CHAPTER - I

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1.1 INTRODUCTION

We are living in an age of information and technology. In the era of globalization the explosion of technologies is impacting the world in more than one ways. Widespread use of computers in all fields of life has been seen. There have been several major trends in emerging technologies particularly in last two decades which have increased access to instructional media with the advent of microchip technology; computers are now readily accessible on desk at reasonable cost. The internet acts as a medium for personal communication; information providers as well as consumers. It is an unparalleled resource for education. Communication and computer technologies have occupied the centre stage of all developments and are making a profound impact on society, e.g. computerized accounting in banks, online payment of property tax, etc.

It has also made a considerable impact on teaching learning process. New types of educational technologies like E-Learning CDs, DVD Lectures, Virtual Classes, etc are emerging at an ever accelerating pace, paralleling the innovations in information and communication technologies. The implementation of new educational technology in the class helps to shift focus from teacher-centered to student-centered. The explosion in the field of knowledge and information technology has virtually altered the characteristics of the learning environment, paving the way for new learning environments and the emerging new learning techniques. By taking this background into consideration, it is the utmost need of the society for research in the field of use of computers and computer aided technology or information and
communication technology in the teaching learning process. The use of ICT in education is seen as a way to produce a more knowledge based work force.

ICT has a great potential to contribute positively towards knowledge dissemination, effective learning & development of more efficient education services. Today’s teachers must be prepared to provide technology supported learning opportunities to their students because this is the need of knowledge based economy today. They must be prepared to use technology & should know how technology can support student learning; therefore it must be made integral to every teacher’s professional repertoire.

Information and Communications technologies are a diverse set of technological tools and resources used to communicate, and to create, disseminate, store and manage information (Blurton, 1999). ICT includes the use of computer technology, including hardware, peripheral devices, media, delivery systems and software. This term is used in the ISTE NETS standards and is used by UNESCO in reference to the integration of technology into teaching (UNESCO, 2002).

Keeping in view the drastic change in globe due to the revolution in information and communication Technology, Eric Ashby (1967) has identified four revolution in education:

1. The first revolution occurred when societies began to differentiate adult roles and task of educating the young was shifted in part, from patents to teachers and from home to school.

2. The second revolution was “the adoption of the written words as a tool for education “. Prior to that time oral instruction prevailed and it was with reluctance that “writing was permitted to co-exist with spoken word in the classroom.”
3. The third revolution came with the invention of printing and the subsequent wide availability of books.

4. The fourth revolution is development in electronic, notably those involving the radio, television, tape recorder and computer.

Behaviour scientists have joined the fourth revolution and have pointed out the importance of defining learning objectives and suggesting ways in which natural learning process can be utilized in the presentation of subject matter by employing these vast resources.

And now digitization of information particularly the educational information with the help of ICT can be called as the fifth revolution in education. It has great potential in the field of education.

ICT can provide access to information sources, enable communications, create interacting learning environment and promote change in methods of teaching. Therefore the ways of learning have been transformed by ICT and are no more restricted to medium of print, bibliographies, and abstracts. The sources of knowledge for students and teachers have also broken out of all geographical boundaries. As such it becomes very important that those associated with teaching learning process should not only be familiarized with this technology but also realize and put into action its useful aspects. In the proceeding paragraphs the meaning of ICT, its historical background, relationship of ICT with students, teachers and education, awareness of teachers etc. have been given, which can provide the conceptual framework for the present study.
1.2 Historical Background of ICT

Information and Communication Technology (ICT) is a word of recent origin which usually confused with Information Technology (IT) and Communication Technology (CT). ICT can be termed as the synchronization of both IT and CT. The history of ICT would be incomplete without discussing CT as well as IT. Let us discuss about the historical background of ICT which was originated from the beginning of a communication era.

Communication has long history, as long as that of the human race. At the primitive age people developed simple ways and means of communication. In due course of time new and sophisticated technologies were invented and used to expand the ability to communicate effectively and efficiently across longer distance and over longer period of time.

The invention of printing technology was a revolution in the area of communication technology. It was, however, first used for reproduction of religious works. As early as 868 A.D., the teaching of Lord Buddha was printed by the Chinese. It took centuries before the mechanical printing press came into existence.

Due to advancements in communication technology, the process of printing becomes mechanical. The first printing press in India came by chance on September 6, 1556. It was set up by a Christian Missionary and used for printing religious books. Gradually printing technology formed the shape of information technology in a span of nearly three hundred years. Book printing was considered as one of the most powerful tool of information technology.

The audio-visual media were the products of the Twentieth Century. The audio media came in 1920s and grew very fast after the world War-II. They are now used for entertainment, education and information all over the world. The visual
media came later in the sequence but expanded very fast. Now more sophisticated technologies, such as video cassettes, cabal T.V., Computers, video text, video disc, video phone, facsimiles etc. are used for communication world over. The communication satellites are geared to bring the world together for welfare of human beings. Gradually, more and more technologies were added to it in the form of micro chip, electronic storage and discrimination, net working, World Wide Web (www).

Similarly, in this fast changing world, people became more and more hunger for knowledge. As the major source of knowledge is information, people invented more and more sophisticated technologies to access retrieve and store huge amount of information. It gave birth to IT, computer and related electronic devices. In this process of innovation and creation, IT mixed up with CT in such a way that it was found difficult to distinguish and separate both. This combination of IT and CT provides huge potential and a platform to access, retrieve, store and process large amount of information and it helps to communicate this processed date to other part of the world. This potential of ICT made it popular among students and teachers. Now every corner of education is trying to incorporate ICT with it.

The first significant technological change that was reflected in education was the invention of typography and printing. But it took several centuries before books were available for every student's individual education. Other attempts in using various teaching aids (generally technology) are connected with the industrial revolution. In education, of course, it is not the steam engine, with which the beginning of technological progress is generally associated. But, for example, the famous inventor Thomas Alva Edison had the idea of replacing the textbooks with motion pictures. Similar ideas appeared with the emergence of phonograph, radio broadcasting, tape players, TV as well as video. These attempts were rather unsuccessful. None of these aids replaced standard textbooks nor changed classical instruction methods. The mass form of one-way information transfer, such as in public broadcasting, prevents individual learning, because it does not reflect
individual needs. The sequential presentations such as tapes and videos, etc. do not allow for working with the piece of information actually needed. Therefore these means can only play a role of supplementary specialized material.

Similar attempts were noticed in the 70's and 80's, when first personal computers reached the markets. There were suggestions that computers would soon replace not only textbooks, but also even teachers. These hopes turned out vain again. The computers of that time were trying to manage the instruction process in such a silly way that the interest of students was rapidly vanishing. Instead of the subject matter the students were keener on gaining the best results, which was often possible without relevant knowledge.

Today we find ourselves in similar situation, but on a different level and with different consequences. Individual technical teaching aids have been transformed into integral information and communication technology. Interconnected computers are able to play the role of all the above-mentioned technical aids including textbooks. There is no need to wait for the exact time the desired information is broadcasted or to walk to the library or video store. The range of possibilities in using the ICT is even much wider. They enable very sophisticated control of the work of the users of educational applications as well as uncontrollable communication of all the connected people via Internet. Bradicka (2003)

**ICT in India**

**ICT** is one of the recent developments of the twentieth century in India. It has changed each and every system around the globe from house related systems to industrial systems. Significantly, it has influenced the educational systems in all its forms. In the educational field different types of Information and Communication media are used to impart education. Radio, T.V., Tape recorder, OHP, LCD Projector, Computer and now with advancement in these technologies has changed the scenario. Internet and advanced computers are now being used in education as an instrument of
instruction. This digitization has made it possible to design, develop, deliver, manage and assess teaching – learning process. It increases the efficiency of the system and makes it more powerful.

The ability to use ICT effectively and appropriately is now seen as essential to allow learners to acquire and exploit information within every sphere of human activity. It can be assumed that specific forms of ICT will change with time. However, the need to be able to aware and use ICT purposefully will remain the key to full participation in an information society.

The school curriculum already reflects the perceived value and importance of developing ICT literacy and indeed, information literacy in all students. For example from 8 to 12 standards, computer is added into the curriculum. This emphasis is followed through in the proposals for the requirements of higher education and still ICT is identified as one of the core skills areas, and as such, the option for assessment and certification of achievement will available. There is also complementary move towards using, for example, multi-media packages in staffdevelopment for teachers by Intel. ICT has changed the scenario of school education and going to add more change in the system. It is also stated in the National Curriculum Framework for School education (2000). Changes in the perception of ‘learning environment’ have been highlighted by National Curriculum Framework (2000), which seek to exploit the potential of ICT. The National Curriculum Framework has emphasized on the utilization of ICT in schools. The success of ICT in school education depends on teachers, students and authorities in the school. Teachers have a major role to play. Teachers can lead the journey forward.

Teacher is the gateway of information, teacher act as a mentor, instructor, director and guide to help students to grasp and make them understand. For that teacher should do best of his part, for that teacher uses different methods, approaches and techniques. But these are not enough in today’s IT world. So he needs to utilize
ICT resources in his teaching which is emphasized by National Curriculum Framework (2000) and many committees because future of the students depends on their performance in secondary and higher secondary education as it is considered as the base for professional courses and higher education. So it is the duty of teacher to clear the doubts of students and make them understand. It can be possible or enhanced by ICT awareness and use of ICT by teachers. So the investigator has made an attempt to conduct a study at secondary and higher secondary level to know the ICT awareness, use and need of secondary and higher secondary school teachers.

In recent years there has been increase in the availability of computer hardware and software in schools, often as a result of Government funded initiatives, and/or sometimes as a result of schools effort to raise funds for ICT resources. However, having technology does not mean that it will automatically be integrated as resources in day to day teaching. The effective and efficient use of ICT will be out of question unless institutions have these and teachers are aware of this technology integration. Successful integration into the curriculum depends on teachers being convinced of the relevance of ICT as a means of providing access to a range of resource for themselves and students. The emphasis must be on using appropriate technologies to enhance and support effective teaching. Indeed, teachers require to be able to select and utilize technology in a useful manner. Even teachers need to be able to exploit modern information sources such as internet for themselves as continuing learning for their personal and professional development. As a result, potential impact of information and effective use of ICT in the classroom has far and wider implications. Sometimes, teachers may not be aware of ICT due to the unavailability of resources and lack of skills. Teachers may be interested to have these skills. For these purpose, teachers have specific ‘needs’ like skill training, availability of resources. Therefore investigator has selected ICT need of teachers as one of the variable.
Several studies conducted with this regards revealed that teachers are aware of the potentials of ICT in education but only few teachers use ICT resources in their teaching due to lack of skill or unavailability of resources. So keeping in mind ICT awareness, use and need of teachers the investigator has decided to conduct a survey. Several variables may be linked with the ICT awareness, use and need of teachers like more education may lead to more awareness in ICT or English medium background may lead to be more aware in ICT. Hence investigator in interested to know the relationship of few background variables with ICT awareness, use and need of secondary and higher secondary teachers.

Saurashtra region is known as the cultural city of Gujarat. It has strong cultural and educational heritage due to the former rulers of Gaikwad rein. Because the maharaja introduced compulsory education hence, the culture of this city uses to be changed according to the change of the time for which it has retained its status as the cultural city of Gujarat.

Whether the teachers of Saurashtra region are managed themselves according to the needed demand of ICT and computer Education. Hence the investigator has taken the proposed study to know ICT awareness, use and need of secondary and higher secondary school teachers of Saurashtra region. It will also help the investigator in term of feasibility of conducting the study. Further, keeping the time factor in mind, the investigator has decided to limited the study only to the schools of Saurashtra region. Even very few research studies have been conducted in this regard to know the ICT awareness, use and need in different dimensions, like, for academic development, professional development and personal development. The present study may through some light on these matters. Hence the present study is an attempt to know the ICT awareness, use and need of secondary and higher secondary teachers.
ICT enhancing teaching and Learning Process

Conventional teaching has emphasized content. For many years course have been written around textbooks. Teachers have taught through lectures and presentations interspersed with tutorials and learning activities designed to consolidate and rehearse the content. Contemporary settings are now favouring curricula that promote competency and performance. Curricula are starting to emphasize capabilities and to be concerned more with how the information will be used than with what the information is. Contemporary ICTs are able to provide strong support for all these requirements and there are now many outstanding examples of world class settings for competency and performance-based curricula that make sound use of the affordances of these technologies (Oliver, 2000). Harris (2002) conducted case studies in three primary and three secondary schools, which focused on innovative pedagogical practices involving ICT. Harris (2002) concludes that the benefits of ICT will be gained “…when confident teachers are willing to explore new opportunities for changing their classroom practices by using ICT.

According to Cabero (2001), "the flexibilization time-space accounted for by the integration of ICT into teaching and learning processes contributes to increase the interaction and reception of information. Such possibilities suggest changes in the communication models and the teaching and learning methods used by teachers, giving way to new scenarios which favour both individual and collaborative learning”. The use of ICT in educational settings, by itself acts as a catalyst for change in this domain. ICTs by their very nature are tools that encourage and support independent learning.

Effective integration of ICT enhancing the quality and accessibility of education

The integration of information and communication technologies can help revitalize teachers and students. This can help to improve and develop the quality of education by providing curricular support in difficult subject areas. To achieve these objectives, teachers need to be involved in collaborative projects and development of intervention change strategies, which would include teaching partnerships with ICT as a tool. According to Zhao and Cziko (2001) three conditions are necessary for teachers to introduce ICT into their classrooms: teachers should believe in the effectiveness of
technology, teachers should believe that the use of technology will not cause any disturbances, and finally teachers should believe that they have control over technology. One of the most vital contributions of ICT in the field of education is- Easy Access to Learning. With the help of ICT, students can now browse through e-books, sample examination papers, previous year papers etc. and can also have an easy access to resource persons, mentors, experts, researchers, professionals, and peers-all over the world. This flexibility has heightened the availability of just-in-time learning and provided learning opportunities for many more learners who previously were constrained by other commitments (Young, 2002).

**ICT enhancing the Learning and Motivation of Students**

ICT presents an entirely new learning environment for students, thus requiring a different skill set to be successful. Critical thinking, research, and evaluation skills are growing in importance as students have increasing volumes of information from a variety of sources to sort through (New Media Consortium, 2007).

Kennewell et al. (2000) feel it is essential that computers be placed in the classroom, in order to maximize the opportunities for curriculum activity. ICT environment improves the experience of the students and teachers and to use intensively the learning time for better results. The ICT environment has been developed by using different software and also the extended experience in developing web based and multimedia materials. ICTs have an important role to play in changing and modernizing educational systems and ways of learning.

ICTs can enhance the quality of education in several ways, by increasing learner motivation and engagement, by facilitating the acquisition of basic skills, and by enhancing teacher training. ICTs are also transformational tools which, when used appropriately, can promote the shift to a learner centered environment. ICTs, especially computers and Internet technologies, enable new ways of teaching and learning rather than simply allow teachers and students to do what they have done before in a better way. ICT has an impact not only on what students should learn, but it also plays a major role
on how the students should learn. Along with a shift of curricula from “content-centered” to “competence-based”, the mode of curricula delivery has now shifted from “teacher centered” forms of delivery to “student-centered” forms of delivery. ICT provides Motivation to Learn.

ICT changes the characteristics of problems and learning tasks, and hence play an important task as mediator of cognitive development, enhancing the acquisition of generic cognitive competencies as essential for life in our knowledge society. Students using ICTs for learning purposes become immersed in the process of learning and as more and more students use computers as information sources and cognitive tools (Reeves and Jonassen, 1996), the influence of the technology on supporting how students learn will continue to increase.

Learning approaches using contemporary ICTs provide many opportunities for constructivist learning through their provision and support for resource-based, student centered settings and by enabling learning to be related to context and to practice (Berge, 1998; Barron, 1998).

**Scholastic Performance enhancement by ICT Usage**

Based on the extensive usage of ICTs in education the need appeared to unravel the myth that surrounds the use of information and communication technology (ICT) as an aid to teaching and learning, and the impact it has on students’ academic performance. ICTs are said to help expand access to education, strengthen the relevance of education to the increasingly digital workplace, and raise educational quality. However, the experience of introducing different ICTs in the classroom and other educational settings all over the world over the past several decades suggests that the full realization of the potential educational benefits of ICT. The direct link between ICT use and students’ academic performance has been the focus of extensive literature during the last two decades. ICT helps students to their learning by improving the communication between them and the instructors (Valasidou and Bousiou, 2005).
Kulik’s (1994) meta-analysis study revealed that, on average, students who used ICT-based instruction scored higher than students without computers. The students also learned more in less time and liked their classes more when ICT-based instruction was included.

Attwell and Battle (1999) examined the relationship between having a home computer and school performance, their findings suggest that students who have access to a computer at home for educational purposes, have improved scores in reading and math.

1.3 RELATION OF ICT WITH STUDENT, TEACHER AND EDUCATION

The ICT need and importance differ from person to person and discipline to discipline. In educational setup also different stakeholders differs with the different ICT needs. Teachers need differ from the need of students. It also differs from the need of administrators and educational planners. Here some of relation of ICT with education, teacher and student are given for understanding the need of ICT for student, teacher and education.

1.3.1 ICT AND EDUCATION

We are living in an information society. In this information society, knowledge is becoming one of the country’s most important strategic resource, whereas learning is becoming the most important process for the individual, for business & industry and for society at a large. The rapid technological development means that knowledge is no longer a “once in a life time” experience for the individual. It is rather an asset, which constantly has to be updated. Therefore, recurrent education gained increasing importance for young people as well as for adults with a view to maintain and develop their earlier acquired qualifications. ICT can leverage the creation of poles of educational excellence where ICT provides access to advanced knowledge, helps to develop educational research capacity, helps to develop and empower teachers and thus breaks their isolation, improves school-
community relation, helps in introducing new educational methods, techniques and new contents. ICT will provide stimuli to improve educational quality on a system-wide basis. Also great deal of the value of ICT in education lies in their capacity to enhance pedagogy and management. Furthermore, ICT have great potential for revolutionizing accustomed methods of educational planning, management, monitoring and evaluation. Their use is not limited to processing and analyzing educational data or to rationalizing communication between stakeholders. Their real strength is the facilitation of more transparent, democratic, and decentralized educational decisions that involve not just the different levels of government but equally importantly, students, parents and civil society at large.

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 improve quality of education, enhancing educational management, its role in higher education are discussed below and shown in Fig. 1.
(a) ICT as a Change Agent in Learning Process

ICT has unique importance in the educational system and social transactions. It has improved 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 favourable 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. In the process of conventional learning, emphasis was given on contents. It follows the particular course structure / syllabus for many years. It is the need of the day to improve quality & structure of the syllabi by enforcing competency & performance based approach towards it. Accordingly, the subject wise textbooks & reference books have been written. One such curricula requires: Access to information types & different forms, Student-centered learning though information access & inquiry. With the help of technologies, it is possible to promote transformation of education from teacher centered instruction to students centered instruction. It supports independent learning and 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.
(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 are 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. 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 communications capabilities of modem technologies provide opportunities for many learners to enroll in courses offered by external institutions rather than those situated locally. In case of geographical flexibility, technology, facilitated educational programs also remove the temporal constraints e.g. 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. 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. 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. Videos, television and multimedia computer software that combine text, sound and colourful 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. The transmission of basic skills and concepts that are the foundations of higher order thinking skills and creativity can be facilitated by ICTs through drill and practice. It has 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." It also 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.

(d) ICT Enhancing Educational Management

Computer software programs are being used in time tabling and school management to improve the use of staff time, student time and space, thus reducing costs significantly. It is noted that ICTs in schools can improve quality with less cost. Old ICTs are still cost-effective for provision of education to out-of-school children and youth in developing countries. New ICTs have a very large potential for teacher education in larger quantity and better quality. A combination of old ICTs to widen coverage and access and new ICTs to provide interactivity are supposed to be cost-effective for teacher education. If a nationwide network of community learning centers equipped with computer laboratories with broadband access and trained staff
to access online distance learning and to provide tutoring support could be set up in developing countries until a computer is available at home, there are possibilities for these countries to take advantage of the benefits of e-learning mentioned above.

(e) Role of ICT in Higher Education

The role of ICT in the education at higher level is recurring and unavoidable. It is a 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; Improvement in learning achievement; Reduction of adult illiteracy rate, with sufficient emphasis on female literacy; Expansion of provisions of basic education and training in other essential skills required by youth and adults; Increased acquisition by individuals and families of the knowledge, skills. It will increase variety of educational services & medium and promote equal opportunities to obtain education & information. It will be helpful in developing a system of collecting & disseminating educational information by promoting technology.

1.3.2 ICT AND STUDENT

It should be noted that learning process always takes place in the cognition of an individual and affects on the psychomotor and affective development of him. Education is therefore a very personal process of leaning. Learner expresses his/ her achievements through the skills and functionalities acquired, which are very much dependent on technologies of the age or tools and techniques the society uses. Hence basic and fundamental process of leaning is very personalized and is independent of technologies and modes to education. However, it needs interactivities with other individuals or learning materials, which are dependent on the technologies of communication age. From an overall point of view it is the objective of education system to qualify human being for working life and for life in general. Thus, it is not solely the aim of the education system to qualify young people and adults to acquire and reproduce the knowledge, which is disseminated by their teacher. The crucial new
factor in connection with the information society is that young people and adults are
to be qualified creatively to sort, select, process and use the great amount of
information, which ICT give access to. Moreover, in connection with the basic
education they are to acquire new methods of learning process in order to enable them
responsibility for a continual and lifelong updating of their qualifications. ICT works
like a boon to the students. It has broken the boundaries of classroom, school, state
and nation. Quantum of information can be piled with the students within few hours.
Now students feel empowered with this invent of ICT.

1.3.3 ICT AND TEACHER

In this age of rapid change and uncertainty, there is one thing of which is
certain that teachers need to adapt to the change for their survival. They have to keep
pace with new methods and technologies. New knowledge based on the latest
research can in a few seconds be distributed globally with the help of ICT.
Knowledge is constantly changing and becoming obsolete so rapidly that the
distributors of knowledge i.e. the teachers can hardly updated themselves with this
pace of change. Knowledge is not static but dynamic. It increases at very high speed
in which the amount of knowledge is increasing globally makes the teachers warn
about their role today and tomorrow. The role of the teacher must change in the sense
that it is no longer sufficient for teachers merely to impart content knowledge. It will
however, be crucial for teachers to encourage critical thinking skills, promote
information literacy, and nurture collaborative working practices to prepare children
for a careers several times. One of the most ubiquitous forms of ICT- the Internet
gives access to an exponentially growing storehouse of information sources, almost
unlimited networks of people and computers, and unprecedented learning and
research opportunities. Sometimes ICT illiterate teacher feels pity while comparing
them with his ICT literate students. Therefore it is necessary to revise the traditional
understanding of the role of the teacher in this information society. Today, the role of
teacher has changed from giving or passing of information to the organizer and
distributor of the teaching
with the integration of ICT in the educational programmes and in teaching learning process. With the integration of ICT in educational process, they can elevated themselves from the arm-chair tutor to knowledge worker. The awareness, use and the need of teachers is felt 18 for the ICT in education which can help them to empower them for the future classes and students.

1.4 ICT AWARENESS OF TEACHERS

The explosion of digital technology has created a revolution in educational instructions. The flexibility, high speed and huge storage capacity of ICT is causing teachers to redefine and rethink the traditional process of teaching. The challenges facing teachers are to evaluate relevant applications of information and communication technologies in the teaching learning process. At the same time, instruction utilizing information and communication technologies must reflect what is known about effectiveness of student-centered teaching and learning process. The digitization of technologies has made a great impact on teachers’role. The impact can be felt in many ways. Digital technologies are changing the ways teachers interact with students in the classroom. As the importance of language to learning, the ways organizing and relating information facilitates understanding and the influence of social factors in the classroom are all impacted by digital technologies. Now the instructional approaches are also influenced greatly, as they are incorporated by a variety of technologies. Now teachers and students alike are interacting in new ways afforded by digital technologies. Teachers and students have virtual discussions related to course content, advice and counseling in a wide variety of times and paces through email and other features of the web. Teachers and students now produce documents with more information and in far more diverse formats as a 19 result of desktop publishing, online libraries and databases and file transfer capabilities. The pervasiveness of digital technologies motivates a thorough review of technological impact of instruction in education. Present school education courses should take advantage of the capabilities of technology and extend instruction beyond or significantly enhance what can be done without technology. Teachers should experience technology as a means of helping students explore topics in more depth.
and in interactive ways. As a large number of teachers are not computer and ICT literate, they have to face a tuff time in near future due to gradual shifting interest of students towards ICT. The time may be imagined to see the miserable conditions of an ICT illiterate teacher teaching ICT literate students. In this context, now it is the high time for every ICT illiterate teachers at least to create awareness about ICT, ICT literate teacher to be the ICT masters and the ICT masters to see it as sky is the limit.

1.4 ROLE OF INFORMATION & COMMUNICATION TECHNOLOGY TEACHERS

In this new technology era, the role of teachers has changed and continues to change from being an instructor to a constructor, facilitator, and coach to create learning situation and environment. ICT is very useful for teachers with this new roles. Teachers can integrate ICT into teaching-learning process effectively if he developed various skills and competences like, creativity, flexibility, logistic skills, skill for project work, administrative and organizational skills and collaborating learning skill. Apart from these skills and competencies, the effective and efficient use of ICT depends largely on the technical competency, 20 attitude, appreciation of teachers for ICT. They should be able to appreciate the potential of ICT and have positive attitude towards ICT. They should operate computer and use basic software for work processing, spreadsheets and power point etc. They have to evaluate the use of computers and related ICT tools in education of students. The minimum use of ICT by teachers are desired. The extensive use of ICT may include the evaluation of educational software and courseware, search on internet for resources and use of e-mail, chat, new ICT based instructional principles, research and appropriate assessment practice, effective multimedia based presentations to support teaching learning, integrate ICT tools into learning activities throughout the curriculum, create hypertext documents and understand about network, and keep up-to-date as far as ICT or educational technology is concerned. There is immense potential of ICT which can be grabbed by the teachers using ICT optimally and maximally in their class instruction and for their professional developments.
1.6 ICT NEED OF TEACHERS

There is a need to change in each and every sphere of the society according to the tune of information and communication technology. It has the ability to enhance every type of development in the society. Education is the only means to incorporate information and communication technology in the developmental aspects of the society. ICT can also be used as a tool to improve the quality of education for preparing the society and its manpower to face the challenge of the future. It requires the proper manpower to handle and use ICT in school in a proper way. In general there is change in every sphere of teaching and learning. This change is going to accelerate the immediate future of education. The very fast change in technology had made the situation worst. When considered, there is little value in placing a teachers, trained in the 1970’s or 1980’s who had no orientation to become sophisticated technology users, in a position where they feel that they are required to compete with a senior student already working in information and communication technology. Variations on these issues are likely to become more common in the years ahead. In this connection teachers’ requirements and needs may very. To face the need of the today’s and tomorrow’s teachers to face the tomorrow’s net-students the ICT need of common teachers would vary according to the level of ICT awareness and use of teachers. Level of essential competence which will enable teachers to integrate information and communication technology in ways which broaden and deepen the teaching learning environments they create for students and access to expert assistance from both Paraprofessionals and other teachers, when they require it. There have been at least major ways of using computer technology in education by the teachers by learning of programming, learning word processors, spreadsheets and database and understanding the power of the computer as an information source. This phase of computer learning is all pervasive as it takes computer uses out of the realm of the enthusiast and requires higher order analytical skills or organizing, evaluating and synthesizing information. Increasingly, teachers in schools will be in competition with networking systems, for example, it may happen with introduction of online schools. The curriculum and its transaction can be chalked out according to the
specific need of the in-service and pre-service teachers. The ICT need of teachers will vary from person to person, some may be interested to be ICT literate, some may be interested to be ICT-savvy and some may be interested to be ICT masters according to their background and interests. Teachers need may vary from instructional use of ICT to the ICT use in management and administration. The need may be for institutional, professional and personal development of teachers. If there is a felt need of teachers for ICT, it can help them to find different ways to learn ICT use in education which can help them to empower them for future schools. Here is an humble attempt to study the ICT awareness, ICT use and ICT needs of school teachers.

1.7 Integration of ICT in Teacher Education

In the digital age, schools will require teachers to have competent technology skills and be able to effectively implement educational technology in classrooms. According to Hasselbring et al. (2000), schools will be equipped with the best hardware and software in the near future, but it is unlikely that teachers and students will use them effectively, if teachers are not trained. The success of technology infusion in schools depends on training, both in-service and pre-service levels. Therefore, it is logical to require pre-service teachers to incorporate technology into the lessons they prepare to teach (Johnson et al. 2000) as teacher education programmes help them to prepare for their future classrooms.

Education plays a vital role in the building of society. Modern societies cannot achieve their aim of economic growth and higher standards without education. The development and prosperity of a nation is always determined by the education. Due to the expansion of population, the need of education correlated to economic development, the social need of the different societies, and the attachment of education with status in different countries of the world. The two crucial problem like, knowledge explosion and population explosion that modern world faced, have raised a large number of difficulties in the field of education like poor physical facilities, less provision of teachers and low enrolment of students due to poor economic conditions,
social superstitions and geographical barriers. Thus to minimize these difficulties educational technologies like, radio, televisions, computer, teleconferencing, videoconferencing, internet, satellite etc. plays an important role. In order to improve the overall efficiency and quality of the teaching and learning process, technology plays an important role. It also plays a very significant role in increasing the quality of learning or the degree of mastery. It reduced the time to attain desired goals. It also increases the capacity of teachers in terms of number of learners taught, without reducing or affecting the quality of teaching and finally, it reduces the cost of education for students.

In the field of education, ICT (information and communication technology) provides the teacher with variety of tools, which help in transforming the teacher-centered classroom into a rich, Learner-centered and knowledge–rich environment.

**Why to integrate?**

Because changes in technology, demography, and internationalization are driving education system to evolve to an open flexible education (or learning) environment depicted in figure 1, which provides learners with quality services encompassing formal, informal, and non formal education. To this regard the “Learning for the Future (LFF)” project recently initiated by UNESCO IITE is a comprehensive approach to integrate ICT in education, renew pedagogy, and enhance learning now and the future, which ensures teachers and students effective use of technologies and resources in strengthening the four pillars of learning for the 21st century: learning to know, learning to do, learning to be, and learning to live together.
What to integrate with ICT?

Technologies of digital learning platforms, conversation media and tools (SNS etc.), pedagogies for a new generation, open access to educational resources (OER, MOOCs etc.), international standards, cloud computing, nurturing teacher’s competence, and open networking, policy making to meet societal changes are targets for effective integration.

How to implement effective integration of ICT?

The first issue is how to nurture competence of teachers and CEO of education institutions. Technological Pedagogical Content Knowledge (TPACK, Lee Shulman, 1986) frame argues that effective integration of technologies for teaching and learning in teacher training must begin with teacher’s understanding and negotiating the relationship among the three components interacting: technology, pedagogy, and content. It claims that teachers are encouraged to equip with 7 different aspects of
knowledge shown in Figure 2: content knowledge (CK), Pedagogical knowledge (PK), Technological knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Knowledge (TPK). In addition, in order to encourage teachers to implement what TPACK demands, the issues of quality school leadership need to be successfully implemented: define and distribute new school leadership responsibilities, develop skills for effective school leadership, and make school leadership an attractive profession.

The second issue is coordination and cooperation among stakeholders. Based on the lessons from best practices, strong leadership, coordination of diverse issues conflicting among stakeholders, and efficient structure of governance are known as strong supporters.

The third issue is how to create innovation culture. It is a very important issue to make change and innovation keep going on as time goes by for sustainable growth of human resources and education institutions. The forth issue is to take holistic
approaches to effective integration of ICT in teaching and learning: legal framework, curriculum redesign, evaluation mechanism, and role play.

Lastly we need to open enough to learn from lessons of the past and others: recognize the different viewpoint of stakeholders, favor incremental innovation, identify potential losers, ensure communication about the benefits of effective integration of ICT, and create culture for innovation and change.

Success of any educational reform depends on the effective learning process which in turn depends on the quality of teachers. The government and community endeavor to create condition which will help and inspire teachers on the constructive and creative lines. Teachers should have freedom to innovate and device appropriate methods of communication and activities relevant to the needs and capabilities of the communities.

To effectively harness the power of new information and communication technologies (ICTs) to improve learning, teachers must have the knowledge and skills to use the new digital tools and resources to help all students to achieve high academic standards. A teacher will be able to integrate the use of ICTs into training/teaching effectively if he develops various competencies like creatively, flexibility, logistic skills and collaboration skills. ICTs can help educators/teachers in the different ways. It enables them:

• To enhance the initial preparation by giving good teaching materials.
• To have access with colleagues, institution and universities and national organization like UGC, NCERT, NCTE and NAAC etc.
• To interact with students over a physical distance.
• To access online libraries, journals and researches to enable individual learning.
1.8 Integration of ICT for effective science teaching

Teaching science provides plenty of opportunities for integrating ICT. There are various types of software, simulations, and additional hardware that make it possible to easily integrate the computer within the classroom. The Internet provides a huge resource for teaching strategies, ideas and lesson plans. The Ontario Ministry of Education licenses software that can be used in the classroom. Each different subject area has unique opportunities for ICT. It is the responsibility of the professor and the teacher to keep current in their professional teaching and with the technology

The issue of the effectiveness and impact of ICT in the core curriculum subjects is important. In science, ICT has opened up a whole range of potential applications. At the same time, a wide range of potential benefits resulting from the use of ICT has been claimed for both students and teachers by a number of groups (policy-makers, researchers, some teachers, employers). Although there is a significant literature on ICT in science education, much of it takes the form of articles on applications for use in teaching situations: the emphasis is on how to use ICT, rather than exploring its effects. There is a sense in which it is taken rather for granted that ICT is a ‘good thing’, with students being motivated when they use it, and this leads to better learning. Thus a central purpose of this review is to assess the strength of the evidence base to support the notion that the use of ICT activities in science lessons enhances students’ understanding of science ideas.

The purpose for which ICT is used in science may be divided into four broad areas: data handling, information, communication and exploration. Each of these areas covers a range of software and hardware, including:

- data logging tools and digital video cameras for data capture
- spreadsheets and graphing tools for data handling and analysis
- simulations and modelling tools, including animations and virtual environments
● information resources such as the internet and CD-ROMs. As well as the uses of ICT which are specific to science teaching, more general ICT applications have been found to be useful, including:
  ● portable ICT devices such as laptops and palmtops
  ● email and discussion groups
  ● school intranets
  ● presentation technologies such as digital projectors, interactive whiteboards, presentation software.

1.9 FACTORS INFLUENCING OUTCOMES OF ICT COURSE IN B.Ed PROGRAMME:

While discussing the factors influencing teacher education, Peck and Tucker (1972, p. 942) observed, “Teacher education involves many factors, which interact simultaneously. Student teachers aptitude, interest, readiness, and attitude towards learning; their parents and their subcultures attitude towards schooling; the administrative policies, and interpersonal organization of the schools; the individual characteristics of the teachers; these and even many more factors are constantly at work in the real setting. Research design, to be adequate, must accurately identify, measure, and account for all these factors and, interacting effects” (p. 122). In the context of introduction of computer education course in B.Ed. programme, it is necessary to explore which factors would significantly influence the process of teacher education and outcome of the course. Such variables are identified and discussed in the following paragraphs.

It would be meaningful if the factors involved in the process of teacher education, which would have impact on outcome of a teacher education programme, are categorized as institutional factors, teacher educator related factors and student teacher related factors. These factors might influence on student teachers learning outcomes which are in turn influence the outcomes of the programme independently and also interactively.
Among the institutional related factors, institutional environment is often assumed to be positively related with teacher education programmes (Buch, 1991). School culture was also considered as a factor influencing meaningful integration of technology into curriculum (Morrell, 2002). Technology training involves unique requirements that distinguish it from other pre-service activities in more traditional subject matter areas. The need for a well-equipped facility is perhaps the most obvious example. While it is possible to run a pre-service session on a new reading or mathematics technique in a traditional classroom, teaching teachers to use a word processing or spreadsheet is only effective if they can work individually or in pairs at a computer (Glenn & Carrier, 1986).

Based on the Billig (2002) study, which surveyed leaders of 17 organizations that could sustain educational innovations for a long time, Billig et al. (2005) claim that the following are necessary for educational initiatives to be successful and sustainable: Strong leadership that promotes a shared vision, strong infrastructure that stress human autonomy, well-organized support structures for professional development, incentives for encouraging practitioners to work for the system and to remain in the system, visibility, credibility, strong and mutually beneficial partnerships, macro-culture development to promote contextual relevance, and sufficient funds from multiple sources. Billig et al. (2005) further listed the factors associated with sustainability and institutionalization of innovative endeavours as (a) leadership and identifiable champions to sustain change, (b) infrastructure for technical support and collaborative learning, (c) resource allocation and stable funding, (d) supportive culture and climate, and (e) individual and system incentives, tangible evidence of success, visibility, and empowered networks.

There are many institution related variables which influence effectiveness of a course. British Educational Communication and Technological Agency (BECTA) have tried to bring out such variables under a common heading “Institutional e-maturity.
1.10 **NEED AND SIGNIFICANCE OF THE STUDY:**

The rapid development in computer technologies has influenced expectations from educational institutions. Educational institutions are expected to prepare the next generation of citizens for the technologically oriented world. Teacher education institutions should supply teachers who create technologically enriched instructional setting or use advantages of technologies in instruction. However, if teacher are not trained to teach with technology and are not continuously supported how to integrate technologies in instruction, educational institutions cannot achieve their goals.

Research says experience with and knowledge about technologies is crucial to the effective use of computers in the classroom (Hannafin, & Savenye, 1993). Many teachers feel poorly prepared to use ICT in their classrooms, and that they under-use available technology has been well established. To encourage pre-service teachers to use technology, education faculty must model the use of technology in their courses (Best, 2002; Cassady & Pavlechko, 2001; Duhaney, 2001; Kreuger & Smaldino, 2000). Teacher educators do not sufficiently model appropriate use of computers for instructional purposes, either in courses or field experiences (Bosch & Cardinale, 1993). Hence there is a need to know computer competency of teacher educators and its relation with the computer competency and computer self-efficacy of the student teachers.

Although many teacher education programmes provide students with a course on computer technology in which the basics of computer use are taught, pilot projects demonstrate that “the sooner school teachers are equipped with a personal laptop, the sooner they will engage in producing digital, educational materials for their classroom” (Laferriere & Bracewell, 1999, p.12). Hence e-maturity i.e., availability, accessibility and effective use of ICT resources is a critical factor influencing student teachers competency attainment. Chen and Chang (2006) reported that computer knowledge, skills and attitudes are equally important for development of teacher technology proficiency.
Hunt and Bohlin (1991) found that student attitude toward working with computers are important indicators of the ways in which students will use computers when they become teachers in their own classrooms. Pre-service teachers’ negative attitude toward learning with computer, prevent the use of computer technology by teachers in the classroom. There are a lot of researches which state computer literacy courses for teachers increase their positive attitude towards computers (Van & Stacy, 2003; Burkett, 2002; Johnson & Howell, 2005; Karagiorgi & Charalambous, 2006; Chen & Chang, 2006; Moursand, 1989). However, the literature also alerts researchers that it is really hard to conclude that the course itself increases positive attitudes (Baylor, 1999; Yildirim, 2000). Therefore it is important to know what type of changes takes place in attitudes of pre-service teachers toward computer education after undergoing a course on computer education. Preparing teachers feel competent to use technology in education is depended on the given credential course. In order to make teachers to feel comfortable using technology in their classrooms, training has to take place in a way that enables them to gain self-confidence in their abilities (Becker, 1998). Providing pre-service teachers with the knowledge, skills and attitudes necessary to work with ICT in their classrooms can be accomplished most effectively by an ICT infused curriculum in their programme of study (Duhaney, 2001; Kreuger et. al., 2000; Luke et al., 1998).

At the initial stage of professional development, psychological or affective factors are critically important. One of the main goals of the course on computer at pre-service teacher education stage is to decrease student teachers’ fear of computers, and to show student teachers that they are able to use computers, because, confidence is as important as competence (UNESCO, 2002a).

Compeau and Higgins (1995) suggested that future research should focus on how computer self- efficacy influences the development of computing skill. Gender differences were reported in computer attitude (Carter, 2004; Morris, 2002), technical
ICT capabilities and situational and longitudinal sustainability (Markauskaite, 2006), computer competency (Chen, 2005) and technology disposition scores (Jung, 2004) in favour of males. But one research reported (Fowler, 2002) absence of such a difference. Gender found to make significant contributions in predicting computer attitudes (Chang, 2005) but failed to be a significant predictor of ICT capabilities. Hence there is no concluding evidence to arrive at a judgement in the relation between computer competency and gender.

It is always assumed that teachers with science background will be more comfortable to work with computers. There is a need for evidences either to confirm or to reject this.

It was observed that most critical factor in the successful integration of ICT into teacher education is the extent to which the teacher educators have the knowledge and skills for modeling the use of ICT in their own teaching practices (UNESCO, 2002c). Hence the status of teacher educator’s computer competency needed to be studied. It is also important to know to what extent teacher educator’s computer competency has got an impact on computer competency and computer self-efficacy of the student teachers.

However, long-term effects on the practice of graduates from an ICT infused program have not been established. The relatively recent and emerging literature focuses on the most effective way to graduate new teachers who are sufficiently ICT capable in their teaching. ICT infused teacher education programs are few in number, and therefore, substantive literature is not available on the actual impact of such programs on teaching practices of the graduates (Vail, Heli et. al., 2007). There is a need to re-examine the existing training model with regard to objectives, methods, costs, and effectiveness (Prakash, A. 2009).
It is observed that effectiveness of teacher education programmes needs to be deeply analysed. The outcome of the programmes has been studied on the basis of only "perceptions", which are generally not seriously responded to. Rigorous systematic studies about the curriculum, the courses, the practices, and the work culture of the institutions should be the concern of the research (NCERT, 2006). The sixth survey of Educational Research also emphasized the need of status study of computer literacy among teachers (NCERT, 2006). In a world of constrained resources, it is no surprise that measuring effectiveness should be near the top of the development agenda. Without demonstrated effectiveness, why would anyone invest in development work, with or without technology?

It is also reported that factors beyond the teacher’s control influence ICT uptake, e.g. institutional cultures, leadership, the curriculum and assessment. Hence it is necessary to study which presage factors influence the outcome of a course. It becomes useful if the predictors of computer competency and computer self-efficacy of the student teachers is identified.

To summaries, it is required to know which presage and context variables influence on outcome variables in the context of introduction of computer education in B.Ed. programme. From system approach perspective, there is a need for a presage-context-product study. By justifying presage-context-product studies Singh L. C. and Malhotra S. P. have remarked “such studies make a contribution to teacher education as they try to answer what preconditions are required to get effective outcome” (Buch, 1991). There are many process product studies especially researched on existing teacher education programmes and studied their effects on teaching competence.

Considering the above mentioned issues, a study which appraises the effectiveness of computer education course of B Ed programme is needed. A study, in which, factors influencing the effectiveness of the computer education course is explored, will give an idea about what preconditions are required to get effective
outcome. The study will give a feedback about the course in the formative stage, will also help in taking key decisions regarding the improvement of the course, which in turn be helpful to the administrators, teacher educators and student teachers of B.Ed. Colleges and teaching community in large. The identified predictors could be used to predict the computer competency and computer self-efficacy of the student teachers. The study can help to add some knowledge base to the quality improvement of the teacher education at secondary level.

**STATEMENT OF THE STUDY**

The title of the present study is

“The impact of ICT on Teaching of Science in B.Ed Program”

The present study considers institutional, teacher educator and student teacher related factors in to cognizance to identify the possible factors influencing effectiveness of Computer Education in teaching of Science in B.Ed. programme. The e-maturity of B.Ed. Colleges, an institutional factor, was studied. The teacher educator’s computer competency, a teacher educator related factor, was assessed. Effectiveness of the course on student teacher’s computer competency and computer self-efficacy was assessed. The factors influencing effectiveness of the computer education course were explored. The predictors of computer competency and computer self-efficacy of the student teachers were determined.

**1.11 OPERATIONAL DEFINITIONS**

**Meaning of ICT**

ICT stand for information and communication technologies are defined, as a “diverse set of technological tools and resources used to communicate, and to create, disseminate, store and manage information”. These technologies includes computers, computer works stations, display facilities, hardware, software recording
and processing system for sound, still and moving pictures, graphical calculator, the internet, broad casting technologies (Radio and Television) and other vide range of communication facilities. It may also be defined as use of hardware and software i.e. storage, retrieval, processing, communication and sharing cultural upliftment. ICT makes the classroom learning interesting and effective, self-learning easy and successful and lifelong learning possible for all.

By 1990, the choice of technologies for education was limited because these were expensive and required high skilled technicians to create and use them. At that time Radio, TV., Overhead Projector, Slides Projector etc. were the best example of technology for use in teaching-learning process. But recently technology applications in education no longer are limited by convenience, cost and their potential.

In recent years there has been a groundswell of interest in how computers and the internet can best be harnessed to improve the efficiency and effectiveness of education at all levels and in both formal and non-formal settings.

With the arrival of internet and broadband connections to schools, the applications of IT knowledge, skill and understanding in all subjects become a reality. This change in emphasis has resulted in a change of name for IT to ICT i.e. Information and Communication Technology. Thus Information Technology (IT) comprises the knowledge, skills and understanding needed to employ information and communication technologies appropriately, securely and fruitfully in learning, employment and every life

Different scholars stated the meaning of ICT in different ways. Some of the definitions of ICT is given here which would help to explain the meaning of ICT.

**According to Raghavan (2000)** ICT refers to a range of technologies, which includes computers, computer work situations, display facilities, hardware, software, recording and processing systems for sound, still and moving pictures, graphics, calculations and a wide range of communication facilities.
Mahajan (2002) defined ICT as the modern science of gathering, storing, manipulating, processing and communicating desired types of information in a specific environment.

According to UNESCO, 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.

According to Chakraborty (2002) “ICT is the collective term for various technologies involved in processing and transmitting information. They include computing, tele-communication and microelectronics.”

According to Garg (2002) “ICT stands for information and communication technology. It is a method that involves processing, storage and communication of information using computers and other electronics devices.”

According to Devmani (2002) “ICT means the advancement of sending and receiving of information from different parts of the world.”

“It is the way of communication by means of technology, which is by telephone, faxes, internet, etc.”

Finally, it can be concluded that ICT is a tool for communication and presentation which helps in bringing individuals together on a common platform for exchange of views, presentation of ideas (through, chatting or E-mail) and increases the interactivities between individuals and between individuals and technologies.

E-maturity: E-maturity is the degree to which an organization makes strategic and effective use of ICT to improve educational outcome (BECTA 2006). In this study e-maturity of an institution refers to overall index obtained for five indicators namely e-learning resources, student access, management strategies, use across curriculum and workforce skills through e-maturity scale developed for the study.
**Computer Competency:** A competency is a set of attributes covering knowledge, skill and attitude for enabling one to effectively perform the activities of a given occupation or a function to the standard expected in employment (UNESCO 2005). Computer competency means computer knowledge, computer skill and attitude towards computer use. In the present study computer competency refers to performance in computer knowledge test, computer skill test and response to attitude towards computer use scale developed for the study.

**Computer Self-efficacy:** Computer self-efficacy refers to judgment of one’s capability to use a computer (Compeau & Higgins, 1995). In the present study computer self-efficacy refers to overall confidence shown in identified areas of computer use in computer efficacy scale developed for the study.

### 1.12 OBJECTIVES OF THE STUDY:

1. To study the difference in Teaching Competency in ICT Trained and untrained student teachers.
2. To implement an ICT package for Teaching of Science in B. Ed Students.
3. To study the effectiveness of ICT and Conventional Methods in relation to Teaching Competency.
4. To compare the difference between ICT and Conventional Method of Teaching in Student Teachers Intelligence.
5. To Study the effect of ICT on Teaching Skills of prospective Teacher in teaching of science.
6. To study the effect of Conventional method on teaching ability of prospective teachers in teaching of science.
7. To study the interaction between the conventional and ICT based method of teaching.
8. To study the interaction of Teaching of Science and other subjects.
9. To study the impact of ICT in Teaching by Male students.
10. To study the impact of ICT in Teaching by Female students.
11. To study the impact of ICT on Socio Economic status of Pupil Teacher.
1.13 HYPOTHESIS:

Following hypothesis were formulated in the study:

1. There is no significant difference in Teaching Competency of Pupil Teacher by ICT method of Teaching
2. There is no significant difference in Teaching Competency of Pupil Teacher by Conventional method of Teaching
3. There is no significant difference between teaching through ICT and Conventional method of Teaching
4. There is no significant difference in intelligence of Pupil Teacher taught by ICT method of Teaching.
5. There is no significant difference in intelligence of Pupil Teacher taught by Conventional method of Teaching.
6. There is no significant difference between male and female pupil teachers taught by ICT Method.
7. There is no significant difference between male and female pupil teachers taught by Conventional Method.
8. There is no significant difference between Socio Economic Status of Pupil Teacher taught by Conventional Method
9. There is no significant difference between Socio Economic Status of Pupil Teacher taught by ICT Method
10. There is no significant difference between Experienced and Non Experienced Pupil Teacher in ICT based teaching
11. There is no significant difference between Experienced and Non Experienced Pupil Teacher in Conventional based teaching
12. There is no significant difference between Graduate and Post Graduate Pupil Teacher in ICT based Teaching
13. There is no significant difference between Graduate and Post Graduate Pupil Teacher in ICT based Teaching
1.14 RESEARCH QUESTIONS:

Every piece of research is based on some research questions which comes in the mind of the researcher. Research questions are the product of the experience of the researcher, review of the related literature and conceptual clarity on the research topic. In the process of research, researcher tries to find the answer of the research questions. Before conducting this piece of research work, the researcher has the following research questions in his mind.

1. How Teaching Competency of the future teachers can be improved by means of ICT?
2. What is the computer competency of teacher educators transacting Computer Education course of B.Ed. programme?
3. Will ICT be helpful in enhancing skills of student teacher in Teaching of Science?

1.15 VARIABLES OF THE STUDY:

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Teaching ability of prospective teachers in Science, Teaching Competency</th>
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<tr>
<td>Independent variables</td>
<td>In this study treatment acted as independent variables</td>
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1. Teaching through ICT method and
1.16 DELIMITATIONS:-

1. The experiment will be restricted 200 pupil teacher only.
2. The sample will be taken from B.Ed. students only.
3. The students will be belonging to Gwalior region only.
4. The ICT presentations will be developed of science subject only.
5. The ICT package will be develop only in English.
6. Although there are various teaching approaches out the present study will be confirmed to ICT only.
7. The effectiveness of ICT will be studied in the subject of Science only.

1.17 CONCLUSION-

In the field of education, ICT (information and communication technology) provides the teacher with variety of tools, which help in transforming the teacher-centered classroom into a rich, Learner-centered and knowledge–rich environment.

In this chapter, the theoretical framework of the study is discussed. The context in which the study was taken up is presented. The objectives of the study are also given. In the next chapter, a review of the studies related the variables considered are discussed.