Chapter 1
Introduction
Teaching and learning are inseparable because learning is a criterion and product of effective teaching. Someone has not taught unless someone else has learnt. Teaching and learning is interdependent because the teacher needs to provide students with the knowledge and skills for a global society and students need ways to access the learning for academic achievement. Teaching requires attention to both the content of the course and the process of moving students from their initial state of knowledge and understanding to the desired level. Although, there are many ways to teach effectively, all require that the teachers have knowledge of three things: a) The material being taught, b) The best instructional strategies to teach the material and c) How students learn?

Today’s teachers face huge challenges. They must understand as much as possible about how children develop and learn, what they know and what they can do. They must be able to apply a variety of teaching techniques to meet the individual needs of students. Equally important, teachers must identify students’ strengths and weaknesses and plan instructional programs that help students make progress (Strickland, et al. 2010).

What is the most effective way to teach students? The answer depends on what students are expected to learn. Although, there is no universal best way to teach, experience shows that some general principles apply (American Association for Advancement of Science 1990a, McDermott et al. 1994 and Mazur 1996):

- Teach scientific ways of thinking.
- Actively involve students in their own learning.
- Help students to develop a conceptual framework as well as to develop problem solving skills.
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- Promote student discussion and group activities.
- Help students experience science in varied, interesting and enjoyable ways.
- Assess student understanding at frequent intervals throughout the learning process.

Learning is the central theme of education. Now a day's education is the primary requirement for all kind of development of the nation. It is time's demand that education should be provided to all kind of students of the country and no student should be deprived from the benefit of it. In this context, many steps and efforts have been taken to improve the educational system and classroom teaching. Since, education and learning are ongoing and dynamic. As such, teaching and learning styles and methodologies are continually reviewed to respond to developments in technology and to the changing demands from society. In educational institutions, computer resources are seen as essential. One of the most important innovations in the field of education is that of the unprecedented advancement and enhancement in the use of educational technology. This change has influenced the classroom teaching and the learning process (Gohel, 2009).

Computers are found just about everywhere at home, school, work, vacation spots, cars, planes and some computers are even attached to human beings. Therefore, one could argue that computer literacy is quickly becoming an essential basic skill to be ranked among the three R's - reading, writing and arithmetic. In western countries, a great deal of research has been conducted on the effects of use of computers as a teaching tool on student achievement, attitudes, learning rate and retention. However, educators, administrators, researchers and parents all have doubts about its real learning value. While no one denies the need for making every student computer literate, there are misgivings about the effectiveness of computers for teaching. Computers in classrooms are more than expensive time-wasting toys and use of computers for teaching enhances learning in demonstrable ways (Cotton, 1991).
Just as technology has improved effectiveness in medicine, finance, manufacturing and numerous other sectors of society, advanced computing and telecommunications have the potential to help students master complex 21st-century skills. Today’s children have grown up immersed in a world of computers and other information technologies. They play video games, listen to music on digital compact disks and help their families program the computerized controls of videocassette players. With all these exciting innovations in computer technology, children have the opportunity to gain a wealth of knowledge without ever leaving home. Schools by comparison can seem dull. Education reformers have been developing new approaches for improving the way in which children learn and interact in the classroom. They are now considering the “technology gap” that exists between the technologically rich experiences children have outside the classroom and the comparatively low-tech in-school environment. Learners engage in guided, reflective inquiry through extended projects that inculcate sophisticated concepts and skills and generate complex products. Pupils act as partners in developing learning experiences and generating knowledge and students’ collaborative construction of meaning is enhanced via different perspectives on shared experiences. Simulation and visualization tools help students recognize patterns, reason qualitatively about physical processes, translate among frames of reference and envision dynamic models. These curricular approaches improve success for all types of learners (Dede, 2000).

Thus, educational technology can be a powerful tool for change in education. Technology, when properly used as an integral part of the curriculum and the instructional approach can be a very effective tool for improving and enhancing instruction and learning experiences in the content areas involving all students in complex and authentic tasks. The use of technology in the classroom can give all students a learning environment that allows discovery and creativity through the use of computer visualizations such as modeling and simulations and has the potential to dramatically change the way we view science and mathematics. Opportunities can range from achieving greater independence and maximizing productivity to connecting with the virtual communities across the world and
sharing information and ideas (O'Shea, Kimmel and Novemsky, 1990). Special needs students can be provided with access to technologies that empower and enable them to be successful in an inclusive learning and working environment (Holzberg and Wiburg, 1995).

Teachers who promote meaningful, engaged learning through authentic use of technology are providing students with opportunities to interact with a wealth of resources, materials and data sets. When educational technology applications such as the internet, distance learning, CD-ROMs and video are used at the classroom level to help achieve challenging standards, they provide powerful alternatives for creating more effective learning environments and more productive learning opportunities. Technology offers educators an opportunity to move away from instructional strategies that focus on presentation of abstract information to the passive learner to an active process in which meaning is developed on the basis of experience. In the constructivist view, the learner is building an internal representation of knowledge and a personal interpretation of experience (Bell and Ramirez, 1997).

Science is an important subject in school curriculum that has two major problem areas that cause ineffective learning; limitations of teacher and lack of audiovisual aids. Most science teachers have in-depth knowledge only in their chosen electives such as physics, chemistry or biology that is required to teach fundamental concepts in the discipline but they are hampered in teaching other branches which they must teach anyway. Many teachers are not adapted to using quick sketches to explain certain content or in drawing diagrams in Biology. Some do not possess the needed knowledgebase to link scientific content with day-to-day examples. For effective teaching of science, teachers need to collect ample background information, for which they may not have the resources, time or inclination. Teachers often need to carry several charts, equipment, specimens etc. even for teaching a single topic effectively. However, often these materials are either unavailable or inaccessible. Moreover, teachers do not have enough time between classes to procure and test it for its usability. Hence, most
science classes are limited to uninspiring and sometimes incomprehensible verbal lectures. However, in the past, new technology in teaching-learning has not always proved effective. Most science teaching material available for use by teachers was not able to accommodate the individual needs of the learner. For example, educational films produced abroad did not match the local curriculum and were hard to understand due to different accents. It is believed that computers cannot only help overcome these problems, but Technology offers educators an opportunity to move away from instructional strategies that focus on presentation of abstract information to the passive learner to an active process in which meaning is developed on the basis of experience. In the constructivist view, the learner is building an internal representation of knowledge and a personal interpretation of experience (Ranade, 2001).

There are many approaches to bring revolutionary changes in the field of science education especially in the use of innovative teaching strategies for teaching of science particularly at secondary school level. Two of these strategies are through multimedia presentation and computer assisted instruction. The present research investigated the significance of these two methods as instructional strategies on acquisition of concepts in physics with learning style and gender as classifying variable.

1.1 MULTIMEDIA PRESENTATION

The human brain is an extraordinary piece of biological machinery. It is capable of coordinating the senses to acquire, process and link vast amounts of information to help people learn, communicate and survive. One can make a strong analogy between the function of the human brain and a computer brain. All computers purchased today are Multimedia PC's. This means that the software installed in the system is capable of combining text, graphics, audio and video with links and tools that help a user navigate, interact, create, communicate, learn and survive both academically and socially (Hofstetter, 1997).
Students respond to information differently. Thus, it is often to our advantage as teachers to use many different formats and modes to teach the subject matter of a lesson. This is why teachers normally use some combination of lecture, text and hands-on laboratory for conveying information. With the advent of the Internet and the multiple formats that can be communicated over the World Wide Web, we now have several new and exciting ways to present information. The web allows the incorporation of animation, moving pictures and sound into lessons which extends our abilities to present materials that encourage student interaction with the subject matter. Pictures and animations help bring to life scientific principles and multimedia allows students to take a more active role in learning. They can watch experiments in action, see microorganisms close up and use a mouse or keyboard to navigate images, simulations and interactive material (Velleman and Moore, 1996).

1.1.1 Historical Perspective

Usage of still graphics combined with audio in slide show and filmstrip projections were pioneered in fifties and sixties. Sixteen millimeter film brought with it the ability to add motion to the presentation. In the 1970’s and 80’s the popularity and affordability of VCR allowed greater ease for these powerful communication media. Today we still use still graphics, audio, motion visuals and animation. Now, however, these media elements are under the control of the personal computer. School-purchased multimedia such as videos and CDs work well but these can be limited by school budgets. Another drawback of these tools is that given the hectic schedule teachers are often forced to keep, it can be a significant strain on their time to review multimedia materials and seamlessly incorporate them into a lesson plan. Finally, juggling a VCR and TV for video, a CD-ROM player, computer, projector and textbook can be technically as well as financially challenging. Ideally, what teachers need is a single system that blends text, images, simulations, video, audio and other multimedia material into a single and coherent environment that is available from school or home (Zimmer, 2003).

Multimedia refers to a combination of communicative elements—text, sound, graphics (Photos and diagrams) and motion visuals (animation and video) used
in classroom or other presentation. The key words are communication and interaction.

1.1.2 Meaning of Multimedia Presentation

Multimedia instruction is the use of computer to present and combine text, graphics, audio and video with links and tools that let the user navigate, interact, create and communicate. This definition contains four components essential to multimedia instruction.

- First, there must be a computer to coordinate what you see and hear and to interact with
- Second, there must be links that connect the information
- Third, there must be navigational tools.
- Finally, there must be ways for you to gather, process and communicate your information and ideas (Hofstetter, 1995).

Multimedia can be described as the combination of various digital media types such as text, images, sound and video into an integrated multisensory interactive application or presentation to convey a message or information to an audience (Velleman and Moore, 1996).

Multimedia is not a product but a combination of technologies. When a teacher is teaching, he can add a variety of information with graphics, text, video etc. In this way, a teacher can help the learner to understand the difficult concepts clearly. The use of sound, colour images, moving video, rapid references in form of glossaries and background details can be used to enhance this valuable teaching reference tool (Anandan, 1997).

Multimedia can be defined as the technology engaging a variety of media, including texts, audio, video, graphics and animation either separately or in combination using computers to communicate ideas or to disseminate information. It is a carefully designed interaction of text, graphics, sound, animation and video (Ravichandran and Sasikala, 2005).
1.1.3 Channels of Multimedia Presentation

Multimedia is made up of a number of communication channels each having their own advantages and disadvantages. In order for any multimedia system to be successful, these channels must be in balance using each for what it does best and not letting one channel dominate over the others (Ogochukwu, 2010).

**Video:** One of the greatest benefits of the first communication channel, video, is its ability to take students beyond the classroom. Video can focus our attention through editing, manipulate time and space through time-lapse, slow motion, microscopic or telescopic views. When these tools are used properly, a video presentation can be more compelling than direct observation.

**Animation:** Animation is another communication channel of multimedia. Animation can be defined as making objects on the screen change or move in real time. Research has shown that motion on the screen is important in holding viewer attention. Because of this, animation plays a major role in multimedia design.

**Narration:** A third channel of multimedia is narration. A spoken narrative can be very effective in attaining attention when illustrated with animations and accompanied by an outline of key points.

**Sound:** Finally, one of the last multimedia channels is sound. The use of sound goes beyond narration with the ability to enrich the multimedia environment. Sound effects can contribute validity to animated objects or they can lighten the mood of a presentation that has grown too serious. In addition, sounds can make mnemonic morphs more memorable.
1.1.4 Formats for Multimedia Presentation

There are many formats for multimedia presentation. Teachers have to keep in mind the purpose to provide the most effective student learning opportunities when choosing the format.

Web Pages

Web pages become multimedia resources and presentations when they are designed with media other than static images and text such as audio, video, animation and virtual reality.

Hypermedia

Hypermedia is a combination of the words, hypertext and multimedia. Hypertext is often referred to as the text on a web page which may include graphics, sound animation and video as well. Navigation of hypertext is designed to be nonlinear allowing the viewer to jump between segments as they choose. The term hypermedia is often used synonymously with hypertext but indicates the presence of various forms of media as part of the resource. A software tool for designing hypermedia is hyper studio. This multimedia authoring software has drawing tools, audio, video, animation and text components. Teacher or student Hyper Studio presentations create an active rather than passive learning environment, engage multiple senses and appeal to a variety of learning styles.

Slide Presentations

Teacher or student slide presentations can be done using a variety of software such as PowerPoint, AppleWorks Presentation, Corel Presentations 8.0 and KidPix Slide Show. Although the capabilities of the programs vary, the purpose of the slide show format is to display work such as student or teacher research, ideas, information outlines or unit material. Test, charts, graphs, audio, text animation, live hyperlinks and video clips can be added to many of the presentation software programs to create multimedia presentations. Slide show presentations can be viewed by a group at the computer or by a class by connecting the computer to a digital projector.
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Video presentations can provide background information in a unit of study for all learners as well as provide a resource for independent learning. Documentary videos help students gain insight to historical events, other cultures and human identities. Videos can also provide the window to the remote like outer space and the inaccessible like the human heart. Student made videos or computer generated videos provide opportunities for students to plan, develop, edit and produce presentations. This can be done with younger elementary aged students with increasing sophistication as the age and experience increases.

Virtual Reality

Virtual reality is the technology that allows us to explore from a computer a three dimensional space. Using a digital camera and photo-stitch software, teachers and students can create their own virtual reality tours for use in a variety of curriculum areas. Once created, the virtual tours can be shared with other classes and schools.

Well-designed multimedia presentation helps learners build more accurate and effective mental models than they do from text alone. Recent surveys indicate that students enjoy attending classes that utilize multimedia presentations because they find these classes to be more interesting and exciting with multimedia (Velleman and Moore, 1996).

1.1.5 Advantages of Multimedia Presentation

One of the advantages of using multimedia presentation is to convey information quickly and effectively to all students and keep them interested in learning. As an effective communication tool, multimedia program provides the user to use all their senses to explore the presentation. Sight is used to see the colorful display or animation, sound is used to hear digitized music or auditory narrative, touch is used to activate the mouse or touch screen display. In other words, the multimedia can stimulate more than one sense at a time and in doing so, may be more attention getting and attention holding. Color slides, sound,
illustrations and moving images are intrinsically interesting. Through this mixed mode of presentation techniques, the multimedia can appeal to learners who prefer to receive information by reading, those who learn best through hearing and those who prefer hands-on environments (Moore, et al. 1996).

Multimedia applications open up a whole new world of discovery and learning. Multimedia empowers a teacher to structure lessons that reach all students, an ability so often desired but not met in the traditional classroom. Multimedia empowers the student to take an active role in his or her own learning. And multimedia helps both teacher and student develop and strengthen all of the multiple intelligences necessary for quality learning (March, 1999).

Multimedia presentation technology provides an influential and multifaceted tool that can change the way we teach and the way students learn. In turn, there is an improved ability to search for abstract or complex material with increased student comprehension and interest (Matheson and Achterberg, 1999).

One potential use of multimedia presentation in high school is to complement traditional instruction. This is accomplished by integrating a variety of media sources such as words, graphs, sound and visuals. The result is an improved ability to present abstract or complex material with increased student comprehension and interest (Kolasa and Miller 1996).

1.1.6 Effectiveness of Multimedia Presentation in Education

Research show that multimedia enhanced learning produces at least 30% more learning in 40% less time at 30% lower cost. When a multimedia presentation is used for multimedia methods of instruction, retention is raised to 80% in contrast to 40% for discussion methods or 20% with the traditional lecture approach using visual aids (White and Kuhn, 1997).

Research supports the effectiveness of multimedia as a powerful tool in ensuring student's ability to remember and retain information. Recent findings in
brain research suggest that this is especially true when the student is engaged in activities that draw upon his/her multiple intelligence strengths. To be truly effective educators, teachers must recognize these implications of living in an information age and adapt their instruction to meet the individual needs of all students. Understanding the ways in which learners learn best will help in choosing appropriate multimedia applications to optimize individual student learning (Hofstetter, 1997).

In a workshop conducted on Performance learning systems, quality learning was defined as "when the student engages in activities that stimulate constant improvement, originality and creativity, integration of topics, depth of subject, complexity, details, active involvement, application, emotions and ownership and pride". Experience has shown that individuals truly understand something when they can represent the knowledge in more than one way. Various multimedia applications can quickly and easily facilitate these needs (Barkley, 1999).

Educators are now introducing more and various forms of software and multimedia presentation driven media into their classroom activities. These creative presentation systems are producing a great deal of excitement among educators (Tolhurst, 1995).

1.2. CAI (COMPUTER ASSISTED INSTRUCTION) PACKAGE

Use of computer in education is referred by many names such as Computer Assisted Instruction (CAI), Computer Aided Instruction (CAI), Computer Assisted Learning (CAL), Computer Based Education (CBE), Computer Based Instruction (CBI), Computer Enriched Instruction (CEI) and Computer Managed Instruction (CMI). Computer-based education (CBE) and computer-based instruction (CBI) are the broadest terms and can refer to virtually any kind of computer use in educational settings. Computer-assisted instruction (CAI) or Computer Aided Instruction (CAI) is a narrower term and most often refers to drill-and-practice, tutorial or simulation activities. Computer-managed instruction (CMI) is an instructional strategy whereby the computer is used to
provide learning objectives, learning resources, record keeping, progress tracking and assessment of learner performance. Computer based tools and applications are used to assist the teacher or school administrator in the management of the learner and instructional process (Britannica Concise Encyclopedia, 2006).

Effective instruction requires presenting information, guiding the learner, practice and assessment of student learning. The use of a computer to provide any combination of these factors is termed as computer assisted instruction. It should be noted that there is no requirement that the computer provides all of these elements. Rather, any combination of these can be appropriate computer intervention in the learning process. It is a self-learning technique, usually online, involving interaction of the student with programmed instructional materials. CAI is the use of a computer as a medium of instruction for tutorial, drill and practice, simulation or games. This is used for both initial and remedial training and typically does not require that a computer be connected to a network or provide links to learning resources outside of the course. Today, microcomputers are powerful enough to act as file servers and CAI can be delivered either through an integrated learning system or as stand-alone software. Typical CAI software provides text and multiple-choice questions or problems to students, offers immediate feedback, notes incorrect responses, summarizes students' performance and generates exercises for worksheets and tests. CAI typically presents tasks for which there is one (and only one) correct answer. It can evaluate simple numeric or very simple alphabetic responses but it cannot evaluate complex student responses. Many features of tutorial CAI are consistent with the traditional classroom. Tutorial CAI provides a one-way (computer to student) transmission of knowledge. It presents information and the student is expected to learn the information presented. Much CAI software presents information in a single curriculum area (e.g., arithmetic or vocabulary) and uses brief exercises that can be easily accommodated within the typical fifty-minute academic period. CAI is designed for use by a single student and can be accommodated into a regular class schedule if computers are placed in a
laboratory into which various whole classes are scheduled. Many educational computer programs are available online and from computer stores and textbook companies. They enhance teacher instruction in several ways. Computer programs are interactive and can illustrate a concept through attractive animation, sound and demonstration. They allow students to progress at their own pace and work individually or solve problems in a group. Computers provide immediate feedback letting students know whether their answer is correct. If the answer is not correct, the program shows students how to correctly answer the question. CAI offers a different type of activity and a change of pace from teacher-led or group instruction (Alessi and Trollip, 1985).

1.2.1 Meaning of CAI

CAI refers to educational software that can be run by students with little or no teacher assistance. In CAI, computer presents information, asks questions and verify responses in much the same way a teacher does. There are six types of CAI: Informational, drill and practice, instructional, gaming, simulation and problem solving. The various types of CAI represent a continuum of instructional formats, ranging from highly structured to unstructured (Levy and Lahm, 1984).

Computer assisted instruction is a term applied to a learning environment characterized by instructional interaction between computer and student. The teacher sets up the learning environment, ensures that each student has the necessary skills to engage in a particular activity and adjusts the learning activities according to students’ needs (Wright and Forcier, 1985).

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 is known as CAI also known as computer-aided instruction or computer-assisted learning (CAL) (Sci-tech dictionary, 2003).

The philosophy of CAI is that the lessons should allow the learners to learn on their own using structured and/or unstructured interactive lessons.
These lessons carry two important features: bidirectional (interactive) learning and individualized learning (Wikipedia Encyclopedia, 2005).

Computer assisted instruction is use of instructional material presented by a computer (Britannica Concise Encyclopedia, 2006). Computer-assisted instruction (CAI) is an interactive instructional technique whereby a computer is used to present the instructional material and monitor the learning that takes place. It refers to the use of the computer as a tool to facilitate and improve instruction. CAI programs use tutorials, drill and practice, simulation and problem solving approaches to present topics and they test the student's understanding (Wikieducator, 2010).

1.2.2 Historical Perspective

The concept of Computer assisted instruction is not new. The origin of computer assisted instruction can be traced back to the invention of small multiple choice items scoring machine by Sidney L. Pressy in 1924 and B.F. Skinner’s work to improve and expand the concept of programmed instruction in late 1950s and early 1960s. In the sixties the first attempts to use computers in educations were based on rather behaviouristic theories with emphasis on feedback and reinforcement actions.

- The teaching path was fixed and linear.
- The communication style was mono directional (from the computer to the student) and imperative.
- Individuality was restricted to the amount of time spent in the learning process (Wang and Sleeman, 1993).

Some of the first computer-assisted instruction (CAI), developed by Patrick Suppes at Stanford University during the 1960s, set standards for subsequent instructional software. After systematically analyzing courses in arithmetic and other subjects, Suppes designed highly structured computer systems featuring learner feedback, lesson branching and student record keeping. 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 students 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. During the 1970s, a particularly widespread and influential source of computer assisted instruction was the University of Illinois PLATO system. This system included hundreds of tutorial and drill and practice programs. Like other systems of the time, Plato's resources were available through timesharing on a mainframe computer (Coburn, 1982).

1.2.3 Types of CAI Software

Computer assisted instruction encompasses several teaching strategies, of which four major categories are drill and practice, tutorial, simulations and games.

Drill and Practice software provides exercise in which students work on example items and receive feedback on their correctness. Feedback and practice provided in the software enable the students memorize learning material or refine skills already taught to them. An example of this would be giving the student a programme to practice typing skills after the student has learned the layout of the keyboard.

Tutorial software uses the computer to deliver an entire instructional sequence similar to a teacher’s classroom instruction on the topic. Tutorial form of CAI teaches the student new information. The student interacts with the computer much like a student would interact with the tutor in a one to one session. Concepts are presented to the student, the student’s understanding is measured and the computer then provides more instruction or remedial instruction based upon his or her response.

Instructional games are courseware with a function to increase motivation by adding game rules to learning activities. Instructional games can be very similar to drill and practice but have an entertaining environment. Students
may be more willing to work at practicing skills if they know they can do so by playing a game. Depending on the particular game, student can compete against the computer or against other student.

Simulation is a computerized model of real or imagined system designed to teach how a system works. Simulations differ from tutorial and drill and practice activities by providing learner structured activities. Educational simulations allow students to experience phenomena that they are not able to witness personally and that would be too difficult or dangerous to duplicate in the classroom setting. Software can simulate manipulating objects performing a set of procedures or acting in a given situation. The person using a courseware usually chooses tasks and the order in which to do them. He can also control the speed of processes to study the effects (Roblyer and Edwards, 2000).

1.2.4 Advantages of CAI

Computer assisted instruction improves instruction for students because students receive immediate feedback and do not continue to practice the wrong skills. Computers capture the students’ attention because the programs are interactive and engage the students’ spirit of competitiveness to increase their scores. Also, computer assisted instruction moves at the students’ pace and usually does not move ahead until they have mastered the skill. Programs provide differentiated lessons to challenge students who are at risk, average or gifted. Because of CAI’s versatility and provision for individualization, several advantages of this type of instruction are discovered: a) errors can be analyzed and positive reinforcement given, b) testing can become a learning process and c) it can provide almost unlimited opportunity for drill and practice. Almost any written material can be adapted for computer exercises using the drill and practice, tutorial, testing, dialogue or simulation and gaming modes (Lavine and Fechter, 1981).

Computer assisted instruction programs have served to increase student learning by affecting cognitive processes and increasing motivation. The mechanisms by which computer programs facilitate this learning are
personalizing information, animating objects on the screen, providing practice activities that incorporate challenges and curiosity, providing a fantasy context and providing a learner with choice over his/her own learning. Personalizing information allows computer assisted instruction to increase learner interest in the given tasks (Padma and Ross, 1987) and increase the internal logic and organization of the material (Anderson 1984, Ausubel 1968, Mayer 1975, Rumelhart and Ortonoy 1977). New information can be more easily integrated into existing schema if a student’s name or other familiar contexts appear in a problem.

The animation of objects involved in the explanation of a particular concept, for example, Newton's First Law of Motion, increases learning by decreasing the cognitive load on the learner's memory thereby allowing the learner to perform search and recognition processes and to make more informational relationships (Reiber, 1991).

Computer-assisted-instruction increases motivation by providing a context for the learner that is challenging and stimulates curiosity. Activities that are intrinsically motivating also carry other significant advantages such as personal satisfaction, challenge, relevance and promotion of a positive perspective on lifelong leaning (Keller and Suzuki 1988, Kinzie 1990). Providing students with choice over their own learning provides learner controlled instruction which contributes to motivation. Increased motivation in turn increases student learning. Also, program controlled instruction as opposed to learner controlled may get in the way of the learner by requiring the learner to study all of the given subject matter rather than only the elements the learner needs. Further, learner controlled instruction makes it possible for individuals to make certain choices in an activity and to affect certain outcomes. As a result, the individual feels competent and self determining and the activity has greater personal meaning and intrinsic interest (Mayer, 1964).

CAI enhances student attitudes toward several aspects of schooling. Some researchers took these investigations a step further by asking students
what it is about CAI that they like. A list of reasons was given by students for liking CAI activities and/or favoring them over traditional learning. These student preferences also contribute to understanding of why CAI enhances achievement. Students said they like working with computers because computers are infinitely patient, never get tired, never get frustrated or angry, allow students to work privately, never forget to correct or praise, are fun and entertaining, individualize learning, are self-paced, do not embarrass students who make mistakes, make it possible to experiment with different options, give immediate feedback, are more objective than teachers, free teachers for more meaningful contact with students, are impartial to race or ethnicity, are great motivators, give a sense of control over learning, are excellent for drill and practice, call for using sight, hearing and touch, teach in small increments, help students improve their spelling proficiency in computer use which will be valuable later in life, eliminate the drudgery of doing certain learning activities by hand (e.g., drawing graphs) and work rapidly closer to the rate of human thought (Robertson, et al. 1987). One of the primary aims of computer assisted instruction is to optimize the learning process. This is implicit in the concept of individualized instruction (Atkinson and Wilson, 1969).

1.2.5 Effectiveness of CAI in Education

Tennyson (1980) found learner control to be instructionally effective when individuals were given advisement on their performance in relation to program criteria. Further, learner control results in more positive attitudes toward the instruction. The use of CAI as a supplement to traditional, teacher-directed instruction produces achievement effects superior to those obtained with traditional instruction alone. Generally speaking, this finding holds true for students of different ages and abilities and for learning in different curricular areas.

Much of the research that examined the effects of CAI and other microcomputer applications on student learning outcomes also investigated effects upon student attitudes. This line of inquiry has brought most researchers
to the conclusion that the use of CAI leads to more positive student attitudes than the use of conventional instruction (Cotton, 1991).

A few researchers undertook to compare the effectiveness of CAI in different curricular areas. Their findings, though not conclusive, indicated that CAI activities are most effective in the areas of science and foreign languages, followed in descending order of effectiveness by activities in mathematics, reading, language, arts and English as a second Language (Capper and Copple 1985, Kulik et al.1985, Rodriguez and Rodriguez 1986).

There is a great deal of evidence regarding effectiveness of CAI in the subject area of science. Research findings support CAI at all grade levels that is from primary to K-12. In the science classroom, students interacting with computers running simulations of experiments enjoyed a more effective learning experience than students watching a demonstration accompanied by teacher-student interaction (Poole 1995). Roblyer (1988) also found that students who received science instruction through CAI simulations achieved more than those who studied in a conventional learning environment. It was also found that CAI activities are most effective in the areas of science and foreign languages.

1.3 LEARNING STYLE

Teacher teaches in the classroom with an aim to give maximum learning experience. Teacher teaches the same content to all the students but in same class and same atmosphere no two students learn same thing due to many factors which affect them. Learning Style is one of the factor and every student has own learning style. In the last many years, a number of educators have proposed that teaching would be more effective if faculty members took account of difference in students' learning style. The idea of individualized "learning styles" originated in the 1970s and has gained popularity in recent years. It has been proposed that teachers should assess the learning styles of their students and adapt their classroom methods to best fit each students learning style. Over 80 learning style models have been proposed, each consisting of at least two different styles. For example, one family of models emphasizes the sensory
The models in this family may use different terms to describe same or similar learning styles. These models often describe the three basic learning styles. Auditory learning occurs through hearing the spoken word. Kinesthetic learning occurs through doing and interacting. Visual learning occurs through looking at images, mind maps, demonstrations and body languages (Gohel, 2009).

The way a person prefers to learn is called his/her learning style. There is no right or wrong/good or bad learning style. It has everything to do with the way a person’s brain works to learn and store information efficiently. This approach to learning emphasizes the fact that individuals perceive and process information in very different ways. The learning styles theory implies that how much individuals learn has to do with whether the educational experience is geared towards their particular style of learning.

Students have different learning styles, characteristic strengths and preferences in the ways they take in and process information. Some students tend to focus on facts, data and algorithms while others are more comfortable with theories and mathematical models. Some respond strongly to visual forms of information like pictures, diagrams and schematics while others get more from verbal form- written and spoken explanation. Some prefer to learn actively and interactively, others function more introspectively and individually (Felder, 1996).

1.3.1 Meaning of Learning Style

Learning styles is the composite of characteristic cognitive, affective and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with and responds to the learning environment (Keefe, 1979).

Learning style is a method of personal choice to perceive and process information. In this sense, learning style is, on one hand, sensory and on the other hand, mental (Kolb, 1984).
Different ways used by individuals to process and organize information or to respond to environmental stimuli refer to their learning styles (Shuell, 1986).

An individual's learning style can be defined in many ways, including the complex manner in which and conditions under which learners most efficiently and most effectively perceive, process, store and recall what they are attempting to learn (James, 1995).

People learn in different ways. There is no same learning style of two people. Some learn best by seeing, others by hearing and still others by touching. Knowing our preferred learning style helps us learn and remember new things (Maclsaac, et al. 2001).

From a biological perspective, the brain is the organ of learning and as such a learning style is likely to be a complex, emergent interaction of the neurophysiology of an individual's brain and the unique developmental process that has shaped it through experience and interaction with the environment. Learning styles should be considered to be flexible and not immutable. An individual's learning style could be actively adapted to a certain extent to different learning environments (Tanner and Allen, 2004).

People learn in many different ways and no two people learn in exactly the same ways. When people learn, they perceive and think. They also interact with resources, method and environments. The tendencies and preferences that they get from their personal experience bring about own learning style (Smith, 2005).

The different ways of learning and making meaning of information is called learning style. It refers to student's preferences for some kinds of learning activities over others. A student's learning styles has to do with the way he or she processes information in order to learn and apply it (Atkin, 2006).

A learning style is a method of educating particular to an individual that is presumed to allow that individual to learn best. It is commonly believed that most
people favour some particular method of interacting with, taking and processing stimuli or information (Wikipedia encyclopedia, 2008).

1.3.2 Classification of Learning Styles

Research data gathered by Dunn and Dunn (1978) yielded eighteen categories that when classified, suggested that learners are affected by their

- immediate environment (sound, light, temperature and design)
- own emotionality (motivation, persistence, responsibility and need for structure or flexibility)
- sociological needs (self, pair, peers, team, adult or varied)
- physical needs (perceptual strengths, intake, time and mobility)

Kolb (1984) described learning preferences using two continuums: active experimentation-reflective observation and abstract conceptualization-concrete experience. The result is four types of learners-

- Converger (Active experimentation - Abstract conceptualization)
- Diverger (Reflective observation - Concrete experience)
- Accommodator (Active experimentation - Concrete experience)
- Assimilator (Reflective observation - Abstract conceptualization)

Kolb designed LSI (Learning style Inventory) to determine an individual’s learning preference. Kolb et al. (1999) presented four learning styles -

- Convergers best at finding practical uses for ideas and theories. They would rather deal with technical tasks and problems than social and interpersonal issues. They like to experiment with new ideas, simulations, laboratory assignments and practical applications.
• Divergers best at viewing concrete situations from many different points of view. Their approach to situations is to observe rather than take action. Such individuals are likely to enjoy brainstorming sessions and working in groups.

• Accommodators prefer to learn primarily from hands on experience. They likely enjoy carrying out plans and involving themselves in new and challenging experiences. They may act on intention rather than logical analysis. They prefer to work with others and do field work.

• Assimilators best at understanding a wide range of information and putting it into concise and logical form. Such individuals are less focused on people and more interested in ideas and concepts. They prefer readings, lectures and thinking things through.

Felder and Silverman (2002) in their model of learning styles, index of learning styles presented four dimensions of learning styles. These dimensions

Figure 1.1: Kolb’s Learning Style Preferences

Concrete Experiencing (CE)

Reflective Observation (RO)

DIVERGER

ACCOMMODATOR

ASSIMILATOR

CONVERGER

Active Experimentation (AE)

Abstract Conceptualizing (AC)

Felder and Silverman (2002) in their model of learning styles, index of learning styles presented four dimensions of learning styles. These dimensions
are as a continuum with one learning preference on the far left and other on far right.

- **Sensory and Intuitive**
  Sensory learners prefer concrete, practical and procedural information. They look for the facts. Intuitive learners prefer conceptual, innovative and theoretical information. They look for the meaning.

- **Visual and Verbal**
  Visual learners prefer graphs, pictures and diagrams. They look for visual representations of information. Verbal learners prefer to hear or read information. They look for explanations with words.

- **Active and Reflective**
  Active learners prefer to manipulate objects, do physical experiments and learn by trying. They enjoy working in groups to figure out problems. Reflective learners prefer to think things through, to evaluate options and learn by analysis. They enjoy figuring out a problem on their own.

- **Sequential and Global**
  Sequential learners prefer to have information presented linearly and in an orderly manner. They put together the details in order to understand the big picture emerges. Global learners prefer a holistic and systematic approach. They see the big picture first and then fill in the details.

As per Memletic accelerated learning manual (2007) many people recognize that each person prefers different learning styles and techniques. Learning styles group common ways that people learn. Everyone has a mix of learning styles. Some people may find that they have a dominant style of learning with far less use of other styles. Others may find that they use different styles in different circumstances. The learning styles are:

- Visual (spatial) - prefer using pictures, images and spatial understanding.
Aural (auditory-musical) - prefer using sound and music.
Verbal (linguistic) - prefer using words, both in speech and writing.
Physical (kinesthetic) - prefer using your body, hands and sense of touch.
Logical (mathematical) - prefer using logic, reasoning and systems.
Social (interpersonal) - prefer to learn in groups or with other people.
Solitary (intrapersonal) - prefer to work alone and use self study.

Figure 1.2: Memetic Learning Styles

Using multiple learning styles and multiple intelligences for learning is a retentively new approach. This approach is one that educators have only recently started to recognize. Traditional schooling used (and continued to use) mainly linguistic and logical teaching methods. It also uses a limited range of learning and teaching techniques. Many schools still rely on classroom and book-based teaching, much repetition and pressured exams for reinforcement and review. A result is that we often label those who use these learning style and techniques as “bright”. Those who have less favored learning styles often find themselves in lower classes, with various not so complimentary labels and sometimes lower quality teaching. This can create positive and negative spirals that reinforce the belief that one is “smart” or “dumb”. By recognizing and understanding learning style, best techniques can be used better suited to learners. This improves the speed and quality of learning.
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Research shows that each learning style use different parts of brain. By involving more of the brain during learning, we remember more of what we learn. Researches using brain-imaging technologies have been able to find out key areas of brain responsible for each learning style. And, by understanding learning styles, teacher can learn to create an environment in which everyone can learn from him, not just those who use his preferred style. (Memletic accelerated learning manual, 2007)

To provide open access to science learning and encourage a broader spectrum of students to pursue studies in the sciences, teachers, instructors and faculty has to begin to address the diversity of learning styles among the students in classrooms (James, 1995). Dunn (1990) stated that regardless of learning style, all individuals can learn when instructional methods complement or are congruent with a learning style. Also, every person has a preferred learning style and strengths that, when complemented with a matching teaching style, will result in maximum learning.

1.4 SIGNIFICANCE OF STUDY

There is no doubt that technology has become incorporated into our school systems. Computers are used not only as a means of helping schools analyze data but they have become a pervasive tool toward optimizing student learning. For example, students are regularly using the internet to gather and assimilate information for use in research assignments. They are preparing electronic presentations using computer presentation programs and LCD projectors. They are using word processing programs to create various other reports. Students are even using spreadsheets to increase their experiences with mathematical concepts. In addition, many schools have incorporated computer-assisted-instruction into their program to provide students opportunities to master specific educational objectives or standards (Patrick, 2003).

Just as computers play a central role in developing and applying scientific knowledge, they can also facilitate learning of science. Computers have a major role in the teaching and learning of science. Computers have become an
essential classroom tool for the acquisition, analysis, presentation and communication of data in ways which allow students to become more active participants in teaching and learning. In the classroom, the computer offers the teacher more flexibility in presentation, better management of instructional techniques and easier record keeping. It offers students a very important resource for learning the concepts and processes of science through simulations, graphics, sound, data manipulation and model building. In the field, the portability of the laptop computer allows students and teachers to actively gather and analyze data and take it back to the classroom for in-depth study and the sharing of information. These capabilities can improve scientific learning and facilitate communication of ideas and concepts. Tutorial and multimedia software engage students in meaningful interactive dialogue and creatively employ graphics, sound and simulations to promote acquisition of facts and skills, concept learning and enhance understanding (Suppes, 1969).

The meta-analysis integrated findings from 51 independent evaluations of computer-based teaching in grades IV through XII indicated that computer-based teaching raised students' final exam scores, improved student attitudes toward computers and toward their courses and reduced the amount of time needed for learning. Researchers are demonstrating how technologies when applied to science learning can help motivate and engage pupils and promote better take-up of scientific disciplines at school and university. Technology can support the kind of student learning advocated by current educational reform (Kulik, 1983).

In other words, new technology can be an appropriate vehicle for promoting meaningful, engaged learning. It allows students to work on authentic, meaningful and challenging problems similar to tasks performed by professionals in various disciplines, interact with data in ways that allow student-directed learning, build knowledge collaboratively and interact with professionals in the field. Technologies can also be used to promote the development of higher-order thinking skills and allow opportunities for teachers to act as facilitators or guides and often as a co-learner with the students. Technology is not transformative on
its own. Evidence indicates that when used effectively, "Technology applications can support higher-order thinking by engaging students in authentic, complex tasks within collaborative learning contexts". Instead of focusing on isolated skills-based uses of technology, schools can promote the use of various technologies for sophisticated problem solving and information retrieving purposes. Rather than using technology for technology's sake, the school can develop a vision of how technology can improve teaching and learning (Gahala, 2001).

The investigator, in the present study developed the multimedia presentation and CAI (computer assisted instruction) package for teaching of physics at secondary level. Investigator took into account the effects of these methods on the achievement of students in physics in relation to their learning styles and gender.

1.5 STATEMENT OF THE PROBLEM

EFFECT OF MULTIMEDIA PRESENTATION AND CAI PACKAGE ON ACHIEVEMENT IN PHYSICS IN RELATION TO LEARNING STYLES AND GENDER

1.6 OBJECTIVES OF STUDY

The present study was conducted to achieve the following objectives

- To develop Multimedia presentations for selected units of physics of grade IX.
- To develop CAI package for selected units of physics of grade IX.
- To develop achievement test for selected units of physics of grade IX.
- To study effect of different instructional strategies (Multimedia presentation, Computer assisted instruction and Conventional mode of teaching) on achievement in physics of IX grade students.
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- To study differences in achievement in physics of IX grade students with different learning styles.
- To study differences in achievement in physics of IX grade boys and girls.
- To study interaction effect of instructional strategies and learning styles on achievement in physics of IX grade students.
- To study interaction effect of instructional strategies and gender on achievement in physics of IX grade students.
- To study interaction effect of gender and learning styles on achievement in physics of IX grade students.
- To study interaction effect of instructional strategies, learning styles and gender on achievement in physics of IX grade students.

1.7 DELIMITATIONS OF THE STUDY

- The present study was confined to class IX science students of three CBSE affiliated schools of Chandigarh and Mohali.
- The study was limited to selected units of physics of class IX.
- The study was confined to only two classifying variables, i.e., learning style and gender.

1.8 OPERATIONAL DEFINITIONS OF THE TERMS USED

- Achievement – Achievement refers to the attainment of knowledge which students acquire during the course of their study.
- Learning style – It is the way a person perceives and processes information.
- Multimedia presentation – It is the means of presenting information using many media like images, texts, animations and graphs.
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• Computer Assisted Instruction – It is a self learning interactive instructional technique where a computer is used to present information and monitor the learning that takes place. It refers to instructional strategy as developed by incorporating essential features.

1.9 ORGANIZATION OF CHAPTERS

Chapter 1 includes introduction, meaning of multimedia presentation, computer assisted instruction and learning styles, significance of study, statement of problem, objectives of study, delimitations of study and operational definition of terms.

Chapter 2 deals with review of relevant literature related to multimedia presentation, computer assisted instruction and learning styles.

Chapter 3 includes description of design of the study, sample selection, tools used, development of instructional materials, development and description of tools, collection of data and statistical techniques employed for analysis of data.

Chapter 4 deals with descriptive statistics, interpretation of results and inferential statistics.

Chapter 5 consists of major findings of study, conclusions, educational implications of the present study and suggestions for further study.