Chapter I

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INTRODUCTION

1.1 CONTEXT OF THE STUDY

Education has been considered as one of the important agents for accelerating the process of change, modernization and development all over the globe. It is a foundation upon which a country develops. Today a nation with superior educational system is superior and dominant.

Education surely is an agent of social change which transforms the society into a better place to live. It is the only means through which a society adjusts to its needs. Therefore, a society can never exist without education. Through education, the members of a society learn the skills to enrich transmit and transform cultural heritage as well as existing social and scientific knowledge for the continuous advancement of the society.

Education as an agent of socialization, as a subsystem to societal system do have major role in keeping young aspirants of the society aware and up-to-date with any kind of developments. It is a dynamic force in the life of every individual influencing his physical, mental, emotional, social and ethical developments. This is fundamental to the all round development of an individual both material and spiritual. Therefore, investment in the education of its youth is considered as most vital by all modern nations. Education has to equip the students to occupy his rightful place in a technologically advanced society.

Education is widely acknowledged as a vital cultural action that enables individual to transform himself into a complete and integral human being. It is a systematic process through which a child or an adult acquires knowledge, experience, skill and sound attitude. It makes an individual civilized, refined, cultured and educated. For a civilized society, education is the only means. Its goal is to make an individual perfect. The right kind of education is undoubtedly a stimulus to think, question and inquire into the truth of life and thereby refine and purify the human consciousness. It is the function of education to impart the right kind of knowledge, skills, attitudes and values to children so that they become harmonious in themselves and resourceful citizens playing their role effectively in the development of the nation.
The root meaning of education is given as bringing up or leading out or making manifest the inherent potentialities in a pupil. Education prepares an individual for better social living and equips him excel in the job he has been fitted in. It modifies the behaviour of the educand by the acquisition of specific knowledge and skills. In brief, the true education is the harmonious development of the physical, mental, moral (spiritual) and social faculties, the four dimensions of life, for a life of dedicated service.

We are living in an age of science. The term “science” is etymologically synonymous with knowledge, which of course does not imply that all knowledge is science. In the literal sense science means the pursuit of knowledge, but it has wider connotations. It can be described as the knowledge of nature in the widest possible form. According to Fitzpatrick (1960) “science is cumulative and endless series of empirical observations which result in the formation of concepts and theories with both concepts and theories being subject to modification in the light of further empirical observations. Science is both a body of knowledge and the process of acquiring it”. “Science is a process of human intellect – it s a way of thinking, a way of doing, a method of discovering new relationships in the physical and biological universe” (Schlessinger, 2000). “Science in fact is more than a subject. It is a method of acquiring knowledge” (Griggs, 1990). “It is an attempt to make the chaotic diversity of our sense experience corresponding to a logically uniform system of thought” (Nanda, 2006).

These definitions emphasize three basic principles of the nature of science. Science is an accumulated and systematized body of knowledge, the scientific method of enquiry and the scientific attitude. The first point indicates the product of science, while the second and third points indicate the process of science. In other words, science is both a product and a process.

Science affects each and every aspect of human life. We can find a network of scientific gadgets everywhere in our daily life. It gives the knowledge about various phenomena and facts. It is a valuable discipline for the country. No country can make scientific advancements without it, which is the need of the hour. Science and technology have been pivotal to India’s development efforts since independence. Economic growth and social transformation of our country are highly dependent on the firm foundation of science education. It is being realized that a welfare state is
possible only through a scientifically literate population. The report of education commission (1964-66) laid much emphasis on science based education by observing that science education should become an integral part of school education and ultimately some study of science should become part of all courses in Humanities and Social Sciences. The commission has also remarked that “there is of course one thing about which we feel no doubt or hesitation; education, science based and in coherence with Indian culture and values can alone provide the foundation and also the instrument for nation’s progress, security and welfare”. “Science strengthens the commitment to men of free enquiry and to the quest for truth and his highest duty and obligation. It loosens the bond of dogmatism and acts as a powerful dispeller of fear and superstition, fatalism and passive resignation”.

Modern society is completely drawn in to the scientific environment and science has become an integral part of our life. Science has helped the man to acquire supremacy over nature. It has opened innumerable avenues for persuading different vocations. Modern science is no longer confined to the surface of the globe; its sphere of achievements reaches beyond the earth. The wonderful achievements of science have glorified the modern world. A man without contact with science and its manifestations will be a complete misfit in modern society. If we conceive education as a process for preparation of a socially efficient citizen, it is imperative that each individual of the society acquires knowledge of science.

Among the academic subjects, science occupies an important place in the curriculum both at school and higher educational level. No subject can be compared with science as far as its importance and utility in daily life are concerned. Science education inculcates special values peculiar to it and which no other subject can provide. Science prepares pupils to think and sharpen their intellect making them more careful and systematic in reasoning. It provides training in truth, inculcates a spirit of enquiry, develops the capacity to know the unknown and gives strength to face failures. Science brings behavioural changes in the learner and enriches his character and personality. It gives opportunity for creative thinking and constructive imagination. Science affects and influences thinking, beliefs, traditions, customs, ways and life styles which in turn affect and influence the culture as a whole. The learner develops the habit of searching for the truth. Learning of science provides training in scientific method and also helps to develop a scientific attitude of mind in
the learner. The qualities imbibed by the learner through learning science are of great value to a citizen living in the modern society. If science is properly taught it can help to liberate the human minds from the grip of myths, prejudices and decadencing traditions and customs that are often injurious for the development of an individual and ultimately national advancement.

The effectiveness of science education to a very large extent depends upon the method of teaching and learning of science. Science as a discipline has distinct nature and characteristics. Scientific theories and principles are the outcome of the methods of science. More precisely; observation, classification, making hypothesis, verification, concept formation, etc. are the important processes involved in the formulation of scientific theories and principles. The paramount importance of process in science learning cannot be over emphasized. An effective instructional strategy cannot overlook the distinct nature and characteristics of a discipline despite the pedagogical principles. Therefore, any instructional design that fails to give due importance to this process component may not produce the desired result in science education. Therefore, the traditional methods of teaching science, which were evolved long ago for traditional society have outmoded in the present context of science education.

Modern educationists attempted to reshape science education. Progressive educators, like Dewey, Montessori, Gagne, Bruner, Piaget and Vygotsky stressed activity methods, productive methods and experimental pedagogy for constructing knowledge in their reaction to traditional education. Constructivism has evolved as one of the prominent learning theories in the broad field of education. According to constructivist theory, knowledge is being actively constructed by the individual and knowing is an adaptive process which organizes the individual’s experimental world. Hence the learner is not considered as a controlled respondent to stimuli as in behaviorist rubric but as “already a scientist”, who actively constructs knowledge while striving to make sense of the world on the basis of personal filters, experiences, goals, curiosities and beliefs. Knowledge for constructivism cannot be imposed or transferred intact from the minds of one knower to the mind of another. The constructivist portrayal is congruent with features of the science classroom envisioned by major science education reform movements, which emphasize inquiry as the
principle of science teaching and learning in pursuit of scientific literacy for all students.

The constructivist theories of learning dominate today and propagate that learning is achieved by the active construction of knowledge supported by various perspectives within meaningful contexts and social interactions. The constructivists emphasize that there is no single version of reality, rather a multitude of realities situated within each learner. Learning is dependent upon the learner’s ability to analyze, synthesize and evaluate information to create meaningful personalized knowledge. Learning is a constructive process in which the learner is building an internal representation of knowledge and a personal interpretation of experience. Various alternatives to traditional, teacher centered instructional frame works have emerged in contemporary education, including methodologies based upon constructivist learning theory.

The quality of education is largely dependent on the quality of instruction we provide in our classrooms. In modern approaches the pupil occupies the central figure in the process of education. In pupil centered teaching, the whole learning process is centered on the needs, requirements, capabilities and interests of the pupils. An appropriate learning strategy which can be adopted to suit the needs, requirements, capabilities and interests of the pupils is individualized instruction system. Individualization imply a system of instruction in which pace, medium of presentation, study style, context and evaluation techniques are adapted to the needs of each individual. “The goal of individualized instruction is each child’s learning becomes self-initiated and self-directed” (Sharma, 1990). Individualized instruction provides a learning environment that encourages the child and motivates intrinsically. Individualization of instruction acts as a catalyst for the development of student’s potentials. It should give the individual the necessary skills understanding and ways of approaching a problem, which allows him to exercise his creativity and individuality.

The individually different students forming heterogeneous group is a reality in our classrooms. Various factors such as physical, psychological and even socio-economic status of the learner may contribute to the individual differences. The individual difference is a challenge to every teacher however resourceful he may be. In our pedagogical practices followed in the school, the teachers find it difficult to
cater to the needs of the individual differences in the classroom situations. Here comes the importance of technology in the field of education. Effective use of technology helps the teacher in providing quality individualized instruction to the learners.

In the present scenario, the world of education has been influenced by the increased use of technology. It has provided valuable help in reducing the task of the teacher, smoothening the process of teaching, learning and enriching the goal of education. Technology makes possible the instant exchanges of information between classrooms as well as individual students; it allows instant access to data bases and online information service and provides multimedia technical resources. Technology usage in the classrooms motivates students and teachers, increases productivity and facilitates instruction. When used with effective instructional practice, technology facilitates learning and students learn the content in depth. Educators use technology to create a rich environment where students work shows evidence of conceptual understanding beyond recall.

Technology is used to provide opportunities for students to apply knowledge in real world contexts and engage in active participation, exploration and research. It is the order of the day that every teacher should use all kinds of educational technologies as their teaching strategy. Then only, all the students will be satisfied in the classroom instruction due to the population and knowledge explosion. Among all other technologies, computer accepted as an important tool to amplify the learning capacity of students. Computers have reached every nook and corner of the world. The entry of computers in human activities paved the way for emergence of massive information society. The role of computers in education is inevitable. It is quite a jump from traditional teaching reliance on text books to the computer use. A student has to participate actively rather than be a passive listener in the classroom while using computer. Computer helps him to be more active and do his activities more effectively.

Computers at school level are an increasingly valuable tool. The presence of computers in schools has increased dramatically and predictions are that this trend is likely to continue. Therefore, one of our educational goals should be to prepare students for a world in which the computer will continue to play a significant role. A child must be computer literate in order to make the society a knowledgeable society.
Computers expose students to modern technology while inculcating in them a new and scientific approach to learning. The computerization of the classrooms at school would allow the faculty to take advantage of these emerging technologies in their class presentations and permit students to have the hands on experience of learning with these tools. One of the most powerful aspects of using computer in the classroom is as a communication device. The internet offers almost instantaneous low cost communication with people in most countries of the world. The internet can provide students with new exciting and challenging resources. Internet can improve communication, increase participation, disseminate information and help share knowledge and skills.

Today, computers have been introduced as a subject in almost all primary schools. Students are provided frequent access to computers, so that they are well-versed with it when they actually step into the society as grown up individuals. Scientists call the computer as the ‘children’s machine’ because students in schools and good many in colleges and universities do not know a world without the computer. They tend to be more visual learners than previous generations because their world is rich in visual stimuli.

Computer technology can help support learning. Students can learn from computers, where technology used essentially as tutors and serves to increase student’s basic skills and knowledge. Also students can learn with computers where technology is used as a tool that can be applied to a variety of goals in the learning process and can serve as a resource to help develop higher order thinking, creativity and research skills. The student’s experience of learning as a result of their interaction with computers has to be understood as an interactive partnership between humans, machines, software and the larger educational environment in which the curricular activities take place. Learning strategies in such environments can be described as active, reflective, mindful, self organizing and socially oriented. In such interactive environments content learning may increase significantly both in quality and in quantity.

1.2 NEED AND SIGNIFICANCE OF THE STUDY

Technology has affected us in every aspect of our lives from communication to education. In the age of science and technology, knowledge is being increased
rapidly and consequently the social changes are being occurred. This has caused revolutionary changes in the educational system. So the developed countries are trying at faster rate to make their education more effective and qualitative by using varieties of instructional equipments and materials to stimulate thinking, reasoning and action of the learner.

During ancient time, education was teacher-centered in which students accepted every thought and philosophy of teacher without any logic and argument. Teacher had to decide the curriculum and what to be taught to the students according to their interest and values. There were least considerations about the age, mental level, aptitude, attitude and interest of the individual student. Therefore, education was not according to the individual differences and mental level of students.

Today information technology and computers have changed every sphere of human life, the society as well as the total educational system. Education has been changed according to the needs of the individual learner. The role of education is not only to provide knowledge but also to develop abilities in the child like curiosity, interest, instinct values, self-study and self-thoughts. Teaching is not considered just as “teacher - centered” but now moreover it is ‘child - centered’. For this it is very necessary to bring revolutionary changes in the methods of teaching- learning process.

There is an emphasis on alternative methods of teaching and learning in the present time. We always endeavor to fine tune the educational process at the school level through implementation of innovative teaching methods, bringing a wide array of innovative approaches in to the academic process. The democratization of the educational process comes first among these approaches, which is aimed at encouraging students to have a greater say in what concerns their studies, the content of those studies as well as to empower students to become leaders within their chosen field.

Autonomous learning is another approach, which is actively implemented in the academic process. It implies gradual shift from traditional teacher-centered studies to a self-learning process. When students are placed in such conditions, they are to employ their critical thinking, creativity, collaboration and communication skills in addition to the problem solving skills that will make them experts on the subject studied.
The implementation of the student’s autonomy requires, in its turn, a fundamental shift of the instructor’s role from that of a teacher who delivers knowledge to the students to that of a facilitator, whose aim is to inspire student’s creativity, independence, motivation, and master academic skills, which is the third key approach to the enhancement of learning.

The above stated approaches can only be implemented through the introduction of the fourth individual approach to the academic process. Democratization, student’s autonomy together with an instructor as a facilitator can only work effectively as long as student’s individuality, his individual cognitive and perceptive abilities and interests are considered.

The fifth back-up approach that supports the first four ones mentioned earlier is co-operative learning directed towards focusing on students team works while doing their projects or assignments.

Co-operative learning as well as the necessity to develop student’s creative skills and academic potential result in the necessity of introducing the task-based approach to learning, which requires using learning situations and tasks that do not make students merely reproduce the knowledge acquired, but also stimulate their creativity in order to find new original answers to unconventional tasks.

All the above mentioned innovative teaching approaches stipulate the necessity of one or more approaches for the intensification of the academic process and enhancement of student’s motivation. This is achieved by using various forms of curricular and co-curricular activities including interactive lectures, presentations, individual assignments, independent and self learning activities during practical classes, seminars, role plays, simulations, case studies, individual and team projects, workshops, the use of multimedia facilities, e-lectures and other visual supports as well as the use of the internet for the academic purpose both by the students, the faculty and others. It is worth saying that all these approaches cannot work successfully without the broad use of information or computer technologies in the academic process.

Nowadays most of the educational views revolve around the concept that child can construct knowledge from his own experience. The two views of education viz. the information transmission view and the constructivist view have been at war for
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centuries. The information transmission view holds that teachers should be masters of particular domains of knowledge and their job is to transmit their expertise about these domains to students through lectures and recitations (Hussain, 2010). This view is teacher centered in nature.

Constructivism is the last decade’s dominant theory that has root in Philosophy, Psychology, and cybernetics and attempts to describe how people know the world (Sarvey & Diffy, 1996). Constructivist approach stresses communication and collaboration of students with their peers as well as with the teacher (Diffy & Cunningham, 1996). The constructivist view holds that teachers should be facilitators who help students to construct their own understanding and capabilities on carrying out challenging tasks. This view puts the emphasis on the activity of the student rather than of the teacher. Teachers are supposed to develop or provide different teaching materials and strategies for different learners based upon the concept of individualized teaching according to the student’s ability. If the teaching method can meet a learner’s specific learning style, then it will facilitate his achievement.

Constructivist learning is based on student’s active participation where they are “constructing” their own knowledge by testing ideas and approaches based on their prior knowledge and experience, applying these to new situations and integrating the new knowledge gained with pre-existing intellectual constructs (Richardson, 1997). Recent interpretation of constructivism suggests that each learner constructs his schemata, bits of knowledge, explanations or pictures of reality according to the learner’s individual goals, previously existing concepts and new perceptions. Learning from that perspective is much more under the control of the learner. A paradigm shift from teacher-centered instruction to learner-centered instruction is needed to enable students acquire the knowledge and skills sufficient to make them fit in the present era (Sarvey & Diffy, 1996).

Educators are always concerned about what educational methods can benefit the learner the most. Nowadays most of the educational views revolve around the concept that child can construct knowledge from his own experience. Each individual has his own needs, interests, capacities and requirements. To meet the different learner characteristics, individualized instruction is an effective learning strategy. The goal of individualized instruction is to make the learning self-initiated and self-directed. Educators and psychologists have highlighted the necessity to take into
account the learner’s individual differences and learning styles because they represent the foundation upon which instructors should build their instructional methods.

The National Curriculum framework (2000) shares the concern in the poor quality of science education in India. It also envisages a process oriented approach in the teaching of science. Science teaching as a process ensures the active involvement and participation of the learner through appropriate learning activity. This makes way for sense learning and consequently enhanced perceptual clarity and conceptual clarity. In this context it is relevant to appreciate the cognitive psychologist Bruner’s idea on the conceptualization and discovery learning. When a learner is involved in the process of science, he is really constructing knowledge of his own (Danadpani, 2001).

Earlier in our State, importance was given to the product aspect of science, while the process aspect was neglected. This comes out very clearly when we analyze the methods of teaching adopted earlier and those proposed by SCERT as part of new curriculum. Earlier science teachers used mainly the lecture method and lecture demonstration method in order to impart large quantity of product aspect of science to the pupils but these methods are not good enough in developing the process aspect of science among the pupils. But now, in our revised science curriculum, we give importance to both the knowledge (the product aspect of science) and the ways by which the knowledge is acquired (the process aspect of science). On account of this the methods of teaching have to be changed. Now we are expected to use modern instructional strategies giving importance to the process aspect of science.

The higher secondary education is a unique investment in the present and future being the ultimate guarantee of national self-reliance. The critical purpose of higher secondary education is to prepare the students for their future professional lives. Meeting this purpose requires supporting the students in developing deep understanding of their discipline. To meet the higher secondary education goals of developing students, professional expertise teaching should be done in a manner consistent with finding an expert performance in domains that are relevant.

Today’s higher secondary level education follows Activity Oriented Method of Instruction. Even though the actual spirit of Activity Oriented Method of Instruction is to make the learner independent, the different strategies adopted in this
method of instruction is limited only to the cognitive level development. There is no option of revising the discussion other than referring to notes made during the session or retrieve it from memory. It is seen that in many higher secondary schools, even though the method proposed is activity oriented method, many teachers still prefer to teach either by lecture method or by demonstration method. Teachers may list out a series of drawbacks of the activity method – time consuming, lack of content coverage, expensive, etc. as the reasons for not using this method in their classes. Also, it is often observed that some pupils do not show adequate interest in ‘doing’ the activities while teachers transact using Activity Oriented Methods.

The taxonomy of science education by Mc Cormack and Yager (1989) is being followed in Kerala State by SCERT. According to this taxonomy there are six domains in science education. They are Knowledge, Application, Process, Attitude, Creativity and Nature of Science. Teacher centered methods like, lecture method, lecture - demonstration method, etc. can satisfy the objectives of the Knowledge domain alone, but cannot satisfy the objectives of other five domains. To develop the objectives of all the six domains and help the pupils for future inventions and discoveries, process oriented innovative approaches should be used in the classroom. Modern instructional strategies play a remarkable role in the educational sector (Anandan & Nallusamy, 2012). Teachers must use different strategies in order to bring enthusiasm in learning. Just to make science learning as an enjoyable and meaningful activity, the teachers must make their children as active participants, instead of being passive listeners (Devaki, 2013).

It is very necessary to use modern technologies in teaching to make teaching effective. These new technologies make teaching student centered (Kumar & Sing, 2004). The present day students are being influenced by a number of new media such as Radio, T.V., Video, Computer, etc. Among all other media, Computer has been accepted as an important tool to amplify the learning capacity due to huge amount of knowledge capacity. Maheswary (2012) emphasized the importance of a range of media techniques including text, sound, diagrams, pictures, video clips and animations to present the subject matter to students through computer based multimedia packages. The computer is a symbol of technological innovation that has brought in phenomenal changes both at work places and in leisure time. The use of computer as a tool involves effective use of software in classroom activities and its
integration in curriculum activities (Srinivaskumar, 2004). The dynamic interaction between the student and the instructional programme is possible through computer than any other media. The computers have a vast potential for instruction ranging from schools to universities. Computer technology has the potential to provide specific activity based better learning environment. It is a transformational tool which when used appropriately can promote the shift to a learner-centered environment. Computer technologies can enhance the quality of education in several ways by increasing learner motivation and engagement by facilitating the acquisition of basic skills and by enhancing teacher training.

One of the most powerful reasons for considering the use of computer technology in an educational system is that they put learning in the hands of the learner. Computer Assisted Instruction can help the student to see the unseen, to list the theoretical concepts, to comprehend abstract ideas, to communicate more effectively reducing the teacher- student ratio and helps to take more informal decisions (Chiniwar, 2013). It facilitates individualizing curriculum, permits learners to dictate the pace of learning and widen the source of information. Computer technology also promotes active learning and allows for interaction between and among peers and mentors, there by the students can construct knowledge. Each student gets the chance to absorb knowledge to his capacity. ‘Learning by doing’ has been considered as one of the best methods of learning. When used appropriately computers enable new ways of teaching and learning rather than simply allow teachers and students to do what they have done before. If designed and implemented properly computer-supported education can promote the acquisition of knowledge and skills that will empower students for life-long learning.

Computer is a powerful tool in the learning environment and a wide variety of techniques of using computer in education have emerged over a period of time and are now become very common in use. Even though a number of Computer Based Learning Materials are available in various subjects, most of them are not according to the context and culture of our system of education. Moreover self learning materials for teaching physics at higher secondary level are scanty. The packages already available are mostly not following constructive approach to teaching physics and they contain only provision for simulation and drill and practice.
The computers have a vast potential for instruction in all educational environment ranging from schools to universities. As computer is now being used in all sectors of life, in a society where most of the work is becoming computer based, education, teaching and learning can’t resist their use for a longer period to cope with the world. The Investigator’s own experience with use of computers in classrooms and the gaps existing in the review conducted in this area motivated the Investigator to undertake a study of this kind to develop an interesting, innovative and interactive Computer Based Instructional Package in Physics at the higher secondary level by following the principles of education like individualized instruction, constructivism and learning by doing and to find out its effectiveness with respect to each of the five domains suggested by Mc Cormack and Yager (1989) in their taxonomy of science education.

1.3 STATEMENT OF THE PROBLEM

Paucity of appropriate learning materials and strategies for transacting the curriculum in science obstructs the learner to construct knowledge. Also there is lack of hardware, software, and maintenance; lack of trained people; and lack of clarity about the objectives (Zamani, 1998). Hence an attempt is made to develop an interactive Computer Based Instructional Package in Physics at the higher secondary level and to measure its relative effectiveness with existing Activity Oriented Method of Instruction on the basis of the taxonomy of science education put forward by Mc. Cormack and Yager (1989). Hence the topic selected for the study is stated as “PREPARATION AND VALIDATION OF COMPUTER BASED INSTRUCTIONAL PACKAGE IN PHYSICS AT THE HIGHER SECONDARY LEVEL”

1.4 DEFINITION OF KEY TERMS

Validation

The term validation means assessment of an action, decision, plan or transaction to establish that it is correct, complete, being implemented as intended and delivering the intended outcome. That means, validation stands for assessing the degree to which an instrument accurately measures what it is intended to measure. It confirms that something (application, experiment, and equipment) consistently fulfills
the required verification that something is correct or conforms to a certain standard (Vockell & Asher, 1998).

By the term validation, in this study the Investigator means ‘testing the effectiveness of the particular strategy used in the experimental treatment’.

**Computer Based Instructional Package**

Instructional Package is a self contained self sufficient and independent pack of activities with primary focus on a few well defined outcomes. It is a document containing all that is necessary for a learner to attain one or more specific objectives independent of the teacher. It is to enable students to develop their knowledge through integration of theoretical and practical material.

When computer is exploited for the development of instructional package and if the learning package is provided to the learner through computer, it is called Computer Based Instructional Package. Here, by the term ‘Computer Based Instructional Package’ the Investigator means an interactive instructional package developed so as to provide the learner with innovative learning activities, which includes illustrations, pictures, graphics and animations through the computer in an interesting manner.

**1.5 OBJECTIVES OF THE STUDY**

1. To prepare a Computer Based Instructional Package in Physics at Higher Secondary School Level.
2. To find out the Achievement of students when taught through Computer Based Instructional Package in Physics at Higher Secondary School Level.
3. To find out the Achievement of students when taught through Activity Oriented Method of Instruction in Physics at Higher Secondary School Level.
4. To compare the gain in Achievement of students when taught through Computer Based Instructional Package and Activity Oriented Method of Instruction.
5. To compare the effectiveness of Computer Based Instructional Package with the Activity Oriented Method of Instruction on the Total Achievement in the selected domains of students in Physics at Higher Secondary School Level.
6. To compare the effectiveness of Computer Based Instructional Package with the Activity Oriented Method of Instruction on the Achievement in Physics of Higher Secondary School students with respect to different domains such as
a. Knowledge  
b. Application  
c. Process  
d. Attitude  
e. Creativity

7. To compare the difference in the Achievement of students in Physics of the Experimental Group in the different domains such as Knowledge, Application, Process, Attitude and Creativity.

8. To study the effect of Computer Based Instructional Package, Intelligence and their interaction on the Total Achievement in selected domains of students in Physics when pre-achievement was taken as co-variate.

9. To compare the effectiveness of Computer Based Instructional Package in three different modes of testing like Pre-Test, Post-Test and Delayed Post-Test.

1.6 HYPOTHESES OF THE STUDY

The hypotheses formulated for the present study were:

1. Total Achievement in the selected domains in Physics of Higher Secondary School Students taught through Computer Based Instructional Package is significantly higher than those taught through Activity Oriented Method of Instruction.

2. The Achievement in Physics of Higher Secondary School Students taught through Computer Based Instructional Package is significantly higher than those taught through Activity Oriented Method of Instruction with respect to different domains of objectives such as
   a. Knowledge  
   b. Application  
   c. Process  
   d. Attitude  
   e. Creativity

3. There is significant difference in the Achievement in Physics of students in the Experimental Group in different domains of objectives such as Knowledge, Application, Process, Attitude and Creativity.
4. There is significant effect of Computer Based Instructional Package, Intelligence and their interaction on Total achievement in selected domains of students when pre-achievement was taken as co-variate.

5. There is significant effect of Computer Based Instructional Package in three different modes of testing like Pre-Test, Post-Test and Delayed Post-Test.

1.7 SCOPE OF THE STUDY

The present study is intended to develop an interactive Computer Based Instructional Package in physics, through which interesting and innovative learning activities are provided to the learner so that the learner can construct knowledge through his own activities. The package is designed with the intention that the learner should develop the objectives of all domains of science teaching viz. - Knowledge, Application, Process, Attitude and Creativity as suggested by Mc Cormack and Yager (1989) in their taxonomy of science education and there by understand the nature of science.

In this package, Computer can provide learning activities through graphics and animations in a colourful manner while focusing attention, eliciting interaction and encouraging involvement through multiple modalities. This will help the learner to develop curiosity, interest and proper attitude among learners. Since this method follows process oriented and constructivist approaches, the learner develops the capacities like critical thinking, reasoning, problem solving, prediction, decision making etc. and get the ability to discover new knowledge.

Computer based learning materials can be used for individualized learning as well as for group learning. Here learner is expected to be at the principal position and teacher acts as a facilitator. In addition, computer can provide immediate feedback to allow students to correct their mistakes immediately, instead of waiting until the homework is checked and returned by the teacher.

It is expected that the findings of the present study would help others in the educational field to understand the effectiveness of computer based learning materials in teaching of science. It can equip teacher educators, school practitioners and prospective teachers in adopting innovative approaches in future.

The findings of the study can be much helpful in curriculum planning. It would also be helpful for curriculum framers to develop computer based learning
materials for all levels of students and for distance education and correspondence courses.

It is hoped that the curriculum developers would compulsorily incorporate provision for innovative approaches in the syllabus and it is also presumed that the findings of the study will promote the use of innovative instructional strategies.

The experiences gained by the learner through the interaction with the computer based learning activities would help the learners to be independent in their learning. The study also aims to point out that the teachers should adopt innovative methods, approaches and strategies to make the learner independent in learning. The Investigator hopes that the study would be helpful to improve curriculum development, curriculum transaction, evaluation and thereby the process of learning.

1.8 DELIMITATIONS OF THE STUDY

Sincere and genuine attempts were made by the Investigator to make the study as objective as possible. The delimitations of the present study were:

1. The study was delimited to higher secondary school students.
2. The sample size was restricted to 120 students with one experimental group and one control group, each consisting of 60 students because providing computer-based activities, in order to construct knowledge by the learner, requires enough number of computers and necessary resource to perform activities.
3. The selection of sample was from only one rural private aided school in Palakkad district.
4. Only one content unit from class XII Physics viz. ‘Ray optics and Optical instruments’ was selected for the development of the Computer Based Instructional Package since development of such packages will be cost effective only if it is developed for a large group by a group of institutions or teachers.

Despite all these delimitations, all possible attempts were made by the Investigator to conduct the study as reliable and objective as possible. It is hoped that the result of the present study would help researchers, teachers, prospective teachers and learners to reach new frontiers in education in general and science education in particular.
1.9 ORGANISATION OF THE REPORT

The research report consists of six chapters.

Chapter- 1: Introduction

The introductory chapter presents a foundation for selecting the present problem, its significance, statement of the problem, definition of key terms, statement of hypotheses, and objectives of the study and a brief description of the scope and delimitations of the study.

Chapter- II: Theoretical Overview

This chapter deals with the concept of Computer Based Instruction and related strategies. It includes nature and features of Computer Based Instruction, different modes of instructional software for curriculum integration, computers and individualized instruction and teacher’s role in computer based instruction. This chapter also describes the theory behind the assessment based on the taxonomy of science education by Mc Cormack and Yager.

Chapter-III: Review of Related Literature

A brief overview of the related studies as well as scholarly works done by researchers with more proximity to the present study is included in this chapter.

Chapter-IV: Methodology

This chapter deals with the method followed in the present study and a brief description of the design selected. Also it describes the development and validation of various tools used in the present study and about the statistical techniques employed for analyzing the data.

Chapter-V: Analysis and Interpretation of Data

It presents details regarding the analysis of data. The analysis has been followed by interpretation of results and major findings.

Chapter-VI: Summary, Conclusions and Suggestions

This chapter presents a retrospective view of the study, major conclusions, educational implications of the findings and suggestions for further research.