Chapter 5

Summary, Major Findings and Conclusion

5.0 Introduction

Education is a socially oriented activity and it develops all kind of skills among person. In order to meet the growing demand for higher education, Information and Communication Technology (ICT) be explored in the form of technology enhanced programs. With the world moving rapidly into digital media and information, the role of ICT has become important and this importance will continue to grow in the knowledge and technology based society. Many Governing bodies like National Knowledge Commission (2009), National Curriculum Framework (2005), UNESCO (2002) has highlighted Importance of ICT in Education and given emphasis on the mechanism for feedback and subsequent interaction between teachers and the student, especially for pedagogical techniques that are new or require more continuous innovation from the teacher. This indicates the shift in emphasis on 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. Every technology has its pros and cons while utilizing. Due to ever changing nature of technology, new digital technologies present new challenges to teachers who are struggling to use technology in their teaching. Thus, well trained and skilled teachers will be able to give quality education to the learner by exploiting ICTs and existing constraints within education system may be overcome.

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. 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. For effective teaching, amalgamation of all three components is essential and teachers should have skills to use TPCK (technological pedagogical content knowledge) in the classroom (Koehler & Mishra, 2009). ICT can be creatively drawn upon for professional development of ICT Skills among pre-service and in-service teachers (NCF, 2005). 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. 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. 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). 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. Thus, teachers needs 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.

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. ICT skills can be categorized in 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, skills related to web enhanced learning environment. These 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.

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. 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. 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.

Science is the systematic study of the structure and behavior of the physical and natural world through observation and experimentation. 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). 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) revealed that teachers often deliver 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). Thus, learning science at school level develops skills, abilities among students to solve problems of daily life, develop 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; and Pillai 2013).

Multimedia and online teaching and 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). 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.

Multimedia has evolved through changes in technology, changes in users and learners, and changes in our understanding of the teaching and 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). 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.

Mayer's principle for multimedia learning helps multimedia designer to develop multimedia learning package and characterize multimedia for the maximize use of multimedia. 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. 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 previous studies and rationale to integrate ICT in teaching learning.

5.2 Review of related Literature

Reviewing study is an attempt to give a brief sketch of researcher carried out in the field of technology and multimedia. Sources used were Survey in Education, Dissertation Abstract International, Internet and educational journals etc.

Review work for this study is divided into four parts:

- Studies related to Utility of Different Media in Teaching Learning
- Studies related to Technology Integration in Teaching-Learning
- Studies related to Attitude of Student-teachers on ICT Integration
- Studies related to ICT Skills

5.2.1 Studies related to Utility of Different Media in Teaching Learning- Major Observations

- ❖ Researcher came across studied related to different forms of media integration across primary to tertiary level.
- ❖ Most of studies carried out in India have similar kind of methodology, tools and data analysis techniques. Majority of researchers choose quasi experimental design- control and experimental group pre-test post-test design.

- Tools used by the researchers were achievement test, reaction scale, opinionnaire, etc. Most of researchers used t test, f test to analyse data in terms of achievement of students. Many researchers took gender as variance and used ANOVA, ANCOVA as data analysis technique. Researchers also used frequency, percentage, chi-square to analyses data obtained through opinionnaire, reaction scale. Different studies revealed that different media integrated teaching has positive influence on student's achievement and students found multimedia based teaching learning effective.
- As most of study revealed, there were significant difference in achievement of students in pre-test and post-test via using different media.
- Few studies adopted qualitative approach; many studies followed mixed method approach.

5.2.2 Studies related to Technology Integration in Teaching-Learning-

Major Observations:

- In the earlier studies, researchers ensured different modes of integrating technology in teaching learning using different analysis methods, tools and techniques. Researchers used variety of tools and techniques e.g. Panel discussions, presentations by learners and teachers, submission of assignments, feedback from students, video recording, workshops, multiple choice tests, guest lectures, case study, projects, remedial teaching, disseminating instructions, easy evaluation methods, online objective testing, student-created projects, experimentations, e-merging learning, hypermedia, interactive multimedia, multimedia presentations, virtual reality community, personal information management programs, departmental information management programs, documentation of teaching materials etc. That gives evidence of passible alternative modes of technology integration in learning.
- Researchers adopted different research design and methods like experiment design, qualitative research, survey study, mix method to carry out study. Researchers used t test, f test, ANOVA, ANCOVA, chi-square, triangulation of data, percentage, frequency to analyze the data

- ❖ Results of the study revealed that utilization of different modes in teaching learning enhance student interest, achievement, motivation. Students' have shown positive attitude toward e learning platform.

5.2.3 Studies related to Attitude of Student-teachers on ICT Integration-

Major Observation

- ❖ Majority of Studies were of survey typed. Researchers studied attitude, potentiality, motivation level, level of application, readiness of teachers, feasibility requirement etc. Researchers adopted qualitative as well as quantitative approach. Some researchers adopted experimental design also.
- ❖ Researchers identified different attributes influencing ICT integration specifically multimedia integration:
    - Time and assess issue
    - Identify belief, relevance, relatedness and personal value
    - Necessity of innovation
    - Lack of pedagogy as per relevance
    - Lack of skilled teachers
    - Appropriate infrastructure facility
    - Teachers role as guidance, mediation, management
    - Provision of technical and emotional support

5.2.4 Studies related to ICT Skills-

Major Observations:

- ❖ Studies revealed that ICT skills are essential for the teachers to integrate ICT in teaching learning. It is essential to cope up with present needs of the society.
- ❖ Researches revealed that multimedia could be effective tool for development of attitude of teachers. It can be effective for enhancement of ICT skills among teachers. Researches have also evidence that it develops ICT skills, problem solving skills, basic computer literacy and typing skills, comprehension, mental ability pertaining to motor skill etc.

5.2.5 Implications of Review of Related Studies

- ❖ After reviewing researches on use of multimedia and ICT in teaching learning process, it was found that use of ICT is well advanced and highly successful in countries like USA, UK, China, Australia, Malaysia etc. While many studies revealed lack of infrastructural facilities create obstacles for development and implementation of multimedia in teaching learning process in the context of India.
- ❖ There exists a great deal of evidence as to the different ways in which young students use technology and internet to support their learning. Review of students explored utilization of different medias particularly in form of CAI, CALM, CAiLL, and Computer Managed Instruction (CMI), Audio-video Media, Computer Based Multimedia Leaning Package (CBMMLP), animation, e-learning approach, online learning and multimedia. Research across the globe is influenced by ICT and provide evidence of improvise integration of ICT all the way from primary level to tertiary level. While the literature review carried out here shows that research in India is somewhat limited in certain areas, particularly regarding evidence on the comparative benefits of different online teaching methods and multimedia at tertiary level. And there are few studies at teacher education level.
- ❖ the research surveyed has evidenced the impact of different modes of ICT integration like using CD-ROM, multimedia instructional system, multimedia information package, computer assisted instruction, computer based instruction, computer based interactive multimedia, multimedia animated demonstration, audio-video instructional package, e-learning, web based learning, hypermedia etc. to deliver learning material. But still, in Indian context self-learning strategies especially at higher level are very less. Strategies like integrating learning with the help of web 2.0 tools, social networking, website, webportal have evidenced of possible alternative modes of technology integration in learning.
- ❖ Researchers have adopted different research designs like experimental design, qualitative research, survey study, mix method to carry out study in the area of ICT. Researchers have used t test, F test, ANOVA, ANCOVA, chi-square, triangulation of data, percentage, frequency to analyze the data. The issue

highlighted by review is that research in this area tends to be either qualitative or quantitative, rather than using a mixed methodology. There is wide scope of utilizing tools and techniques like- panel discussions, presentations by learners and teachers, submission of assignments, feedback from students, video recording, workshops, multiple choice tests, guest lectures, case study, projects, remedial teaching, training the absentees, disseminating instructions, easy evaluation methods, online objective testing, student-created projects, experimentations, documentation of teaching materials, interview, online discussion etc.

- ❖ Though different tools are used to develop multimedia package like Macromedia Flash MX, Microsoft Excel, and Microsoft Direct. More efforts are needed to create new programs using multimedia elements and multimedia authoring tools to fulfill a content-rich learning software and courseware.
- ❖ Researches have evidenced that multimedia packages in subjects like science, mathematics, language learning were found to be effective. Results have revealed that utilization of multimedia in teaching learning enhances students' interest, achievement and motivation. Few studies have identified factors like belief, relatedness, personal values, motivational factors to be kept in mind while development and implementation of multimedia based teaching at pre-service level. Multimedia can be effectively used for enhancement of ICT skills among teachers. Researches have also evidenced that it helps in developing different skills like problem solving skills, basic computer literacy and typing skills, comprehension, mental ability pertaining to motor skill etc.

5.3 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.

5.4 Statement of the Problem

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

5.5 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.

5.6 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.

5.7 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.

5.8 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.

5.9 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.

5.10 Methodology

Researcher adopted experimental design for the present study presented as follows.

5.10.1 Design of the Study

The present study was experimental in nature. The researcher adopted Quasi-experimental Design. Pre-test Post-test Nonequivalent group Design was chosen for the present research. The researcher did the real-time experiment for the present study, where it was difficult to use randomization for the selection of samples for experimentation and thus the researcher took the sample purposively.

5.10.2 Population of the Study

The population for the present study consisted all B. Ed. Student-teachers studying in English medium B.Ed. Institutions of Gujarat.

5.10.3 Sample of the Study

Sample for the present study was selected purposively considering the experimental nature of the present study and keeping in mind the feasibility aspect of the experimentation. Two teacher education institutions of Vadodara city were taken purposively as the sample for the present study. Student-teachers of the Department of Education, The Maharaja Sayajirao University of Baroda were selected as experimental group and student-teachers of Navrachna University were selected as the control group. There were 48 and 47 student-teachers in the sample of experimental and control groups respectively having Science/Chemistry/Physics/ Biology as one of their method. Pre-test was administered to both control and experimental group. Total 34 student-teachers attended intervention program fully while 32 student-teachers of Navrachna University attended both the pre and post-test. So, the sample comprised of 34 student-teachers of The Maharaja Sayajirao University of Baroda considered as experimental group and 32 student-teachers of Navrachna University considered as control group.

5.10.4 Tools and Techniques for Data Collection

Achievement Test: The researcher constructed achievement test as a pre and post-test to test academic achievement in ICT Skills among student-teachers. Achievement test was developed based on blue print of the achievement test. The achievement test constituted the questions covering different aspects like knowledge, understanding and ICT Skill. It covered all types of questions related to awareness about the use of ICT in Education, knowledge about educational software packages in Education, ICT skills and application of Web 2.0 tools in Education. The constructed achievement test was given to the experts in the field of Technology and Education for the purpose of its validation. The suggestions of the experts were noted down and incorporated then it was revised. The achievement test is given in appendix I and Blueprint of the achievement test is given in appendix II.

Perception Scale: Perception Scale was prepared by the researcher to study the perception of student-teachers regarding Information and Communication Technology and related skills. Perception scale having twenty five statements covering statements comprising of skills of data processing, skills of technology integration, skills of media design, skills of communication and collaboration in education, skills of web enhanced learning environment etc. Student-teachers marked their perception on a 5 point Likert scale ranging from 'strongly agree' to 'strongly disagree' through 'agree', 'can't say', and 'disagree'. Student-teachers were supposed to show their reaction by putting a tick mark (√) in the appropriate box for each statement. For validation, the perception scale was given to the experts from the field of Education and ICT for their suggestions and accordingly their suggestions were incorporated in the perception scale. The perception scale is given in Appendix III.

Reaction Scale: Reaction Scale was prepared by the researcher that was of 5 point scale to know reaction of the student-teachers toward developed multimedia learning package used for developing ICT Skills among student-teachers. Reaction scale having twenty five statements covering various aspects of the multimedia learning package like clarity of concepts presented under package, comprehensiveness of the package, ICT skill development through package, usability of the package, utility of the package etc. The five points of reaction were ranging from 'strongly agree' to 'strongly disagree' through 'agree', 'can't say', and 'disagree'. Student-teachers were supposed to show their reaction by putting a tick mark (√) in the appropriate box for each statement. For validation, the reaction scale was given to the experts from the field of Education and ICT for their suggestions and accordingly their suggestions were incorporated in the reaction scale. The reaction scale is given in Appendix IV.

Rubrics: Rubrics was prepared to assess developed digital lesson plans and Powerpoint presentation by the student-teachers. There were total 25 marks assigned in the rubrics for all the items and components of developed lesson plans and 25 marks for the Powerpoint presentation too. Rubrics to assess digital lesson plan containing assessment criteria for the items of the digital lesson plan like unit summary, design of instructional objectives, design of instructional strategies, use of materials, organization and presentation, use of technology, way of assessment etc. Rubrics to assess powerpoint presentation containing assessment criteria for title

slide, content presentation, organisation of content, use of audio and video, use of images/charts/smartArt, use of animation and slide design, references and websites referred etc. Digital lesson plan and PowerPoint presentation were analyzed based on rubrics and marks were given out of 25 marks for the developed lesson plan and PowerPoint presentation. Rubrics to assess digital lesson plan and Powerpoint presentation is given in appendix V.

5.10.5 Development of Multimedia Learning Package

The researcher developed multimedia learning package for enhancing ICT skills. In order to develop a multimedia learning package the researcher followed different stages of its development.

- Selection of the content and categorization in terms of topics and sub topics
- Assembling the features with text, pictures, audio, video graphics in multimedia learning package
- Developing video script and video of the content to be presented in the package
- Validation of Multimedia Package
- Tryout- The pilot study

5.10.6 Procedure of the Study

Phase 1: Development of Tools for Data Collection

Present research has total four tools to collect data from the student-teachers. Researcher developed tools like Achievement test, Reaction scale, Perception scale, Rubrics for the data collection. Researcher identified components of the tools. After identification of the components, researcher designed blueprint for the achievement test, outline of the perception scale, reaction scale, and rubrics. After drafting and reviewing many time, draft of the tools were prepared. Experts from the field of ICT and Education validated the tools. Valuable suggestions were collected and noted down. Suggestions were incorporated after discussion with guide. After drafting tools many times, final draft of the tools was prepared. All the tools- achievement test, perception scale, rubrics, reaction scale are given in the appendix I,III,,IV and V respectively.

Phase 2: Development of Multimedia Learning Package

Multimedia learning package was developed in the subject of ICT in Education as a combined output of varied aspects in the form of text, audio, video and animation. During design integration of ICT components and content were the main constituents. Along with this context is also vital while integration of technology. So it was important to select appropriate media and learner control along with content selection. The researcher took care of all these components, selected topics and designed learning material carefully, took care while use of text, images, audio and video carefully. Researcher also took care of learner control during development of the package. Researcher used language that is understandable for all learners. Necessary software like M. S. Office 2010 package, Adobe Reader, Picasa, Skype, VLC player etc. were also given along with Fonts setup CD provided to the student-teachers. User's Manual was also given along with CD.

Phase 3: Administration of the Pre-test and Perception Scale

Researcher took the required permission from teacher education institutes of the control and experimental group to conduct study (Permission letter is given in Appendix VII and VIII). Researcher administered pre-test and perception scale on student-teachers of the control and experimental group. Both the control and experimental group students were informed about the test before implementation. Time duration of the test was fifty minutes for the 50 marks' achievement test, and 20 minutes for the perception scale.

Phase 4: Implementation of the Multimedia Learning Package

Implementation of the developed multimedia learning package was done after the administration of pre-test and perception scale. Researcher managed total 40 periods in the morning time before college time and in regular classes in the timetable each with the duration of 45 minutes from August to March month during the academic year of 2014-15 for the implementation of the multimedia package. The researcher taught to the whole experimental group for the eight months period with the help of the developed multimedia learning package. Initially orientation was given about the program and multimedia learning package. Researchers took sessions and taught student-teachers of experimental group. Along with the process of teaching-learning

the researcher acted as a facilitator and guide while practical work. To facilitate self learning, CD of the multimedia learning package was given to all the student-teachers of the experimental group. During the same duration the control group was taught by their own teacher through traditional method.

Phase 5: Post-Test

After intervention of the program, the student-teachers were given post-test, perception scale and researcher collected Digital lesson plan and PowerPoint presentation developed by the student-teacher in Science subject. Along with that researcher also implemented reaction scale to seek the reaction of the student-teachers of the experimental group about multimedia learning package.

In the last week of March 2015, researcher completed the implementation program for experimental group through multimedia package. After intervention researcher implemented same achievement test and perception scale as a post test on both the control and experimental group. Same time was given to answer achievement test (50 mins) and perception scale (20 mins). The reaction scale was administered only on experimental student-teachers of experiment group. Enough time was given to the student-teacher to mark their opinion. Similarly Digital lesson and Powerpoint presentation were collected from the student-teachers of experiment group in the form of CD.

5.10.7 Procedure of Data Analysis

Data collection was done in 3 Phases during Academic year 2014-15.

1) By employing pre-test and implementing perception scale before intervention on both the control and experiment group student-teachers.
2) By collecting developed technology based digital lesson plan from experiment group student-teachers.
3) By employing post-test, perception scale and reaction scale after the intervention. Post-test, perception scale was employed on both the control and experiment group student-teachers and reaction scale administered only on experiment group student-teachers.

5.10.8 Data Analysis

The data collected through pre-test and post-test was analyzed by employing quantitative data analysis techniques. The non-parametric techniques was used to analyze the data as the sample was taken purposively. Mann-Whitney U-test was used to analyze the quantitative data collected through post-test as it is considered as the most powerful non-parametric equivalent of t-test of parametric family. The researcher calculated mean, Standard Deviation, Standard Error of Mean and Mann-Whitney U-test. For testing the significance between the perceptions of student-teachers of experimental group, non-parametric Wilcoxon Sign Rank Test was used to know significance before and after implementation of the package among experimental group's student-teachers. Researcher used Wilcoxon Rank Sum Test for two independent groups. To study level of change in perception between control and experiment group student-teachers, intensity index (II) was used by the researcher. Percentage, frequency and intensity index (II) for the reaction scale were used as data analysis techniques. Digital lesson plan was analysed with the help of percentage and frequency. Manual calculation and SPSS software were used to analyse data and major findings are presented below caption.

5.11 Major Findings of the Study

1. U-value and Z-value were found to be 823 and 4.185, respectively null hypothesis (Ho) of z, for $z \leq 4.185$, referring the table for normal probability, the two-tailed probability was found to be 0.00003 which is lesser than the decided significant level (α) i.e. 0.05. Hence the developed Multimedia learning package was found effective in terms of academic achievement in ICT compare to traditional approach.
2. Assessment of developed digital lesson plan revealed that 84.36 percent student-teachers were good with required ICT skills. Thus, it can be said that Multimedia-learning package can be useful in developing digital lesson plans and PowerPoint presentation in science.
3. Researcher used Wilcoxon Sign Rank Test to know significance of difference among student-teachers of control and experiment group. Z-value was found to be -4.374 and P value was found to be 0.0000 which is less than 0.05 and so null hypothesis is rejected means there is significant difference in perception of

student-teachers of experimental group regarding ICT and related skills before and after the implementation of the multimedia learning package. Thus, multimedia learning package was found to be effective in terms of perception of the student-teachers of experimental group regarding ICT and related skills.

4. Researcher used Wilcoxon Rank Sum Test for two independent groups. Z-value was found to be 4.33 as well P value found to be 0.000 is less than 0.05. Thus the null hypothesis can be rejected. Hence, there is significant difference in perception of control and experimental student-teachers. It can be said that multimedia learning package has significant impact on the perceptions of student-teachers regarding ICT and related skills.
5. Overall change in perceptions with respect to skill of data processing among control group student-teachers was 0.109 and 0.773 for the experimental group student-teachers. Therefore, change in perception regarding skill of data processing was higher in student-teachers of experimental group compare to student-teachers of control group.
6. Average change in perceptions with respect to skill of technology integration was 0.851 among students teachers of experimental group, that was higher than the change in perception among student-teachers of control group that was -0.039.
7. There was a positive change in perception with a value of 0.785 for the student-teachers of experimental group while -0.010 for the student-teachers of control group towards the Media Design.
8. Average changes in perception were 1.025 and 0.113 with respect to skill of web enhance learning environment for student-teachers of control and experimental group respectively. It could be observed here that there was positive change in perception in case of student-teachers of experimental group while negative change in perceptions for student-teachers of control group towards the use of social medias for the collaboration and communication.
9. The average intensity index was 2.88 for the statements related to the clarity of content presented under reaction scale. It shows that examples were helpful, teaching points were logically sequenced and demonstrations shown were relevant.
10. With the average intensity index 2.77 for the statements related to the comprehension of multimedia learning package, student-teachers found content

covered was sufficient and relevant with reference to content covered under each unit, illustration with example, relevancy of the content.

11. The average intensity index was 2.81 for the statements related to skill development through multimedia. It indicates that the multimedia package was useful in developing ICT skills, skills of information management, skills of media designing, skills of collaboration and communication, techno-pedagogical skills, skills of creating web enhanced learning environment and developing creativity.
12. Examples provided under multimedia learning package were easy to understand, clear and students found this approach interesting with the average intensity index 2.86.
13. Based upon the opinion of student-teachers, it can be said that student-teachers were in favor of utility value of multimedia package. The average intensity index was 2.84. Student-teachers showed their strong agreement with the learning materials and its utility as self-learning, strategies presented provided practical exposure, these learning experiences were helpful for planning digital lesson.

5.12 Implications of the study

The study conducted revealed the use of multimedia was an effective strategy for learning soft skills. The use of ICT in Education helped novice teachers to develop, plan and implement technology enabled lessons in science. The quality of the instruction had marked effect on teaching learning as seen from the perception of student teachers. As technology is changing very fast, in order to keep pace with the growing trend in technology use, todays teachers need to understand its importance and ways to integrate in classroom teaching. Teachers understand the use of technology beyond the classroom teaching. In Teacher education there should be a way to integrate technology and interact with student outside the classroom to solve the problem. Multimedia takes care of different learners and their learning style, it is an amicable tool to integrate and learn through technology.

- ❖ With these added advantages of technology enabled learning teacher be trained to integrate technology in their teaching learning to develop interest among students in learning.

- ❖ Study also revealed that science teachers be taught to give concrete learning experiences and make science teaching realistic.
- ❖ Engaging students outside classroom is a great concern and using the potentials of students in a right direction. Hence the use of applications of ICT tools be explored by the teachers to engage students outside class hours.
- ❖ Student-teachers need to be made aware of the latest technological advancement and adding it to their existing knowledge of technology.
- ❖ There should be online consortium of teachers to share resources which will work as a repository of knowledge.
- ❖ Technology can be used to connect learning to day to day life experiences, thus using multimedia tools learning science can be made meaningful for students.

5.13 Suggestions for the Further Research

There are several areas that needs to be explored and studied in relation to technology education at pre-service level as well as at school level. Following are some of the areas the researcher would like to suggest.

- ❖ To study the development of creativity using technological tools in teaching science at High school.
- ❖ To study the issues related to technology enabled classrooms.
- ❖ Development of metacognitive skills by integrating social media in teaching learning at pre-service level.
- ❖ Evaluating web-resources for development of problem-solving skills among student teachers
- ❖ To study potential of social media in developing life skills among pre-service student teachers.

5.14 Conclusion

The findings of the study has clearly indicated that the multimedia-based approach was found to be effective at Pre-service level. Therefore, it can be stated here that the significant difference in the post-test establishes the fact that multimedia approach helps a student-teacher to teach effectively in the classroom. Study also highlights that student-teachers liked self-paced learning. Learning the concepts was made easy and better with the help of multimedia learning package. Future teachers can develop

their classroom website and web 2.0 tools to collaborate students outside. Student-teachers also agreed to promote web 2.0 tools to increase interaction amongst students, teachers and parents. While studying the change in perception through multimedia learning package regarding skill of media design, it was found that experimental group student-teachers had favorable perception towards the use of multimedia and use of ICT in teaching learning. Student-teachers were able to master the skill to create videos, movie, storyboard related to contents and that may lead to better visualization of the scientific concepts. Multimedia based learning and developed multimedia learning package was also useful in developing digital lesson plan in the area of science. Present study also revealed that student-teachers of experiment group learnt ICT skills, which helped them to teach Science subject with the help of technology. The use of multimedia approach not only helped student to teach effectively but also helped the learners to learn in a better way. Hence, more encouragement is needed to create this awareness among other teachers.