Chapter 1

Conceptual Framework

1.0 Introduction

Education is a socially oriented activity and it develops all kind of skills among person. With the world moving rapidly into digital media and information, the role of ICT has become important, this importance will continue to grow in the knowledge, and technology based society. In order to meet the growing demand for higher education, Information and Communication Technology (ICT) be explored in the form of technology enhanced programs. Government of India announced 2010-2020 as the decade of innovation (National Innovation Council, 2011). National Knowledge Commission (2009) has given emphasis on the mechanism for feedback and subsequent interaction between teachers and students, especially for pedagogical techniques that are new and require continuous innovation from the teacher. As per 8th Millennium Development Goal (United Nations, 2011), under which one of the objective is to make available the benefits of new technologies, especially information and communications with the cooperation of different sectors in providing education. The National Curriculum Framework (2005) has also highlights the importance of ICT in Education. According to UNESCO (2002), it is desirable that affordable ICT tools and techniques be integrated into classroom instructions so as to enable students to develop requisite skills.

It is indicated that teacher should use new innovative techniques and approaches to tackle demands of the students and society. As ICT is seen as an avenue to fulfill growing demands of education and society, new technology should be integrate with pedagogy. This shift is emphasized ICT in teaching learning and imparting instructions in education, and organizing various learning experiences. For this, it is essential to have motivated and well trained teachers. Without Successful teacher training, it is very difficult to develop competencies among teachers and without competent teacher; it is very difficult to achieve goal of education. Thus, well-trained and skilled teachers will be able to give quality education to the students by exploring ICTs and existing constraints within education system may be overcome.

2.0 Education in India

Education in India is provided by the public sector as well as the private sector. Education in India falls under the control of both the Union Government and the states. The Union or the State Government controls most universities in India.

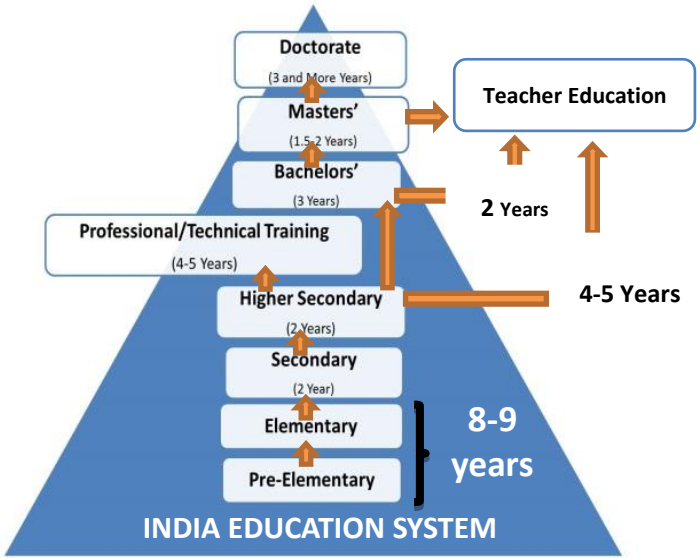

Figure 1.1

Indian Education System

As shown in figure1.1, after grade 12 Examination, students may enroll in general degree programs such as bachelor's degree in Arts, Commerce or Science, or professional degree programs such as engineering, law or medicine etc. India's higher education system is the third largest in the world, after China and the United States. The main governing body in India at the tertiary level is the University Grants Commission, which enforces its standards, advises the government, and helps coordinate between center and state. Student can enroll in teacher education after high school for primary teacher training program and they can enroll after graduation for secondary teacher training program.

2.1 Scenario of Teacher Education in India

The National Council for Teacher Education (1998) has defined teacher education as "A program of education, research and training of persons to teach from pre-primary to higher education level." Main goal of teacher education is the development of teacher proficiency and competence that would enable and empower teacher to meet

the requirements of the profession and face the challenges of the present. The current system of teacher education is supported by a network of national, provincial and district level resource institutions working together to enhance the quality and effectiveness of teacher preparation programs at the pre-service level and also through in-service programs for serving teachers throughout the country. There are different degree courses for the professional development as a teacher like Bachelor of Education (B.Ed.), Bachelor of Physical Education (B.P.Ed.), Primary Teachers Certification (PTC), Pre Primary Teacher Certification (Pre PTC).

The B.Ed. program is offered in colleges of education and university departments of education. The program is also offered through centres of distance education/open universities. There has been an increase of private colleges offering B.Ed. over the past number of years. As on 31st December 2009, 12,482 teacher education institutions offering 15,101 courses have been recognized by NCTE with an approved intake of 11,45,425 teacher trainees (MHRD, 2010,a). As per latest data given by NCTE, there are around 13,867 Teacher education institutions till 2012-13 (NCTE, 2014).

Table 1.1

Number of Teacher Education Institutes in India

Course Name	No. of Govt. Institutions	Approved Intake	No. of Private institutions	Approved Intake	Total Intake (Govt. + pvt.)
D.Ed.	757	49,089	4,831	2,98,278	3,47,367
B.Ed.	224	20031	5,730	6,09,486	6,29,517
M.Ed.	102	3672	790	25,285	28,957
B.P.Ed.	19	1284	538	28,150	29,434
Others	76	16760	800	51,422	68,182
Total	1178	90836	12,689	10,12,621	11,03,457

Source: NCTE (2014) and Kothari & Bhagwat (2014)

There have been a number of initiatives for increasing standards of teacher education like four year integrated Bachelor of Elementary Education (B.El. Ed.) program for the preparation of elementary school teachers offered by the selected affiliated colleges of the University of Delhi. NCERT's experiments with the four year integrated program leading to the degree of B.Sc.Ed. and integrated M.Sc.Ed.

National Curriculum Framework for Teacher Education (NCFTE, 2009), Justice Verma Commission (2012) gave recommendations to make teacher education part of higher education system and the duration of the program be enhanced. By following these recommendations for strengthening identity of a teacher and improvement of the quality of teacher education government of India decided to increase the duration of B.Ed. and M.Ed. program from one year to two years from academic year 2015-16.

Courses and components of B.Ed. and M.Ed. program were reframed to cater to the competencies of student-teachers prior to enter in classroom. Following are the competencies focused in two year B.Ed. program to impart quality education as recommended by the NCFTE (2009) and Justice Verma Commission (2012):

- To attend to the need of the students as per the individual needs
- To develop concern among students towards society and its development
- To create learning environment which supports learning process
- To incorporate ICT in various learning situations and all teacher activities
- To build cordial relations with parents for development of students
- To participate in the development and evaluation of curricula
- Organize learning activities for developing teamwork, creative potential of students.
- To collaborate with other teachers and other professionals involved in teaching at same level
- To provide avenues to teacher trainees for self-analysis and introspection for self-feedback
- To organize and advance one's own professional requirement as a part of lifelong learning

The teacher education program for prospective teachers is been designed and implemented so as to develop the requisite potential and capabilities among teachers. Still there are certain issues regarding implementation of the program that is as presented below.

- For student-teachers to understand the need of the students and arrange as well organize learning experiences as per the individual need, and also to consider the inclusive classroom. Student-teachers required to provide enough time to be with students in schools and interact with them.

- In terms of developing skills and competencies among student-teachers with regard to organizing lab experiments, projects and activities for students. There should be well equipped laboratories as well as facility for students to plan and organize various learning experiences.
- Although the program of pre-service training is conceptualized very ideally, but in its implementation in terms of internship, action research is limited.
- Curriculum of teacher education across country is different. There are no consensus among different teacher education institutes regarding courses offered, methodology adopted and practiced, grading pattern and evaluation adopted.
- Scope for self feedback, self- analysis and self-introspection in one year B.Ed. program there is no scope for student-teachers for self-introspection and leading to self-feedback.
- Professional development and lifelong learning. This is one of the area where the student-teachers needs to be initiated for their professional development programs in future career. For this student-teachers should have skills to work collaboratively, skill to communicate, skills for research, skills to share ideas etc.
- Today's teachers must be proficient in ICT skills. As today's classrooms will be equipped with ICT tools. The present generation students are very much accustomed with technology usage, so as a teacher they must know how to take advantage of the technology to involve students in teaching learning activities and use potential of students in a right direction.

3.0 ICT in Education with Special Reference to Teacher Education

As technology has created change in all aspects of society, it is also changing expectations of teacher education in terms of what student must learn in order to function in the 21st century. 21st century is characterized with the emergence knowledge based society wherein ICTs plays a vital role. In almost all sectors of education, the role of teachers is changing from being not only a transmitter of knowledge but also a facilitator of learning. Teachers need to help their students in construction of knowledge and abilities to learn. Olive (2002), Rani & Shukla (2014) have highlighted that learning has become more relevant to learners' needs, and

learning outcomes has become more deliberate and targeted with the help of ICT. According to Takwal (2003) IT driven education is changing the methods of content generation, content storage, content packaging, and content delivery and hence offers a new paradigm of education.

With the spread of ICT, there is a growing demand for it in teacher education. The National Policy on Education 1986 stressed upon employing educational technology to improve the quality of education. Few initiatives have been taken up by the government to increase usability of multimedia and computers in school education by introducing schemes like Educational Technology (ET), Computer Literacy and Studies in Schools (CLASS) and Information and Communication Technology @ Schools in 2004 (MHRD, 2012). It was also highlighted in Sarva Shiksha Abhiyan Program. Again, it figured comprehensively in the norm of schooling recommended by Central Advisory Board of Education (CABE), in its report on Universalization of Secondary Education in 2005. Use of ICT effectively requires a change in classroom practice along with acquisition of technical skills. Teachers need to familiarize themselves with possibilities approaches and application in the use of ICT. It has opened up new possibilities of reaching out to the still un-reached disadvantaged groups and children with special needs. Thus, it is a great responsibility on the shoulders of the teacher educators to equip them with some short of competencies or skill at pre and in service level, which leads to quality enrichment in teaching learning. ICT skill is the pre-requisite of the techno-savvy skills, and knowledge of hardware and software is essential to become techno-savvy teacher. Thus, teacher education needs to orient and sensitize teachers toward effective use of ICT. In a way, ICT can be creatively drawn upon for professional development of ICT Skills among pre-service and in-service teachers (NCF, 2005). Student-teachers at pre-service level should not only learn about various technologies and their application software but also to integrate this technological application in teaching learning.

3.1 Challenges of Technology Integration in Teacher Education

Technology changes at a faster rate that makes teaching with technology more complicated. Digital technologies such as computers, handheld devices, and software applications are ever changing with the advancement in the field of technology. Introduction of computers and their software have modernized education with e-

learning, online classes, video conferencing, chat rooms, bulletin boards, smart board technologies, CD Rom software, Internet tools etc. According to Wilson (2007), It is necessary to bring the learner and the learning process to an even greater understanding and advantage than ever before in the history of education. There is greater need to build further awareness about teaching methodologies, learning strategies, and learning.

Due to ever changing nature of technology, new digital technologies present new challenges to teachers who are struggling to use technology in their teaching. Every technology has its pros and cons while utilizing. Many a times it is found that social and institutional contexts are often unsupportive of teachers' efforts to integrate technology use in their work. An appropriate approach is needed to integrate appropriate technology in a given context.

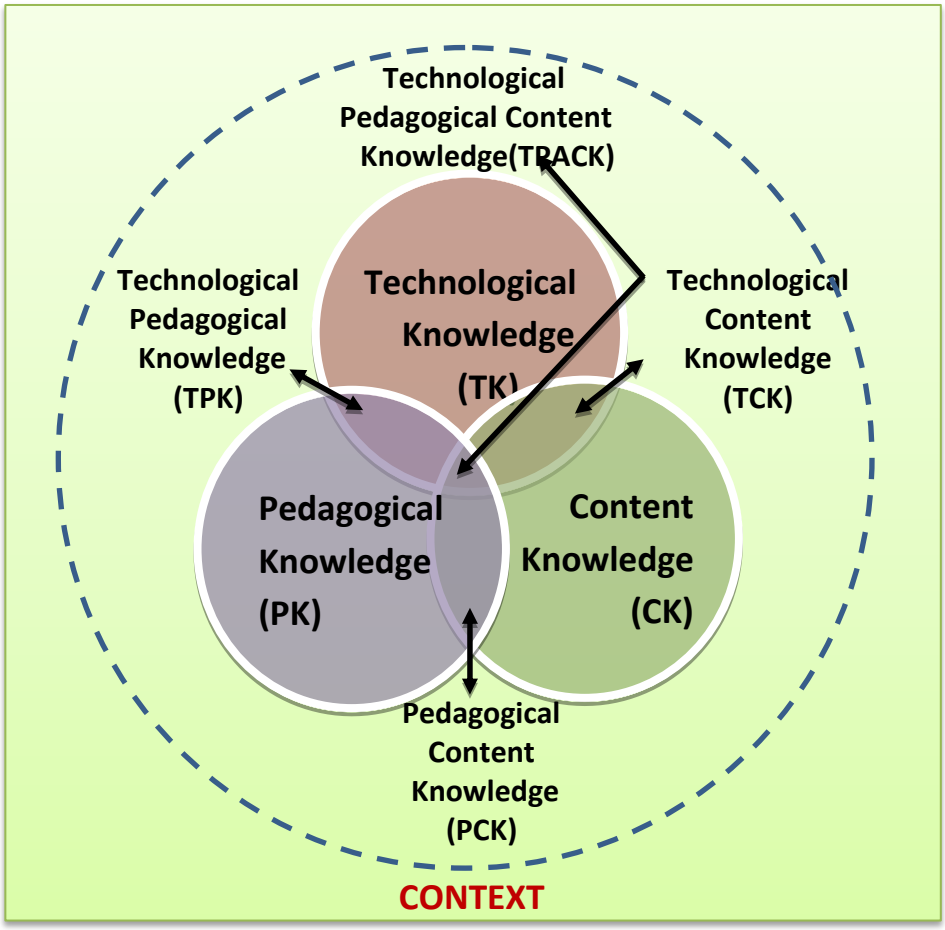

Figure 1.2

Technology, Pedagogy, and Content Knowledge (TPACK) Framework

Source: Koehler and Mishra (2005)

These are three core components: Content, Pedagogy, and Technology while integration of technology in teaching and all three components are connected with each other. Koehler & Mishra (2009) established relationship among all three knowledge-Content knowledge (CK), Pedagogical knowledge (PK) and Technology knowledge (TK) and gave the core of the technology, pedagogy, and content knowledge (TPACK) framework. Content knowledge (CK) is teachers' knowledge about the subject matter to be learned or taught. Pedagogical knowledge (PK) is teachers' deep knowledge about the processes and practices or methods of teaching and learning. Technology knowledge (TK) is working with technology can apply to all technology tools and resources. Pedagogical Content Knowledge (PCK) is applicable to the teaching of specific content. Technology Content Knowledge (TCK) is an understanding of the manner in which technology and content influence and constrain one another and Technology Pedagogical Knowledge (TPK) is an understanding of how teaching and learning can change when particular technologies are used in particular ways. All come together and form TPCK (technological pedagogical content knowledge), a transformed knowledge through proper interactions of CK, PK and TK. Technological Pedagogical Content Knowledge is an understanding that emerges from interactions among content, pedagogy, and technology knowledge. It is an emergent form of knowledge goes beyond all three "core" components (content, pedagogy, and technology). For effective teaching, amalgamation of all three components is essential and teachers should have skills to use TPCK in the classroom. Thus, it is necessary that pre-service and in-service teachers have basic ICT skills and competences to reap the full advantage of ICTs in leaning with appropriate use of TPCK in teaching.

3.2 ICT and Paradigm Shift in Teacher Education

Contemporary education demands attention to enrich curriculum and pedagogy by infusing ICT at the pre-service and in-service level. Present generation students do not restrict themselves to books and classroom lectures, they have accessibility to large number of information from the Internet and Intranet sources. They collaborate and communicate with others to accomplish complex tasks effectively for representing and knowledge generation.

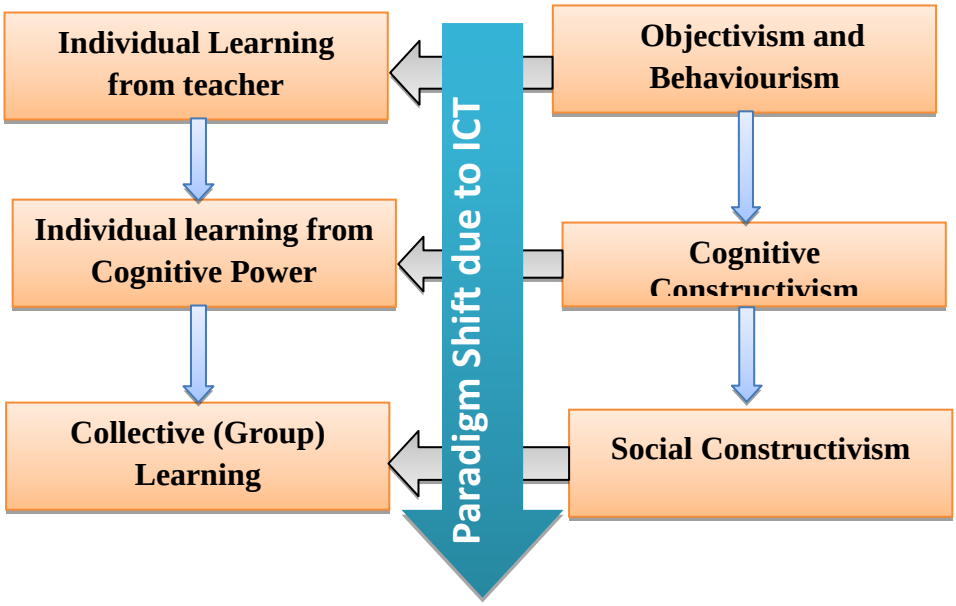

Figure 1.3

Paradigm Shift through ICT

Source: Patel et al. (2011)

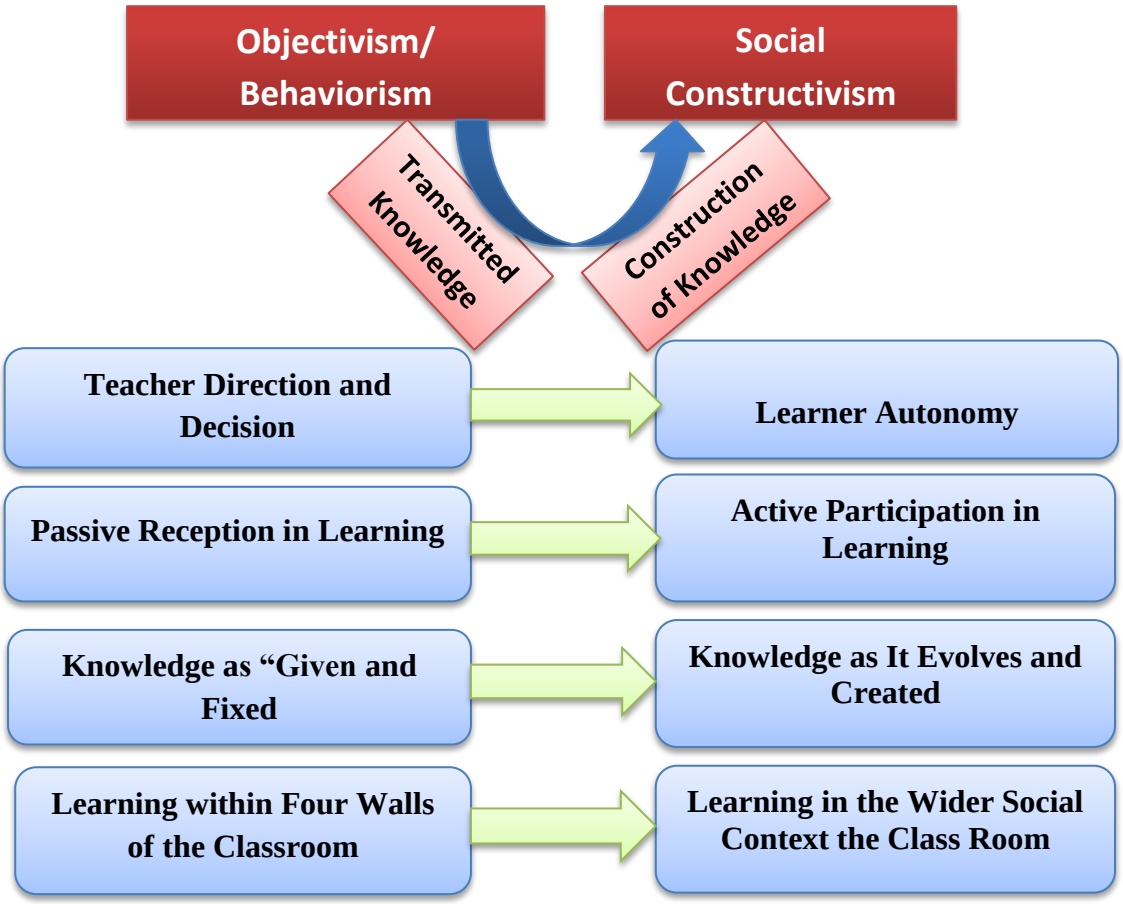

Figure 1.4

Paradigm Shift from Objectivism/Subjectivism to Social Constructivism

Source: Patel et al. (2011)

This paradigm shift changes perspectives of education from objectivism to constructivism. The moves towards constructivism from Objectivism have been pushed by the emergence of universal connectivity through ICT. Technology-adoption as a process of involving social groups into the innovation process where learning takes place on the learners' experiences, knowledge, habits, and preferences leading to a Social Constructivism (Patel et al., 2011). This paradigm shift through ICT is shown in figure 1.4 and elaborated below.

1. Teacher centric, stable designs → learner-centered, flexible designs: Basic differences between traditional classroom and learner centric classroom are that teachers use a linear model and one-way communication in traditional classroom, while teachers use more personalized, student-centric, nonlinear and learner-directed models to teach students. ICT enriched learning provides many opportunities for constructivist learning through student centered environments based on their context (Oliver, 2002). The current trend in learning needs to integrate ICT based cognitive tools, which can be adapted for intellectual partnerships among teachers and students and facilitate critical thinking and higher-order learning (Young, 2003).

2. Teachers direction and decisions Vs Learner autonomy: Traditional teaching learning process is more teachers centric. Teachers are more autocratic thus scope of students' expression are very less. With the effective use of different tools of ICT, scope of interaction with classmates and teachers has opened a door to express themselves. This may reduce the shyness of the student also and makes student confident and independent learner.

3. Passive reception → active participation in learning: Students have more burden in the classroom due to classroom activities, homework, school activities and formative as well as summative evaluation, such a hectic learning sometime makes students passive. Advent use of advance technology like Synchronous learning, Asynchronous learning, E-learning, M-learning, Web based learning makes learning effective and interesting. Through online learning and instant messaging and easily accessible internet, students can take help of classmates in development of assignments, activities, homework, solution of problems outside classroom also. Such effort of blending education and entertainment and formation of EDUTAINMENT makes learner active, positive and compatible.

4. Learning within the four walls → learning in the wider social of classroom context: Now a days, learning is not restricted to four walls of the classroom. ICT based constructivist approaches lead students to be more collaborative. With the influence of high bandwidth internet, Web 2.0 Tools and Social Networking, learning outside classroom is also possible, where students share their ideas, discuss educational threads.

5. Knowledge as given Vs knowledge as it evolves and created: With the help of ICT based constructivist approach, students get exposure to world that may not be possible to see within the four walls of classroom. Such exposure opens new avenue to generate knowledge. So such approach does not treat knowledge as fixed, static or confined in books but as something being constructed through various types of experiences. It is created through discussion and interaction.

Thus, teachers need to be equipped with basic ICT skills that acted as a facilitator, as a guide in every aspect of the life and facilitate lifelong learning. According to Neo & Neo (2001), with the advancement of the Information and Communication Technology (ICT), multimedia technology have rapidly permeated and increasingly altered the landscape in the educational arena.

3.3 ICT Skills

ICT skills can be defined as the ability to use computers and its applications and then transmit the stored information through communication networks (Quadri, 2012). It includes steps like accessing and receiving digital information, storing it and after reshaping the information and resending it. Digital information can be in any form like written, audio or audio-video.

According to Swamy (2012), teacher training should encompass ICT skills along with a full understanding and complete mastery of ICT as a pedagogical tool. It is also necessary to extend a stronger understanding of future learning needs and future environments for ICT skills. ICT skills may depend on technological proficiency to a certain extent; they also require cognitive skills, such as those underlying literacy, numeracy and problem solving, which are critical for using ICT effectively.

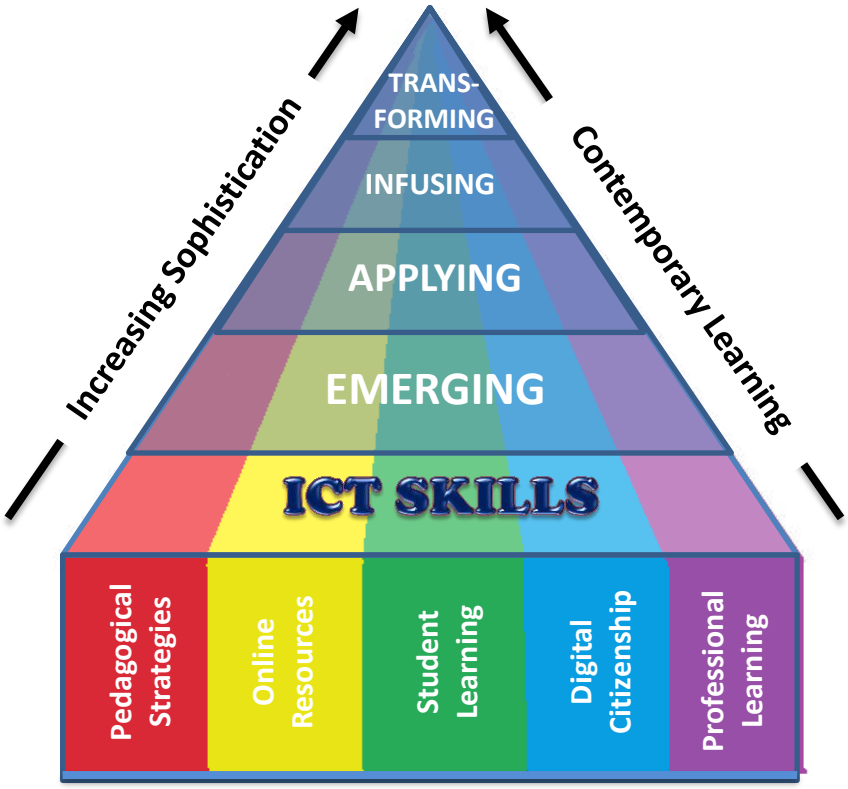

Figure 1.5

ICT Skills Pyramid in Context of Contemporary Learning

Source: March (2009)

March (2009) listed out essential ICT Skills required in Technology driven 21st Century to reflect the best practices of "Web-enhanced" education. This generation uses technology as a means to promote Sharing and Collaboration of Learning. Teacher should have technology-enabled skills listed as below:

i. **Pedagogical Strategies:** Pedagogical strategies have provided a working definition of skills of integrating technology into their pedagogy to prepare our pre-service teachers to teach with technology. According to Beaudin & Hadden (2005), it is hybrid approach of meta-teaching, technology exposure, and critical reflection can be used to enhance instruction.

ii. **Online Resources:** These skills enable teachers to engage students with the help of email, Web portal, Web 2.0 Tools, and Social Networking in more authentic learning tasks. This is achieved by creating a public forum for student expressions; building critical thinking into the culture of classroom routines; and using rich resources to augment course content.

iii. Student Learning: This skill is essential for teachers to develop ownership of learning in student through progressive and developing integration of course goals with students' understanding. Teacher can develop Educational Site of Classroom and invite students to share their ideas and belief to express themselves. Learning as per students' own time and pace, effective use of Multimedia representation of the subject content may lead to lifelong learning.

iv. Digital Citizenship: Such skill is important to develop critical thinking, reflection and, when required, informed action among students rather than teaching. Teachers can develop ICT integrated lesson plan for the enhancement of the effectiveness of the teaching. Online collaboration with the help of internet may lead to Digital Citizenship.

v. Professional Learning:

This skill encompasses

- Communication and collaboration
- Motivation and learner expectations
- Interactivity
- Knowledge creation and management
- Critical, creative and reflective thinking
- Local and global networks
- Problem solving
- Personalization
- Negotiation and risk-taking
- Assessment

Table 1.2

ICT Skills required for 21st Century Teachers

	Teacher can/should be
Online Resources	Using E mail to facilitate learning
	Creating and posting documents online
	Technical skills for finding rich resources
	Technical skills for adding posts to a blog / wiki / intranet page
	Using the online presence to promote student engagement
Pedagogical Strategies	Pedagogical skills for Looking Tasks
	Using software to support Critical Thinking
	Exploring Web tools to facilitate access to rich resources

Student learning	Supporting student use of a Personal Learning Environment
	Facilitating student "Knowledge-Building"
Digital Citizen	Participating in the Digital World: posting images, video
	Participating in the Digital World: contributing content in any format like visual, written, video, audio, presentation, etc. The forum may be a wiki, professional journal, educators' social network, iTunes, etc.
Professional Learning	Focus on communication and collaboration, motivation and learner expectations, interactivity, knowledge creation and management, critical, creative and reflective thinking, local and global networks, problem solving, personalization, negotiation and risk-taking, assessment.

Source: March (2009)

After reviewing studies conducted by Khirwadkar (2007), Goel & Goel (2008), and March (2009), researcher identified ICT skills that could be enhanced among student-teachers for technology driven education for the present study:

Skill of Data Processing: Using data management tools for efficiently managing learning and effective presentation of data. Using technology to gather, organizes, present and report information about student performance.

Skill related to Accessibility of Technology: Take advantage of Internet and Intranet and locating useful information for the development of lesson plans. Evaluating and selecting appropriate software for a particular subject and as per student needs.

Skill related to Technology Integration: Integration of technology into real time teaching. Developing assignments and project work for students; giving them broader and deeper knowledge in a field of study; developing critical thinking and infusing creativity among students.

Skill related to Media Design: Developing tools to evaluate technology-based student projects including multimedia, word processing, database, spreadsheet, PowerPoint, and Internet/telecommunications

Skill of Collaboration and Communication: Using Internet to support professional development including locating professional organizations, communicating with other teachers electronically, and participating in online collaboration.

Skills related to Web enhanced Learning Environment: Creating learning environment for teaching with the help of online collaboration, Virtual learning. Integrating Web 2.0 tools in teaching learning and also for collaboration, professional development, online discussion.

The above-identified ICT skills are very essential to inculcate among student-teachers. As these are 21st century skills, teacher must change their role in the technologically driven education to meet the requirement of teaching.

3.4 Changing Role of Teacher in Technology Driven Education

This is an era of technology and innovation. Many practices are already been implemented in the form of innovation by the schools and different educational Organizations. Information and Communication has opened a new avenue to stay connected outside classroom. With the help of ICT, Virtual classroom, Video Conference, E-learning, Internet collaboration could be possible. This has extended learning beyond imagination. Teachers can use ICT to deliver his/her lesson more effectively by using different media like Audio, Video, Animation, Picture etc.

It is very crucial that today's teachers should be techno-smart to deal with the students' expectation. It is also essential that teachers should be well trained to use ICT maximally for the effective teaching. Government has taken few initiations viz. transform traditional classroom to smart classroom by providing adequate facilities of software, hardware and required infrastructural facilities under different schemes (MHRD, 2012). Teachers are expected to contribute more in teaching learning through variety of asynchronous learning tools outside the classroom. Hence, there is an urgent need for providing proper training in implementation of ICT and ICT related tools in the classroom. Teachers should also know how to use web 2.0 tools for educational purpose, for sharing Information, online collaboration, accessing and assessing information to guide students in right direction. 'Teacher should equip not just with basic ICT skills, but should encourage the evolution towards integrating

technologies into teaching subjects and practices' (Hooker, 2009). The goals of web driven education should centered on learning how to use ICT and learning with ICT.

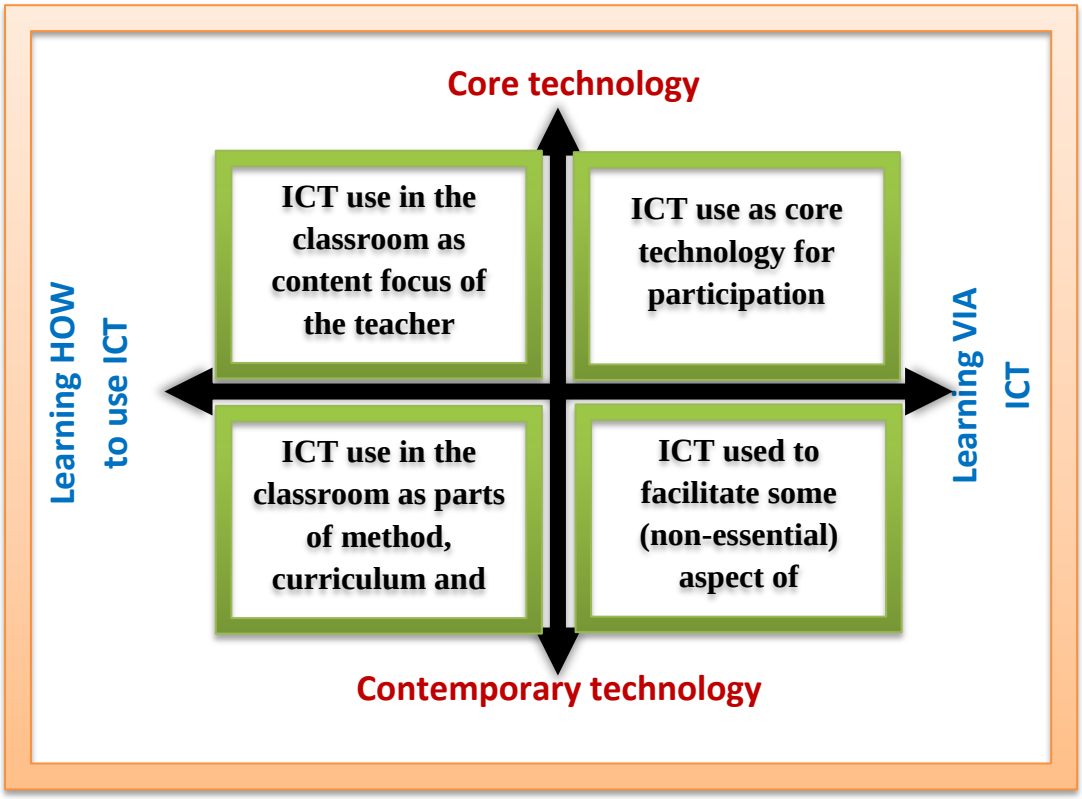

Figure 1.6

Two Dimensions of ICT Integration in Teacher Professional Development

Source: Collin & Mooner (2001)

Technology integration in teaching learning encompasses understanding of ICT and application of ICT in teaching. Contemporary teacher should take care of both the things while implementing ICT in classroom. Focus of teaching should be on the use of web 2.0 tools in or outside the classroom. Role of teachers is also important while organizing learning experiences because it should cover all three components pedagogy, technology and content for effective teaching. Teacher should use complementary technology as well as new emerging technology based on feasibility and context. Teachers at pre-service level should be initiated for the use of ICT in teaching learning and develop lessons/learning experience based on technology integration in teaching. Collin & Mooner (2001) gave dimensions in which teachers should be trained to encounter challenges in technology driven education that is

presented in figure 1.6. Following set of techno pedagogical skills, Teachers should acquire for making learning process effective in the classroom.

- Teachers should have the skill to communicate, collaborate, search and explore with the help of ICT.
- Teachers should have the skill to identify different tools and their potential to integrate them in the curriculum transaction.
- To acquire computer skills such as: Tools to collaborate: exchange files, chat, news groups, white board technology
- Tools to search: teachers should be able to use a search engine, logical operators in a process of identifying information
- Tools to explore: teachers should be able to use exploratory educational software or to use tools as a spreadsheet in an exploratory way.
- Tools to collect process and store data
- Teachers should be aware of technological innovation and its consequences in Education.
- The teacher has the skill of assigning team work, project work, independent learning and to provide resources and access to the students

The challenges before teachers are to understand and use the potential of relevant technology to improve the development of higher order thinking skills and knowledge creation. ICT can not simply be downloaded onto existing system. When this approach is taken, it is likely that computers will remain unused, misused or under-utilized. As technology has created change in all aspects of society, it is also changing expectations of teacher education in terms of what student must learn in order to function in the 21st century.Under this situation teachers must have a pro-active attitude towards technological innovation,

- be committed to use ICT and be able to integrate it in the learning process
- teachers must have a critical view of the use of technology in Education instead of a remaining a mere passive consumer of technology and must promote this critical view in their teaching
- Teachers must consider the students as the centre of the learning process and play a role of guide or mediator to the students in the learning process

In the context of ICT usage in schools, teachers become often moderator for student activities promoting team work, promoting project work and independent learning and acting as a resource facilitator mediating collaborative learning. The choice for a particular methodology should be based on co-participation of students. This includes the participation of students in producing a specific methodology promoting a conversational approach.

3.5 Various Recommendations for Integrating ICT in Teacher Education

Since independent, different committees and commissions recommend to improve quality of school education and higher education. From the National Policy on Education (1986) to Justice Verma Commission (2012) gave lots of emphasis on development of ICT enabled teaching at all level of learning from primary to higher Education which is presenting in figure 1.7

NPE (1986) emphasized upon the use of computers in higher education and for the first time in the history of Indian Education, NPE (1986) has observed that, "Educational Technology will be employed in the spread of useful information in training and retraining of teachers to improve quality of education".

NCFTE (2009) recommended teacher education institutions to prepare a workforce of trained teachers who are fully conversant with the technology. It also recommended sustained professional development of all teacher educators from all recognized institutions and making ICT a part of teacher education curriculum.

UNESCO (2009) emphasized to adopt Virtual Learning Environments (VLEs), which will incorporate collaboration and communication tools such as wikis, blogs, forums and chat, web-based social networking tools such as Facebook, Google Docs, Blogs in teaching and learning. It also recommended in developing course material using a combination of face-to-face and computer based approaches. This allows states to engage with each other despite the vast distances between them.

National Knowledge Commission (2009) recommended Online Distance Learning (ODL) to make education available to all learners who discontinued their education and want to get further education. NKC recommended access and e-governance in Online Distance Education (ODE), and integrate print, audio-visual and internet based

multimedia into education. NKC also recommended developing web based common open resources.

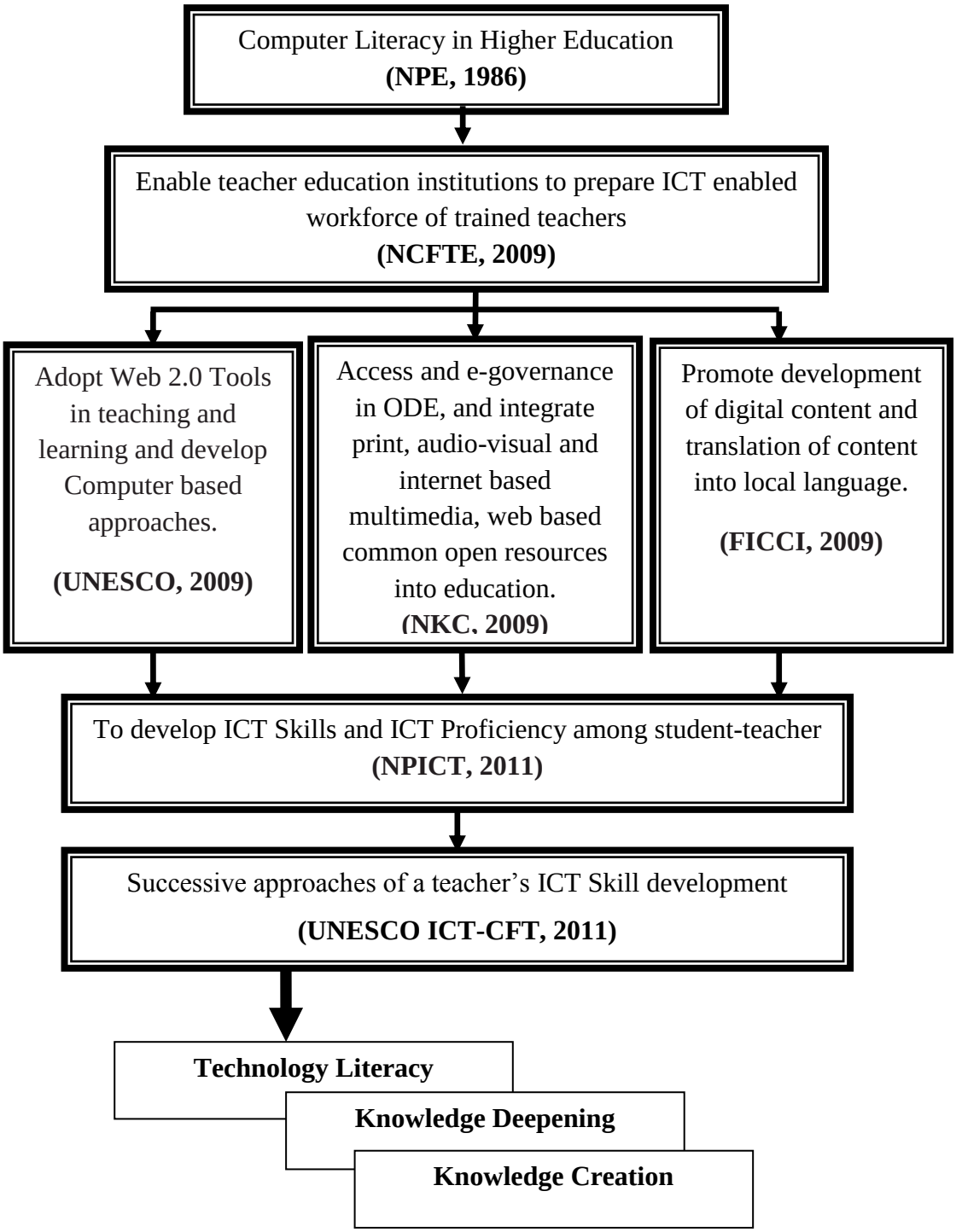

Figure 1.7

Recommendation in the context of ICT Skills

Federation of Indian Chambers of Commerce and Industry (2009) recommended to promote development of digital content and translation of content into local language in the private and the public sectors. It also recommended to develop multiple IT Systems/ICT based packages which can be customized to the Indian context. These should be made available to recognized Higher Education Institutes (HEIs) free of cost, giving HEIs the freedom to choose the most suitable package and relevant modules.

National Policy on Information and Communication Technology (ICT) in School Education (2011) recommended ICT enabled teaching-learning in School Education which encompasses a variety of techniques, tools, content and resources aimed at improving the quality and efficiency of the teaching-learning process. Ranging from projecting media to support a lesson, to multimedia self-learning modules, to simulations to virtual learning environments, there are varieties of options available for the teacher to utilize various modes/ICT tools for effective pedagogy.

The UNESCO ICT Competency Framework for Teachers (UNESCO, 2011) emphasizes to develop ICT skills among teachers and thus, they will be able to teach their students. Teachers need to be able to help learner become collaborative, problem-solvers, creative learners using ICT so that they will be effective citizens and members of the workforce tomorrow.

UNESCO-ICT Framework (2011) recommends three successive approaches for a teacher's development. The first is **Technology Literacy**, enabling students to use ICT in order to learn more efficiently. The second is **Knowledge Deepening**, enabling students to acquire in-depth knowledge of their school subjects and the third is **Knowledge Creation**, enabling students, citizens and the workforce to create new knowledge required for more harmonious, fulfilling and prosperous societies.

Different committees and commissions suggested that Educational Technology can be used to disseminate knowledge to different modes of learning viz. synchronous, asynchronous learning, online learning, e-learning, virtual learning, multimedia-based learning, integration of web 2.0 tools in teaching learning. Learning resources can be converted in digital form and be open for all teacher as well as students. E-governance should be promoted make academic and administration processes easy and competent.

Technology should be infused with curriculum across all level of learning. It is also suggested to all recognized teacher education institutions to make ICT a part of teacher education curriculum at pre-service level to produce techno savvy teacher to teach students of 21st century and it also highlighted to adopt ICT to generate knowledge.

3.6 Present Scenario of ICT in Teacher Education

There have been a number of initiatives for increasing standards of teacher education like four year integrated Bachelor of Elementary Education (B.El.Ed.) program for the preparation of elementary school teachers, four year integrated program leading to the degree of B.Sc.Ed., two-year B.Ed. program and integrated M.Sc.Ed. etc. (NCFTE, 2009).

ICT enabled education and training would not only be cost effective but also make education effective and efficient while offering mass customization of learning, and rendering continuous support. According to Dodia (2012) and Swamy (2012), school teachers do not use email, internet to collect information to enhance teaching learning process. They do not have knowledge about subject related educational software, ICT based tools and materials. They do not maintain continuous, positive, constructive feedback to encourage student's participation in ICT based activities, and cannot maintain healthy and social relations with other teachers and students for academic discussion.

With the realization of the deficiency of ICT integration infrastructure, Government has introduced the Scheme of Information and Communication Technology in Schools (ICT in Schools) during the XI Five year Plan between 2007-2012 to promote ICT based learning (MHRD, 2010, b).

Table 1.3

Facilities provided by the Government of India under ICT in Schools

10 PCs (or one Server with 10 Terminals), 1 Projector
1 Printer, 1 Scanner, 1 Web Camera, 1 modem, Broadband antenna, Generator/ Solar Package, UPS, video camera, etc.
Operating System and Application Software
Educational Software and CD ROMs

Source: MHRD (2010,b)

Under the scheme of ICT in Schools, all Government and Government-aided secondary and higher secondary schools have a minimum level of ICT infrastructure. Sensing the deficiency of the lack of ICT educated human resources, National Council for Educational Research and Training (NCERT), the Indian Society for Technical Education (ISTE) and UGC conducting and organizing different computer literacy program for teachers (Kanshal, 2012). Few more initiations were like MoU between Intel Technology India Pvt. Ltd. and NCTE, Wipro, UGC-Infonet (a joint programs of UGC, NFLIBNET and ERNET) have significant footmark in the area of integrating ICT in Teacher Education given in the following Table 1.4.

Table 1.4

Different Organizations having initiated in the field of ICT in Education

A MoU between Intel Technology India Pvt. Ltd. and NCTE.	(i) Capacity building of teacher educators for effective use of ICT (ii) Enhancing the knowledge and skills of the future teachers (iii) Promoting qualitative teaching and learning practices
2 year partnership Program among EZ Vidya, Wipro Applying Thoughts in Schools (WATIS) and school.	Provides training sessions and conduct School Based Support Program (SBSP), where in trainers from EZ Vidya would discuss with the teachers on how specific techniques can be implemented in their classrooms. (WATIS, 2012).
Collaboration between Wipro and The Goodbooks Trust	Create a website that serve database for children's literature by using the archives procured from The Book Review. So Teachers and Parents get aware about students' Creativity (WATIS, 2012).
Azim Premji Foundation (APF)	It has collaborated with the government in different States of India with programs in curriculum, pedagogy, assessment, school management, teacher education to improve and Better Education for all. It produced Digital Learning Resources (DLR) in education, exciting lessons for children from classes I to VIII made in

	18 languages including tribal ones, they were designed to be completely integrated in school curriculum (APF, 2012).
UGC-Infonet, a joint programs of UGC, Information and Library Network (INFLIBNET) and, Education and Research Network (ERNET).	This is the Wide Area Network (WAN) connecting more than 170 universities and R&D Institutes etc. The main objective of this program was to share the library resources, qualitative and collaborative research, distance learning, multimedia application and accessibility of Intranet and Internet to the member institutions. (UGC-Infonet, 2012).

Different Government and Private sectors, NGOs, and other working bodies have significant contribution in the development of ICT Proficiency among In-service and Pre-service teachers. These initiatives have encouraged other Teacher Education Institute to develop a large manpower with ICT skills.

3.7 ICT as a Core Course at Pre-Service level

With the initiatives of the Government to integrate ICT in teaching learning process, it will be mandatory for all teachers to undergo training in use of ICT in teaching during the pre-service training meant for secondary teachers. NCTE (2010) has prescribed course of training of ICT in Education of 55 hours; course outline is given in following table 1.5

Table 1.5

ICT in Education Course Outline given by NCTE

Sr. No	Topics
1.	Computer Overview
2.	Operating systems (any scalable, standardized and least support required OS)
3.	Working with Multimedia and making movies and recording sounds
4.	Using and integration of Word, Excel and power point in classroom learning
5.	Database creation and management
6.	Networking/Internet/e mail

7.	Subject specific TL Tools, e.g. labs, animation, museum etc.
8.	Classroom learning and teaching tools (whiteboards, collaborative cooperative tools)

Source: NCTE (2010)

Realizing the importance of ICT in Education, most of teacher training institutes introduced ICT as one of compulsory course. Few examples are: 1) Department of Education (CASE), The Maharaja Sayajirao University of Baroda introduced 'Information and Communication Technology (ICT) in education, a two credit compulsory course at the B.Ed. Program from 2002-2003 onwards, 2) Navarachana University, Vadodara has integrated ICT as a Core component at B.Ed. level. Some teacher education institutes also introduced ICT as one of the specialized subject to be studied at B.Ed. Program. Thus, student-teachers at B.Ed. level get an exposure to use and integrate ICT in teaching learning at school level. In two year B.Ed. program the component of ICT in Education is provided under the name of "Critical Understanding of ICT".

3.8 Approaches to ICT integration in Teacher Education

Information Technology means competence and confidence in the handling of technological Information. Use of ICT within teacher training programs around the world is being approached in a different ways with varying degrees of success. Koehler & Mishra (2005) have identified four approaches namely: 1) ICT Skills development approach; 2) ICT Pedagogy approach; 3) Practice driven approach and 4) Subject specific approach which is diagrammatically presenting in the figure 1.8

Every approach has its own advantages and Limitations but all these approaches lead to a common goal of developing knowledge about ICT and ICT Competencies among student-teachers. With the realization of importance of Information and Communication technology in education, UNESCO (2002) has identified teachers' competencies with respect to modes and modalities of ICT integration in teaching learning and organized ICT competencies into four groups that are Pedagogy, Collaboration and Networking, Social Issues, Technical Issues.

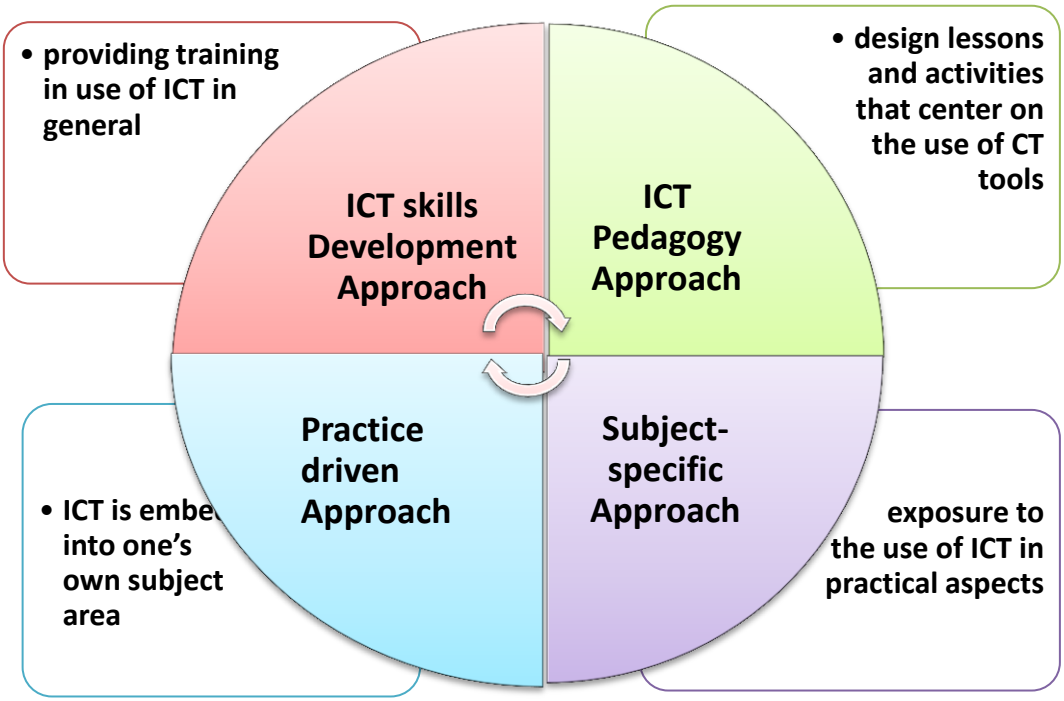

Figure 1.8

ICT integrated Approaches

Source: Koehler & Mishra (2005)

Every approach has its own advantages and limitations but all these approaches lead to a common goal of developing knowledge about ICT and ICT competencies among student-teachers. With the realization of importance of Information and Communication Technology in education, UNESCO (2002) has identified teachers' competencies with respect to modes and modalities of ICT integration in teaching learning and organized ICT competencies into four groups that are Pedagogy, Collaboration and Networking, Social Issues, Technical Issues.

Four Competencies of ICT given by the UNESCO (2002) is elaborate as follow:

Pedagogy:

Pedagogy is the most important aspect of infusing technology in curriculum. Teacher needs to consider local context, individual approach and subject discipline while infusing technology and these aspect must be intermingle for proper fusion. Teachers should develop their pedagogical use of ICT to support learning, teaching, and curriculum development, including assessment of learners and the evaluation.

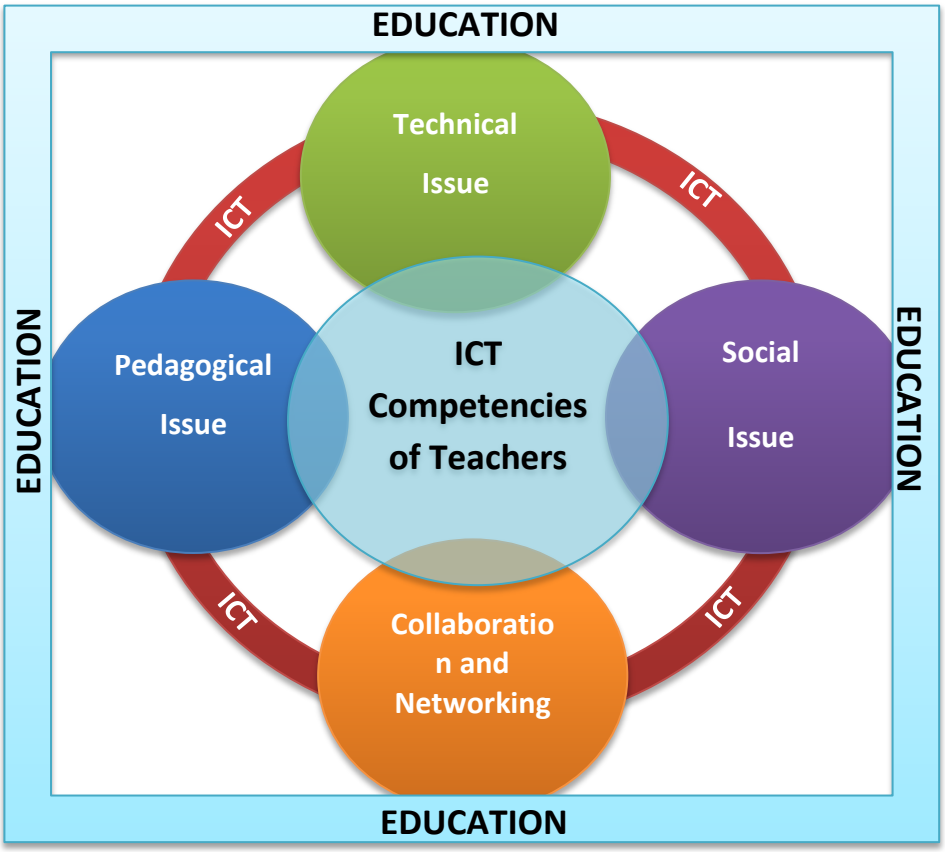

Figure 1.9

Four Competencies of ICT Integration

Source: UNESCO (2002)

Collaboration and Networking:

With the advancement in the technology and Internet Access, ICTs can be powerful tool to support communication between learning groups and beyond classrooms. The teacher's role is to expand Information and Communication Technology to collaborate globally. Both local and global understandings can be enhanced using ICTs. Through collaboration and networking, teachers can promote learning within the classroom and expand this learning by exploring themselves outside classroom.

Social Issues:

The great power becomes great responsibility is also applicable in the context of ICT. Legal and moral codes need to be extended. Cyber-crime is the evil of technology driven society and plagiarism is the major disadvantage of ICT in teaching learning. One should be aware of the copyright issues. Proper amalgamation of technologies with ethical and moral values should be a part of the curriculum in a way that involves

learners and helps them to understand appropriate application of ICT. Teachers need to understand social surroundings and apply that understanding in their practice.

Technical Issues:

Technical issue for integration of ICT in the curriculum include the technical competencies and providing both infrastructure and technical support for technology use in the curriculum. In many contexts, the lack of technology competence, infrastructure and technical support can create barriers to access and reliability for curriculum. Simply providing technology for learners and teachers is not enough. They should have basic technical skills while integrating technology in teaching learning.

For proper integration of ICT, reliable technology infrastructure and technical assistance, ICT integration training should be provided at teacher education level. Teacher should upgrade his/her knowledge of current and emerging applications of ICT within education. Knowledge of technology and its application in teaching learning is very important in order to bring newness, creativity, challenging experience for learners in the modern world. Subjects like science, social science mathematics have wider scope to integrate modern technological tools in teaching learning making learning meaningful and interesting for learner.

4.0 Scenario of Secondary School Science

Science is the systematic study of the structure and behavior of the physical and natural world through observation and experimentation. Science subject is taught to the students at primary level as an integrated subject at a letter stage it is taught as Science subject which includes Chemistry, Physics and Biology at higher secondary stage it is taught as a separate discipline. Science teaching is conducted primarily in three types of learning environments: classroom, laboratory; and outdoors (Orion et al., 1997). One can find answer to the questions like Why? How? When? with the help of Science. Students at secondary level learn science to know fundamentals like principles, laws, and facts. Basic Information and knowledge about science and technology is provided at these stages of education. At secondary level, Science is taught as three different sub branch of Science like Biology, Physics and Chemistry. At the secondary level, students have to learn all these sub branches in detail.

Knowledge about all sub branches helps student to select appropriate subject at higher Secondary level. Thus, it is essential to know and understand basic fundamental principles of Science at secondary level.

Science in schools is often criticized for being too prescribed, impersonal, lacking in opportunity for personal judgment and creativity. The processes of doing science should not be separated from scientific content and the aims of science education should be clearly spelled out (Chunawala, 2006). The National Curriculum Framework of India (NCF, 2005) focuses on three issues with respect to science teaching in India. First, science education is still far from achieving the goals of equity enshrined in our constitution. Second, science education in India, even at its best, develops competence but does not encourage inventiveness and creativity. Third, the overpowering examination system is a fundamental problem for science education in India. Various studies undertaken by the government and private agencies in primary and elementary classes show evidence of very poor learning levels among children in mathematics (Education Initiatives, 2010; Pratham, 2011). Understanding of mathematics in primary classes is largely limited to 'procedural or rote-based learning' and, in fact, falling averages as we move from the primary to the elementary classes indicate an increase in the level of incomprehension for children (Education Initiatives, 2010; Dewan et al., 2012). Research by Malhotra (2006) and Pillai (2013) find that teachers often lecture and students largely observe the teacher rather than actively participating in the classroom. The teaching is mainly expository type in which the focus is on telling, memorization, and recalling information. The students are passive recipients of knowledge. Student participation is restricted to asking and answering questions on what teacher has taught (Wipro, 2011). The ASER report (Pratham, 2011) shows that nearly 47% class V students cannot read class II text, while over 63% of class III students cannot subtract. These findings are corroborated by the Wipro EI Quality Education study (Wipro, 2011) of India's elite schools on-Student performance in Class IV, VI, VIII in science, social sciences, mathematics, and English on student attitudes and values, learning environments and organizational aspects of the school.

According to Bhide (2002), exploration and experimentation have become extinct in the present system of education. It is unfortunate that majority of students in schools

across the country learn science in a boring and mechanical style, which allows little room for original thinking and innovation (Kumar, 2002). Students should be motivated to ask questions and there should be room for developing curiosity among students while learning science. It must be recognized that at the root of every major discovery in science there lies a fundamental question. Science in schools is often criticized for being too prescriptive, impersonal, and lacking in opportunity for personal judgment and creativity. If the objectives of teaching science are to be achieved, it should be borne in mind that science needs to be taught by focusing on both the process and the product. Students should be given ample opportunity to observe, explore, manipulate, estimate, predict, hypothesize, and measure and then come out with some findings as to why things happen as they happen.

Various committees and commissions from the Secondary Education Commission to the National Curriculum Framework (2005) have recommended that science be taught through purposeful, concrete, and realistic situations. In order to strengthen the quality of science education at all levels, there seems to be an urgent need to practice a learner-centered activity-based and competency-dependent inquiry approach for teaching science, which will make learning of science an enjoyable experience for children.

According to NCERT (2006), the objectives of teaching of Science are to enable the learner to

- know the facts and principles of science and its applications, consistent with the stage of cognitive development,
- acquire the skills and understand the methods and processes that lead to generation and validation of scientific knowledge,
- develop a historical and developmental perspective of science and to enable student to view science as a social enterprise,
- relate to the environment (natural environment, artifacts and people), local as well as global, and appreciate the issues at the interface of science, technology and society,
- acquire the requisite theoretical knowledge and practical technological skills to enter the world of work,

- nurture the natural curiosity, aesthetic sense and creativity in science and technology,
- imbibe the values of honesty, integrity, cooperation, concern for life and preservation of environment, and
- cultivate 'scientific temper'-objectivity, critical thinking and freedom from fear and prejudice.

Thus, learning science at school level develops skills, abilities among students to solve problems of daily life, develops skills of observation, interest, and curiosity about the natural phenomenon, develops vocational and productive skills, scientific skills that link science learning to Productivity (Shelat, 2012; Ramesh, 2013; Pillai, 2013).

Multimedia and online teaching-learning can contribute to a good learning science environment and can bring about good science education standards through proper designing and effective utilization of technology (Deshmukh et al., 2012). Science education must be the basis for informed participation in a technological society, a part of a continuing process of education, a preparation for the world of work, and a means for students' personal development (Science Council of Canada, 1984). Thus, It is essential to give best knowledge to student-teachers at pre-service level. So they can develop scientific attitude and scientific skills among students. With the realization of changes in learning style, NCTE and NCERT continuously molding syllabus and objectives of science pedagogy at pre-service level. NCERT (2015) reframed aims after course shifting from one year to two year B.Ed. program. Pedagogy of Science covers pedagogy of biological science as well physical science. The courses will enable the student-teachers to-

- gain insight on the meaning and nature of science for determining aims and strategies of teaching-learning
- facilitate inculcation of scientific attitude and temper among students
- appreciate that science is a dynamic and expanding body of knowledge
- nurture curiosity of learners about her/his natural surroundings and relationships of everyday's experience with concepts of sciences

- explore different ways to create learning situations for different concepts of sciences and for learners of different abilities
- effectively use different activities/experiments and laboratory experiments for teaching-learning of sciences
- formulate appropriate and meaningful inquiry episodes, problem-solving situations and investigatory projects based on upper primary, secondary and higher secondary curriculum
- examine and prioritise different pedagogical issues in science
- develop appropriate assessment tools for the evaluation of learning of different concepts of sciences
- develop linkage of different concepts of sciences with life skills and its development
- stimulate curiosity, creativity and inventiveness in the field of sciences
- understand the process of science and role of laboratory in teaching-learning situation

On the basis of Becta's analysis (2003), ICT can have positive effects on the teaching and learning of science. A key problem in science is that many students lose interest in the subject as they progress through school (Murphy, 2003). ICT can play a major role in enhancing and extending practical work in science. Prentation of content with graphing software makes learning easy to understand which gives more time to explore and discuss the underlying concept (Newton, 2000; Trindade et al.,2002). It is needed to solve various problems along with the ever-evolving technology. This scientific literacy will benefit students to deal with the various problems they face in their day to day life. For the development of scientific skills and attitude teacher can take help of Information and Communication Technology to minimize constrains of science learning. To achieve this, pre-service student-teachers are required to be equipped with certain ICT skills in during their training. Thus, it is very essential to develop ICT skills among student-teachers and equip them with the adequate ICT proficiency. Apart from offering ICT as a compulsory and special course, integrated approach is needed in methods courses which will help student-teachers to understand the importance of skills like analyzing, accessing, skimming, scanning, etc. in a digital world.

5.0 Concept of Multimedia

Multimedia has evolved through changes in technology, changes in learners and changes in our understanding of the teaching learning process (Dobbs, 2003). Multimedia is highly useful in Research, Teaching, and Learning. Different forms of multimedia are viz. Hypermedia, Interactive multimedia, Multimedia presentations, Virtual community, Personal information management programs, Departmental information management programs, Documentation of teaching materials, etc. (Nelasco et al., 2007). The use of Multimedia has offered an alternative way of delivering instruction. It can be an effective tool from the educational point of view. The way we are influenced by modern technology, multimedia has the potential to revolutionize education in terms of learning and communication. According to Stemler (1997), Multimedia learning is a process, rather than technology, that places new learning potentials in the hands of users.

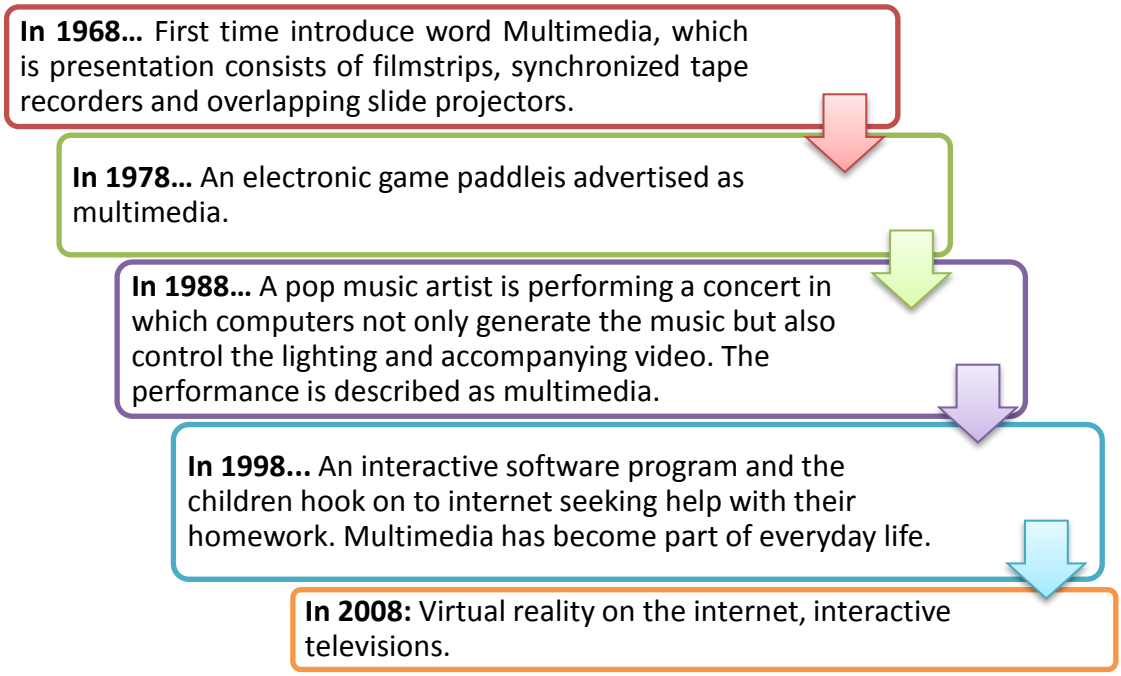

Figure 1.10

Evolution of Multimedia

Source: Pant (1998)

People heard Multimedia word first time in 1968 and after that an electronic game paddle was introduced in the form of multimedia. In 1988, computer generated music and accompanying video, was described as multimedia. An interactive software

program was introduced in the form of multimedia and become part of everyday life and now world take advantage of internet in the form of Virtual reality.

In the last decades due to advent of Computer technologies, information delivery has got new meaning. Development, access, transfer of text, sound and video data have given unique face to classrooms, libraries, training and resource centers (Mishra & Sharma, 2005). Multimedia are the set of information technologies that satisfy the growing demand of end users for richer interactive experiences (Hong et al., 2003), which is a judicious mix of five basic types of media into the learning environment: text, video, sound, graphics and animation or it may mean the development of computer-based hardware and Software packages produced on a mass scale and yet allow individualized use, all of which are organized into some coherent program" (Phillips,1998; Fenrich, 2005; Asthana, 2012).

Simplicity is one of the most important goals of multimedia software design. Establish a background by consistently placing related elements of text, graphics and navigational controls. Be consistent in the typeface, graphics, and labels. Save special effects for key moments of interaction, so that they will be noticeably different from the user's established expectations.

5.1 Multimedia in Educational Context

In the context of education, technology refers to the process of applying the tools for educational purposes. The advancement of technology has made a significant impact on the teaching methods from traditional face-to-face teaching to Computer-Based Learning (CBL) or e-learning systems in all levels of education. Modern education and communication environments can offer alternative ways in the learning process (Nusir, 2012). Multimedia technology is probably one of the most exciting innovations in the information age. The rapid growth of multimedia technologies over the last decade has brought about fundamental changes to computing, entertainment, and education (Norhayati & Siew, 2004). The advent of multimedia and multimedia technologies has changed the way educators teach and students learn. The use of multimedia as a platform for teaching is made even more possible with the availability of the MPCs (Multimedia PCs) that are powerful, fast and able to process

all media elements effortlessly and quickly and multimedia software packages that are user- friendly yet power-packed (Neo & Neo, 2001).

According to Neo & Neo (2001), Margie & Liu (1996), Ellis (2001) and Lindstrom (1994), Bhushan & Sethi (2012) following are the educational implications of the multimedia:

- ✓ With multimedia, the communication of the information can be done in a more effective manner and it can be an effective instructional medium for delivering information
- ✓ Multimedia has the potential to create high quality learning environments, with the capability of creating effective learning context through its different media
- ✓ Multimedia application design offers new insights into the learning process of the designer. It reinforces learners to represent information and knowledge in a new and innovative way
- ✓ It also helps allowing a learner to take better control of the learning situation. Learning with self-pace and place could be possible with the help of Multimedia
- ✓ The prospect of multimedia as a tool can enrich a learning environment. It can engage larger number of learners through multiple communication channels
- ✓ Multimedia provides a means to supplement an effort to greater attention, increase retention, and improve comprehension, which consequently results in people remembering 20% of what they see, 40% of what they see and hear, but about 75% of what they see and hear and do simultaneously
- ✓ Multimedia can provide a range of resources for education, including encyclopedias, databases, electronic books, simulations, instructional games, multimedia libraries, instructional aids, interactive tutorials, reference works and teaching materials
- ✓ It is greater ease of access to multimedia products and technologies, particularly to increased access opportunities for rural and remote communities

It plays a very important role in assisting students in learning process. The Multimedia enhances and enables students to learn in a more effective way (Nusir et al, 2012). Gayeski (1993) defined multimedia as "Classroom of Computer driven interactive Computer system which creates, stores, transmits and retrieves text information."

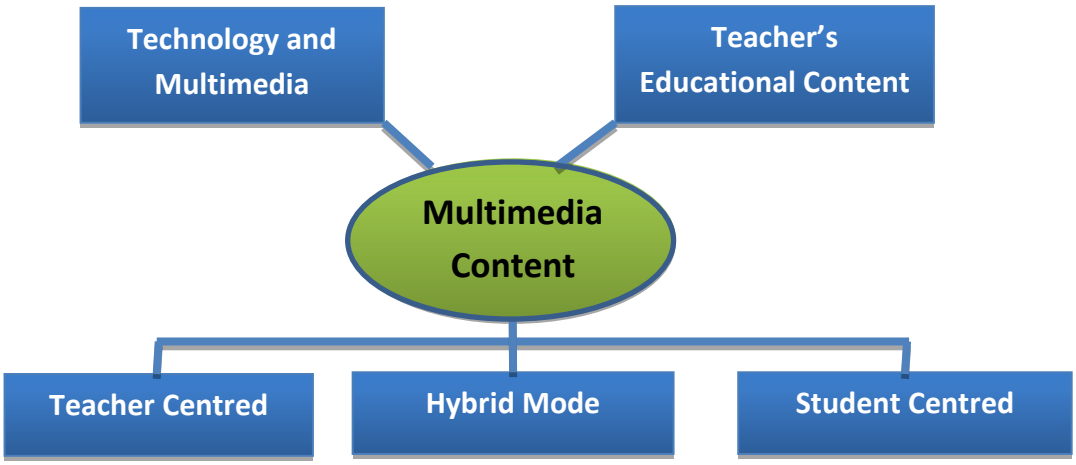

Figure 1.11

Application of Multimedia

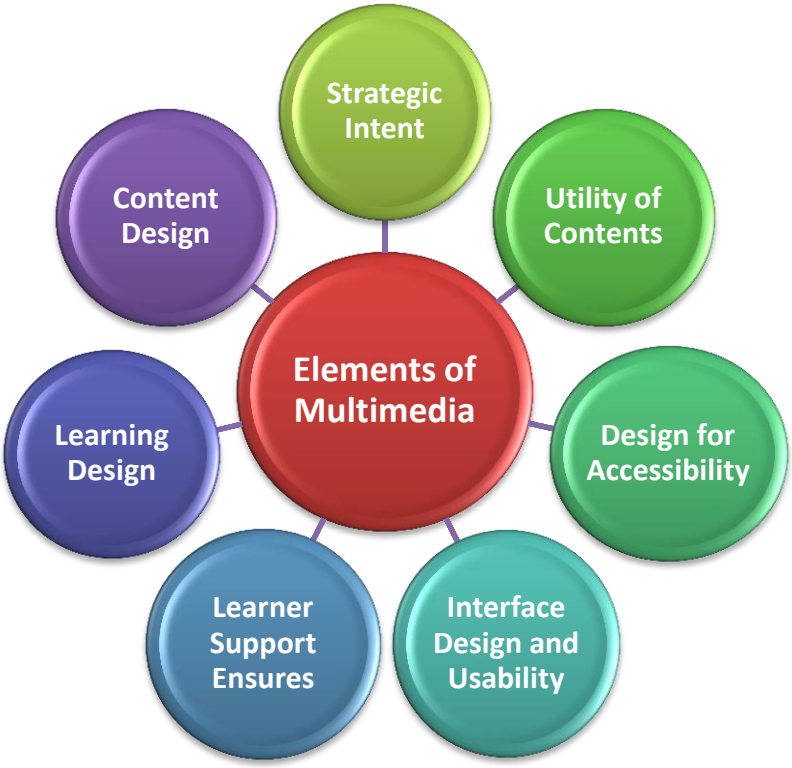

Figure 1.12

Elements of Multimedia

With multimedia, the teacher is now the director of the knowledge and can use the various combinations of media elements to create and communicate educational content. The result is a stimulating environment for learning and retaining the information delivered. The amalgamation of content and multimedia technology

results in interactive multimedia materials which can be delivered to the students in teacher-centered, student-centered, or mixed teaching and learning modes.

Dobb (2003) described number of critical elements need to be considered in the design of multimedia, such as:

1. ***Strategic intent,*** i.e., there must be a clear and agreed articulation of the strategic intent of the program, the rationale behind its development and its purpose.

2. ***Learning design,*** which is applicable from lower level to the highest level (for example, constructivist or instructivist) to more detailed level for example, building on existing knowledge, ensuring clear linkages between content and objectives, and building a community of learners where appropriate.

3. ***Content*** includes the breadth, depth and authority of the subject matter. This element needs to be backed up by quality assurance processes including contribution and review by recognized (and accredited, where appropriate)

4. ***Interface design and usability:*** A number of factors contribute to the users' perception of that environment and the ease of working within it. These factors include concepts such as interaction design, navigation design, information design, screen design, graphic design and usability.

5. ***Learner support*** ensures the provision of assistance to the users at all stages of interaction. The support can range from simple tracking aids or help menus on a CD-ROM to the planning for intervention by teachers, mentors or learning facilitators in an e-learning solution.

6. ***Utility of content*** must be evaluated to consider the potential for multiple use of the content and functionality. An assessment of the potential utility of the product involves both technical issues and learning design issues.

7. ***Design for accessibility*** is necessary since many governments have implemented legislation to ensure that the rights of people with disabilities are protected.

In the teacher-centered mode, the teacher is the one in control of the information that is received by the students and is responsible for how much information is being disseminated to them. The teacher-centred methods include presentations and

demonstrations to process the information. Students are also able to retain and recall the information as well as obtain mastery in the subject matter with drill and practice, tutorials, which are highly interactive. The multimedia courseware can also be packaged on the CD-ROM and delivered in a networked classroom leading to a teacher-centered mode where the courseware is opened on their PCs and the students follow the teacher's lecture on their PCs.

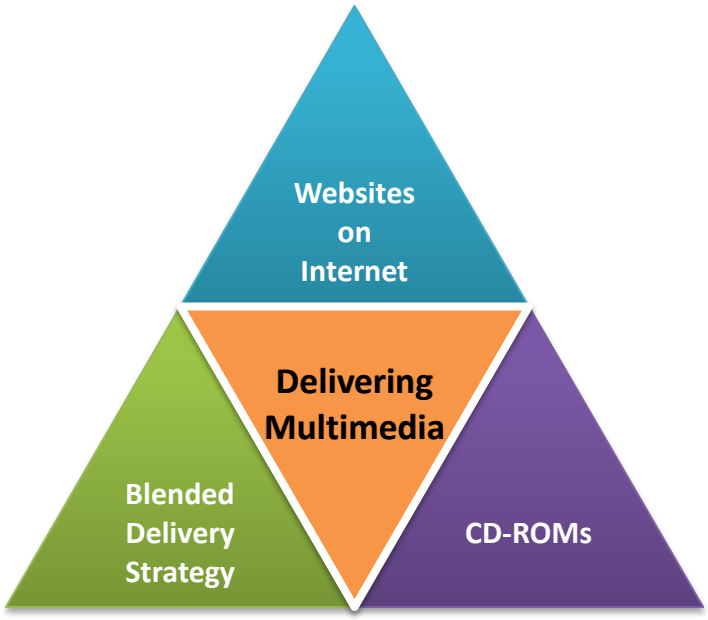

Figure 1.13

Delivery of Multimedia Content in the Context of Education

Source: Padhiyar (2010)

Tannenbaun (2000) suggest that for a presentation to be truly considered as multimedia; it must enable the user to interact with the material and influence the course of presentation. According to Padhiyar (2010), multimedia can be delivered in three ways:

1. Website on Internet: In which developed multimedia material is upload on educational website. Learner views the learning multimedia material and Interaction taking place through website. For such type of delivery mechanism learner should have compatible computer system with internet connection.

2. CD ROM Based: In which multimedia package is provided in the form of CD-ROM, Floppy, External Drive etc. CD is provided to the learner and they view and

study material as per their time and pace. It does not require Internet but requires compatible computer with CD ROM.

3. Blended delivery Strategy: In which Multimedia can be delivered in Blended form, means modules in the form of printed material is given to the learners along with CD of developed learning material. Interaction takes place face to face or through website.

In a student-centered method, the students construct their own knowledge and bring their authentic experience into the learning process where teacher acts as a facilitator. The multimedia course content can also be packaged as a website and delivered on the Internet in a web browser, it results in online courses where the students access the courseware from a browser on their PCs. The student is then free to engage in learning on his or her own time and pace and consequently, the learning mode is student-centered. This multimedia material can be used to foster team-processing and active learning as with collaborative and cooperative methods. This encourages higher- level learning, increases comprehension and retention rates, and focuses on the total development of student in self-accessed and self-directed learning.

In the mixed mode, the teacher has the flexibility to incorporate two teaching and learning approaches whenever they deem them useful, to increase and enhance their students' learning processes. Here, the same multimedia courseware content can also be packaged and delivered over satellite and broadband technologies for distance learning. Here, the student learns the materials on his or her own time and pace and interacts with the teacher via video-conferencing in real-time.

Alongside choosing proper delivery mechanism for the multimedia, multimedia implementer should take care of other component of ICT integration like Technology, Content, Context, Learners and Pedagogy as identified by the Engida (2011). Good teaching is not simply adding technology to the existing teaching and content domain. Rather, the introduction of technology causes the representation of new concepts and requires developing sensitivity to the dynamic, transactional relationship between all five components, which is diagrammatically presented in the figure 1.14.

Student-teachers be trained to handle various learning situations using /exploring ICT. Due to technological innovation, the world is reduced to a small village where teacher at any point of time can connect himself/herself with rest of the world to share,

discuss, information for Professional development as well as for academic sharing. This advanced feature of technology has given a way for learning based on Multimedia approach.

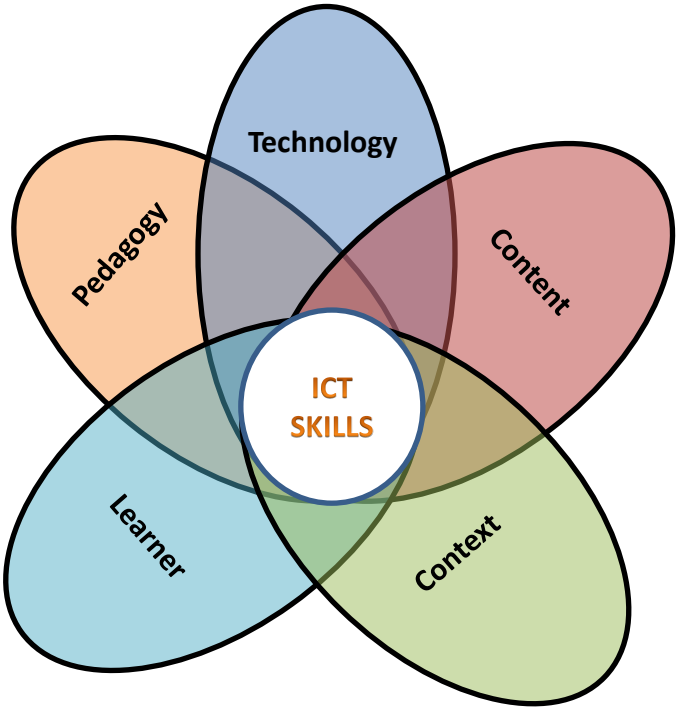

Figure 1.14

The ICT enhanced Teacher Development Model

Source: Engida (2011)

Inclusion of non-textual media into courseware adds pedagogical value to the application. If the multimedia includes a few images have little pedagogical values, it gives relief from screens of text. For example, a courseware describe application of ICT would be more valuable to the students, if it includes images and videos of its application, such as mass communication, better visualization, portability, easy and affordable access etc.

The development of technical skills alone would be a potential benefits to quality learning that the technology promises. In a cyber age, both teachers and students will need not only to know where to locate information appropriately and efficiently but also to be able to make critical judgments about its validity and reliability. Teacher should know how to engage student in learning process. So students can not divert their mind from learning. In a way teacher can prevent students to misuse advantages of technology.

5.2 Social Media and Social Networking Sites

As this era is identified and recognized as the era of innovation and technology endeavors, teaching learning process becomes easy and flexible with the propagation of technological software, apps, website, webportal, e-learning, m-learning etc. With increasing demands and facilities of internet and web users, teaching learning process can be expand outside the classroom also. Evolution of Internet started in early 80s when Internet was born in 1973. In the beginning it was used to share files, documents, information, dialogues, graphics, sound files etc. This service was called World Wide Web (WWW). Networking using the WWW continued until 2001 and later expanded with the invention of dot com. Other services like Google, Wikipedia, Facebook, Twitter began to appear on WWW that known as Web 2.0. It had moved towards becoming a read/write platform to engage, contribute and publish information in formats like text, graphics, animation, audio, video etc. Tim O'Rielly (2005) popularised this new use of the WWW as Web 2.0, a term that became widely accepted although the term had been used several years previously. WWW was used for educational purpose since early 90s. Initially schools, training colleges and universities developed websites as part of the proliferation of information accessible globally. As web 2.0 becomes more common place in education, it becomes more interactive technology based environment that enables users to share knowledge freely.

Social media is web or mobile based platform that enables an individual to communicate interactively and enables conversation of user generated content. Social Media in recent times have become synonymous with Social Networking Sites such as Facebook or Micro Blogging sites such as Twitter. Kaplan & Haenlein (2010) classified social media into six different types: collaborative projects, blogs and micro blogs, content communities, social networking sites, virtual game, and virtual social worlds. Social network sites are the web-based services that allow individuals to construct a public or semi-public profile within a bounded system, articulate a list of other users with whom they share a connection, and view and negotiate their list of connections. Social Network Sites (SNSs) such as Facebook, Orkut, LinkedIn, Twitter and Blogs have attracted millions of users all around the world and it attracts users all over the world.

Social networks allow teachers to follow and potentially participate along with students. Richardson (2005) describes a scenario of a teacher's possible use of weblogs and RSS. Such networks are supported by connections between students' and teachers' weblogs through RSS feeds combined with social bookmarking. These tools help in establishing network among students mutually as result of their interest and situation. By having an access to each others work, it provides a scope for discussions between students and teachers. Such discussions are different from the discussions in a discussion forum. The discussions based on weblogs arises from the individual entries of students whereas a discussion forum is shared. Students can subscribe to different weblogs, they can create their individual network, using social software tools such as wikis, weblogs combined with RSS feeds and social bookmarking.

In addition synchronous and asynchronous modes of learning increased use of web 2.0 tools for learning as they provide high level of interactivity among learning community. The online tools like blogs and wikis for sharing viewpoints and ideas are used extensively. The widespread use of these tools is bringing about changes in the way we communicate and exchange information. More and more teachers are discovering that they can be valuable tools for enhancing learning particularly to develop the research and communication skills, developing creativity among students. There is growing concept of web based communities and services like social networking sites, video sharing sites, wikis, blogs and folksonomies, RSS feeds, social software and web application programming interface provide enhancement over read only web sites.

Facebook:

The most popular social networking site is Facebook and the master brain behind this is Mark Zuckerberg. It was initially started as college networking site. Attractive features of the Facebook are “Homepage”, “Applications”, “Photos and Video Sharing”, “Update Ideas”, “Creation of Group”, “Page”, etc. This is one of the tool to communicate from the school or Institute to parents/students. According to Kayri & Cakır (2010), Facebook can be used for educational purpose. Facebook media not only makes lesson enjoyable but also provides lots of electronic material. Building social network with Facebook provides collaboration in group. Teachers can use it for education purpose in the following ways:

Events: Teacher can use event feature for educatioanl purpose. Teachers/ Organisation members can announce important events like Program, Seminars, Teachers Meeting etc. Students can also used it for online discussion of certain topics. By the announcement on event, one can post topic, time and time duration so all interested students get together at the same time and online discuss can be organised.

Post Update Status and Photo/Video: Status and photo/video update is most common and widely used features of Facebook. Teacher and students can used it for multi purpose. Teachers can used it for updating classroom information, small notes for students, some time they can use it for uploading online experiments/videos of classroom activities/program and stay connected even after school hours. Students can also use it just like teachers, they can connect themselves with other classroom or schools. Here teachers and students from different schools may connect and share ideas and experience of teaching learning of different learning environments.

Page: Teacher can create Page of their school community in their name and invite students and other members of the schools/ organisations for collaboration. It is just like a website of classroom or organisation. Educational institutions are using Facebook pages for promotional reasons also. This is another way for schools and universities to market themselves. As lesson materials are saved on Facebook, students can access information and give their reflection, idea, question and is answered or reacted by other users, mentors.

Create Group: Schools can use Facebook groups to communicate with students. This is a very powerful tool for sharing information and collaborating with students. Facebook groups do not require members to be friends with each other. Members of the groups can exchange files, links, information, polls and videos very quickly. Anytime someone contributes the members will receive a notification.

One can create groups of similar interest/ hobby. Option of Open group selection allows users to join group and selection of close group option allows users to authorized person or members of the groups. Teachers or students can create their group of similar interested/organisation/community and share their ideas, ask questions, organize discussion and important announcements.

Students constantly use Facebook because of its user friendly features. It enables students to interact outside classroom. Thus, Facebook could be used as a supplemental tool in education. Facebook media not only makes lesson enjoyable but also provides lots of electronic material. Building social network with Facebook provides a way of collaboration among groups.

Blogs:

Blogs are descriptive content created and maintained by individual users and may contain text, photos and links to other web sites. The main interactive feature of Blogs is the ability of readers to leave comments and the comment trail can be followed. A community of Blogs is referred to as Blogosphere and can be used very effectively to measure public opinion.

A blog is a type of website or part of a website. Blogs are usually maintained by an individual with regular entries of commentary, descriptions of events, or other material such as graphics or video. A blog is similar to an empty book. This book can be in the form of a sketchbook, a diary, a dictionary or writing portfolio it depends on the content that we put into this book. "Tech savvy administrators are using blogs as a tool to keep parents, teachers and students informed of the things going on in their schools." The commenting feature of blogs allow for immediate feedback on a posting and active participation. The content that can be posted to a blog can be text, images, files, hyperlinks, audio and video. Altun (2005) classifies blogs with regard to their purpose like Personal Blogs, Group Blogs, Press Blogs, Project Management Blogs, Library Blogs, Educational Blogs, and Institutional Blogs etc.

Edublogs can be written by teachers for the improving classroom instruction, by students to post their assessment tasks and by policy makers who need comment on education. Edublogs allow all students to participate in discussion on any topic. Mainly used as an additional communication channel to share information with students. Teacher acts as a facilitator in blog-based teaching learning, and moderates the discussion process to keep it on the right track, provide necessary instructional materials and Communicate with parents. Write comments, opinions, or questions on daily news items or issues of interests, showcase their best writing pieces, post instructional notes for students, resources, and important links.

Micro blogging:

Micro Blogs are similar to Blogs with a typical restriction of 140 characters or less. It allows users to write and share content. It can be done in the form of text message, instant message or even email. Twitter is a micro blogging site that enables its users to send and read text based messages or "tweets" of upto 140 character length. These Tweets are posted on the user's account and the site allows others to "Follow" the user. While Tweets are public by default, they can also be restricted to just the followers. Tweets can be generated via web, smartphone or even through SMS on some mobile phones.

There is a value in networking and real-time interaction that we can get using Twitter. Many educators and academicians find this to be an effective strategy for dealing with the isolation that can come from working in the classroom or office. Imagine encountering technical difficulties during our lesson and having a means of receiving assistance within minutes. Twitter is an effective communication tool for concise messages and news items, or links to longer messages and news items. Twitter is fun to use and may, therefore, be effective in engaging students in discussions who do not need to write longer essays. Consider the ability to receive assistance from others during teaching where we don't know the answer to a student's query. We can share events at work and this helps us know our friends a bit more and adds an additional layer of community within our online network. One can customize and use it to meet ones specific needs and interests.

Twitter often links to an RSS feed from the website that automatically tweets a news article when it is published on the website. Teachers have been setting up subject or class Twitter accounts that students can follow. The teacher then tweets information related to their class.

Vlogs and Video sharing sites:

Video Blogs or Vlogs are blogging sites that mainly use video as the main form of content supported by text. Such sites especially enable those who may have limited knowledge of English and share their experiences over internet. Vlogs are an important category of content over YouTube – the largest video sharing site. YouTube is a video Live Casting and video sharing site where users can view, upload

and share videos and even leave comments about videos. However, for uploading and sharing registration is required.

The availability of Information and Communication Technology (ICT) tools and programs spread all over the world. Those tools emerged to be part of not only high class well educated people; rather, Internet, cell phones, etc. are used to help people in their daily life activities: shopping, maps, information about restaurants, land, knowledge, science, etc. By providing the ability for students to use these tools in their education besides using them for entertainment or social activities, this may have positive impact on education (Nusir, 2012).

5.3 Characteristics of Multimedia

Contemporary teacher should have access to appropriate way to design technology driven learning atmosphere. Thus, learners can take advantage of multimedia capabilities without losing focus. Gagne's (1985) nine events of learning include (1) gaining attention, (2) informing the learner of the lesson objectives(s) and activating motivation, (3) simulating recall of prior learning, (4) presenting the stimulus material, (5) providing learning guidance, (6) eliciting performance, (7) providing feedback, (8) assessing performance, and (9) enhancing retention and learning transfer. Many of the multimedia features correspond to Gagne's events and represent the functions performed by instruction that support the internal learning process (Stemler, 1997).

There are many ways to featurise Multimedia in terms of Screen Design (Visual elements: Colors, text, graphics, animation), Learner control and navigation, use of feedback, student interactivity, and video as well audio elements (Grabinger, 1993). There are three basic events that a designer can try to enhance: (a) getting the learner's attention, (b) helping the learner find and organize pertinent information, and (c) integrating that information into the learner's knowledge structure. Rather than focusing on individual text elements, multimedia developers should instead focus on arranging text, graphics and audio visual elements in order to create organized, structured and visually interesting screens. Design multimedia program in such a way that leads better understanding of particular concept. Proper Synchronization of component of multimedia provides better platform for the learning. One should take

care of elements like Screen design, Interaction, Navigation, Learner Control, Colors, Graphics, Animation, Audio, Video etc. while construction of multimedia package. Status and progress information, navigational buttons, content display control buttons, and illustrations should be used and graphic devices such as shading, lines, and boxes should be used to separate one area from another.

Screen Design:

Screen design includes proper amalgamation of textual and media elements to present sequenced content in order to facilitate learning. Each instructional screen in a multimedia package must provide effective instruction, appropriate navigation tools, and visual aesthetics. Screen design plays the same role as "gaining attention" in Gagne's events of instruction model. It serves as the internal cognitive structure that prepares the stage for learning (Stemler, 1997).

Good screen designs are expected to fulfill a number of requirements: (a) focus students' attention, (b) develop and maintain interest, (c) promote processing, (d) promote engagement between the student and lesson content, (e) help students find and organize information, and (f) facilitate lesson navigation providing cognitive benefits in the students' ability to perceive, organize and integrate information (Hannafin & Hooper, 1989). Some of characteristics of Screen design for effective learning according to as per Hannafin & Hooper (1989) and Milheim & Lavix (1992) are focusing on aspects like 1) Screen design should reflect balance among learning attributes, content factors and processing requirements of the learning task. 2) All the components should be correlated with each other. 3) To avoid confusion and overwhelming, screen should be as simple as possible. 4) People read text on a computer screen at a rate 28% slower than reading from a book. It is recommended that developers utilize as many screens as needed and not fill individual screens with text information. 5) Indentation, leading sentences, and text chunking strategies are also equally valuable for both print and computer display. 6) Well designed screens should visually stimulate, be easy to read, and exhibit no annoying or distracting features. 7) Highlighting text as per necessity could be fruitful for the students. Similarly flashing may destruct students' attention. 8) Certain parts of the screen should be associated with specific tasks such as titles or headlines, operational instructions (navigation buttons), and areas for help or a glossary etc.

Well-designed screens allow for maximum learning from the materials while providing the student with appropriate control of the learning process. It causes students to develop and maintain interest in lesson content, promotes the engagement of the student with the material, and facilitates deep processing of important information. Screen designs should aid the student in the complex process of taking the information out of the program and integrating it into his or her own conceptual knowledge base.

Interaction:

Multimedia allows for individualized learning, making students active participants in the learning process. By enabling the individual to interact with and control the flow of information with the computer. The instructional events of the lesson, with which the students must interact, should be based on a model of events of instruction that are related to a known organizer for their thinking similar to Gagne's nine events of instruction (Stemler, 1997).

Navigation:

There is a great need to develop interfaces with orientation indications that help students navigate through large multimedia databases. Navigation and management features serve to enhance learning and make an interactive multimedia module easy to use. Characteristics of good Navigation pane according to Hannafin & Hooper (1989), Park & Hannafin (1993) and Milheim & Lavix (1992) are 1) Navigation should be provided within the system and for accessing online support. 2) Navigational item location should be consistent throughout a program so a student does not have to search for the buttons. 3) A screen design template should be established and used consistently. 4) An effective screen design often includes buttons or hot spots to quit the program or to access die next screen, previous screen, help screens, glossary and main menu. 5) To give more complete control of the program to the learner, carefully selected words or icons should be used with navigational keys in the program. 6) Universal icons like play, stop, and pause for video or audio clips should be used when possible. 7) The navigational bar containing the icons should be placed at the bottom of the screen and the location of the icons should remain constant throughout the multimedia module.

Learner Control:

Greater control over the learning event promotes satisfaction. Students feel more responsible for their own learning process. Prior knowledge, learner ability, the use of structural guidance, and procedures for monitoring lessons all influence the effectiveness of learner control environments. Hannafin (1989), Schwier & Misanchuk (1993), Overbaugh (1994) explained characteristics of Learner Control as 1) Students should be given more control over the content, access to the content, and interaction with the multimedia content. 2) Instructional components should be clearly identified and separated to facilitate students' selection and sequencing according to their needs and interest. 3) Do not provide full learner control of content when all topics in the instructional presentation are required for successful completion of the program and there is a hierarchical order to the materials.

Browsing can be done by providing students with a list of the topics covered in the program through the use of a menu, list of navigational and informational choices, and with content search glossaries.

Color:

The use of color in multimedia modules can be effective, but also should be considered carefully. Color should be used cautiously, consistently for signifying and highlighting; and a consistent color scheme should be used for the entire presentation (Merrill, 1983; and Merrill & Bunderson, 1979). Furthermore characteristics can be extended viz. Not more than six colors be used per screen, brightest colors can be used for the most important information, use significant contrast between text and a background color to provide a higher degree of text readability, always use dark letters on a light background for text, very hot colors should be avoided since they may appear to pulsate on the screen.

Graphics:

Multimedia software can easily present information in either text mode or graphics mode but, when possible, both should be used. Students who do not understand information delivered by text quite often will understand it if it is presented or augmented by various visuals. In particular, difficult topics sometimes become easier to understand when augmented by graphic displays. Some of the essential characteristics of Graphics as suggested by Park & Hannafin (1993), Sponder &

Hilgenfeld (1994), Hooper & Hannafin, (1988) are highlighted here- 1) Photos and scanned images can be used to illustrate almost any fact, concept, or procedure. Information translated in form of image tends to better understanding of concept. 2) Information presented in text is often better recalled and retained when supplemented with pictures. 3) Text based instructional strategies from books often reappear in the form of pictures or graphics in multimedia training. Caution should be exercised when using graphics for decoration or cute effects; used in this manner, graphics can become tiresome and/or interrupt the flow of the lesson.

Animation:

Most graphics or pictures can be animated to illustrate points, teach facts or concepts, motivate students, and demonstrate procedures. Animation can be use for both for the explanation of dynamic processes and for improving the impact of presentation. It is generally recognized that the use of animation can offer many subtle benefits such as highlighting key information, enhancing student's interest and facilitating recall. When the animation is congruent to the learning task, it can offer instructional benefits to the learners (Rieber, 1990).

Audio:

Many multimedia programs contain text along with Audio as a critical instructional component, which reduces difficulties of poor students. It is easier to complete lessons which use audio extensively to present information (Orr, Golas, & Yao, 1994). The combination of visual presentation with audio explanation delivers information in an easily understandable format. Audio should be designed so that the leaner can interrupt the audio at any time and continue the program. Whenever audio is used to support text, it is important to provide a way for the learner to pause or repeat the sound. Students can go through a text passage more than once, or may want to pause the audio to study an unfamiliar word. Prerecorded readings of teacher-directed instructions in multimedia modules were effective because (a) they focused only on the most important information necessary for understanding the text, (b) they included direct and explicit instruction, and (c) students were familiar with this type of traditional (lpek, 1995). Orr, Golas, & Yao (1994) suggested precautions before creation audio narrations like- 1) Audio presentation should facilitate visualization images that will be presented on the screen during the narration. 2) Use style and tone

appropriate to students' language ability, subject matter, knowledge and vocabulary. 3) Write the script for the ear and not for the eye. 4) Keep the language simple, use the active voice and be direct. 5) Make the transition from one concept to another clear. 6) When possible, provide a corresponding visual for every piece of narration.

Video:

Multimedia programs can be used to present information in many exciting ways by combining different components with instruction. Instructional video including information about particular things, strategies, components of learning etc. is often a major element of multimedia software, but computers need special hardware and/or software to display video. Alongside, it consumes a lot more storage space than simple animations. An abstract video segment may serve well as the medium for an advance organizer and for a brief lesson summarization. Appropriate synchronized audio and video with content reinforce the student to understand the concept (Taylor, 1992). Hooper & Hannafin (1988) have found that media that employ both print and video are likely to result in deeper processing than a medium that employs just print. Multimedia instructional packages become nightmares when designers try to dump anything and everything into a single program simply because the capability is there. Audio and video should be used only when they will enhance learning of the content; overuse of both can be distracting.

Multimedia can provide an enhanced and augmented learning experience and it can provide long term benefit to all. Multimedia enables learning through exploration, discovery, and experience. With multiple Sensory Approach, the process of learning can become more goal oriented, more participatory, flexible in time and space, unaffected by distances and tailored to individual learning style and increase collaboration between teachers and students.

5.4 Principles for the Design of Multimedia Learning Package

Richard Mayer and his colleagues at the University of California at Santa Barbara have conducted experiments on how to best use of audio, text, and graphics to optimize learning in multimedia. Mayer's principles for the design of multimedia learning (Mayer, 2001) are presented as follow:

Multimedia principle: Students learn better from words and pictures than from words alone. Proper amalgamation of text, images, audio, video, graphics in multimedia package leads to better learning.

Segmenting principle: Students learn better when a multimedia lesson is presented in learner-paced segments rather than as a continuous unit. Content of the lesson should present in segments as per the requirement of the learner. Proper navigation helps students to study better. They can jump easily from one point to another.

Pre-training principle: Students learn better from a multimedia lesson when they know the names and characteristics of the main concepts. Orientation of the multimedia and content presented under helps students to recognize names and characteristics of the concepts. Along with that user's module along with package also increase interest of the students.

Modality principle: Students learn better from animation and narration than from animation and on-screen text. Researches also proven learning through animation and narration leads to better learning.

Coherence principle: Students learn better when extraneous words, images, and sounds are excluded rather than included. Selection and use of words, images and sounds is always important because inappropriate selection leads to destruction.

Signaling principle: Students learn better when the words include cues about the organization of the presentation. It is always important to guide students when they really stuck at any stage of learning. Necessary buttons in form of link help students to jump one page to another as per their requirement as well as navigation bar also helps students when they need help.

Spatial contiguity principle: Students learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen. Organisation of content presented on screen is important for better and effective viewing.

Temporal contiguity principle: People learn better when corresponding words and pictures are presented simultaneously rather than successively. Again organization on screen should be appropriate for better learning. Students should visualize concept at

a same time. Proper presentation in form of image and text serve the purpose for the same.

Personalization principle: Students learn better when the words are in conversational style rather than formal style. Presentation of content should be in continuing form. Shifting from one topic to another should also be in continuing form. So students sustain their interest in learning.

Voice principle: Students learn better when words are presented in form audio or video form. In which voice should be in understandable language as per the context of learning. As per the requirement content should present in regional language also.

Image principle: Students learn better when content presented along with image. But selection of image is essential that is as per the requirement of the content and should provide effective presentation of the content.

Individual differences principle: It is always challenging for teachers to present or teach concept in Indian context because of diversity in classroom. Multimedia design should cater requirement of all kind of learners. Presentation should be stronger for slow learners. Multimedia design should in a way that helpful to students in self-learning.

Mayer's principle for multimedia learning helps multimedia designer to develop multimedia learning package and characterize multimedia for the maximize use of multimedia. With all these advantages of Multimedia based teaching, research in present study developed multimedia learning package covers features like Screen Design, Graphics, Learner Control, Navigation, Color, Audio- Video based on Mayer's principle of multimedia package design and used as per the accommodation and feasibility in Multimedia learning package. The present study was designed based on the following rationale to integrate ICT in teaching learning.

6.0 Rationale of the Study

Information and communication has opened a new avenue to stay connected beyond boundary. Present generation is far ahead in using technology. They can use smartphones, laptop, tablet better than us. However, problem is that they are not using their potential for the educational purpose. They are using it for socialization,

enjoyment, exploration but very few are using for education purpose. One of the reasons for not using ICT in education is that students are not aware of it and some extend teachers are responsible for that. Students are techno-savvy, techno-intelligent i.e. they know where and when to use which technology. Government has initiated to develop smart classroom by providing software, Hardware and requires infrastructural facilities under different schemes (MHRD, 2012). Many practices have already been initiated in the form of innovation by schools and different educational organizations. But still there is lacuna in utilization of ICT laboratory facilities and provided educational software and apps. Teachers are not aware of such educational application of technology, apps, games etc. It is highly essential that today's teachers are techno-smart to deal with the learners' expectation. It is essential that new teachers should be trained to use ICT for effective teaching learning. With the help of ICT, virtual classroom, video conference, e-learning, Internet collaboration is possible. Teachers can use ICT to deliver his/her lesson more effectively by using different Medias like audio, video, animation, picture etc. In the same line, different committees and commissions like NPE (1986), National Policy on Information and Communication Technology (ICT) in School Education (2011), NCFTE (2006), UNESCO (2002, 2009), UNESCO ICT-CFT (2011), NKC (2009), FICCI (2009) have also recommended for integration of ICT in classroom and train novice student teachers in such a way that in future they can use technology in classroom effectively.

Pre-service teacher education is a preparation stage for the future teachers. It would also provide student-teachers with needed experiences prior to entering classrooms and give them a common frame of reference to discuss remedies for problems they might encounter. Student-teachers at this stage grooming to be a good teacher and courses like ICT in education viz. use of CAI, CALL, CALM, e-learning, virtual learning, multimedia based learning in teaching learning and develop lessons/learning experience based on integration of technology in teaching can be the good strategy to make effective use of ICT in teaching learning. Pre-service student-teachers are expected to contribute to class teaching through a variety of asynchronous learning tools outside the classroom. Hence, there is an urgent need for proper implementation of ICT and ICT related tools in the present teacher education, if the quality of teacher training is to be significantly enhanced. NCTE (2010), UNESCO (2011) recommended that student-teacher should have knowledge about Microsoft Office

Word, PowerPoint, Excel, database management and creation, networking, e-mail, animation, subject specific tools, educational website, collaborative tools and integrate it into teaching learning practices. Student-teachers should be equipped with the knowledge of different skills, strategies and techniques to handle the subject matter according to the psychology of the student. Teachers should have capacity to engage students in teaching learning activity. Hence, teachers should know how to use web 2.0 tools for educational purpose, for sharing information, online collaboration, accessing and assessing information to guide students in proper direction. Multimedia-based courseware can be utilized to teach effectively use of ICT and make student aware about how to use technology in teaching learning.

Learning science at school level develops skills, abilities among students to solve problems of daily life, develops skills of observation, interest, and curiosity about the natural phenomenon, develops vocational and productive skills, scientific skills that link science learning to productivity. NCF (2005) also highlighted that teaching of science at school level should develop interest, curiosity, literacy, scientific attitude, expression, exposure, and make learning activity based teaching. But scenario of science teaching is not showing clear picture of quality science teaching at the secondary school. Status of science at school level is always questioned regarding quality teaching. Learning science is boring and mechanical (Kumar, 2002), the processes of science are separated from scientific content (Chunawala, 2006), science classroom is mostly teacher centred (Malhotra, 2006; Pillai, 2013), teachers use "TU PADH" method to teach science (Shelat, 2012) are few of significant remarks by the researchers. ICT can be use as a tool to make science learning active, interactive and realistic. Science teachers can make use of virtual learning, Internet, animation to make science subject more realistic. With the help of technology problem of proper visualization in science subject can be solved. Learning scientific principals requires experimentation, simulated experiments, learning by observing and all this can be easily done with help of various software applications. Basic knowledge about ICT and ICT tools will help student-teachers to maximize learning experiences in Science.

Apart from offering ICT as a compulsory and special course, integrated approach is needed in methods courses which will help student-teachers to understand the importance of skills like analyzing, accessing, skimming, scanning, etc. in a digital

world. Teachers are expected to know how to process raw data and use data management tools for efficiently managing learning and effective presentation of the data. Along with that teachers are also expected to take advantage of Internet and Intranet and locating useful information for the development of lesson plans. Integration of technology into real time teaching, use technology based tools to evaluate technology-based student projects including multimedia, word processing, database, spreadsheet, PowerPoint, and Internet/telecommunications. Teacher also can use e-learning, virtual learning and different web 2.0 tools in teaching learning. As these are 21st century skills, teacher must change their role in the technologically driven education to meet the requirement of teaching. Multimedia Learning Package will be an effective tool for developing understanding and skill to use different applications. The focus of the program was on the processes of learning, about ICT and its applications. Developing ICT skills among pre-service trainees enabled them to plan and implement ICT integrated learning experiences or creating learning environment for students. Interactive CD-ROMs and blended learning environment have been proved effective in teaching students wide variety of subjects. Thus, teachers can take advantage of web 2.0 tools and ICT facilities for effective science teaching. The following research questions were raised.

- ✓ Whether multimedia can be used to enhance ICT skills of student-teachers?
- ✓ Whether multimedia can be used effectively for teaching learning in science?
- ✓ Whether student-teachers studying through multimedia do better as compare to student-teachers studying through traditional method?
- ✓ Whether learning through multimedia has impact on perceptions of student-teachers towards Information and Communication Technology?

These were the research question raised by the researcher, in order to seek answers to the above raised question, the presented study was conceptualized to integrate ICT for teaching science. This would develop skills and understanding among pre-service teachers to conceptualize and learn various applications of the technological tools and software.

7.0 Statement of the Problem

Developing and Implementing Multimedia Learning Package for Enhancing ICT Skills of Student-Teachers at Secondary Level

7.1 Objectives of the Study

1. To develop multimedia learning package for enhancing ICT skills at pre-service level.
2. To implement multimedia learning package for enhancing ICT skills at pre-service level.
3. To study the effectiveness of the developed multimedia learning package with respect to academic achievement in pre-test and post-test of student-teachers of experimental and control group.
4. To study effectiveness of multimedia learning package in terms of ICT based lesson plan developed by student-teachers of experimental group.
5. To study the change in perception of student-teachers of control and experimental group with respect to ICT skills and application of ICT in Education
6. To study the reaction of the student-teachers of experimental group on developed multimedia learning package.

7.2 Hypothesis of the Study

- There will be no significant difference in the mean achievement score of the student-teachers of experimental and control group in pre-test and post-test.
- There will be no significant difference in the perception of the student-teachers regarding ICT skills and application of ICT in Education of experimental group before and after intervention.
- There will be no significant difference in the perception of student-teachers regarding ICT skills and application of ICT in Education between control and experiment group.

7.3 Operationalization of the Terms

Effectiveness: Effectiveness in the present study is the difference between mean score of the student-teachers at pre-test and post-test with respect to given treatment through developed Multimedia Learning Package.

7.4 Explanation of the terms

Multimedia Learning Package: Multimedia Learning Package consisted of various features like learning resources in form of text, audio, video, graphics using software packages like Microsoft Word, PowerPoint, Excel, Publisher. Development of movies/videos with the help of Microsoft Moviemaker and PICASA Software, development of educational website with the help of Google Site, educational uses of web 2.0 tools like Social Networking Sites, Blogs etc. Face to face interaction, Discussion/Activities/Demonstration etc. and CD of Multimedia Learning Material prepared for self-learning.

ICT Skills: The study includes ten ICT skills viz. Skill of Data Processing, Skill related to Accessibility of Technology, Skill related to Technology Integration, Skill related to Media Design, Skill of Collaboration and Communication, and Skills related to Web enhanced Learning Environment. These skills were assessed based on the lesson plan developed by student-teachers in teaching of Science at Secondary level.

7.5 Delimitation of the Study

Present study was delimited to the student-teachers of B.Ed. offering Teaching of Science as one of the method and having English as medium of instruction, for the academic year 2014-15.