CHAPTER I-INTRODUCTION

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1.01 Introduction

The 21st century world can be called a scientific world, advancing rapidly in information technology, medicine, engineering, space communication, astronomy, astrophysics, artificial intelligence, robotics and many other disciplines. For all disciplines stated above mathematics is the base. Economics was considered as separate subject free from mathematics but now mathematics considered as the integral part of Economics. (Wikipedia Foundation, 2012) Mathematics allows economists to form meaningful, testable propositions about many wide-ranging and complex subjects, which could not be adequately expressed informally. Further, the language of mathematics allows economists to make clear, specific, positive claims about controversial or contentious subjects that would be impossible without mathematics. Much of economic theory is currently presented in terms of mathematical economic models, a set of stylized and simplified mathematical relationships that clarify assumptions and implications. This is one of the examples of the usefulness of mathematics. Mathematics is also useful in our day today life. (Ramani & Patadia, Computer Assisted Instruction in Teaching of Mathematics, 2012)Mathematics is an abstract subject and has symbolic language. The reasoning in mathematics possesses a number of characteristics, namely, characteristics of accuracy, verification of results, certainty of results, similarity to reasoning in life, originality. All these characteristics automatically become a part and parcel of a child when s/he learns mathematics. Students find it difficult to understand mathematics because of symbols and abstractness. Mathematics plays an important role to provide technically skilled manpower in our country. (NCERT, 2000) recommended mathematics as a compulsory subject for all school students till tenth standard. Thus, mathematics enjoys a unique status in the school curriculum.(NPE, 1992)Mathematics should be visualized as the vehicle to train a child to think, reason, analyse and to articulate logically. Apart from being a specific subject, it should be treated as a concomitant to any subject involving analysis and reasoning. With the recent introduction of computers in schools, educational computing and the emergence of learning through the understanding of cause-effect relationships and the interplay of variables, the teaching of mathematics will be suitably redesigned to bring it in line with modern technological devices. Yet many school students find difficulty with learning of mathematics and fail in mathematics. (Ravindra, 2006)A major reason for the failure is that the teachers quite often pay no attention to the

basic concepts and generally adopt methods of solving questions with crammed up formulae.

Ours and previous few generations have failed to produce good mathematics teachers at school level in adequately large numbers. The corpus of this enormous knowledge that man built over the last few centuries will be too burdensome to carry into future on the shoulders of ill-equipped school Mathematics teachers. This is so since teaching mathematics to impressionable young minds is a specialized task that many mathematicians may not measure. Mathematics is a hard task master that demands implicit and whole attention from the disciple.(Patel M. , 2006)in her study specifies that one of the reasons for the selection of commerce stream was that students felt science stream to be difficult, as it requires a lot of hard work to be put in. The study also stated that few of the students who earlier took up science stream later on got shifted to commerce stream, as they could not cope up with Physics and Mathematics.

(The National Research Council, 2001) points out the principles for helping students with learning difficulties: (1) Learning with understanding involves connecting and organizing knowledge; (2) Learning builds on what children already know; and (3) Formal school instruction should take advantage of children's informal everyday knowledge of mathematics. In order to overcome the difficulties faced by the students, teacher should adopt different methodology in teaching of mathematics like drill method, using different audio visual aids, computer aided instruction, mathematical club etc. One of the methods is auto-instructional method. It is a method of individualized instruction. One of its forms is CAI (Computer Assisted/Aided Instruction) auto instructional teaching. It is very useful to the teachers and the students as it lessens the burden of teaching and learning and it makes teaching and learning interesting. It also helps the students to learn at their own pace and at their own convenience. It motivates the students and increases the enthusiasm of the students. In this method students read different frames and answer the questions that follow and by this way they learn automatically. Even the learning that takes place through CAI is accurate and untiring. The most beneficial part of CAI is it provides the mixture of wide range of visual, graphics and pictures to make the teaching learning more interesting. This aspect is elaborated in topics that follow.

1.02 Nature of Mathematics

(American Association for the Advancement of Science, 1990) Mathematics relies on both logic and creativity, and it is pursued both for a variety of practical purposes and for its intrinsic interest. For some people, and not only professional mathematicians, the essence of

mathematics lies in its beauty and its intellectual challenge. For others, including many scientists and engineers, the chief value of mathematics is how it applies to their own work. Because mathematics plays such a central role in modern culture, some basic understanding of the nature of mathematics is requisite for scientific literacy. To achieve this, students need to perceive mathematics as part of the scientific endeavour, comprehend the nature of mathematical thinking, and become familiar with key mathematical ideas and skills.

Language of mathematics is symbolic and less verbose. In modern world we use mathematics where we have to be more and more exact and more accurate to the split of a second and we use terms and quantities that require large calculations which demands minute mathematical understanding. Mathematics is the science of patterns and relationships. As a theoretical discipline, mathematics explores the possible relationships among abstractions without concern for whether those abstractions have counterparts in the real world. The abstractions can be anything from strings of numbers to geometric figures to sets of equations.

(American Association for the Advancement of Science, 1990) Mathematics is also an applied science. Many mathematicians focus their attention on solving problems that originate in the world of experience. They too search for patterns and relationships, and in the process they use techniques that are similar to those used in doing purely theoretical mathematics. The results of theoretical and applied mathematics often influence each other. The discoveries of theoretical mathematicians frequently turn out sometimes decades later to have unanticipated practical value. Studies on the mathematical properties of random events, for example, led to knowledge that later made it possible to improve the design of experiments in the social and natural sciences.

(Sidhu, 1995), "Mathematics is the science of number and space. Mathematics is the science of measurement, quantity and magnitude. Mathematics is also called science of logical reasoning. Mathematics may also be defined as the science of abstract and imaginative form."

(Report of the Education Commission, 1964-1966) "One of the outstanding characteristics of science culture is qualification of Mathematics".

- Mathematics is hierarchical in nature.
- Mathematics is science of logical reasoning.
- Mathematics is more than computation

- Mathematics has peculiar language and symbolism. It has a different language and syntax and uses many words from day today life but in different sense.
- Mathematics is abstract in nature.
- Mathematics is the science of patterns and relationships. As a theoretical discipline. Mathematics explores the possible relations among abstractions without concern for whether those abstractions have counterparts in the real world.
- Mathematics is also an applied science. Many mathematicians focus their attention on solving problems that originate in the world of experience. They too search for patterns and relationships, and in the process they use techniques that are similar to those used in doing purely theoretical mathematics.

According to (Sharma R. , 2005)Characteristics of Mathematics is listed as follows:

- It is the science of number and space.
- It is the science of calculation.
- It is the science of measurement, quantity and magnitude.
- It is systemized, organized and exact branch of science.
- It deals with quantitative facts and relationship.
- It is the abstract form of science.
- It is science of logical reasoning.
- It settles in the mind the habit of reasoning.
- It is an inductive and experimental science.
- It has its own language, consists mathematical terms, mathematical concepts, formulae, theories, principles, signs etc.
- It involves conservation of abstract concepts in to concrete form.
- It helps in developing scientific attitude among children.
- It gives reliable and accurate knowledge.
- Its knowledge is exact, systematic, logical and clear so that once it is captured it can never be forgotten.
- Its rules, laws and formulae are universal and that can be verified at any place and time.
- It develops the ability of induction, deduction and generalization
- Its language is well defined, useful and clear.
- Its knowledge is applied in the study of science and its different branches; example Physics, Chemistry, Biology and other sciences.

- It is not only useful for different branches of science but also helps in its progress and organization.
- It is the gate way and key of all science.

1.03 Importance of Mathematics

Epistemologically mathematics means mathema- explaining and understanding, tics- techniques such as counting, ordering, sorting, and measuring. Right from pre historic period there have been problems to solve. Problems may be over basic requirements like food, water, shelter or accomplishment like constructing multi-storied building. Now the Communications revolution that is sewing humanity, symbolised by Internet and mobile cell-phones would not have been possible without a copious application of Mathematics. In this modern era we cannot think of a field, where calculation or computation is not used. Knowingly or unknowing we use mathematics in our day-to-day life. It ranges from household to industries, business, education, science and technology, art and craft and even in music, dance etc., Mathematics is part and parcel of daily life. Mathematics is used in learning almost all subjects. We cannot imagine learning engineering disciplines without mathematics. Biology, medicine, computer, science, economics etc. all use mathematics. The revolution in information and technology is due to advancement in mathematics. Statistics uses mathematics for analysing of data. Different commissions have given different views on the place of mathematics. Everybody uses mathematics whether they realize it or nor, for example a cook uses mathematics to modify amount according to the number of persons or to modify recipe. Shopkeeper uses mathematics to calculate change, tax, and sales prices. Travellers use mathematics to plan their trips, they calculate time of arrival and departure. Even homeowners use mathematics to determine the cost of materials when doing projects.

1.04 Aims and Objectives of Teaching Mathematics at School Level

As per the (NCERT, 2005) the goals of teaching of Mathematics are mentioned below:

The main goal of mathematics is the mathematisation of the child thought processes. As per (Wheeler, 1982) "It is more useful to know how to mathematise than to know a lot of mathematic." According to (George, 1969), there are two kinds of aims for school education: a good and narrow aim that of turning out employable adults who (eventually) contribute to social and economic development and a higher aim that of developing the inner resources of the growing child. With regard to school mathematics, the former aim specifically relates to

numeracy. Primary schools teach numbers and operations on them, measurement of quantities, fractions, percentages and ratios: all these are important for numeracy.

In developing a child's inner resources, the role that mathematics plays is mostly about thinking. Clarity of thought and pursuing assumptions to logical conclusions is central to the mathematical enterprise. There are many ways of thinking, and the kind of thinking one learns in mathematics is an ability to handle abstractions. Mathematics offers the way of doing things: to be able to solve mathematical problems and to have right attitude of problem solving and to be able to attack all kind of problems in a systematic manner.

1.05 Computer Assisted Instruction (CAI)

The different definition referred by the investigator are given as follows (McGraw-Hill Dictionary, 2003)The use of computers to present drills, practice exercises, and tutorial sequences to the student, and sometimes to engage the student in a dialog about the substance of the instruction. Abbreviated as CAI also known as computer-aided instruction; computer-assisted learning (CAL).

(ThefreeDictionary, 2008) Use of instructional material presented by a computer. Since the advent of microcomputers in the 1970s, computer use in schools has become widespread, from primary schools through the university level and in some preschool programs. Instructional computers either present information or fill a tutorial role, testing the student for comprehension. By providing one-on-one interaction and producing immediate responses to input answers, computers allow students to demonstrate mastery and learn new material at their own pace. A disadvantage is that computerized instruction cannot extend the lesson beyond the limits of the programming.

Mathematics and computer are both important in today's life as they open the gate of ample opportunities in this modern world. Mathematics is widely used in computers in both hardware and software. Computer helps in improving the knowledge of mathematics. Computer helps in making classroom teaching lively. Computer can play vital role in learning process as it can work with the imagination of students. Any concept in mathematics can be explained with the help of pictures and this visual image can help in understanding the concept at ease. In paper pencil method student can get bored easily and can find it difficult to practice the sum repeatedly. CAI works as a change in teaching learning method, increases the curiosity of students and they can learn interestingly without any difficulty. In addition, whatever is learnt through computer aided instructions, the contents can be retained in the memory of students for longer time as they use more senses of the students. Certain chapters

like Profit and loss, Simple and compound interest can be explained very easily using CAI. Variety of exercises can be provided and this ensures active involvement of the students. The material can be provided according to the needs of the students.

1.06 CAI in Learning Mathematics

Investigator has referred the definition of CAI in learning mathematics and it is stated as follows (Initiative, 2010)Computer Assisted Instruction (CAI) software for maths: Computer Assisted Instruction, or CAI, software refers to instruction via a computer for the purpose of skill development or learning, in this case aiding in the development of maths skills. Computer Assisted Instruction software typically:

- is interactive and can illustrate different concepts via animation, sound and demonstration. For example, learners are able to hear, see and take action to complete simple arithmetic, demonstrate concepts, solve problems and learn from their mistakes)
- offers immediate feedback by noting incorrect responses to questions and allows user to progress at own pace
- summarises performance
- generates exercises for worksheets and tests at a range of different levels (i.e. from simple counting through to advanced university level mathematical concepts).

1.6.1 Advantages of CAI in learning Mathematics

In this age of technology the teacher should be aware of student's need. CAI can help to satisfy the needs of the students. CAI lessens the workload of the teachers, besides it has many other advantages such as it provides wide range of experiences, it provides motivation, it can provide individualized instruction, interactive learning. Each of these uses is explained further.

Provides Wide Range of Experiences

CAI helps the teacher to provide a wide range of experience s/he can give many examples and illustrations and can make the concept clear. Concept can be explained using Word Problem, Play, Audio Visual aids, three-dimensional figures etc.

Provides Motivation

It can sustain the motivation of the students as the topic can be presented in an enjoyable manner as concepts can be presented systematically, interestingly and immediate feedback can be given which sustains the motivation of the students. Graphics and pictures can be presented which can attract and retain student attention. Children get reinforcement when

they answer the question correctly and the topic is presented in a systematic manner in an increasing order of difficulty. When student attempts a question correctly the screen showing "GOOD KEEP IT UP" with claps can be displayed.

Individualized Instruction

CAI is an individualized instruction as it caters to the individual difference. Some students are slow learners and some are fast learners. The Indian classroom is a heterogeneous group. Some students need more time to learn while others need less time, so learning speed differs from learner to learner. CAI also provides different learning experience according to the understanding level of the students. It also provides facilities like selecting the topics of their own interest. It provides individual attention to each and every student and thus enhances the quality of teaching learning process and thus we can overcome the problems faced in a overcrowded classroom. Slides can be arranged in the increasing order of difficulty so that a fast learner can skip the slides and go to a slide s/he finds it challenging whereas a slow learner can move from one slide to another without skipping.

Interactive Learning

CAI provides immediate feedback to the students and thus constantly interacts with them. In CAI students actively take part in the learning process. As it contains many examples and diagrams it makes the learning process interesting. As the student progresses from one level to another, slides showing "CONGRADULATIONS LEVEL 1 IS SUCCESFULLY COMPLETED BY YOU" can be displayed to make them understand the successful completion of that level.

1.6.2 Steps to be followed in CAI

For designing CAI the following steps may be adopted for achieving the objective, user friendly and need centred.

Practice: CAI enables the students to practice as many times as they like so this will enable them to achieve the required competencies. Students come from different background it is a heterogeneous group so their understanding level differs from student to student so a single teacher cannot cater such heterogeneous group so there is a need of right learning tool and a supporting environment. Practice makes a man perfect. Many psychologists like Thorndike support the usefulness of practice in learning.

Immediate feedback: CAI enables the students to see the correct answer immediately as soon as they answer a particular question so that they can correct themselves. If the answer is correct then they will get immense happiness and added confidence. If the answer is wrong

they can correct themselves immediately. In traditional classroom teaching, teacher gives students homework for practice. The child comes to know of any mistake when the teacher checks the homework and corrects the mistake. Normally teachers do not provide the correct answer during checking, so child knows that his answer is wrong but does not know the correct answer. If the teacher does sometimes provide the correct answer, the child may not pay due attention to the corrected answer and may consider it as a part of his work is to complete the homework and would proceed with the next homework.

Self-Evaluation: CAI enables the students to find their strengths and weaknesses and student can overcome his weaknesses before proceeding further.

Reinforcement: CAI reward students immediately whenever they answer the question correctly immediate reinforcement gives immense pleasure as indicated by many psychologists.

Immediate Evaluation: As soon as each concept is completed students should answer questions related to that particular concept this enables immediate evaluation.

1.07 Necessity of CAI

To achieve mastery learning

Mastery is a recent innovation introduced in the sphere of education. Mastery learning implies a systematic approach to the process of teaching or instruction. It is based on the idea that all students are potential learners, and that every child can learn equally well, provided the teacher presents the subject matter in a systematic manner. In mastery learning, instruction or teaching is matched to the learner. The chief objective of mastery learning is to promote excellence in learning. This objective is achieved through systematic planning, proper motivation, better methods and materials for learning, self-guided instruction and objectives based evaluation.

'Learning for mastery' is a technique of instruction developed by Bloom and his associates. He developed an instructional plan based upon the guiding principle that the learner should achieve mastery of one unit of the subject matter before going on to the next unit.

Individual differences

Each and every child is different. In a classroom teacher teaches to a group of students. Some students are slow learners, some are medium, and some are gifted. Classroom group is a heterogeneous group they come from different family background and with different interest.

Some are extrovert and some are introvert. So to cater to each and every child in a classroom a supplement is necessary.

To make learning continuous

When the child is absent on the previous day he cannot understand the lesson taught on that day because of lack of continuity and whatever is taught on that day he finds difficult to comprehend. CAI helps him to understand the concept without any difficulty whenever he misses a class.

Span of attention

The time span the student remains attentive in a class. This is different for different students.(Dandapani, 2001)Definition of attention

"Attention may be described as the selective activity of the human organism whereby one's consciousness is focused upon a specific, narrow field to the exclusion of everything else in the environment."

In typical Indian classroom teacher hardly gets time period between 35 to 40 minutes for teaching mathematics. Hence teacher spends approximately 5 minutes for introduction, 15 to 20 minutes for content explanation, 10 to 15 minutes for question and answers to heterogeneous groups verification and confirmation either at the end or continuously along with teaching. Thereafter, the teacher recapitulates all the subtopics. It is not possible to interact with all students, so teacher interacts with about 4 to 5 students. Having confirmed that these 4 to 5 students have understood the content explanations, the teacher assumes that the entire class has followed the content (rest of more than 40 students). Some students are mere spectators because they did not get a chance to answer. Sometimes students nod their head even though they didn't understand this behaviour makes teacher to assume that all students understood the concept. In this process teacher cannot cater to slow learners, obviously the teacher does not have time. This is not the teacher's fault but the System's fault. Certain students cannot grasp the contents fully. So it is not possible for the Teacher to cater to all the students. Certain methodology and supporting methods are needed hence there is a need for development of CAI.

- CAI helps in learning mathematics.
- It reduces the burden of teaching and learning.
- It makes learning an enjoyable experience.
- Considering the heavily crowed heterogeneous classroom and nature of CAI it can be concluded that CAI is necessary to solve the problem faced by the students and teacher.

- It should be developed and used wherever possible.

1.08 Challenges for Preparing CAI

In order to prepare CAI there are some challenges such as the person should have content mastery in the topic s/he is preparing CAI, sound psychological background of the learners, written communication skill, creativity, technical knowledge related to computers and programming CAI.

- Constructing CAI needs a highly specialized such as logical sequencing of the content, user-friendly language, graphics and pictures.
- The designer of CAI should have thorough knowledge of the subject matter so that s/he can construct CAI according to the level of the learners and many illustrations can be given in the selected topic.
- The learner may get demotivated if s/he commits more mistakes while going through CAI. In order to avoid this situation the steps of CAI should be constructed from simple to complex in a suitable sequential manner along with enough illustrative examples so that error-rate of a learner can be minimized.

1.09 Rationale of the Present Study

Mathematics is an important subject to be learnt at school level. According to the (NCERT, 2005), "Mathematics education in our schools is beset with problems. We identify the following core areas of concern: A sense of fear and failure regarding mathematics among a majority of children." Analyses on the above areas of concern have led (NCERT, 2005) to recommend engaging every student with a sense of success, to change modes of assessment to examine student's mathematisation abilities rather than procedural knowledge and to enrich teachers with a variety of mathematical resources. The investigator has attempted to address the above concerns and analyses in her study. As mentioned in (NCERT, 2005)for mathematics curriculum in upper primary stage, "Mathematics is amazingly compressible: one may struggle a lot, work out something, perhaps by trying many methods. But once it is understood, and seen as a whole, it can be filed away, and used as just a step when needed. The insight that goes into this compression is one of the great joys of mathematics. A major goal of the upper primary stage is to introduce the student to this particular pleasure. The compressed form lends itself to application and use in a variety of contexts. Thus, mathematics at this stage can address many problems from everyday life, and offer tools for

addressing them. Indeed, the transition from arithmetic to algebra, at once both challenging and rewarding, is best seen in this light."

There is huge gap between prescription and practice of a mathematical curriculum. Most of the time the classrooms of mathematics are preoccupied with routine teaching that leads to mechanical learning of problem solving of mathematics without bothering for the link between the process and product. Students hardly ask questions in a mathematics classroom underlining the need for a more responsive system. The teacher education colleges in India prepare the mathematics teachers at secondary level and unfortunately, some of the teachers educating colleges have teacher educators in mathematics who had not studied mathematics as a subject at degree level or have experience of teaching mathematics at school level.

(Kapoor, 1997) stated that, " Quality of research is good, but quantity is poor. In Mathematics education both research and development should go together and it was time that the utilization of research should be considered as important as research." Developmental research is important in two ways. First it increases the applicability of educational practices in specific situations, and secondly in generating better insight into the instructional process. Thus application of research in mathematics education is very important at all levels. Many a times teacher adopts the conventional method rather than interesting methods of teaching that will not enable active involvement of students. In this scenario CAI plays an important role in helping students to learn mathematics at upper primary level without stress, so that students become independent and they can learn by themselves, at their own pace and also apply the mathematical content in their day to day life.

Students in class VIII are in Formal operational stage (adolescence and into adulthood): as stated by Jean Piaget. In this stage, (Wikipedia, Piaget's theory of cognitive development), "Intelligence is demonstrated through the logical use of symbols related to abstract concepts. At this point, the person is capable of hypothetical and deductive reasoning. During this time, people develop the ability to think about abstract concepts. Logic: Piaget believed that deductive logic becomes important during the formal operational stage. This type of thinking involves hypothetical situations and is often required in science and mathematics. Abstract thought emerges during the formal operational stage. Children tend to think very concretely and specifically in earlier stages. Children begin to consider possible outcomes and consequences of actions. Problem-Solving is when children use trial-and-error to solve problems. The ability to systematically solve a problem in a logical and methodical way emerges."

CAI is one of the methods to learn mathematics; it is especially helpful to slow learners and gifted learners who can learn at their own pace. Thus, CAI leads to a better appreciation and understanding of mathematics and thereby develops a sense of self-esteem and self-confidence among learners. This would also help students to lessen their dependency on tuition classes and would definitely encourage self-study and thereby encourage self-directed learning. Arithmetic is the oldest and most elementary branch of mathematics, used by almost everyone, for tasks ranging from simple day-to-day counting to advanced science and business calculations, such as addition, subtraction, multiplication, and division. As discussed in the reviewed studies it is found that students are weak in mathematics because of concept gaps, confusion in understanding mathematical language, stereotype way of presenting contents and lack of openness in teaching. Also from the reviewed studies, it was found that studies related to CAI in arithmetic at upper primary level were not conducted. Such studies are very important and needed because of the overcrowded and heterogeneous classrooms in Indian scenario. All the eleven studies reviewed related to mathematics in CAI; there are only two studies in arithmetic topic of mathematic. These studies are conducted for lower primary level; therefore, there is a great need to study the effectiveness of CAI in the arithmetic topic of mathematics, considering its importance as stated above.

1.10 Statement of the Study

Development and Implementation of Computer Assisted Instruction in Mathematics for Standard VIII Students

1.11 Objectives of the Study

- To develop the CAI in Mathematics for Standard VIII GSHSEB (Gujarat State Secondary and Higher Secondary Education Board) students.
- To study the effectiveness of the developed CAI in terms of students' achievement in Mathematics with one of the experimental groups of standard VIII students.
- To study the effectiveness of the developed CAI in terms of students' achievement in Mathematics with another experimental group of standard VIII students along with treatment of simultaneous discussion.
- To study the relative effectiveness of learning mathematics in class VIII among the three groups A, B and C (Where C is the control group and A and B are experimental groups) in terms of achievement of the students.

- To study the reaction of the students belonging to experimental groups about the mode of learning mathematics at the end of the experimentation.

1.12 Hypothesis

- There will be no significant difference in the achievement scores of group C students and group A students.
- There will be no significant difference in the achievement scores of group C students and group B students.
- There will be no significant difference in the achievement scores of group A students and group B students.

1.13 Explanation of the Terms

- CAI with Discussion: The learners will learn arithmetic unit with the help of CAI along with the simultaneous discussion led by the investigator with students where ever and whenever needed.
- Reaction of Students: The belief of the students of experimental groups regarding the learning mode of arithmetic unit.

1.14 Operationalization of Terms

- **CAI**: For this study CAI means Computer Assisted Instruction, which will be a self-learning software package, developed by the investigator after observation of mathematics classroom to understand the student's ability, potential, grasping power and other learning behaviour.
- **Achievement in Mathematics**: The marks scored by each student in the test constructed by the investigator on the arithmetic unit will be the achievement of that student.
- **Effectiveness**: In the context of the present study effectiveness refers to two things viz. (1) Relative increase in the scholastic achievement of the two experimental group students compared to that of control group students and (2) Overall positive reactions obtained from the students of two experimental group on a reaction scale given to them.

1.15 Delimitation of the Study

The present study was delimited to English Medium GSHSEB students and only arithmetic unit of the mathematics textbook was covered during experimentation of the present study.

1.16 Organisation of the Thesis

Chapter I deal with introduction. It begins with importance of education in general, importance of mathematics, nature of mathematics, aims and objectives of teaching mathematics at school level sand all details of the study like rationale of the study etc.,

Chapter II deals with Review of related literature the chapter begins with an introduction and review of studies conducted for high failure rates in mathematics, studies conducted in the improvement of learning and teaching of mathematics, studies conducted for mathematics weakness, review related to PLM, studies conducted in the field of CAI in India, Studies conducted in the field of CAI in Abroad. This chapter ends with a discussion based on review of related literature and its implication for the present study.

Chapter III deals with Plan and Procedure of the study the chapter begins with an introduction followed by methodology, design of the study, population, sample, tools, Development of CAI, Implementation of CAI, and Procedure for data collection, Data Analysis and conclusion.

Chapter IV deals with Data Analysis and Interpretation of data. The chapter begins with an introduction, effectiveness of CAI, Major Findings and conclusion.

Chapter V deals with Summary and Major Findings related to different aspects of the study.