CHAPTER-I

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Education is an engine for the growth and progress of any society. It is a powerful tool for social change, social mobility. It is a continuous process which transfers the morals, values; of our culture to the next generation (Yashpal, 2011). Education in general is undergoing rapid transition from the traditional teacher dominated teaching to the more self motivated mode, constructivism. It has become a complex process with time because of complex nature of modern industrial civilization and explosion of knowledge due to scientific discoveries of inventions. In order to understand the progressive nature of society and to meet the challenges of time and educational aspirations of society, there is a need for effective system of education in the country. The process of education is believed to begin in the womb that continues through all the phases of our life as knowledge is oceanic and one can never claim to have acquired all of it. It has rightly been stated by (Fawe, 1972) in the report of international commission on education that as far back as we can go in the history of education- which is admittedly not very far-it (education) emerges as a natural characteristics of human societies. It has contributed to the destiny of societies in all phases of development (Bala, 1995).

Education is a purposefully designed process aiming at fostering the harmonious and healthy development of an individual as productive, successful and well adjusted person in the society. It imbibes moral and ethical values in the individuals and their education, in turn, helps in the creation of a healthy society that bears a deep understanding of principles and the philosophy of life. It is concerned with ever-growing man in ever-growing society as it teaches us the right behavior, the good manners and making us civilized. Thus education, in real sense, is to humanize humanity and to make life progressive, cultured and civilized.

Education cultivates us into mature individuals, and makes us capable to plan our future and take the right decisions. It is the process of learning that broadens a person’s cognitive horizons and arms us with an insight to look at our lives and learn from every experience. Bill Beattie, one of the famous authors and writers concludes that education teaches us how to think, rather than what to think. Eric Hoffer, an American social writer, believes that education produces learning individuals and
not necessarily learned ones. Bishop Creighton, on similar lines states that education aims at creating people who continually ask questions. By this he means to say that education nurtures the inquisitiveness and curiosity in individuals. Education is a life time insurance plan for a nation as it fosters principles of equality and socialism and forms a support system for talents to excel in life. Education also paves the path leading to disillusionment as it is a self-enlightening process. It wipes out all the wrong beliefs; create a clear picture of everything around us and we no more remain in confusion about the things we learn.

Education brings up questions and also devises ways to find satisfactory answers that lead us to enlightenment. It is education that builds in every individual, a confidence to take decisions, to face life and to accept successes and failures. It instills a sense of pride about the knowledge one has and prepares him/her for life as the true purpose of education is to bring about profoundness to one’s emotions, to broaden one’s perspectives and to lead to a healthier approach of looking at life.

1.1 ACADEMIC ACHIEVEMENT

In the present scenario, the main concerns of all educational efforts is to see what the learner achieves ‘ as achievement is considered as end product of all educational endeavors (Gupta & Kapoor, 2012). Achievement refers to the level of success and of proficiency attained in some specific area concerning academic work. Academic achievement or academic performance is the outcome of education - the extent to which a student, teacher or institution has achieved their educational goals. It is commonly measured by examinations or continuous assessment but there is no general agreement on how it is best tested or which aspects are most important - procedural knowledge such as skills or declarative knowledge such as facts ( Annie, Howard & Mildred, 1996). Achievement in the educational situation has frequently been referred to as scholastic achievement or academic attainment. The term scholastic achievement signifies various aspects of learning as “Ability to learn” (Titlon 1949), “Scholastic aptitude” (Traverse, 1949), “Measures of motivation” (McCleland 1965), “Level of aspiration” (Sawrey, 1958) and “Creative capacity” (Torrence, 1982). Dictionary of Psychology (Chaplin, 1965) defines educational or academic achievement as specified level of attainment proficiency in academic work as evaluated by the teacher, by standardized tests or by combination of both.
According to Dictionary of Education (Carter 1959), "Academic achievement means the knowledge attained or skills developed in school subjects, usually determined by test scores or by marks assigned by teachers or both." Thus, academic achievement refers to marks or grades obtained in subject taught in school after an examination, be it written or oral. It is universally accepted that marks serve the basis of classification and certification, motivation and measurement of educational performance. Academic achievement also means the attained level of students functioning in the school task such as languages, mathematics, science etc. as shown by school marks. Academic achievement is employed as a customary criterion to measure the level of knowledge, understanding and acquisition of skill. Yet in spite of this one is still far from reaching an understanding of the actual process of academic achievement. With the result, current level of understanding the complexities of school achievement, especially at high school stage, falls far short of what is desirable. Achievement tests in educational system are designed to assess the educational objectives. Such assessment reveals how far the objectives specified have been achieved. In this situation, when the focus is on the achievement of objectives, teacher's main concern is with the average students to increase the scholastic achievement of the students.

Academic achievement is the unique responsibility of all educational institutions to promote a wholesome scholastic development of the students. It helps the students to understand the hierarchy based on academic achievement. It is the most desirable outcome of school life. All the activities of school revolve around the scholastic achievement of the students. Administrators, educators, curriculum planners, teachers and students work to make teaching-learning process feasible for academic excellence. Academic achievement is an index of success of students' performance, teachers' efforts and significance of curriculum and educational objectives.

The recent development in education call for a more holistic and integrated approaches to the educational process. In this context, schools play an important role. Teaching and learning are the two independent and psychological processes but they have to go in hand by hand where ever teaching and learning process comes. Providing students with high quality learning activities in relevant situations beyond the walls of the classroom is vital for helping students appreciate their first hand experience from a variety of different perspectives. A child entering the new century.
will likely face more risks and uncertainties and will need to gain more knowledge and master more skills than any generation before. Quality of performance has become the key factor for personal progress. In fact, it appears as if the whole system of education revolves round the academic achievement of students though various other outcomes are also expected from the system. Thus a lot of time and efforts of the educational institutions are used for helping students to achieve better in scholastic endeavor. Therefore, in schools great emphasis is laid on scholastic achievement, right from the beginning of formal education. Thus, academic achievement holds a cardinal place in the field of education and is considered as the outstanding inducement for the progress of individuals.

Though the goal of all educational programmes of every country is envisaged as maximizing the achievement of students, experience reveals that students do not attain the same level of success. With due recognition to individual differences in ability, interest and aptitude, it is evident that all children are not capable of reaching the same educational standard although all of them are quite capable of being improved upon. Consequently, attention is being increasingly focused by educators upon the causes that underlie variations in achievement. So, it is necessary to take a programme of quality improvement. In order to chalk out any meaningful programme of quality improvement, we shall have to first identify determinants of quality of academic achievement.

Academic achievement itself depends upon various factors like study habits, attitude, aptitude, mental health, self-concept, socio-economic status, motivation, intelligence, learning style and the students' knowledge in a particular subject etc. Various other organic and environment factors like gender, birth order, locality, type of institution, home environment & digital school environment (smart class) and method of teaching etc. also determine the academic achievement of students. These cognitive and non-cognitive variables though basically and inevitably being a personal matter cannot be studied in isolation. Misra (1984) found that school environment was significantly related to academic achievement. Singh (1984) found out that study habits were related to the academic achievement significantly. Lembke (1985) and Okebukola (1986) revealed that academic achievement was enhanced when the students were taught through their preferred style. Kia et al. (2001) found out that among students, those with visual learning style had the
greatest academic achievement. Parida (2003) revealed a significant difference in academic achievement of the respondents due to school environment. Sellstrom and Bremberg (2006) found that despite the different pupil outcomes and the variety of determinants used, a school effect was evident. Chandvir (2009) explored a significant relationship between scholastic achievement and self-concept of adolescents. Gupta & Kapoor (2012) examined that the school environment with more creative stimulation, high cognitive encouragement and less permissiveness respectively resulted in to higher scholastic achievement in English of the students. Gupta, Mamta & Pasrija (2012) found the significant difference in academic achievement among adolescents with high and low level of achievement motivation in relation to gender, locality and type of schools.

The quality of education we provide to our children depends to a large extent upon the quality of teachers we inject into the education system, which in turn depends on the quality of teachers’ preparations through emergence of innovative tools. Preparing students to be successful in an innovation based economy is a function of empowering educators to teach 21st century content in a 21st context using 21st century tools (Marurizio, 2004). Smart education is therefore a paradigm shift from teacher centered education to learner centered education whereas the child is empowered to create knowledge and develop competencies and ability for lifelong learning. Various studies shown that ICT is also a significant factor in enhancing achievement level of students.

Basu (1981) studied the effectiveness of multimedia programmed material in the teaching of physics and found that the multimedia semi-programmed instruction was better than the strategy of programmed teaching. Sinnathambi (1991) indicated that the students who were taught by the video method learned more concepts on energetic than those who were taught by the lecture method and the students improved their achievement on ‘energetics’ after viewing the video programme. Vij (2003) found the mean gain score of the group of Pupils taught Science through Computer Managed Instruction was significantly higher in Achievement than the group of Pupils taught Science through traditional method. Ludwig and Daniel (2004) found that multimedia content organized with a slide ware tool can generate productive and stimulating presentations that lead to greater retention, application to new situations, and performance on assessments. Naser-Nick Manochehr (2007)
showed that students with learning styles Assimilator and Converger did better with the e-learning method. In addition, students with learning styles Accommodator and Diverter received better results with traditional instructor-based learning. Rai (2009) described that the use of Multimedia, not only brings creativity but encompasses all arenas of education through text, graphs, moving images, sound and music with the help of computers. Semra (2012) demonstrated that teaching mathematics with a computer-assisted instruction method increased student success significantly in mathematics lesson. Gupta & Nagpal (2013) revealed that multimedia teaching package enhance the achievement of fifth graders in mathematics.

Heads of the institutions, curriculum planners, teachers and others who are involved in the task of helping students to achieve better would like to have knowledge of the extent of the influence, these correlates exert on achievement. Further, a synoptic view of the researches done would be of utmost importance to the educational researcher to enable him to explore greater depths in this, rather important area of achievement (Anand and Padma, 1989). Thus, in the present study an attempt is made in the direction of exploring the impact of IT-Enabled Instructional Package on academic achievement in science of school students.

1.2 ICT AND EDUCATION

We live in tumultuous times. The 21st century is an era marked by unprecedented change happening at unprecedented speed (Md. Mahmood Alam, 2011). In the last decade, modern civilization has transformed from “The Information Age” to what Daniel Pink calls “The Conceptual Age”, an age marked by millions of “Prosumers” who produce nearly as many knowledge and information products as they consume with web 2.0 technologies (Pink, 2007). The rapid changes and increased complexity of today’s world present new challenges and put demands on our education system. The teachers need to perform a number of roles i.e. manager of teaching-learning, community leader, promoter of education technology, protector of environment, character builder and last but not the least a Nation builder (Gupta & Nagpal, 2011). If teaching is an art, science, or profession then certain skills and techniques are required to become a teaching “artist”, scientist”, or professional. Furthermore, these artists, scientists, and professionals demonstrate their skills in the act of teaching. Hence, as educators seek ways to meet the demands put upon the education system
in today's world of rapid changes and ever increasing complexity, it may be helpful to recognize that there is a need for both teachers and trainees to welcome innovative tools and techniques in teaching learning process. We have seen phenomenal development in application of media and technology in education. With the emergence of amazing internet connected personal computers and mobile devices distributed around the world, the field of education has tried to exploit the web as a communication channel to connect distant learners with instructors. There is revolutionary impact of e-learning on the complementary two way process of teaching and learning in real class room activities.

Today we can't imagine our existence without the use of technology in our daily routine because it has entered in each and every aspect of human life. Whenever we think of education whether it is formal or informal we have a set pattern of classroom setting and traditional teaching learning process. ICT transforms the present isolated, teacher-centred, book-centred learning environment into a rich student-centred environment which is the integration of Broadcasting and Digital technologies. This new learning environment developed by the ICT is called Interactive Learning Environment. ICT aims at transferring the old traditional paradigm of learning to the new paradigm of learning.

ICTs stands for Information and Communication Technologies and are defined, for the purposes of this study, as a diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information. These technologies include computers, the internet, broadcasting technologies and telephony. It refers to a range of technologies including computers, computer work stations, display facilities, hardware, software, recording and processing system for sound, still and moving pictures, graphic calculator and wide range of communication facilities present in world. ICT is a scientific, technological and engineering discipline and management technique used in handling information, its application and association with social, economical and cultural matters.” (Chidnandappa & Dhamendra, 2006). It may be defined as the use of hardware and software for efficient management i.e. storage, retrieval, processing, communication and sharing information for social, economical and cultural upliftment.
"The illiterate of the 21st century", according to futurist Alvin Tofler, "will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn. Efforts must be made by the educationists to change the process of teaching-learning in order to prepare the students to adjust themselves to the society which is rich in information and technology (Desh, 2007). According to the faculty of Emory University, "In the Nineteenth Century it took about fifty years to double the world’s knowledge. Today, the base of knowledge doubles in less than a year" (Emory University, 2006). Without question learning must be understood as a lifelong endeavour. Teacher as well as administrators must foster a collaborative environment to become role models of continuous learning. Though use of ICT in classroom settings is in initial stage but it is the most versatile, effective and dynamic form of teaching-learning process in present arena because computers, mobiles and internet are in reaches of common people. New education is visualized to be technology mediated, learner and learning centric, innovation centric, promoting curiosity with diversity and excellence, promoting cooperative learning, developing and nurturing universal human values in A3 (anyone, anytime, anywhere) and L3 (life-long-learning) scenario (Takwale, 2007).

Teaching is, no doubt, a complicated process and in today's world of science and technology, the use of ICT has become a necessity to make teaching-learning process effective and interactive. It is very much essential to use more than two media, which is generally termed as Multimedia. Multimedia refers to the use of more than two media of communication in a learning package or instructional procedure. These are used in different situations to make the instructional programmes more effective. Multimedia can stimulate the students' mind and encourage the learning through maximum use of senses with the help of more than one media. Side by side it also helps the teacher to supplement the text and study material. As we know, the teaching – learning technology has progressed from classroom lectures, seminars to video disks and CD-ROMs to web based training and wireless communication through various learning objects. The demand of new technologies and the global environment cannot be satisfied with the only source of classroom instructions, with its inherent classroom limitations. The students can do self learning using enormous potentials of internet and proving them with several online exercises. Given the importance of IT in interactive learning, it is most
important that the teacher must be educated and trained more thoroughly about IT, its importance and how it can be infused in teaching. One word of caution though is that the undoubted tremendous potential of IT be harnessed in wise and conscious way (Varinder, Monica & Parul, 2011).

1.2.1 History of ICT in Education

In India, use of ICT in education goes back to the colonial era of the British government. India aired its first radio broadcast in June 1923 by Radio Club of Mumbai. In the 1930s, British Broadcasting Corporation (BBC) aired educational and cultural programs in India through broadcast radio. In 1937, All India Radio (AIR) broadcasted educational programs for school children (Agrawal, 2005). Since 2002, India’s first educational radio station called Gyan Vani (Voice of Knowledge) has been on the air. This full-fledged educational radio station provides programs for different types of learners including adult learners (Agrawal, 2005). In 1959 India acquired its first television set for an experimental television service in Delhi. Television gradually expanded to the urban rich. In 1961 Educational Television (ETV) was introduced in the secondary schools in Delhi. This was a pilot project by UNESCO and the Ford Foundations. As part of the project, lessons for physics, chemistry and English were televised to secondary school students (Mohanty, 1984). To develop the rural community through education, in 1975 an experimental project was implemented called Satellite Instructional Television Experiment (SITE) with the help of the USA (Agrawal & Sinha, 1981). In 2000, a 24-hour educational channel was launched known as DD-Gyan Darshan. In 2003, in collaboration with Indira Gandhi National Open University (IGNOU) and Indian Institute of Technology (IIT), a technology education channel was launched targeted to 1.5 million engineering and technology students (Agrawal, 2005). In India, using computers related to education first started in 1984. The project was called Computer Literacy and Studies in School (CLASS). As part of the project, computers were introduced to 250 higher secondary schools. An evaluation study of the CLASS project finds that students had a positive attitude towards computer learning regardless of the type of school (Agrawal, 1996, 2005). To facilitate the computer-based education, the first degree in computer education was offered in 1989 in Indore, India (Goel, 2000).
1.2.2 Functions of ICT in Education

In the emerging Indian society, knowledge creation, exchange, networking, and maximum utilization have become most vital for the advancement of nature. We need to make the system of education more innovative and futuristic; knowledge and information sharing serve as a major resource of bringing innovative trends in teacher education programs. In the last years, the so called ‘digital revolution’ brought the computers into the classroom in order to support and enhance pedagogical practices. Technologies available in classroom today range from simple tool based applications to internet based multimedia, e-mail communication, blogs, wikis and podcasts. Research into the use of technology in classrooms demonstrates that technology plays a critical role in student learning (Russel, Lucas, & McRobbie, 2003). Some of the large scale studies have shown the significant increase in achievement scores of students using technology as a learning tool (e.g., Lei & Zhao, 2007). Schroeder et al. (2007) showed the positive influence of the use of instructional technologies on student learning. The authors found that the most effective teaching strategy on student learning is “enhanced context strategies” such as making the content relevant to students’ everyday life experiences. As the authors suggested, real world experiences can be easily brought to students through technology since the technology facilitates authentic science activities in the classroom. For example, project-based science curricula that include learning technologies provide an opportunity for students to engage in inquiry (Hug, Krajcik, & Marx, 2005). Students design and conduct inquiry projects using various learning technologies such as handheld personal computing devices and digital measurement instruments. Some of the important functions of ICT such as ICT as a change agent in learning process, the impact of ICT on place ‘when’ and ‘where’ to learn and improve quality of education are discussed below and shown in Fig.1.1.

A) ICT as a Change Agent in Learning Process

ICT has unique importance in the educational system and social transactions. It has enhanced the way students/teachers work, learn, play and most importantly communicate. Its approach in teaching learning is psychologically sound and motivates the students for learning. The use of technological approaches in teaching learning has a positive effect on education, motivating students, promoting learning
and changing classroom interaction (Picchio, 2001; Honey, McMillan Culp & Spielvogel, 2005). It provides conducive learning environment so that students can participate actively and is learner centered in the sense that it can accommodate learner’s needs and interests. The use of multimedia makes classroom interesting, livelier and improve the student’s achievement. Consistent findings were found in Cotton’s (1992) extensive literature review regarding the improvement in student achievement through computer use. Cotton also found that computers improve student motivation to learn and attitude toward course content and school in general.

![Functions of ICT in Education](image.png)

**Fig.1.1: Functions of ICT in Education**

a) **Conventional Learning Process:** In the process of conventional learning emphasis was given on contents. It follows the particular course structure / syllabus for many years. Accordingly the subject wise textbooks & reference books have been written. By using relevant material to the subject teachers supposed to teach through lectures
and presentation. Teachers used their lesson plans, tutorials, different way of assessment to evaluate student performance etc.

b) **Competent Course Structure / Syllabus:** It is the need of the day to improve quality & structure of the syllabi by enforcing competency & performance based approach towards it. To include advance technology and practical approach is also one of the importance. The role of ICT in the education at higher level recurring and unavoidable. It is challenge to integrate ICTs with universities, into their strategies and educational process. It should be implemented at national & international level. It will be helpful to improve qualify and flexibility, the widening access to the field of tuition. One such curricula requires,

- Access to information types & different forms.
- Student-centred learning though information access.
- Learning environment concentrated on information access & inquiry.
- Real life examples.
- Teachers as mentors rather that content experts.

c) **Change In The Way of Learning:** We discussed ICTs are cause to make a move from a teacher centred learning to competency based learning. Universities are also responsible to make supporting changes in the way students are learning. Traditional way of learning is based on Transmissive modes. Use of ICT in education also affects the way students learning. The following points are particular forms of learning.

i) **Students Centred Learning:** With the help of technologies it is possible to promote transformation of education from teacher centred instruction to students’ centred instruction. e.g. 1) Increased use of web as a source. 2) Internet users can select the experts from whom they will learn. 3) Process will become problem-based learning. 4) The proliferation of capability, competency and outcomes oriented curricula. It supports independent learning. Students become immersed in the learning process by using ICT.

ii) **Supporting Knowledge Construction:** The emergence of ICTs as a learning technology unknowingly insists to think on alternative theories for learning. The conventional teaching process has focused on teachers planning and leading students through a series of in structural sequences to achieve desired outcome. This way of teaching follows the planned transmission of knowledge though some interaction
with the content as a means to consolidate the knowledge acquisition. It depends on the process of personal understanding. In this domain learning is viewed as the construction of meaning rather than memorization of facts. Use of ICTs provide many opportunities through their provision and support for resource based, student centred learning.

B) The Impact of ICT on place ‘When’ & ‘Where’ to learn

In the past, there was no or little choice for students in terms of method & manner in which programs have been delivered. Students typically being forced to accept what have been delivered. ICT applications provide many options & choices in the same case. It is the good opportunity for students to undertake education anywhere, anytime & any place.

a) Any place learning: The use of ICT has extended the scope of offering programs at a distance. The off-campus delivery was an option for students who were unable to attend the campuses. Today, many students are able to make this choice through technology – facilitated learning settings. e.g. In many instances traditional classroom learning has given way to learning in work-based settings with students able to access courses and programs from their workplace. The advantages of education and training at the point of need relate not only to convenience but include cost savings associated with travel and time away from work, and also situation and application of the learning activities within relevant and meaningful contexts.

- The communications capabilities of modern technologies provide opportunities for many learners to enrol in courses offered by external institutions rather than those situated locally. These opportunities provide such advantages as extended course offerings and eclectic class cohorts comprised of students of differing backgrounds, cultures and perspectives.

- The freedoms of choice provided by programs that can be accessed at any place are also supporting the delivery of programs with units and courses from a variety of institutions. There are now countless ways for students completing undergraduate degrees for example, to study units for a single degree, through a number of different institutions, an activity that provides considerable diversity and choice for students in the programs they complete.
b) **Any time learning:** In case of geographical flexibility, technology, facilitated educational programs also remove the temporal constraints.

- Through online technologies learning has become an activity that is no longer set within programmed schedules and slots. Learners are free to participate in learning activities when time permits and these freedoms have greatly increased the opportunities for many students to participate in formal programs.

- The wide variety of technologies that support learning are able to provide asynchronous supports for learning so that the need for real-time participation can be avoided while the advantages of communication and collaboration with other learners is retained.

- As well as learning at anytime, teachers are also finding the capabilities of teaching at any time to be opportunistic and able to be used to advantage. Mobile technologies and seamless communications technologies support 24x7 teaching and learning. Choosing how much time will be used within the 24x7 envelope and what periods of time are challenges that will face the educators of the future.

c) **Access to remote learning resources.** Teachers and learners no longer have to rely solely on printed books and other materials in physical media housed in libraries (and available in limited quantities) for their educational needs. With the Internet and the World Wide Web, a wealth of learning materials in almost every subject and in a variety of media can now be accessed from anywhere at any time of the day and by an unlimited number of people. This is particularly significant for many schools in developing countries, and even some in developed countries, that have limited and outdated library resources. ICTs also facilitate access to resource persons—mentors, experts, researchers, professionals, business leaders, and peers—all over the world (Tinio, 2003).

**C) Improve the Quality of Education**

Educators who advocate technology integration in the learning process believe that it will improve learning and better prepare students to effectively participate in the 21st century workplace (Butzin, 2000). ICT encompasses the effective use of equipment and programs to access, retrieve, store, organize, manipulate and present data and information (Dabbagh, 2007). Improving the quality of education and training is a
critical issue, particularly at a time of educational expansion. ICTs can enhance the quality of education in several ways: by increasing learner motivation and engagement, by facilitating the acquisition of basic skills, by enhancing teacher training and by collaboration.

a) Motivating to learn: ICTs such as videos, television and multimedia computer software that combine text, sound, and colorful moving images can be used to provide challenging and authentic content that will engage the student in the learning process. Interactive radio likewise makes use of sound effects, songs, dramatizations, comic skits, and other performance conventions to compel the students to listen and become involved in the lessons being delivered. NCERT (1994) study found that students do significantly better in mathematics, environmental sciences and language skill with audio visual representation if teachers too get involved with them. More so than any other type of ICT, networked computers with Internet connectivity can increase learner motivation as it combines the media richness and interactivity of other ICTs with the opportunity to connect with real people and to participate in real world events.

b) Facilitating the acquisition of basic skills: The transmission of basic skills and concepts that are the foundation of higher order thinking skills and creativity can be facilitated by ICTs through drill and practice. Educational television programs such as Sesame Street use repetition and reinforcement to teach the alphabet, numbers, colors, shapes and other basic concepts. Most of the early uses of computers were for computer-based learning (also called computer-assisted instruction) that focused on mastery of skills and content through repetition and reinforcement. Kalimuthu (1991) found that the higher secondary students taught through the video programme learnt more of the concepts on environmental pollution than those who were taught by the lecture method; the higher secondary students improved their achievement on environment pollution after viewing the video programme.

c) Enhancing Teacher Training: ICTs have also been used to improve access to and the quality of teacher training. For example: In Indira Gandhi National Open University, satellite-based one-way video-and two-way audio-conferencing was held in 1996, supplemented by print-materials and recorded video, to train 910 primary school teachers and facilitators from 20 district training institutes in Karnataka State. The teachers interacted with remote lecturers by telephone and fax.”
d) **Collaboration:** provides opportunities to learners to meet in a virtual space with other users, members and practitioner experts to discuss issues, answer questions and even participate in simulations and management games without having to leave their office or home.

### 1.3 INNOVATIVE TECHNOLOGICAL APPROACHES IN TEACHER EDUCATION

In teacher education institutions, a number of learning techniques or approaches have been introduced for the betterment of learning which ultimately makes teaching effective in reverse manner. No doubt, traditional methods of teaching and learning cannot be avoided at any cost but blending of them with new technological approaches may be fruitful for teacher as well as learners in the future technological race so as to promote the efficiency and effectiveness of education. Some of these new technological approaches are being explained here as depicted in Fig-1.2.

**E-Learning**

E-Learning is the learning facilitated and supported through the use of information and communication technology. Elliot Masie, one of the renowned experts of E-Learning, suggests that E-Learning is the use of network technology to design, deliver, select, administer and extend learning. The development in computer technology has resulted in E-Learning. It is a technology based distance learning program conducted online where in students can communicate with peers and instructors. E-Learning is considered a more effective way of teaching to a large group of students, thereby providing consistency in educational quality. Some of the institutions offering online courses include e-school world.com, e-learn.UK.com, and oxford open learning international; University of South Australia etc. Some virtual universities: Euro PACE-A Virtual University of Europe, Monterey Tech Virtual University etc. In **Synchronous E-Learning**, learning and teaching takes place at the same time while the trainer and learner are physically separated from each other. Internet telephony, web conferencing, online lectures, distance learning via interactive satellite, audio-video conferencing are the types of synchronous E-Learning. In **Asynchronous E-Learning**, the user can take the training independent of any schedule. It doesn’t need a facilitator or instructor and is one of the most popular E-Learning deployment methods. Examples are self paced course taken via internet and CD-ROM, stored audio-video presentation level or seminars.
Asynchronous activities used technologies such as blogs, wiki and discussion boards. In India, there is an immediate need to incorporate E-Learning in teacher education program. Through E-Learning, they will not only acquire crucial concepts of philosophy, psychology, sociology and so on but e-simulation and e-games will also give them practical exposure to the school and class environment. E-Learning can work in prefect synchronization with the teacher and the books to give the best to our students. As technological information becomes a necessary resource and commodity in the digital era, providing E-Learning services is more important to all educational institutions in each and every corner of the whole globe.

![Innovative Technological Approaches](image)

**Fig.1.2: Innovative Technological Approaches**

**U-Learning**

"Ubiquitous learning is an idea without barriers, inspiration without limits and innovation without boundaries." (Ubiquitous Learning Institute at the University of Illinois). It is a digital revolution and faster growing teaching-learning process in
present arena. It is connected, collaborative learning process which provides environment in which learners can learn at own pace. According to Hiroaki Ogata Dregs, University Of Tokushima, Japan, the feature of U-Learning is permanency, accessesibility, immediacy, interactivity, situating of instructional activities and adaptability. It has the characteristics of both e-learning and mobile-learning. Mobile e-Learning is a new way to learn using small, portable computers such as personal digital assistants (PDAs), handheld computers, two-way messaging papers internet-enabled cell phones, as well as hybrid devices that combine two or more these devices into one. These technologies have enormous potential as learning tool. Though U-learning is in acclivitous stage but it is the most advanced technology used in learning till today. It is a revolutionary beginning in the teacher education institution in present digital epoch.

Web Based Learning

Telecommunication technologies combined with web-enabled technologies have created a new technology based learning call web-based learning. World Wide Web (www) is the most successful educational toll which combines and integrates text, audio & video with mutual interaction among teachers as well as learner. By using this web based technology, the teachers can make learning easier and more flexible for students to gain access to learning opportunities and resources. The trainers distance education providers and teacher education institutions at all levels are increasingly using the web as a medium for delivering lectures. At the most, basic level course content such as course notes, lecture notes and administrative details can simply be pasted on the web and at a more complex-level; relevant web based resources can be linked to course notes and lecture notes to form interactive learning materials. In web based teaching courses, the role of a teacher have changed from
that of instructor to the facilitator or guide. Sansanwal and Nawayot (2001) defined Web Based Instruction as a hypermedia-based instructional programme that utilizes the attributes and resources of the WWW to create a meaningful learning environment, where learning is fostered and supported. The comparison between traditional learning environment pedagogy and web based learning environment pedagogy is given in table 1.1.

**Table 1.1: Comparison between Traditional Learning Environment Pedagogy and Web Based Learning Environment Pedagogy**

<table>
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<tr>
<th>Aspects</th>
<th>Traditional Learning Environment Pedagogy</th>
<th>Web-Based Learning Environment Pedagogy</th>
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</thead>
<tbody>
<tr>
<td>Instructional philosophy</td>
<td>Intuitivist</td>
<td>Constructivist</td>
</tr>
<tr>
<td>Active</td>
<td>Activities prescribed by teachers and whole class instruction.</td>
<td>Activities determined by the learners and small group instruction.</td>
</tr>
<tr>
<td>Creative</td>
<td>Reproducible learning and apply known solution to problems.</td>
<td>Productive learning and find new solutions to problems.</td>
</tr>
<tr>
<td>Teacher’s role</td>
<td>Didactic lecturer</td>
<td>Facilitator</td>
</tr>
<tr>
<td>Student’s role</td>
<td>Passive learner</td>
<td>Active learner</td>
</tr>
<tr>
<td>View of collaboration</td>
<td>Cheating</td>
<td>Constructing knowledge</td>
</tr>
<tr>
<td>Learning paradigm</td>
<td>Content-driven</td>
<td>Concept-driven</td>
</tr>
<tr>
<td>Problem solving</td>
<td>Algorithmic</td>
<td>Situated and relevant</td>
</tr>
<tr>
<td>Time on task</td>
<td>Limited by class period</td>
<td>Asynchronous and synchronous</td>
</tr>
<tr>
<td>Pedagogy</td>
<td>Abstract to concrete</td>
<td>Concrete to abstract</td>
</tr>
<tr>
<td>Sequence and duration</td>
<td>Bounded by college term points</td>
<td>Flexible entry and exit</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Teacher-directed and summative</td>
<td>Student-initiated and diagnostic</td>
</tr>
<tr>
<td>Adaptable</td>
<td>Not-individualized</td>
<td>Individualized for learner</td>
</tr>
<tr>
<td>Integrative</td>
<td>No link between theory and practice</td>
<td>Integrate theory and practice</td>
</tr>
</tbody>
</table>


Computer Supported Collaborative Learning (CSCL)

Collaborative learning here refers to instructions that involve students working in team to accomplish a common goal, under conditions that include the elements such as positive interdependence, individual accountability, face to face interaction, appropriate use of collaborative skills and group processing. It is based on the idea that learning is a naturally social act in which participants talk among themselves. This is a sort of computers assisted instructional strategy of E-Learning which assists the classroom teacher to make his teaching effective. It has proven to be effective for all types of students, including academically gifted, mainstream students and English language learners because it promotes learning, foster respects and friendship among diverse group of students (Behal, 2012). Although collaborative strategies are used more at school level than at higher education level. However due to higher potentialities it can be used at higher level like in teacher education institutions for better learning experiences. The picture from ITEIP developed by the investigator has been given as under.
**E-Mails**
Communication through electronic mails has emerged out to be an important way of communication. It facilitates the sharing of ideas, information and experience with others. Through these mediums, learners can get information about some graphics and textual content in relation to their studies. The files of the textual material and graphics can be transferred from one person to other for avoiding wastage of time and money which make it very convenient and economical tool for efficient teaching and learning.

**Online-learning**
Online learning is defined as the use of internet to access learning material; to interact with the content, instructor and other learners, and to obtain support during the learning process. Through online-conferencing, we can discuss with a number of people simultaneously. This facility can be used for person to person interaction or group communication. Online conferencing features like posting messages, sharing files or instant messages helps in enhancing and promoting an interactive teaching and learning environment.

**Digital Libraries**
Gone are the days when information collectors moved from library to library in search of desired information. Online library websites present information at a click. Digital libraries are emerging as an important area of research and education. This is a collection of documents in organized electronic form, available on the internet or on the CD-ROM disks. The learners with its help can acquire a variety of information at any time.

**Computer Aided Assessment**

Source: Original Pictures from ITEIP
CAA (Also referred to as e-Assessment) ranges from automated multiple choice tests to more sophisticated systems. With some systems, feedback can be geared towards a student’s specific mistakes. Branched programs are most common brain storming assessment programmes available. The computer can also navigate the student through a series of questions adapting to what the students appear to have learned or not learned. The assessment acts as an Information-gathering, Impetus for innovation: uncovers a problem and points to possible remedies, Provides feedback, and Enhances faculty & student engagement. It reinforces motivation for teaching improvement and act as a link between teaching improvement & assessment improvement.

**Distance Learning**

Keegan (1986) defined distance learning as a distinct form of education, parallel and complement to traditional face-to-face learning. It is a process whereby the education of students occurs in circumstances where the educators and the students are geographically separated and the communication across this distance is accomplished by one or form of technology (Gilbert & Moore, 1998). It focuses on pedagogy, technology and instructional systems design that are effectively incorporated in delivering education to students who are not physically on sight to receive their education. In this method, teachers and students may communicate at times of their own choosing. Distance Education librarians have much more critical roles to play in supporting the system in the new learning environment.

**Smart Class**

Smart class is a digital initiative of Educomp which is rapidly transforming the way teachers teach and students learn in schools with innovative and meaningful use of technology. Powered by the world’s largest repository of digital content mapped to Indian School Curriculum, smart class brings in technology right next to the blackboard for teachers in the classrooms. Students learn difficult and abstract curriculum concepts watching highly engaging visuals and animations. This makes learning an enjoyable experience for students while improving their overall academic performance in school.
EDUSAT

EDUSAT as an agent of learning have created a revolution in the field of education. It is commonly called SKY teachers; world’s first exclusive satellite for serving the education sector in 2004 has, infact, given tremendous boost to the learning approach in the country. EDUSAT or GSAT-3 was launched on 2004-09-20 by the Indian Space Research Organisation. It is the first Indian satellite built exclusively to serve the educational sector. It is mainly intended to meet the demand for an interactive satellite-based distance education system for the country. The lectures are delivered by the experts in the fields and broadcast live from the studio with an uplink facility at Department of School Education Research and Training. It enables the simultaneous training of a large number of geographically diverse people and access to high rated instructors and learning resources.

1.4 CONCEPT OF MULTIMEDIA

Multimedia is a melody sung in harmony with multi-channel and multi-modal bits of knowledge and creation. Sometimes it is as small as a rotating globe used as logo in an amateur"s website or is as huge as Xbox 360 games or DreamWorks” Shrek series. Its ultimate role is to inform, educate and/or entertain all. Multimedia is all-pervading, thrilling and involving method of info-edu-tainment with multiple facets and long lasting approbation. In simple terms, Multimedia can be defined as the integration of multiple forms of media which includes text, graphics, audio & video etc. Technologically, Multimedia refers to electronic products that include (or at least can include) the full range of visual and auditory elements-images, audio clips, video clips. Presentation software such as PowerPoint, Macromedia Flash and Swish
meets that definition. There is lot of definitions of Multimedia available on Internet and in books in printed form. Some of them are as follows: i) The use of several media, such as movies, slides, music, and lighting in combination normally for the purpose of education and entertainment. (www.publicspeakingcourse.com) ii) Multimedia is a term used to describe a range of products that have some audio and visual basis; for example, encyclopaedia programmes are labelled as being “Multimedia”. (www.yougamers.com/dictionary/3/) iii) Presenting data in more than one medium, such as combining text, graphics and sound. (www.m2ketch.com/hardware_glossary.htm) iv) Multimedia originally indicates a capability to work with and integrate various types of things together including audio, graphics and especially video. (Ambron & Hooper, 1988).

From the above given definitions of multimedia, it can be easily interpreted that multimedia encompasses a wide range of applications and technology, which is generally used in the field of education and entertainment. Multimedia games and simulations may be used in a physical environment with special effects, with multiple users in an online network, or locally with an offline computer, game system, or simulator. Enhanced levels of interactivity are made possible by combining multiple forms of media content But depending on what multimedia content you have it may vary Online multimedia is increasingly becoming object-oriented and data-driven, enabling applications with collaborative end-user innovation and personalization on multiple forms of content over time. Examples of these range from multiple forms of content on web sites like photo galleries with both images (pictures) and title (text) user-updated, to simulations whose coefficient, events, illustrations, animations or videos are modifiable, allowing the multimedia "experience" to be altered without reprogramming.

The succession of “Multimedia” is based on five themes: Time & Visionaries; Text, Processing and Software; Audio & Telecommunication; Video & Animation. Multimedia is generally categorized into two forms i.e. Linear Multimedia and Non-Linear Multimedia. Linear active content progresses without any navigation control for the viewer such as a cinema presentation. Non-linear content offers user interactivity to control progress as used with a computer game or used in self-paced computer based training. Non-linear content is also known as hypermedia content. Multimedia presentations can be live or recorded. A recorded presentation may allow
interactivity via a navigation system. A live multimedia presentation may allow interactivity via interaction with the presenter or performer.

### 1.4.1 Elements of Multimedia

Any multimedia application consists any or all of the following elements such as text, audio, video, images, animations, movies and user control which are explained below and shown in Fig.1.3.

**Fig.1.3: ELEMENTS OF MULTIMEDIA**

1. **Text**: Inclusion of textual information in multimedia is the basic step towards development of multimedia software. Text can be of any type, may be a word, a single line, or a paragraph. The textual data for multimedia can be developed using
any text editor. However, to give special effects, one need graphics software which support this kind of job. The text can have different type, size, colour and style to suit the professional requirement of the multimedia software. Web is HTML (Hyper text Mark-up language) originally designed to display simple text documents on computer screens, with occasional graphic images thrown in as illustrations. When PC was in their infancy running under MS-DOS they run in two modes: text and graphic. In graphic mode a program had to light up each pixel. The screen was 640 pixels wide and 480 high so to clear the screen in graphics mode a program had to turn off 307200 pixels. Text on those early PC’s was displayed using the ASCII charter set which was a series of 2 numbers that could be send to the monitor. Each of those two digit numbers represented an alphanumerical character. The 8 by 8 matrix made the screen 80 character wide and 60 charters high. To clear the screen only 4800 characters had to be cleared and only two digits had to be sent for each character. The first version of Windows was awful, especially when you compared it to the Mac or the Commodore Amiga. Windows and other graphical operating systems used a font to paint text on the screen in the graphical mode. The system is similar to ASCII concepts. Now the program specified the font and the charter. The full evolution of text was the vector based, true type, proportional font introduced by Adobe which was smart as a skilled typesetter.

2. Audio: Sound is perhaps the most element of multimedia. It can provide the listening pleasure of music, the startling accent of special effects or the ambience of a mood-setting background. To be clear we should explain that the size of a wave file depends largely to the Sample Rate of the Recording. Sample rate is the number of samples of a sound that are taken per second to represent the event digitally. The more samples taken per second, the more accurate the digital representation of the sound can be. Sound may be sampled at a size of 8.12.16 or 32 bits. The PCM format encompasses samples containing binary data of these sizes. The telephony format applies to samples are encoded Dialogic ADPCM (VOX), A-Law or ISDN A-Law. The text format is for plain text numbers ranging from -1.0 to 1.0 or -327768 to 32767. Hybrid format that further compress PCM files such as MPEG-3 and MPEG-4 are often used when sound files are part of a movie or to create a smaller footprint for files that were sampled at a high rate.
3. Video: The video part of the multimedia can be used as a powerful communicator providing clear cut instruction. Digital video has supplemented Analog video as the method of choice for making video for multimedia use. Video in multimedia are used to portray real time moving pictures in a multimedia project. To add full-screen, full-motion video to your multimedia project, you will need to invest in specialized hardware and software or purchase the service of a professional video production studio. In many cases, a professional studio will also provide editing tools and post-production capabilities that you cannot duplicate with your Macintosh or PC.

4. Images: Images whether represented analog or digital plays a vital role in a multimedia. It is expressed in the form of still picture, painting or a photograph taken through a digital camera. There are dozens of computer colour mixing systems and an endless numbers of custom palettes. Essentially however, all computer colours are created by mixing red, green and blue. Typically pallets are calculated using 255 parts of all three colors creates white while no parts of any of the primary colors produces black. The numbers of colours you can display, paint with or print with depends upon the capability of video card.

5. Animation: Animation is the rapid display of a sequence of images of 2-D artwork or model positions in order to create an illusion of movement. It is an optical illusion of motion due to the phenomenon of persistence of vision, and can be created and demonstrated in a number of ways. To create the most convincing illusion of motion frames should be played at movie speed of 30 frames per second. To create smooth playing animation we must consider the complexity and size of each frame as well as the colour depth and numbers of frames per second. Only the very fastest of modern desktop computers can play back full screen, 24 bit color video at 30 frames per second. Movies, unlike an animation that we can create from drawings or images a movie is created by a photographic process and converted or ported to computer so each frame has data stored in every pixel. Movie size on disk and in memory depends upon the video play back window size, the frame rate, the audio sample rate and size and the code used to encode the file.

6. User Control: There has to be some degree of user control so as to provide students with the option to leave certain parts of the application and thus prevent
boredom. On screen, options should exist for them to visit other areas of the program.

1.4.2 Applications of Multimedia

Use of Multimedia in various applications can be justified by levels of user friendliness, it provides (to its) users with interactivity and customization. Multimedia is widely used nowadays in various applications. Let us discuss some applications of multimedia in detail.

Education: In education, multimedia can be used as a source of information. Students can search encyclopaedias such as Encarta, which provide facts on a variety of different topics using multimedia presentations. Teachers can use multimedia presentations to make lessons more interesting by using animations to highlight or demonstrate key points. A multimedia presentation can also make it easier for pupils to read text rather than trying to read a teacher’s writing on the board. Programs which show pictures and text whilst children are reading a story can help them learn to read; these too are a form of multimedia presentation.

Entertainment: Multimedia power is used for new ways of having fun. The idea is to use computers as a medium for entertainment. With the addition of computer games to the multimedia revolution, entertainment has reached new heights. Multimedia games are a popular pastime and are software programs available either as CD-ROMs or online. Some video games also use multimedia features. Parents watching their children play innovative see how powerful multimedia is teaching them how to read or solve math problems even though the children perceive that experience as just a game. Buildings on the power of these perception innovators have increasingly used multimedia to support all kinds of activities that are not just games. Multimedia is also great for artistic expression. In addition, multimedia is heavily used in the entertainment industry, especially to develop special effects in movies and animations.

Virtual Reality: The goal of virtual reality is to create a three-dimensional world which feels real. The high level of interactivity is desired and is achieved by simulating world. Virtual reality uses headsets and data gloves. The headset covers the eyes and ears and projects sights and sounds generated by the computer. The glove transmits orientation of hand, enabling the computer to tell where you are.
looking, reaching or pointing. This technology will enhance multimedia by supporting real time, interactive, three dimensional graphics.

**Kiosk Displays:** Kiosk Displays are usually stand alone applications, frequently used in museum displays, trade show exhibits, automated information centers in company lobbies and store promotional devices. Typically the equipment is enclosed in some sort of housing with only the monitor showing and is left unattended. The user interacts with such an application through a touch screen monitor. Some of the benefits of such displays include making huge amount of data available to the casual user, running video on demand to show a promotional piece about a product, and allowing potential customers to feel comfortable, obtaining information without a salesperson.

**Software Training:** As computer application programs become more complex, software publishers are building multimedia presentations into their programs to introduce new features and walk the user through them. In companies, this form of presentation will take a big load off the overworked technical support staff. For individuals at home or in small business, it will make programs easier to learn and use. Software engineers may use multimedia in Computer Simulations for anything from entertainment to training such as military or industrial training. Multimedia for software interfaces are often done as collaboration between creative professionals and software engineers.

**Commercial:** Much of the electronic old and new media utilized by commercial artists is multimedia. Exciting presentations are used to grab and keep attention in advertising. Industrial, business to business, and interoffice communications are often developed by creative services firms for advanced multimedia presentations beyond simple slide shows to sell ideas or liven-up training. Commercial multimedia developers may be hired to design for governmental services and non-profit services applications as well.

**Office work:** Multimedia is not just for expensive commercial productions. It can be used to enhance ordinary communications. Using technology such as Microsoft OLE and Active X OR OpenDoc, you can insert sound and movie objects into other applications such as word processing or spreadsheet documents. Media player can be embedded in a document belonging to other application.
**Business:** Multimedia provides various ways to maintain a competitive edge for a company especially in training, market speculation and public relations. One can present various aspects of a business such as marketing plan for a new product, its impact in the market, consumer reaction etc. Simultaneously or even you can combine all these to make the computer feedback on the product launching. Companies can make electronic brochures, which can hold customer’s attention longer by making the brochure fun and interactive. In the Industrial sector, multimedia is used as a way to help present information to shareholders, superiors and co-workers. Multimedia is also helpful for providing employee training, advertising and selling products all over the world via virtually unlimited web-based technologies.

**Creative industries:** Creative industries use multimedia for a variety of purposes ranging from fine arts, to entertainment, to commercial art, to journalism, to media and software services provided for any of the industries listed below. An individual multimedia designer may cover the spectrum throughout their career.

**Mathematical and Scientific Research:** In Mathematical and Scientific Research, multimedia is mainly used for modelling and simulation. For example, a scientist can look at a molecular model of a particular substance and manipulate it to arrive at a new substance. Representative research can be found in journals such as the Journal of Multimedia.

**Medicine:** In Medicine, doctors can get trained by looking at a virtual surgery or they can simulate how the human body is affected by diseases spread by viruses and bacteria and then develop techniques to prevent it.

**Multimedia in Public Places:** In hotels, railway stations, shopping malls, museums, and grocery stores, multimedia will become available at stand-alone terminals or kiosks to provide information and help. Such installation reduce demand on traditional information booths and personnel, add value, and they can work around the clock, even in the middle of the night, when live help is off duty.

### 1.5 DEVELOPMENT OF IT-ENABLED INSTRUCTIONAL PACKAGE

Interactive multimedia is becoming increasingly popular in education, entertainment and business. Because of the capability of incorporating various media, and of supporting interactivity and learner control, multimedia often used in delivering
instruction. Furthermore, the World Wide Web technology with its interactive multimedia capability has been perceived to be one of the most promising technologies in the future. While there is general consensus among educators that interactive multimedia has the potential for enhancing learning, educators also agree that having well-designed multimedia software is critical in order for the technology to have any impact on learning. Literature on instructional design has detailed the process for developing instruction in general terms. The development of IT-enabled Instructional Package involves various phases as shown in Fig. 1.4.

It is clear from the Fig. 1.4 that, first of all, subject matter for which IT-enabled Instructional Package is developed, has to be selected. In the next phase, after selection of the subject matter, it is divided in the form of sub-units and chapters, so that it should become simple, motivational and highly informative. After the completion of the second phase, instructional package is developed with the help of appropriate software by using text, picture, animations, sound and bright colours for simulations. The last phase of the package with its different steps have been explained below and shown in Fig. 1.5.

![Fig.1.4: Phases of Development of IT-Enabled Instructional Package](image_url)
I Selection of Appropriate Technology Tools

In this step, plan about appropriate ICT for each media element such as graphics, text, audio, video, animation and interactivity for each learning experience. She has to select required hardware and software for making of each element of IT-Enabled Instructional Package.

II Script Designing

In this step, the script of all the necessary elements of IT-Enabled Instructional Package i.e. **Text, Graphics, Audio, Video and Animation** is designed. Analysis of subject matter form the bases for script designing which is more worked out version. In this phase we prefer to make a prototype. The outcome of this phase is a mixture of paperwork (text specification, AV scripts, graphics etc.) and prototype.

III Integration of Elements

The investigator has integrated the different elements of IT-Enabled Instructional Package i.e. text, audio, video and animation in this step. But if the investigator found any difficulty at any step, he/she may modify the script and implement it again.

IV Assessment of IT-Enabled Instructional Package

Special emphasis is given by investigator on this step. After making the rough format, the package was shown to the subject as well as technical experts for getting valuable suggestions so that necessary changes could be made in the package before finalization. For this An opinionnaire can be developed by the programmer to check
the effectiveness of IT-Enabled Instructional Package.. Views of various subject experts regarding validity of Package is taken through this scale.

V Final Shape of IT-Enabled Instructional Package (ITEIP)

After assessment of IT-Enabled Instructional Package by Experts, the final shape of IT-Enabled Instructional Package is given by incorporating suggested changes.

1.6 THE PEDAGOGICAL STRENGTHS OF MULTIMEDIA BASED TEACHING

In the current scenario of educational institutions, multimedia has dig up its own kind of space in some or the other way as a tool of educational technology. Multimedia has overcome the barriers of time and space and provides evidence to be accepted as an anytime and anywhere tool for educating multi-disciplinary masses (Malik & Agarwal, 2012). The process of knowledge acquisition becomes more efficient when the learners experience an event through a multimedia simulation. Multimedia technology empowers the educational process by means of increased interaction between teachers and the students. Apart from the fact that multimedia can provide educators and students with endless possibilities of quality teaching and learning, taking vital considerations of the pedagogical strengths and limitations of Multimedia, it can be used to its fullest potency. Multimedia provides a technology based constructivist learning environment where students are able to solve a problem by means of self explorations, collaboration and active participation. (Neo & Neo, 2009). Simulations, models and media rich study materials like still and animated graphics, video and audio integrated in a structured manner facilitate the learning of new knowledge much more effectively. Parihar (1978) study revealed that use of films with an experimental group resulted in more learning in lesser time. Students exposed to films shared better retention as well as more interest in the subject than those were not exposed to them. It uses the natural information processing abilities that we already possess as humans. Our eyes and ears, in conjunction with our brain, form a formidable system for transforming meaningless sense data into information. The old saying that "a picture is worth a thousand words" often understates the case especially with regard to moving images, as our eyes are highly adapted by evolution to detecting and interpreting movement. Shim, Park & Kim (2003) findings revealed that VRT Simulations allow comfortable
interaction with computers and increase the interest of students and their understanding of scientific concepts and phenomena.

Multimedia facilitates mastering basic skills of a student by means of drill and practice. It helps in problem solving by means of learning by doing, understanding abstract concepts, provide enhanced access for teachers and students in remote locations, facilitate individualized and cooperative learning, helps in management and administration of classroom activities and learning content, and simulate real life problem handling environments. Steve (2010) determined the effects of interactive multimedia simulations and virtual dissection software on depth of learning among students participating in biology and chemistry laboratories. The results indicated that participants changed their depth of learning after completing simulation and virtual dissection software. For the students, if the multimedia courseware includes only a few images at least it gives relief from screens of text and stimulates the eye, even if the images have little pedagogical value. Some of valuable benefits of Multimedia from students-context as well as teachers –context are discussed below:

a) Students-context

The development of multimedia help to make learning more differentiated and customized to individual needs and broadened horizons with more opportunities for creative expression. Oguz serin (2011) revealed that there is statistically significant increase in the achievement and problem solving skills of the students in the experimental group that received the Computer-Based Science & Technology instruction. It increased motivation through learning that stimulates stretches and takes into account prior and concurrent experiences in and out of school. Rai (2009) described that the use of Multimedia, not only brings creativity but encompasses all arenas of education through text, graphs, moving images, sound and music with the help of computers. The personalized feedback on progress based on the use of assessment tools, and the ability to record and share achievements with others; wider access to learning and participation, particularly for learners with special educational needs and disabilities, and those unable to attend school due to illness or disaffection with traditional learning methods.

Nimavathi & Gnanadevan (2009) examined that the students learning through multimedia fared better in their study habits than the students learning through the
conventional method. Students get better informed choices through greater access to information, guidance and support services and develop the ability to use new technologies to enhance, extend and enrich their learning, reflecting the increasingly ICT-rich environment in which they live and learn. Cepni & Kose (2006) studied the effect of Computer-assisted Instruction Material related to ‘photosynthesis’ topic on student cognitive development, misconception and attitudes. The result showed that using CAIM in teaching photosynthesis topic was very effective for students to reach comprehension and application level of cognitive domain.

b) Teachers-context
The development of Multimedia contribute to improved professional status, help to increase capacity and provide opportunities for career development and progression that build on the recognition and reward of effective e-learning practice. It provides a comprehensive range of advice, guidance and support for teachers of all subjects at all levels on how ICT can be used effectively in classroom practice to embed ICT in teaching and learning across the curriculum. It gives opportunities to access a wide range of resources that simplify the preparation and enrich the delivery of lessons. Cox, Abbott, Webb, Blakeley, Beauchamp and Rhodes (2004) has found positive effects of ICT on pupils' attainment in almost all the National Curriculum subjects, particularly regarding mathematics and English at all key stages. This study further has suggested that a crucial component in the use of ICT within education is the teacher and their pedagogical approaches. The impact on attainment was greatest for those ICT resources that have been integrated in teachers' practices for a long time. The authors concluded that ICT has a positive impact on pupils' learning when the use of ICT was closely related to learning objectives and when the choice of how to use ICT was relevant to the teaching and learning purposes. It revitalized professional networks supporting communication and collaboration, including the sharing of resources and best practice, within and between schools. It also support for workforce remodelling through the automation of routine administrative tasks and the availability of technical support; increased opportunities to develop innovative and creative ways of supporting students' learning, enabling seamless links with experiences beyond the conventional classroom and timetable.
Nalayini (1998) found the attainment of the cognitive factor “Application and skill” lower for the students who learn through traditional method when compared to the
students who learn through computer. Stark, Gray and Payne (2000) investigated that ICT improved motivations, enhanced learning and teaching, improved communication and access to information, and improved efficiency and feelings of independence. Patel (2001) study the learning through CALM in relation to selected production variables and contiguity. The findings revealed the significant gain through interaction with CALM on Solar System and Magnet. Balasubramanian and Meera (2002) found that CAI in Drill and Practice is more effective than the Tutorial and Simulation modes in teaching Biology at Standard XI and it helps the students to learn at their own pace.

Vij (2003) indicated that the group of Pupils taught Science through Computer Assisted Instructions was effective in raising the Self-concept of the Pupils. The post-test mean scores of the Pupils taught Science through Computer Assisted Instructions increased significantly which indicates that Computer Assisted Instructions enhanced study involvement of the Pupils. Macwana (2004) study focused on the development of Computer Assisted Learning Material (CALM) on optics for Standard IX Gujarati medium students and found its effectiveness in terms of the achievement of students and Reactions of the students and teachers. The study revealed that CALM was effective in terms of achievement and reaction. Desai (2004) found the relative efficacy of teaching through the traditional method and multimedia approach in the subject of Home Science, particularly, proteins. Kohli (2005) findings established that Computer Assisted Model and Concept Attainment Model were found to be effective in improving the achievement level of students. Unlike conventional method, students got feedback and remedial teaching which automatically improved their achievement and promoted their self-concept. Jayaraman (2006) indicated that the performance of the students who have learned through CBMMLP is higher than the performance of the students who have not learned through CBMMLP. Teachers perceived ICT to be useful for streamlining current teaching procedures, gaining access to new professional opportunities and new exciting teaching opportunities. Jyothi (2007) indicated that that the self-instructional module prepared by a teacher through simple power point presentation could show immense impact on learning of chemistry.

Nimavathi and Gnanadevan (2008) identified that the students learning with the help of multimedia programme fared better in science than the students learning through
the conventional method. Suman (2009) findings shown that mean scores of Science achievement at post-test stage was significantly higher than the mean score of science achievement at pre-test stage of E-content group. The results also revealed that E-content improve achievement in science significantly higher in comparison to Conventional strategy when groups were matched on pre-achievement in science. Leonard, James & Shawn (2009) investigated the impact of video games on high school students’ engagement and learning about genetics and found significant difference in participants’ level of engagement while interfering with the video game. Ponraj & Sivakumar (2010) examined the effect of CAI software on the achievement in zoology. The results shown that teaching the zoology by using CAI is more effective than conventional strategy. Steve (2010) determined the effects of interactive multimedia simulations and virtual dissection software on depth of learning among students participating in biology and chemistry laboratories. The results indicated that participants changed their depth of learning after completing simulation and virtual dissection software. Phillip, Jacksin & Dave (2011) studied the effect of Computer-Assisted Instruction on student’s attitude and Achievement in Matrices and transformation in secondary schools in Kenya. The result of the study indicated higher achievement & positive attitude with CAI treatment group. Ada, Faith & Victoria (2012) indicated that students taught using (CAI) package performed significantly better than their counterparts taught using the conventional method of instruction. Students taught using CAI performed better than the control group in retention test. Telima and Aderonmu (2012) revealed that unavailability of CAI equipments and low level of teachers’ competency in computer usage affects the use of CAI-PS for content delivery. It was also recommended amongst others that there should be compulsory inclusion of computer usage in teaching, for all teacher education programmes. Bindal & Sharma (2013) revealed that a teacher is expected to know successful integration of ICT into his / her subject area to make learning meaningful. ICTs in education are not transformative on their own transformation requires teachers who can use technology to improve student learning. ICT integration in teaching and learning is being perceived as a necessity and is growing exponentially. Eze & Olusola (2013) recommended that teacher training institutions, professional development schools, societies and public educational agencies must continue to identify study and disseminate examples of
effective technology integration that answer professional development needs. Khushnir, Manzhula & Valko (2013) developed approaches allowed us to improve a range of disciplines including "Information Technology", which is taught for students of all teacher specialties. Warren (2013) recommended that to prevent future ICT failures and to give ICT every chance to be successful in secondary schools, educational practitioners need to be aware of the ICT risk factors and adopt suitable strategies to reduce them. With this knowledge, we can expect to achieve our educational goals in a manner that resonates with our digital native students.

1.7 RATIONALE OF THE STUDY

An important progress in computer technology and software has been realized in recent years. Use of computer in education as well as the infusion of Multimedia in teaching learning has altered considerably the instructional strategies in our educational institutions. The traditional teacher-centered method of teaching used for decades in our educational system has been modified and enhanced. There is nothing which is untouched with the use of technology. It plays a vital role in all spheres of human activities. Education sector is also not an exception either. ICT is doing a commendable job in almost all subjects, especially in sciences. Students can have access for all the necessary information in the form of text, pictures and videos on Internet. It is supposed to be used as a tool where and when considered useful. In the realm of science education, there has been a strong link between computer and science. Kiboss (2004) also studied the effectiveness of computer mediated simulations programmes in Biology on pupils learning outcomes in cell theory. The study concluded that the use of the CMS programme to augment conventional biology teaching has major implication for secondary biology instruction in this area. Ponraj & Sivakumar (2010) conducted a study to examine the effect of CAI software on the achievement in zoology. The study has shown that teaching the zoology by using CAI is more effective than conventional strategy. Oguz serin (2011) revealed that there is statistically significant increase in the achievement and problem solving skills of the students in the experimental group that received the Computer - Based Science &Technology instruction. Research exploring the use of technology in science classrooms clearly indicates that the use of technology has positive influence on the wide variety of student learning outcomes including understanding of science and development of scientific reasoning skills (Dani &
These studies proved that ICT could be a potent tool in teaching-learning process of Science. Also appropriate educational technologies have the potential to make the science concepts more accessible through visualization and multiple representations and students can be engaged in more powerful scientific activities and they are able to perform investigation that would not be possible without the use of technology. Also Computer based Multimedia learning environment consisting of text, graphics, pictures, audio, video and animation offer a potentially powerful venue for improving students’ understanding.

Integration of multimedia in education is still far from desired. The use of multimedia in teaching and their integration in the classroom and in the teaching training institutes have remained almost unexplored. A very few studies have been conducted in this direction that too in limited disciplines. Many linked queries and issues have remained unfold. Thus a lot of work is to be done in this direction to answer such problems. Therefore it is significant to conduct a study to evaluate the impact of multimedia package for a subject like Science at school stage. Keeping in view, the above factors, the researcher decided to develop IT-enabled Instructional Package to teach Science to School Students in an interesting and effective way.

1.8 STATEMENT OF THE PROBLEM

DEVELOPMENT OF IT-ENABLED INSTRUCTIONAL PACKAGE IN SCIENCE AND ITS IMPACT ON ACADEMIC ACHIEVEMENT OF SCHOOL STUDENTS

1.9 OPERATIONAL DEFINITIONS OF KEY TERMS

The terms used in the statement are defined as under:
1. Development: In the context of the present study development of IT-enabled Instructional Package means Subject matter analysis, script designing, plan and production of multimedia package. It also includes validation of programme by subject teacher and subject expert.

2. IT-Enabled Instructional Package: In the context of the current study, IT-enabled Instructional Package refers to the package which provides an integrated form of text, graphics, colors, animation (3D), pictures, X-ray features, audio and video with interactivity on the same screen. To develop the package text,
animations, pictures and figures were prepared by using software such as Swish 2.0, Adobe Photoshop, Adobe Illustrator, Adobe After Effects, Adobe Sound booth (for recorded sound/ narration) and Frutiloop (for music). It was developed to achieve the specific objectives.

3. **Academic Achievement:** In the present study, to know the Achievement in Science of the students of class X, an achievement test in Biology based on the Science syllabus of class X was developed.

### 1.10 OBJECTIVES OF THE STUDY

The present study is designed to realize following objectives:

1. To develop IT-enabled Instructional Package in Science for X class students.
2. To develop an Achievement Test in Science (Biology) for X class students.
3. To develop an Opinionnaire for effectiveness of IT-Enabled Instructional Package.
4. To analyze the opinions of subject experts towards the effectiveness of IT-Enabled Instructional Package.

**Before Experimental Treatment**

5. To compare the mean achievement scores in science of Experimental and Control group (E & C) of tenth class students to be taught through IT-Enabled Instructional Package (ITEIP) and conventional method teaching before experimental treatment.
6. To compare the mean achievement scores in science of boys of Experimental and Control group (BE & BC); and girls of Experimental and Control group (GE & GC) to be taught through IT-Enabled Instructional Package (ITEIP) and conventional method of teaching before experimental treatment.

**After Experimental Treatment**

8. To study the effect of treatment on achievement in Science of tenth class students after experimental treatment.
10. To study the interaction effect of treatment and gender on achievement in Science of tenth class students after experimental treatment.
11. To study the effect of treatment on mean gain achievement scores in Science of tenth class students after experimental treatment.

12. To study the effect of gender on mean gain achievement scores in Science of tenth class students after experimental treatment.

13. To study the interaction effect of treatment and gender on mean gain achievement scores in Science of tenth class students after experimental treatment.

1.11 HYPOTHESES OF THE STUDY

Before Experimental Treatment

\( H_{01(a)} \) There exists no significant difference in the mean achievement scores in Science of the two groups (E and C) of tenth class students taught science through IT-Enabled Instructional Package and conventional method before experimental treatment.

\( H_{01(b)} \) There exists no significant difference in the mean achievement scores in Science of the two groups of boys (BE and BC) taught science through IT-Enabled Instructional Package and conventional method before experimental treatment.

\( H_{01(c)} \) There exists no significant difference in the mean achievement scores in Science of the two groups of girls (GE and GC) taught science through IT-Enabled Instructional Package and conventional method before experimental treatment.

After Experimental Treatment

\( H_{02(a)} \) There exists no significant effect of treatment on Achievement in Science of tenth class students after experimental treatment.

\( H_{02(b)} \) There exists no significant effect of gender on Achievement in Science of tenth class students after experimental treatment.

\( H_{02(c)} \) There exists no significant effect of treatment and gender on Achievement in Science of tenth class students after experimental treatment.

\( H_{02(d)} \) There exists no significant effect of treatment on mean gain achievement scores in Science of tenth class students after experimental treatment.
H_{02(e)} There exists no significant effect of gender on mean gain achievement scores in Science of tenth class students after experimental treatment.

H_{02(f)} There exists no significant effect of treatment and gender on mean gain achievement scores in Science of tenth class students after experimental treatment.

1.12 Delimitations of the Study

Keeping in view the constraints of the time and available resources, the study is delimited to:

1 Students of class X only.
2 Students of private schools affiliated to CBSE only.
3 Students belonging to urban area only.
4 English medium schools only.
5 Biology in Science subject of class X.

1.13 CHAPTERISATION SCHEME

The present study has been divided into six chapters. Out of the six Chapters, Chapter I is Introduction which includes Rationale of the Study, Objectives, Hypotheses and Delimitations of the Study. The Chapter II is devoted to the Review of Related Literature. In chapter III, Design & Procedure of the Study, Method, variables involved, Sample, Tools, Procedure and Statistical Techniques have been presented. The Chapter IV deals with the Analysis and Interpretation of the Data along with the Discussion of the Results. In Chapter V, the Findings, Educational Implications of the Study and Suggestions for Further Research have been presented. The Chapter VI is allocated to the Summary of the present study.

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