classroom teacher? The answer is definitely not but one thing is certain: that nothing can substitute the face-to-face interaction in an ideal classroom environment. The question that naturally follows is: do we have an ideal classroom situation complying with all principles of best instructional principles? And do we encourage interactive learning in the present one way system? Various attempts are made to find answer to this question and the present study is one such attempt.

In the cyberage, the explosion of knowledge and transmission of information are so fast that science and technology look to artificial intelligence to supplement or complement instruction. The conventional assumption regarding the traditional role of teacher is expected to be altered, as cautioned in the Programme of Action in the National Policy on Education, 1986 to enhance manpower development. The teacher is expected to rise to the occasion, develop gradual technology compliance, and make earnest efforts to apply the principles of information technology in education particularly in classroom instruction.
When the society is in a stage of transition and various agencies are vying with one another in becoming exporters of knowledge, can we think of strategies to be followed by well-defined mechanism to hone up our core competency of thinking and learning so that India can become “Knowledge Society” by the year 2008 as envisaged by our Prime Minister. The important tools in this purpose are “knowledge creation and knowledge exploitation”.

1.1 TEACHING AND INSTRUCTION

‘Instruction’ is also one of the activities related to the teaching. Sometimes we term instruction as teaching. But instruction and teaching are not the same. There are many examples which convey us that the instruction is not included in the teaching such as, when the activity to teach a dog to stand on feet or to sit down or to bring some object, it would be wrong to term it as ‘providing instruction’ or ‘providing guidance’.

Whenever we happen to provide instruction or guidance, it means we are performing the task of teaching. But when we are teaching, it is not necessary that instruction too is included in the teaching.

Under instruction or guidance, causes are explained, and evidences are supplied. In short, instruction or guidance are concerned with understanding. In training, more attention is paid towards habit formation and behaviour development, and less towards the acquisition of knowledge. Hence, the instruction activity is only small part of the comprehensive concept of teaching.
Instruction cannot reach to the high level of teaching. The teaching includes the presence of the teacher, participation of the pupils and their activeness, while these are not essential in instruction. Instruction is possible through radio, tape-recorder, television etc. In the teaching task, such type of hardware material related to the instruction can be used. Hence, all the activities related to the instruction can be included in the teaching process, but inclusion of entire or total teaching is not possible in the instruction.

1.2 THINKING SKILL

1.2.1 MEANING OF THINKING

Thinking is a behaviour which is often implicit and hidden and in which symbols are ordinarily employed, i.e. images, ideas, concepts etc. Thinking is not confined to the 'head'. It also involves the whole body. Brain is undoubtedly primary in thinking and reasoning. Muscular activity during thinking suggests that many parts of the body cooperate with the brain, in the acquisition of knowledge.

![Diagram](Fig 1.1)
Either directly, or through media, a teacher can teach a subject or a concept. The one stereotype teaching can be attuned to the learner according to his kind of perception, that is it diffuses differently to different learner. His experiences and think give a mental image to the teaching. If it is tuned to a specific purpose with clear aim or object, the instruction has a goal to reach in the learner. So, the learner level, attitude, learning situation, his abilities are considered. So, learning is more purposeful. Both these objectives are implanted when the instruction is “structured” like Programmed Learning Materials (PLM) says Skinner (1958) in his five Golden Rules as guidelines for individualized instruction.

Thus thinking in specific line and wider imagination on the Concept Taught can occur in an individual. They follow different pathways. Thinking is a mental manipulation of existing and new concepts or ideas in problem solving.

Imagination is a wider operation for exploration. Creative thinking or divergent thinking may result in contributions.

Such an attempt is made while drafting the Computer Assisted Instruction on basic Statistics for collegiate learners.

1.3 TEACHING

In teaching, an interaction occurs between the teacher and the pupils. As a result of which the pupils are directed towards the objectives. In other words, the main element of teaching i.e. the mutual relationship or the interaction
between the teacher and the pupils and they advance towards objectives together. The learner can imbibe many traits along with knowledge from a teacher.

1.4 INSTRUCTION

The instruction does not involve an interaction between the teacher and the pupil. Still the instruction can direct the pupils towards objectives. The main difference between teaching and instruction is that the teaching includes instruction but the instruction does not include teaching. In spite of this, all the three cognitive, affective and psychomotor aspects of the pupils can be developed by teaching, while by instruction, any one aspect can be focused. In short, instruction is process, which directs the pupils towards the objectives of cognitive development.

1.5 LEARNING

Learning involves active participations and gaining experience. Both teaching and instruction influence learning through various activities and enrich experiences. Hence, the learning and teaching mean the modification of pupils' behaviour through activities and experiences.

Learning is self-regulatory activity and has a personal responsibility. Teaching and learning must be synchronized so that the best result of cognitive manipulation can occur. The effective learning can be measured only by the behavioural change in general and acquisition of knowledge in particular.
1.6 STRUCTURED INSTRUCTION AND SCHEMATIC LEARNING

Careful planning, appropriate sequence and pace of teaching is essential to ensure in forming an organized structure of knowledge called a "Schema". It is vital to develop the skill of abstract reasoning. For any abstract reasoning, concrete is essential. Always there is reversibility between abstract and concrete, and they mutually inter changeable and reinforce one another as the demand arises.

To facilitate right way of schema formation, the psychological steps specified need to be carefully understood and applied in developing instruction either orally or aided with technology. Scientific planning in well-defined structured approach is found to be a convenient format. Computer Assisted Instruction (CAI) is preferred is a structured and Technology based medium proved for effective self instruction (KULIK and KULIK, 1984)

1.7 MATHEMATICS AND REFLECTIVE INTELLIGENCE

Learning mathematics involves abstract mental operation decided or controlled by the mental abilities, speed of thinking, abstraction ability and to a certain extent comprehension of language. The subject matter of mathematics is not to be found in the physical world, accessible to our vision, hearing and other sense organs. Mathematical concepts have only abstract mental existence. So in order to use our intelligence for mathematics, one has to turn away from the
world of sensory objects to an inner world of purely inner objects. This ability of the mind to probe inward on itself that is to reflect on something that some of us use it so habitually that we may fail to realize what a remarkable ability it is.

1.8 THE FORMATION OF MATHEMATICAL CONCEPTS AND SCHEMATIC LEARNING

Mathematics is a subject in which the dependence on earlier knowledge is of particular demand. Algebra depends on arithmetic, calculus depends on algebra, dynamics depend on calculus, and analytical geometry depends on algebra and elementary geometry and so on. Even within these areas, the same interrelationship is found.

Concept should be formed out of experience and lead to certain structures. Furthermore the same structures should be if possible meet in different situations.

In elementary mathematics the process of abstraction comes from the experience of dealing with discrete objects. The trouble with the latter parts of mathematics is that these experiences get rather scarce as we get higher up in the mathematical hierarchy of concepts. Understanding mathematics is realizing what symbolism corresponds to structures that have been abstracted.

Since mathematics is a dynamic subject, it is best taught by teachers who are mathematically active, making deliberate efforts to learn new mathematics, to teach mathematics and even to create new mathematics. It is the prime duty of the teachers to make the students appreciate the intrinsic nature of the mathematics
and the full impact of its cultural and scientific significance. If teachers become actively involved enough, they can influence learners through CAL (Computer Assisted Learning) so that it will offer them greater freedom, greater flexibility and greater effectiveness as well as a pleasanter professional and learning experience in general. But if teachers ignore use of technology they will probably find that they are out moulded and out casted in the wave and Technology revolution, which is sweeping the world in all walks of life.

Mathematical education should not be a succession of arbitrary rules rather the pupil’s attention should be drawn to certain evidence, and he should be invited to think about it. In mathematics, there is always a pattern, you have only to look for it.

1.9 INFORMATION TECHNOLOGY

In the technology-vision document, software engineering and the associate Information Technology products serve as the core components. The High Level Committee at the national level on the “Information Superhighway” reports that “India will take a lead in Information Technology (IT) in a decade”. We feel proud of the recognition given to our nation for having the intellectual power for higher-level software production. It provides a challenge to our best minds and at the same time, it has to percolate to the grassroots level so that the future citizen - the human resource - can be trained by instructional software to stimulate
thinking and interacting with information. The task at hand is to employ the informational processing technology to suit the delivery system in classroom situation. The electronics has been brought “within the reach of the flexible fingers, to acquire skills in information processing according to their own cognitive levels”.

The writings of various intellectuals like ABDUL KALAM, A.P.J., President of India and formerly Principal and Scientific Advisor, Government of India, SUBRAMANIYAM, C., PALKHIVALA, N.A. and VIKRAM SARABHAI highlight the need for indigenous software production and to train our teachers for the future as the agents of change in the cyberage.

Apart from exploring the mechanism of synthesising instructional software for its effectiveness and efficiency, it is believed to produce a ripple effect in the minds of the rest of the teaching community in setting a new direction in the creation of a “Techno Teacher” for developing the knowledge society of the new millennium.

The “Techno – guru” of the future generation must have extensive stock of information of most recent nature, flexible to accommodate the new inputs of technology, readily available at the “finger tips” of the learners to make him to face any challenge by developing his competence. According to the Father of the nation, “Education is to bring out the best out of the learner”. In the process of bring out the best, he may
have to utilise various media suitable to the innate abilities of the learner. Hence individually the learner's needs are identified and met with as much as it is possible, with the known limitations in a delimited area in the scientific attempt made in the study.

1.10 INDIVIDUALIZED INSTRUCTION

Nearly four decades ago the fourth revolution in education began from SKINNER's (1958) contributions, "The science of Learning and the art of teaching". He says, "We are on the threshold of an exciting and revolutionary period ----". The string was taken up from late 1960's by individualized instruction. Individualized instruction makes the learning "custom built", or "tailor made", to fit to each student, as far as possible. The important point a teacher has to look for is the individual differences, which affect learning process in an individual.

RAMSEY (1969) emphasizes the necessity of the knowledge of the student by saying "Individualized instruction attempts to provide a complete instructional paradigm, designed explicitly for each individual, taking into account his background, interest and ability".

DAVIS (1980) notes down the responsibility of the teacher as "The teacher's most powerful contribution is before the student is confronted with the learning materials, he has prepared and organized as stimulating modeling".
The thinking teacher will be instrumental in changing the pedagogic paradigm says WILKES (1977). The role of the teacher is more a guide and consultant in the new strategy is accepted by MEYER (1984). LEONARD (1981), GABRIEL (1981) and SILBERMAN (1970) say that the teachers do need alertness and readiness to respond to and help individual student in his various activities, in the new learning situation.

1.11 PHILOSOPHY AND PRINCIPLES OF INDIVIDUALISATION

The Classical Conditioning of PAVLOV (1945) opened a new chapter in teaching and learning and the behaviourists gave importance to reinforcement as a major condition for learning. EDWARD THORNDIKE (1913) improved the reinforcement procedure with stimulus (reinforcer) - response reaction. SKINNER (1961) expanded this idea as Operant Conditioning, which led to the invention of Teaching Machine. Both kinaesthetic and information feed back are identified to play crucial role in Skill Learning by GAGNE (1963). LUMSDAINE (1964) proposed a new definition to Instructional Technique which was later applied in Programmed Instruction. The five golden rules applied in this preparation of Programmed Learning Material (PLM) and the need for defining the objectives in behavioural terms in the preparation of instructional software material are proposed as essential by DANIEL DAVIS (1965)
In the application of the Basic Teaching Model (GLASER, 1962), the components of the model, instructional objectives, entering behaviour, instructional procedures and performance assessment have been recommended to be effectively linked for cybernetic feedback. In computer based instruction, the learning procedures are as complex as the learner himself and it provides facilities to observe these complexities at a closer level as proposed by DANIEL DAVIS and LAWRENCE STOLOROW (1965).

FLANDERS (1964) recommended various learning activities built in the CAI teaching for interactivity in learning. The freedom to teacher is provided in the preparation of instructional material and freedom to the learner is provided through enough time for interaction and mastery. In other words learning is learner control operation. The principle in curriculum planning finds a place in the organisation of teaching concepts. They are found in GABRIEL (1991) who proposed the steps to be employed in adopting the CAI instruction to individual differences.

However, CAI is not free from criticisms. "Machanised means of instruction" and "de-humanising influence" are the threats and challenges facing the innovative method. May be the full utilization of the wide range of media like multimedia may help to bring it closer to the realities in face-to-face instruction in future.
1.12 TECHNOLOGY - A CATALYST IN THE LEARNING PROCESS.

Education technology is the application of procedures and techniques for the systematic design of a learning experience.

Information technology can be an effective delivery mechanism for existing forms of education. It provides capabilities for responding to new demands that traditional schoolroom cannot meet adequately.

Technology for individualized instruction include equipment and materials designed for individual operation as in Teaching Machines, Learning Modules, Programmed Instruction, Computer Assisted Instruction, Personalized System of Instruction, learner controlled instruction etc.

Educational technology as a widely applied concept does not necessarily imply the use of machines and other items of hardware. In short educational technology, in its wide sense as understood today includes “the application and evaluation of systems techniques and aids in the field of learning”. As such its scope encompasses educational objectives, media and their characteristics, criteria for selection of media and management of resources, as well as their evaluation.
1.13 MEANING OF PROGRAMMED LEARNING

The programmed learning is a method of instruction in which the pupil acquires self-learning with the help of teaching machines, textbooks and some special type of curriculum. In this instruction, the education material is organized in small parts or frames arranged in a sequence. The pupil moves towards the second frame after answering the first question correctly. The correct answers are available from some other page of the PLM book or from machine.

According to SUSAN MARKLE, (1997), ‘Programmed learning is a method of designing a reproducible sequence of instructional events to produce a measurable and consistent effect on the behaviour of learning in every student.’

The American authors have used the term ‘Programmed Instruction’. According to them, programmed instruction is a process of arranging the material in smaller frames in a sequence which is to be learnt and these frames are constituted in such a way that the pupil passes through self-instruction and moves from known to the unknown. The pupil moves towards highly complex knowledge and principles, from simple and precise concepts.

1.14 DIFFERENCE BETWEEN PROGRAMMED INSTRUCTION AND TRADITIONAL TEACHING METHODS

It is essential to understand the difference between the programmed instruction and traditional teaching methods. These differences are as follows:
(i) Individual Differences – Programmed instruction is based on the individual differences, such as the attention is given to the learning-pace of the pupil, but student have to keep pace with the teaching of the teacher.

(ii) Immediate Feedback - There is a provision of immediate feedback in every step of learning in programmed instruction but the traditional teaching methods lack this thing.

(iii) Specification of Objectives – The specification of objectives in the programmed instruction is given to learner for self achievement, while the objectives are in the hands of the teacher in traditional teaching methods.

(iv) Use of Teaching Principles – In the programmed instruction the pedagogic principles are practically used but it is difficult to use these in teaching principles in the traditional teaching methods.

(v) Size of Information Unit – The size of instruction unit of frame is small dosages in programmed instruction but the material is not divided into frames in the case of traditional teaching methods.

(vi) Emphasis on Students Participation – The pupils are forced to respond continuously in the case of programmed instruction. In the traditional teaching method, the pupil remains completely passive and it fails to tell us whether the pupil has learnt anything or not.

(vii) Organization of Subject Matter – In programmed instruction, the subject matter is organized in order or increasing difficulty while the traditional teaching method lacks such material.
1.15 COMPUTER ASSISTED INSTRUCTION (CAI)

From teaching Individualized instruction has evolved giving importance to the individual student’s participation in the learning strategy. It is a student-centered learning procedure. All learning procedures are organized to specific goals to the advantage of the individual learner. The selection of any suitable learning strategy in individualized instruction is being influenced by the learning potential of the learner, says GABRIEL and PILLAI, (1988).

GABRIEL (1996) defines that Computer Assisted Instruction (CAI) is a structured instruction and a mode of learning able to influence the faculties and for maximizing the interactive learning to achieve the set objectives”. He adds CAI can be a learning process with a chain of stimuli with which the student interacts as guided by computer. It is based on pedagogic principles and tries to cover individual differences that crop up based on mental abilities and socio economic status of the heterogeneous group of students.

Computer has occupied a vital position in Technology and it is accepted for the “Human Work”. In teaching and learning it is made a slow entry than otherwise. From the time of Skinner’s Teaching machine, to artificial intelligence, always there are attempts to introduce the hardware technology into instructional technology.
Advantages of technology based instruction are overwhelming and awesome. Varieties of learning needs are fulfilled by technology oriented instruction from students with special needs like visually handicapped being helped by JAWS, slow learner with animated learning materials, physically handicapped has special peripherals for instructions etc. Thus, technology has been proved to be a boon in instruction.

1.16 WHAT IS A CONCEPT?

Many definitions on Concept are available, but essentially it is the theme or central idea. Concepts guide our thinking and provide lead our thinking. If the concepts are clear, then our thinking would also be clear and appropriate. A concept is a generalized meaning that is attached to an object. The concepts are outcomes of our experiences. In this way generalized images of objects get developed in our mind on any Concept and becomes abstract idea for wider application.

According to WOODWORTH (1989), “Concept is an important tool of thinking.” He further adds that, “The concept is the sum total of what you know about the object.”

According to MUNN (1994), ‘Concepts are products of reasoning and once developed, play an important role in further thinking.’
HAMMERTON (1992) has defined the concept in this way, ‘The concept is the process of discrimination of the common features and relations in the world of events, things and persons.’

In simple words, MORGAN (1989) has defined the term concept as, ‘a process representing a common property of objects or events.’

According to BORING, LANGFIELD and WELD (1994), “A concept is a general idea, an item in thinking that stands for a general class.”

1.17 CONCEPT MAPPING

The mental operation or pre planning of any concept needs a stimulant. On perception of such stimuli, the related neuronic chain gets excited and the process of thinking commences. Such a stimulant is the “Concept Map”. Concept map may be embedded in a framework of propositions, it may be similar to an outline or a flow-chart, a concept map is a way of representing or organizing fact or idea in presentation sequence linearly or other wise. The concept develops as a means of facilitating analysis of any information by manipulating a structural device for representing understanding of a complex phenomenon. It is schematic mental operation for specific action.

Purpose of Concept mapping can be different in different operations. To generate ideas, to design a complex structure, to communicate complex ideas, to aid learning by explicitly integrating new and old knowledge and to assess understanding or diagnose or misunderstanding. Thus we need to verify whether
it is successful enough in preparing the future learners to meet the challenges in his learning. Disciplines which have overlapping concepts help to relate the mapping ability with background knowledge and skills. Hence, the study is mainly concentrating on the mathematics overlapping in the interdisciplinary concepts.

Advance organizer is a complex concept map based technique. It will help to trace the linear relationship in mapping skills in the students (secondary, tertiary level) or advance organizer by mentally preparing for the forth coming concept. Basically Teaching of mathematics is no way different from explaining. The concept of numeric is to quality or measure in abstract nature. Unless the child is in the right track by appropriate method or approach the mathematics learning now a days though Technology intervention is believed to be a solution but scanty in education. The on set of CAI in self instruct explores a gold mine of learner centred environment, but after it back participatory opportunities. More as media or a device many CAI package are commercially available spoiling the reputation of CAI in true educational sense.

1.18 MAP CREATION

Creation of a concept map, needs facts, location, sequence and relationship. Facts for concept are selected based on their importance, it is like the mile stones. Some of the facts play the key role to mark the steps of development in a continuum of progress. It need not be the steps but indicators
of a route. They help in easy scaling to a travel in unknown. The effective map must successfully help a new traveler to reach the set goal in shortest time, spending less energy or save energy for further progress. To avoid distraction in understanding and to avoid the onset of confusion, the map will be an intellectual plan. The principles of map construction needs the foresight of the intellectual journey and the key concepts for direction or route. It is the minimal but essential route to like the network on a outlay for the gestalt approach. It aids to develop a totality of understanding of the concept.

For the construction of the intellectual journey, mastery in subject is essential. The branches in the map can provide diversified approach in terms of inter disciplinary or cross-disciplinary nature. Statistics is one such, with wide application and in depth of operation on conceptuality. A bold statement may be attempted to generalize that every discipline has a spice of statistics in it. So the comprehensive understanding has compulsorily need based.

For a learner the direction setting will help to remove the narrow outlook, from narrow generalization to broader comprehension. On the other hand, the design of map must possess wide knowledge of specification and generalization (Bloom) so that a perspective outcome will emerge. The researcher being mathematics professional with wide experience of teaching for a sample of vertical distribution has drafted the map with goals applicable at various levels. Pruning of the map according to the need is the learner's choice. At time a
branch may be frequently used, instead of the whole or a new node may add a
new dimension to an existing map. Thus it is dynamic and highly flexible.

Holistic understanding can be perceived from concept map. The branch
in the node of map leaves to the imagination of concept formed in by the earlier
reading materials provided in the CAI.

The self learning materials in the form of CAI is reinforced by the map
and provide the guideline for anticipatory learning to occur in the course of
learning to come. Display role may be minimal, but the role it pays is essential in
anticipatory learning operation that is initiated as a means.

The network of links can made by concept map. As a learning device it
can initiate the process of new link formation as well like an advance organizer
concept map may facilitate planning in advance to anticipate the new experience.
It can alert the new chain formation in the neuronic network for fresh
connectivity.

Gestation approach gives a bird’s eye view of the whole situation.
Concept mapping is an aid to develop such mental frame of reference. The
individual modular units in CAI, remain united to the core or objectives. The
picture puzzle like organization will not remain isolated but meaningful fusion is
caused in the learning operation.
As an independent learning device, Concept mapping, but in this research, Concept mapping is inbuilt in the CAI. Technological facilities provides better learning environment for help learning. Frames are basic units of learning interactively, these is explanation in simple steps, with interactive facilities. The learning process is checked for total understanding by a feedback control mechanism. Failing in understanding enforce repetition of learning. In such environment, in addition concept mapping is in built to hasten learning and understanding. Thus concept mapping in CAI environment is created as a new self-learning device in the experiment, by the researcher.

1.19 CONCEPT TREE

Concept tree is made of laws as the trunk, the branches of the tree are of the principles, the stem is of laws, the twigs are the key concepts and the leaves are concepts. In other words it is flow chart with many branches from each key point. Or it may be viewed as a network of related principles on a subject area.

“What am I going to face when I turn to the next page?” will make him mentally alert in each frame of learning through CAI. A high tempo in the learning environment is believed to be maintained throughout the learning by constant questioning and challenging. The learner experiences in successive stages in each frame a new knowledge as a result to quote “the decentered stability of adult intelligence gives it more mobility – the ability to apply mental operations quickly and efficiently to the solution of new problems” (DECECCO, 1988).
It is to elicit the interactivity of the learner with the learning CAI package at an optimal level. The instructional materials are believed to operate in successive sequences with the learner as decided by the instructional objectives. The learning materials and activities are presented with a view to achieve these objectives. In other words the learning operation is specific and well structured and directed to achieve the goal. In that process the responsibility of learning is given to the learner. The anticipatory learning confirms the responsibility as overtly expressed by the learner, activity.

1.20 CONCEPT MAPPING IN FRAME: A Technology Assimilation

The frame of CAI is the body that bears the instruction. The tri part frame area has instructional part, enquiry part and response part. The traditional organization is altered to suit to the objective of research. Why CAI has been selected to carry Concept Mapping is for it has been well established as a means to carry educational influences to alter the internal learning environment of the learner.

1.21 RATIONALE OF THE PROBLEM

The concept develops as a means of facilitating analysis of information by manipulating a structural device for representing understanding of a complex phenomenon. It is schematic mental operation.

Concept mapping can be done for several purposes. To generate ideas, to design a complex structure, to communicate complex ideas, to aid learning by explicitly integrating new and old knowledge and to assess understanding or
diagnose or misunderstanding. Thus we need to verify whether it is successful enough in preparing the future learners to meet the challenges in his learning ability.

Disciplines which have overlapping concepts help to relate the mapping ability with background knowledge and skills. Hence, the study is mainly concentrating on the mathematics overlapping in the interdisciplinary concepts.

It will help to trace the linear relationship in mapping skills form the students (secondary, tertiary levels)

As stated by the various education commissions, there is a high demand for exploring various methods to teach abstract mathematical concepts.

The need for the study is many folded the assumption that triggered the research such as

- can a CAI process help learner and flexible enough to permit opportunities for manipulation
- can a CAI help in setting a direction for guided learning with Concept Map
- can a CAI assist in identify the key concept before or after learning as guide or key solution

It presents a number of prepositional relationships for analysis, and would also be expected to influence the form of organization of these propositions in learning Mathematics. So, it can be used as an instructional display and verify among students.
In the recent decades, concept maps have been widely used both to promote and to measure meaningful learning in various disciplines, in science teaching (KINCHIN 2000a: NOVAK and GOWIN 1984). So, the concept map is used in the mathematical (statistics) teaching.

Concept map as a tool for meaningful learning and assessment in an introductory statistics courses is studied by ANU HAPPALE et al (2002). This study focused on the ways in which students represented knowledge as a result of instruction to introductory statistics, so as to form a platform on self instruction in Basic Statistics Concept Mapping with CAI has been suitably adopted.

The use of concept maps as an assessment tool of academic achievement is an important recent application (AIDMAN and EGAN 1998: WILSON 1994, PARKESE et al. 2000) and will form the focus of the context of an introductory statistics course for the education degree. More specifically it aims at examining how the students map work to support their learning process and how it is related to their learning outcomes. The results of the study will bring valuable knowledge. So, the present study can checked in the interdisciplinary level at various colleges.

The study of Concept map in CAI environment is relatively new concept because only a few studies (ROBERTS 1999: SCHAU and MATTEN 1997) have been reported using this technique. In statistics instruction, ROBERTS (1999) used concept maps to measure university science student’s understanding of fundamental concepts in statistical inference and problem definition. Here, the
investigator used concept maps to assess the understanding of the concepts in statistics by students from the different disciplines.

SCHAU and MAATERN (1997) suggest that concept maps constructed by the students may stimulate their connected understanding and enhance the formation of networks of interrelated propositions in statistics.

The traditional examinations have even been noticed to be dysfunctional for the students learning process because they easily result in superficial and trivial learning (ENTWISTLE et. al., 1993). This emphasis on the cognitive theory in research on learning. (BROWN et. al., 1992) has contributed to the changes in the methods of assessment, which better take into attention, the nature of learning as a complex and contextual action.

Modern cognitive theory recognises that higher order thought and the ability to perform complex skills depend on the interaction of knowledge and self monitoring of mental processes associated with Meta cognition.

Concept maps among other strategies of authentic assessment, encourage meaningful learning and conceptual understanding (ROBERTS 1999; SHAVELSON et. al 1993).

ANU HAAPALA et. al. (2002) explained the study which is analysing and comparing concept – map and non- concept map groups student’s knowledge of statistics before and after introductory statistics course which can also conclude how concept mapping facilitates student’s conceptual change in understanding statistical concepts. These ideas can be verified / checked through the present study.
Concept mapping is based on AUSUBEL's theory of meaningful learning. In concept mapping process the learner is required to make a conscious effort to identify the key concept in new information and relate them to concepts in her existing knowledge structure of student's ideas, with emphasis on the relations between ideas. Because of these effectiveness the study is undertaken.

The graphical representation of information reflected by concept maps depicts the student's knowledge structures of statistics and relationships among concepts. Concept maps can be graphical representations of an individual's knowledge framework and usually they consist of nodes and labelled lines. (NOVAK, GOWIN and JOHANSEN 1983).

In concept maps, hierarchical structure and integration of concepts (cross - links between branches of concepts) are indices of an elaborated map (NOVAK and GOWIN 1984 ) and can reflect a more elaborated structure on the given sphere of knowledge of an individual. Thus the study is assessed among the college students.

Traditional concept mapping has also certain limitation for revealing representations of the structure on individual's statistical knowledge. (SLOTTE and LONKA 1999). Spontaneously made concept maps were used as a cognitive tool that facilitates transferring of performance and comprehensive learning. That is, the maps constructed by students who use this graphic meta-cognitive tool without its being strictly experimenter imposed. Some studies expressed that the students got only a list of some key concepts of statistics and very flexible
instructions to construct concept maps. Therefore these map could very substantially in their extent and complexity (ANU HAAPALA et.al.2002)

The students could use the whole course duration to reconstruct and edit their concept maps and this may assist students to build schemata for understanding ‘concepts and their relations. While participating in the lessons and lab working and simultaneously building the concept map, the students may be more actively engaged in analysing the contents of this course.

Concept Mapping is a cognitive tool which can be useful in transferring students knowledge across learning task says (PARKES ET. AL., 2000) and suggested that (i) concept maps seem to bring consistency to the student’s performance in examinations (ii) it reduces construct – relevant variance. The concept maps seem able to minimise context specificity of tasks and help the student focus on the underlying conceptual framework.

1.22 CONCEPT MAP AS A TOOL FOR LEARNING STATISTICS

The cognitive psychologist (AYERSMAN 1995) knowledge representation reflects the way in which information is linked in individually meaningful ways proposed model of memory. As an aid towards visualizing a network, connected concepts have been applied for use of a concept map (as developed by NOVAK and GOWIN 1984). Concept mapping is a highly flexible tool that can be adapted for use almost for any group of learners in education for students and teachers from primary schools to universities. For
example concept mapping has been referred as a cognitive tool that facilitates transferring of performance and comprehensive learning (e.g. PARKES et al. 2000).

Concept mapping is based on Ausubel's theory of meaningful learning. In concept mapping process the learner is required to make a conscious effort to identify the key concepts in new information and relate them to concepts in her existing knowledge structure. Therefore, concept maps represent the structure of students' ideas, with emphasis on the relations between ideas. A critical component of students' cognitive understanding is the negotiation among the many concepts and ideas they are continually processing (AYERSMAN 1995). The graphical representation of information reflected by concept maps depicts the students' knowledge structures of statistics and relationships among concepts. Concept maps are representations of an individual's knowledge framework, and usually they consist of nodes and labeled lines. (NOVAK, GOWIN and JOHANSEN 1983; NOVAK and GOWIN 1984.) The nodes correspond to relevant concepts in a domain and the lines (links) express a relationship between a pair of concepts. The label on the line expresses how two concepts are related (SHAVELSON, LANG and LEWIN 1993). The lines (visually displayed as one- or two-headed arrows) should be labeled so that the meaning between the two concepts (nodes) is explicitly expressed as seen in CAI package. The combination of two concepts and a label line is referred to as a proposition, which
is a unit of factual knowledge - or "the smallest item of knowledge that can stand as an assertion"

In concept maps, hierarchical structure and integration of concepts (cross-links between branches of concepts) are indices of an elaborated map (NOVAK, GOWIN and JOHANSEN 1983; NOVAK and GOWIN 1984) and can reflect a more elaborated cognitive structure on the given sphere of knowledge of an individual.

Traditional concept mapping has also certain limitations for revealing representations of the structure individual's statistical knowledge. The specific domain of statistics and students lack of prior knowledge combined with briefly introduced graphic tools and very short time to construct the concept map may not support effectively students for achieving their learning tasks (SLOTTE and LONKA 1999). They define spontaneously made concept maps as, "..., that is, maps constructed by students who use this graphic metacognitive tool without its being strictly experimenter-imposed". So Concept Map in CAI is a predetermined structure incorporated in the instructional material.

1.23 STATEMENT OF THE PROBLEM

The problem of the study is the role of Concept Map in CAI platform for learning basic Statistics by collegiate students.
1.24 TERMS AND DEFINITIONS

Concept Map is a learning toll used as a guide for learning. It may serve as an advance organizer by helping the learner to form a mental expectation and preparation in advance. Either to present the learning material or to make a generalized perception of meaningful learning it can be used.

Computer Assisted Instruction is the individualized learning material assisted by Computer for pre designed presentation of content under control. Learning is assisted by stepwise verification. Time spends for learning and wrong attempts are monitored by the system.

Basic Statistics is a portion for many disciplines like Physical Sciences, Biological Sciences, Arts, Commerce and Mathematics. Thus a variety of learners are used for identifying their differences in learning pattern.

1.25 OBJECTIVES OF THE STUDY GENERAL OBJECTIVES

Develop and validate Computer Assisted Instructional package with Concept Map by effective self learning on Basic Statistics.

Identify the causes for interactive learning by drawing relationship between internal learning potentials in lieu of external learning environment for enhancing achievement or learning rate.
1.26 SPECIFIC OBJECTIVES

Develop Computer Assisted Instruction on basic Statistics with sufficient content coverage necessary with Concept Map in hierarchy for guided learning.

Relate effective learning in CAI with Concept Map in a control learning situation to increase in achievement.

Associate the causes for effective learning to internal potentials.

Link supportive variables from outside to the learning environment that are necessary

Project the pattern of learning among various types of learners in terms of internal potentials related to external.

1.27 ASSUMPTIONS

The problem envisaged is posed with various assumptions for designing the approach. It forms the guidelines for structuring hypotheses. Normally assumptions are made from the objectives framed. The following assumptions are made

It may be possible to develop a CAI package with Concept Map in basic Statistics for collegiate learners at inter disciplinary level.

Operation of Concept Map in CAI environment may be more conducive for studying the learner behaviour in self learning.
Learning pattern of learners from different learning environments may be related using Mean Achievement Score as output.

Mean Achievement Score may draw relation to learning rate of the learner under the same conditions of learning in CAI.

Internal learning potentials may be contributing equally when learning is under control situation in CAI.

Internal learning potential and external learning environmental variables may interact for effective learning.

The objectives are given a possible explanation in the assumptions.

1.28 DESIGN OF THE STUDY

The design of the study is Quasi experimental post-test non equivalent group design (JOHN W. BEST, pp. 128, 1992). The samples drawn are not equal, but represent the true existing nature in learning situation. They are drawn from across differences in gender, learning background, earlier experiences with technology.

1.29 SAMPLE

The sampling technique used in this study is Purposive sampling. The students from FOUR different learning situations are used as sample. They represent three learning environments such as Urban, Semi Urban and Rural, autonomous and affiliated system. The rural women and urban represent two
different universities. Subjects like Biology, Physical sciences and arts are utilised.

1.30 SAMPLE DISTRIBUTION

Indian and foreign students are used as sample. It is truly purposive sampling. The main focus is on CAI in Mathematic learning by individualised approach.

1.31 VARIABLES IN THE STUDY

In the present study the variables selected for operation are based on the Technological orientation such as their interaction with learning material as the major variable and their internal skill for self learning ability.

1.31.1 DEPENDENT VARIABLES

The index of learning is Averaged post test score which is arrived from the total score of the learning. It is measured continuously and it is the final post test score. Pre test score is used for entry behaviour and form homogenous group for comparison. Mean Achievement Score is used for measuring the outcome of learning through CAI with Concept Map.

LEARNING RATE

It is believed to be one of the key variable in either establishing the nature of the structured learning material or the ability in the self learning with the specific instructional software.
1.31.2 INDEPENDENT VARIABLES:

It is believed to form the base for learning ability of the learners. Hence, it is further divided into external and internal variable.

A) Externally observable independent variables

Gender refers to sex and Learning environment refers to the infrastructural facilities available in the institution in which the student is studying. Types of CAI is the mode of learning, which is known as Concept Map mode and non-Concept Map mode of learning. Concept Map mode of learning is purposively in built in the CAI frame material to make mental preparation of what concept he is going to study in the next step. Group of study refers to the choice of discipline in undergraduate level such as Arts group and Science group.

B) Internal Independent Variables

i) Language Proficiency in Mathematics

ii) Abstract Reasoning

iii) Speed test in Mathematics

1.32 STATISTICAL TECHNIQUES USED

The statistical techniques used in this study are

1) 't' test
2) ANOVA
3) Post ANOVA
1.33 ORGANIZATION OF STUDY

The organization of study is depicted diagrammatically.

Keep the CAI with Concept Map as the focus the dependent variables are given importance, since they are reveal the learning operation. The internal potentials like Abstract Reasoning, Language Proficiency and Speed in learning
given next importance. The outer circle represents the visible independent variables like gender, CAI types and learning environments like urban male, rural women and semi-urban women.

Conceptually CAI package with Concept Map focus the platform for the research study. It has been selected because the learning environment will have less contamination by other influences. Learning responsibilities given to the learners focus to have interaction with the content according to the internal potentials for learning in terms of the conductive influence on learning. Hence the semi controlled experimental conditions are created to monitor the learning process.

Certain potentials like language proficiency learning speed and abstract reasoning ability are presumed to contribute to effective learning. They are internal abilities, residual and believed to be the learning potentials in a learner. The discipline of the sample gender differences any types of CAI provide addition variables to be considered for inter and intra reactions between the variables.

The over influence of the learning operation is monitored in terms of achievement mean score validated on criterion referenced work. Elaborate treatment of interaction of variables in operation is observed through ‘t’ value in terms achievement of the participating learns categorized as above and below mean in the internal potentials. Subsequently the learning rate is also used to
indicate the learning processes since it takes care of time spend for learning and the amount of mistakes committed by the learners.

Final consolidation carried out it terms of Achievement Mean Score for above and below mean in internal potentials confirms the contributive variable for effective learning in CAI package based learning of Statistics.

Both learning rate and achievement mean scores are able to be revealing the effective learning, which is mediated in CAI with Concept Maps. It has been supported by the learning environment of the learner.