APPLYING TECHNO-PEDAGOGY IN THE SCIENCE CLASSROOM: A CASE STUDY OF NEPAL

Tapash Das

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AN ABSTRACT

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Abstract Approved by: _____

Asst. Prof. Parbat Dhungana

Dissertation Supervisor

The development in technology and its use in teaching learning process have increased significantly in the global academia; however, Nepalese classrooms still remain dominated by conventional practices. This study focuses on excavating its (computer and internet facilities) reasons from the experiences of Nepalese Schools practicing techno-pedagogy. The study takes cases of four Schools aligning to interpretive inquiry design.

The study finds the schools evaluate techno-pedagogy as an essential tool for modern day's teaching learning. The study marks its use that can be meaningful by addressing some of the identified challenges in Nepalese classrooms; mostly, the teachers' knowhow with the technology as a pedagogical means; resistance to change; and negative multiplier effects of technology within the society has increased rejection to it. The economy is always a regular challenge in the least and middle-income societies and irregular power supply along with long hour power cuts, encourage teachers adhere to conventional pedagogy in the Nepalese Schooling. The master plan for 'ICT in Education (2013-2017)' can only materialize on addressing the noted challenges by the study.

Keywords: *Techno-Pedagogy, Education, Teaching Learning, Computer, Internet.*

_____ 18 August 2013

Tapash Das, Degree Candidate

DEDICATION

To my parents who always inspired me to live being honest, patient and truthful and worked as a buttress for pursuing my higher education dream.

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APPROVED

---------- 18 August 2013

Asst. Prof. Parbat Dhungana

Dissertation Supervisor

---------- 18 August 2013

Prof. Mahesh Nath Parajuli, PhD

Member, Research Committee

---------- 18 August 2013

Assoc. Prof. Bal Chandra Luitel, PhD

Member, Research Committee

---------- 18 August 2013

Prof. Bishal Sitaula, PhD

External Examiner

---------- 18 August 2013

Prof. Tanka Nath Sharma, PhD

Dean, School of Education

I understand that my dissertation will become part of the permanent collection of Kathmandu University Library. My signature below authorizes release of my dissertation to any reader upon request for any scholarly purposes.

---------- 18 August 2013

Tapash Das

Degree Candidate

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Tapash Das

Degree Candidate

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ABBREVIATIONS

ADB	-	Asian Development Bank
BEd	-	Bachelor of Education
CDC	-	Curriculum Development Center
CE	-	Computer Education
EESD	-	Environment Education and Sustainable Development
FAD	-	Facebook Addiction Disorder
GoN	-	Government of Nepal
IAC	-	Industry-Academia Collaboration
ICT	-	Information Communication Technology
IT	-	Information Technology
MoE	-	Ministry of Education
NGO	-	Non-Governmental Organization
OLE	-	Open Learning Exchange
OLPC	-	One Laptop per Child
PCK	-	Pedagogical Content Knowledge
SLC	-	School Leaving Certificate
SSRP	-	School Sector Reform Program
UNESCO	-	United Nations Educational, Scientific and Cultural Organization
USAID	-	United States Agency for International Development
WB	-	World Bank
WWW	-	World Wide Web

CHAPTER I

INTRODUCTION

Chapter Overview

Proper planning is always essential to reach any target; otherwise, the whole work could be misguided from its ultimate destination. It usually divides the whole process in different stages to fix the work plan. This planning is very important for the academic research because it strictly maintains time orientated framework for its stages. To give the proper essence of this research, this chapter contains on what condition it was started, what were the problems, objectives, research questions, significance, limitations and delimitations of the study.

Background

Since the time I joined the Environmental Education and Sustainable Development (EESD) course, I was thinking on what issue I would choose for my final dissertation. I always like to generate something new because creation is the art of life. I thought about different issues but could not conclude with any specific one. One day, I was working on my laptop, and then I suddenly got the idea that I could do a research on the impact of technological use in the classroom.

Since my childhood, I have much been fascinated by the technological things. To use and adapt with the new technological product is my hobby that always magnetizes me. Most of the technological inventions have been used to make our life more modern and standard though they have great potential risk factors for human destruction. Around us, we find the technological advancement as kinetics of every development. Technological fascination inspired me to choose a topic on

technological use in education. My educational background also helped me to think about the issue of technology and educational co-operation because I am a graduate in education. To narrow down my research area, I have fixed that my study area will be technological impact on science education.

Science refers to a system of acquiring knowledge. This system uses observation and experimentation to describe and explain natural phenomena. Science is an intellectual activity carried out and designed by humans to discover information about the natural world in which humans live and discover the ways in which this information can be organized into meaningful patterns (Gottlieb, 2012). Technology is one of the blocks of science. Students with the help of technology learn better in all major subject areas (Schacter, 1999). All these pieces of information create curiosity within me to see the technological impact on the Nepalese educational system. They include technology inside their education system as a tool for delivery instruction because of having better future as compared to other educational techniques (Schacter, 1999). I feel that we can do compromise with everything in life but not with education since our future prospect is largely dependent on it.

Now, environment education is disseminated in all courses in each grade of school as a cross-curricular activity because it is not only limited itself to the environment education course. For example, the science textbooks of grade nine and ten have the contents of *natural disaster, the universe, classification of living things, life cycle of insects, ecosystems, adaptations, evolution, cells tissues and organs, sense organs, skeleton systems, virus, stimulation and reaction, reproduction, reproduction of plants through spores, genetics, ecosystem, history of the earth, atmosphere*. Therefore, my course contents in EESD suit on carrying out a research on the science classroom.

Introduction

In education, teaching and learning are the two major processes, which ultimately make the difference on learners' mind, and thus affect knowledge, skills, attitudes, and the capacity of young people to contribute for contemporary societies (James & Pollard, 2012). In traditional concept, teachers teach and students learn accordingly, but in modern concept, teaching learning is an interactive process between teachers and students (Sampath, Panneerselvam, & Santhanam, 2007, p. 9). This teaching-learning process is known as 'pedagogy' in education. However, pedagogy covers all issues of teaching learning but earlier only teaching was under it (Pollard, 2010).

For teaching, a teacher can use different types of methods, tools, instruments, and other necessary things. As Egan (2005) says that a teacher can use any tools in his teaching for the benefit of students. By using the tools several times, s/he can understand the effectiveness of these tools in education (as cited in Tasar, 2007). Along with the passage of time, technology has been producing and improving all educational tools. We are getting different advantages from technologies, which create more dependency on these gadgets and gizmos. If we assess, than we will identify that in a day we cannot cross any single time without the help of technology (Sampath et al., 2007).

Teacher and student both are getting benefits from the technology. For teacher training, multi-media materials can be developed which enhance training materials, facilitating simulations, capturing and analyzing practice teaching, bringing the world experiences, modifying sources of materials and supporting and so forth for better teaching-learning (ICT in Education, 2011). Technology assist the students for their access to the study materials any time and from anywhere: lifelong learning and

continuous learning; increase learning motivation then regular time, and provide instant feedback which are very important for the students' (University College London, 2012). Not only normal students get benefit from technology but also the children with learning disabilities also get more support from the technologies than that of their teachers (Zorigian & Job, 2012).

Developing Techno-pedagogy

In modern education system, few words like- ICT (Information and Communication Technology), multimedia used classroom, multimedia enhanced institution, computer based instruction and so forth are very common. All these things are relatively new for education but actually, "Issac Pittman" a person from England, who thought about the distance education first time in the late 1800s, first invented the use of technology in education. Then in 1902, Charles Urban exhibited the first education films about the growth of plants, emergence of a butterfly, and undersea views. After that more technological instruments were produced and they in turn influenced education. However, after the invention of projectors, home base computers and vast use of internet facility, technology is being incorporated in education more strongly (Liu, 2012). Jaiswal and Mital (2005) also stated that after the World War II, improvement of computer has helped more to incorporate technology in education (as cited in Pudasinee, 2009).

Now, more schools are using technology as an instructional tool, not as a subject of instruction. Technology helps students to improve their technological skills within the context of the regular curriculum. Technological integration activities utilize the web, PowerPoint, excel, digital photography, interactive white boards, and so forth (Starr, 2011). "To learn from e-learning" a pilot project is currently running in few South Asian countries by Asian Development Bank (ADB), which will assist

students' learn from computers (ADB, 2012). Therefore, technological influence on education is increasing continuously.

The term 'techno-pedagogy' describes how technology is incorporated in the teaching learning process. In teaching, the teacher needs to use different tools and materials for giving proper concept about the respective issues and students always learn better if they have the replica of that situation, can participate in and experience it with the real life situation (Lovett, 2012). Conventionally, teaching style was more abstract for the students; they had to learn by heart rather than having the practical situation or see the real condition. However, in modern period, the teacher can visualize the situation in front of students with the help of technology, and they can feel the fact more clearly. ICT promotes more effective learning situation (Belland, 1998, as cited in Pudasinee, 2009). Audio, video, audio-visual, PowerPoint, internet and so forth are used as technological methods to teach in education (Sampath et al., 2007). Now all the things are in teachers' hand who can utilize the entire sources for effective teaching.

In the classroom, a teacher is the facilitator to guide or help all students to acquire learning and influence them for innovation that they can learn effectively and can feel learning. Therefore, the teacher needs to understand perfectly the use of teaching tools for every subject (Szucs, 2012).

The classroom facilities have impact on classroom environment and learning outcome (Mutalib, Sapri, & Rahman, 2011). To use technology in the classroom, we need mainly two types of facilities. In physical facility part, proper environment, continuous power supply, availability of technical devices, software and so forth are needed. We need to remember that effective teaching learning would not be possible without adequate physical facilities for the students' and teachers' (Khan & Iqbal,

2012). On the other hand, we need trained work force to maintain and use these technical devices in the classroom because proper training is essential rather than having all the facility in the classroom (Kaminski, 2009).

Technology can be incorporated in any subject; science is not apart from this. It is more appropriate to use technology in the science classroom because science always deals with technology (Moxley, 1989). Teachers in today's classrooms are experiencing students who are "digital natives" along with their parents and in some contexts; students are more proficient to use it than their teacher is (Martin, Sexton, Franklin, Gerlovich, & McElroy, 2010). As Ediger (1994) studied on technology in the 'Elementary Classroom' and found several positive points to student learning by the use of technology; (1) It increases interest even in rote tasks; (2) It provides purpose for learning; (3) It can attach meaning to an ongoing lesson; (4) It provides opportunities to perceive knowledge as being related, not isolated bits; (5) It allows for individual student differences; and (6) It can affect students' attitudes toward learning (as cited in Martin et al., 2010).

Like everything, technology has also both positive and negative consequences. Using technology does not always have the positive feeling for the students. Motivation in some situations can be very low for the subjects; technology can reduce the teacher's capacity to interact; education cost will increase, and some pedagogical contents cannot be explained by the technology (Toyama, 2011).

As Klaus (2013) states that for using technology in the classroom, instructors need to be aware of the potential hindrances of technology because every minute is very important in the classroom pedagogy. If teacher is not well-known about technical devices that can reduce the efficiency of these devices and students can lose

valuable learning time from their life. Author furthermore mentions that over dependency on technology can deny the students' demand in classroom.

A limited use of gadgets can be quite useful for students', as it will allow them to be up to date with the current technology. However, the overuse of these advancements can really hamper or even damage student development in the personal growth, communication and educational department because they always think about the technological devices and their applications that affect all types of activities in life (Martin, 2013).

In the education system, internet is the real collaborating force of technology because it increases the quality of education. In contrast, students lose their critical thinking and analysis capacity because they can find everything in the internet that increases incidences of plagiarism for assignments and an overall lack of respect for correct language usage within essays. This indicates that technology may have grabbed the current generation's thinking abilities and the overall power of the internet (Brahmbhatt, Duncan, Hardikar, Kasinger, & Pillai, 2012).

Therefore, technological inclusion in education increases the students' ability to develop for better future as well as misuse and overuse of these can decrease the students' overall development capacity. That is why; my research interest was to see the present situation while we implement techno-pedagogy in the science classroom.

Statement of the Problem

We have been using ICT in Nepal since 1970s but Nepal government implemented ICT policy in 2000. The policy tries to develop ICT-based human resources to infuse ICT in education, health, and other sectors for development (MoE, Nepal, 2013). Since then, ICT utility has increased across different sectors like- Community Radio and Television, ICT Project 2000, Nepal Internet Exchange,

Women Empowerment through ICT, Nangi Village School Project and so forth (Reddi & Sinha, 2003). Radio education program was started in the early 1970s and then USAID-funded for 'Radio Education Teacher Training Project' from 1984 to 1989. Radio plays a major role to disseminate education in remote parts of Nepal (Holmes, 1990) and is efficient enough when other sophisticated ICT tools are in place. Recently, Ministry of Education (MoE) aimed to implement its 'ICT in Education Master Plan (2013 – 2017)', for improving the speed of internal communication and staff access to essential working documents and information (Global Resource and Information Directory, 2012).

After the ICT policy, in Nepal different NGOs are running programs to include technology in classrooms, like- One Laptop per Child (OLPC) program, Open Learning Exchange (OLE) and so forth. The National Curriculum Framework (2007) stated that ICT is currently being used in schools in three ways: as a teaching tool in other subjects, as a school administration tool, and as a subject in its own right (as cited in Global Resource and Information Directory, 2012). Even though ICT has not been properly addressed by the curriculum as a subject and as a teaching and learning tool; intentions of all those programs and projects were not only including ICT in education but also getting the best benefit from it. There are plans for teacher training, content development, infrastructure development and so forth to ensure its effectiveness (UNESCO, 2007) and on the other hand, there are always challenges in implementing the policy to action in a country like Nepal.

Schools in urban areas are using more technology and have trained more human resources than schools in the rural areas. These differences are more visible between private and public schools. To improve the quality of teachers using ICT in classrooms, the government wants to supply at least two computers in selected

secondary schools (UNESCO, 2007). Moreover, the barriers for using ICT in education are lack of infrastructure, high up-front costs, widespread illiteracy, language barriers, absence of local content, poverty and the lack of public awareness about the internet and its use (Reddi & Sinha, 2003) and qualified teaching personnel (Global Resource and Information Directory, 2012). The World Bank (2010) found that classrooms do not have sufficient technological instruments for using and promoting ICT in education but Nepal has good appreciation for technology. Moreover, limited experience of teachers, lack of budget and training are the obstacles to create a digital society (Koirala & Bird, 2011).

For science education, Nepal government had bitter experience because instruction styles and instruments for science classes were in poor condition (Holmes, 1990). Still now, Nepali students are consistently ranked poor in science from international standards and mainly are failed on this subject in the compulsory School Leaving Certificate (SLC) exams (Bhatta 2004, 2005, as cited in Bhatta, 2008). Few school teachers believe that school computers are only usable for computer course not for other courses; even in science course, they do not want to use them (Bhatta, 2008; Center for Social Innovation, 2012). In this light, OLE program wants to improve digital teaching learning concept among the teachers and it develops modules for interactive digital learning content for Science (Global Resource and Information Directory, 2012).

Therefore, my research focused on bringing the experiential data of science classroom using ICT as a pedagogical tool; how teachers were using techno-pedagogy to deliver the lessons and while doing that what types of challenges and opportunities they were facing. This study was also concerned with technological contributions in classes and the students' perception about technology use in the classroom.

Purpose of the Study

The purpose of my study was to explore ways and their experiences in which teachers apply techno-pedagogy in science classroom.

Research Question

- How do teachers perceive techno-pedagogy and its contribution to enhance learning in the science classroom?
- What challenges and opportunities are there for implementing techno-pedagogy in the science classroom and why?

Significance of the Study

To impart better education to students, a huge amount of money is spent on education by the government every year and it is increasing continuously. In 2011-12 financial year, the budget allocation for education was of 17.1 per cent of the total national budget and its increment is 24.5 per cent compared to the education budget of the previous year (Sedhai, 2011). The Government of Nepal also takes a project for One Laptop per Child (OLPC) to bring changes in students' mind and create new learning environment (Pudasinee, 2009). Likewise, Open Learning Exchange (OLE) Nepal is closely working with the government to provide the technological supports in education for creating "E Pustakalaya[1]" and "E Paath[2]" strongly. Their main view is to provide all educational subject matters available in e-sources according to the national curriculum and to create access for the teachers and students these materials in any time (The World Bank, 2010). For the improvement of the quality in education, School Sector Reform Program (SSRP) is going on under the help of ADB, where

[1] E-Pustakalaya is an education-focused digital library containing full-text documents, books, images, videos, audio files, and interactive educational software that can be accessed through an intranet or on the Internet.

[2] E-Paath is a collection of subject-specific, and grade-specific digital learning materials that were designed and developed by educators and curriculum experts to help teachers and students meet the learning objectives.

improvement in teaching learning situations and qualities are the main agendas (Asian Development Bank, 2012). For teacher training and implementing proper educational situation, the government is taking necessary steps but the situation is different from what we expect from education. Technology is a tool that makes education more easy and visible to the students. However, in real situation how are teachers using these instruments for educational prospect? If I can discover all the present ways of using technology in the science classroom, then Nepalese educational sector will benefit and the future generation will have a better chance for getting modern education. Science expands every moment and only through technology, we can be informed at the same moment (Valdez, 2005). That is why; I wanted to see the science classroom situation specifically equipped with ICT tools.

Ministry of Education, Nepal will be benefited from my research because it will give them the better understanding for implementing technology in present education system. All types of educational experts who are working to develop better educational situation will get assistance from it. It will also be beneficial to all the researchers who want to research on this track after me.

Delimitations of the Study

The term 'Techno-pedagogy' covers all technological aspects used in an educational setting in schooling. This helped me expand techno-pedagogy to incorporate all teaching learning situations for my research. However, in my research, I will focus only on the technological devices, e.g., computer, internet, multimedia projector, PowerPoint, and clips commonly used in everyday's teaching-learning process by science teachers. To be specific, it is "what types of technical devices s/he uses for delivering the lessons, such as audio-video, PowerPoint slide along with

computer and projector facility, utilizing internet access to give vast knowledge on specific subject, project works, and presentations."

Limitations of the study

The findings of the study have some limitations because the data were collected from four schools and the teachers from respective schools. The schools are from urban areas due to the time and other resource constraint. The findings of this research definitely are not applicable for all but represent the real case of Nepalese schools and feed to policy and further research along with other study in the area. The case findings can be contributing to the other regions having similar contexts.

Chapter Summary

The general background along with my experiences and interest directed the research to highlighting the major concerns about techno-pedagogy in education. I have introduced the statement of the problem and set the research questions to simplify the problem followed by rationale of the study. Limitations and delimitations of this research also guided me to make the outline of working area for this issue.

CHAPTER II

LITERATURE REVIEW

Chapter Overview

Usually, literatures (e.g., journals, articles, reports, books, publications, policy and so forth) provide various types of information to us for developing knowledge, concerns, idea and so forth responsible actions about the respective issues. In academic research, these literatures validate the respective concerns from different angles to establish the matter more strongly. These also helped me to conduct the whole research. In literature reviews, it has two separate parts- thematic and theoretical. In the thematic part, it covers the different themes while it covers the related theories, which are very much related with this research issue, in the theoretical one.

Thematic Review

Thematic review approach allows us to look at the specific issues more closely and make the relation between all these respective concerns. On basis of these themes, I can justify my research problem and questions.

Techno-pedagogy

Literally, 'pedagogy' refers to the art-science of teaching and 'techno' refers to the art-skill in handcrafting, derived from the Latin word 'texere'. Therefore, techno-pedagogy refers to weaving the techniques of the craft of teaching into the learning environment itself (Fischer, 1996). Fischer describes techno-pedagogy as the incorporation of technology in the classroom situation.

There are many components of technology, which help education in various ways. Among them multimedia, information communication technologies (ICT), computer education, internet, projector, e-learning[3] and so forth are well-known. Tuovinen (2000) stated that for the distance education, multimedia could be used in different ways. Therefore, technological inventions are helping us to explore education widely.

In the elementary level, computer-based education has the positive effect for the students' achievement (Kulik, Kulik, & Bangert-Drowns, 1985) and for college level, students have also affirmative outcome for computer-based tests (Kulik & Kulik, 1985). Therefore, educational technologies have greater impact on students' learning from elementary to upper levels; in every stage, students get the benefit from technology.

E-learning is the use of internet technologies to enhance knowledge and performance. E-learning technologies offer learners' control over content, learning sequence, pace of learning, time, and often media, allowing them to tailor their experiences to meet their personal learning objectives. Students do not feel that e-learning is replacing the traditional instructor-led teaching, rather they take it as a complement to it, forming part of a blended-learning strategy. E-learning needs digital libraries to manage access to e-learning materials, consensus on technical standardization, and methods for peer review of these resources. Innovations in e-learning technologies point toward a revolution in education, allowing learning to be individualized (adaptive learning), enhancing learners' interactions with others (collaborative learning), and transforming the role of the teacher (Ruiz, Mintzer, &

[3] E-learning is a broadly inclusive term that describes educational technology that electronically or technologically supports learning and teaching.

Leipzig, 2006). Thus, through e-learning we have greater chances to explore more educational resources for developing ourselves.

Technology had a modest impact when the first generation people used it in pedagogical process because only a few subject matters were related with it. However, next generations can explore it further in education because more subject matters, curriculum design, educational planning and others issues will consider with technological aspect (IT for change, 2011-12). Therefore, along with the time, technological involvement in educational issues is increasing and the role of technology will change from tools to methods of delivering lectures.

Techno-pedagogy provides new opportunities for learning environment because it creates self-organized learning environment within social context. Every individual can get the best support from it. This pedagogic process facilitates learners to develop the independent learning skills through both collaborative and individualized language learning to take increased responsibility for self-organizing their own learning in both school and community (Coombs & Ravindran, 2006). Therefore, lifelong and continuous learning environment is created for every individual.

Through gender prospective, girl students can enjoy more freedom than traditional educational system because the world becomes the playground of education where classroom is a small component. Technological inclusion in curriculum creates new opportunities for new faces (Gurumurthy, Vishwanath, C, & Jha, 2011). Hence, including technological aspect in curriculum opens doors for everyone to be empowered and knowledgeable.

Not only that education has the positive impact on technology, it can also influence health sector. Supplementing conventional asthma care with interactive

multimedia education can significantly improve asthma knowledge and reduce the burden of childhood asthma (Krishna, Francisco, Balas, König, Graff, & Madsen, 2003).

Along with the positive effects, technological use in education also brings negative consequences. Use of cell phones in the classroom is an application of modern communication process. While the students use cell phones in the classroom, then they become extremely distracted from what is actually being taught. They randomly look on it and are playing games or going on social networking sites instead of listening to their teachers. In few cases, students can use it to give answer in the exam by copy the information from the internet (Hamilton, 2013). Hamilton's view is that technological misuse in classroom distracts students' mind from the learning situation.

Technological use in education can cause some serious problems for the students as elevated exasperation with the parents while doing work with computer or internet; deteriorated patience because of longer hour use of technical devices. It is also declining writing skills because technology takes the place of hand written work; and lack of physical interactivity because of virtual connectivity with all, reduces personal communication skills with others (Martin, 2013). He mentions that excessive use of technology creates personal and social problems for the students because they face problem to balance between reality and virtual world.

Privacy of the students becomes insecure in different social media due to lack of privacy settings and systems; they become distracted from their original work because many options divert them; different social and health issues also affect them in their daily life because of the misuse of technology (Hatch, 2011). He tries to

mention the all-negative consequences of having more option in students' hand that can spoil them from the original path of development.

Technology has the multidimensional effects for the overall educational process. All types of educational segment and approach are getting modification and advantages through it. At the same time, it creates various obstacles in students' personal and social life for not using all these things appropriately. All these information helped me to understand the concept of techno-pedagogy from different angles, develop questionnaires and put me in a position from where I can judge the situation neutrally.

Technology and Science

The relationship between science and technology is symmetrical but science generally begets technology in a one-way or hierarchical relationship when they consider from the angle of behavior analysis. However, in the larger context of relationship between science and technology, they are seen as two-way, or symmetrical (Moxley, 1989). Thus, in shorter format, science is dominant of technology but in a border context, it is not visible.

All over the world, IT inclusion in science education was successful but in Arab region, the Arab science educators faced major professional challenge because of language difficulty, cost of education, social structure and so forth related issues of education (Haidar, 1998). Therefore, to meet these challenges effectively in science education, both of its promises and concerns should be taken into consideration.

In recent times, science and technology are far more closely linked than is normally perceived and this change occurs within four to five years time. This change is described on basis of biotechnology patents and bioscience papers (Narin & Noma, 1985). We have the wrong concept that the paths of science and technology are

separate, moreover, we believe science dominates technology but these two are not separate or unidirectional. Actually, these have a relationship of mutual dependency, that is, symbiotic (Wiens, 1999). Thus, the relationship between technology and science becomes stronger along with the time and new conceptual development.

Development of science and technology changes human knowledge and perception about education largely. This information helped me to realize the association between these. Actually, without realizing the bonding between science and technology, it was not possible to validate my research work and as well as analyzing and interpreting the respondents feelings towards proper conclusion.

Challenges in Applying Techno-pedagogy

Technological use in education started long ago but until present, many of the issues related to use of technology in the classroom remain challenging. These restraining, and resisting forces are identified by different researches. These things are access to hardware and software as well as funding, time for planning, personal exploration, online access, and skill development, technical and administrative support and resources, training and expertise and so forth (Earle, 2002). For incorporating technology in education, we need to develop both physical and technical capacity; otherwise, implementation level will not be up to the satisfactory mark.

For including technology successfully in classroom activities, we can add high-level technological devices in schools, offer teacher training, and develop favorable policies but the output of technological use in the classroom can be low because without developing teachers in pedagogical beliefs, nothing will work out properly. We can describe it as an additional barrier for using technology in the

classroom (Peggy, 2005). Therefore, teacher professional development is very important for getting the benefit from technology.

Despite the tremendous push for educators to integrate technology into their classrooms, many are struggling to find consistent successes with technology-based instruction because of different hidden barriers there, which ultimately work as challenge for teachers to create an effective learning environment. A framework called 'Individualized Inventory for Integrating Instructional Innovations' is planned to help teachers for getting success to technology-based classroom and identify the potential barriers that impacts on technology integration efforts (Groff & Mouza, 2008). Thus, to make the best utilization of technology in the classrooms, we need to identify the hidden constraints and solve these.

The constraints which are visible in education for using technology can be divided into two major categories: first-order barriers and second-order barriers as extrinsic to teachers (e.g., access, time, support, resources, training) and intrinsic to teachers (e.g., attitudes, beliefs, practices, resistance) respectively. However, here both seem to be complementary to each other rather than forming seemingly dichotomy as the writer asserts, "Even if every first-order barriers were removed, teachers would not automatically use technology" and in fact, rather than being eliminated completely, such barriers will "continue to ebb and flow throughout the evolutionary integration process" (Ertmer, 1999). Moreover, a new concept about the technology integration in education is the third-order barrier (Tsai & Chai, 2012). Actually, to use technology in education is a great challenge because the entire barriers will come one by one and we need to take proper preparation to overcome them.

Shields and Behrman (2000) stated that excessive and unmonitored use of computers in schools could cause an enormous problem in students' physical, social and psychological development. Their use of computer time need to be limited and exposure to different types of content must be supervised.

Johnson and Bartleson (2001) suggested that school authorities should learn computer skills properly to improve organizational effectiveness to improve communication, planning, and record keeping (as cited in Bataineh & Brooks, 2003). They mention that self-awareness or eagerness to learn technological use is lacking among the school administrators that is a major challenge for using technology properly (ibid).

Technological inclusion in education is facing different types of challenges from beginning to till date. These challenges are both visible and hidden. All these challenges gave me initial idea about different technological constraints in education, which made me more focus about different uncovered issues and validated my research finding in the Nepalese context. However, we need to solve all these problems to get the best output for techno-pedagogy.

Opportunity in Applying Techno-pedagogy

Techno-pedagogy opens doors for new educational revolution because all related sectors get benefits from it. Above all, teachers and students are the major beneficiaries.

Technological integration helps teachers in their professional development because traditional teacher-training program gives emphasis mainly on theoretical development of teachers but the technology gives space for them to explore new skills and knowledge along with traditional concept (King, 2002). Therefore, technology helps in teachers' both professional and personal development.

Teachers are getting more technological trainings to manage computer-based technology in schools and classrooms for better instructional skills. It is found by researches that relatively new teachers are more experienced to maintain technological devices than more experienced colleagues; those new teachers reported higher levels of comfort with technology and used it more frequently in the classroom. In contrast, experienced teachers reported using technology more often in classroom for delivering instructions in learning activities (Russell, Bebell, O'Dwyer, & O'Connor, 2003). Hence, it gives the idea that new teachers are getting more chance to learn technology and use it in their practical level work than others.

Teachers need to do many works apart from teaching in the classroom, such as managers, psychologists, counselors, custodians, and community "ambassadors", not to mention entertainers too. It is easy to understand that all these issues can make teacher frustrated and disillusioned. Technological adhesion helps teachers to reestablish their role and value in classroom. Firstly, turn in classroom situation towards learner centered and secondly, create more collaboration between students' and teachers' work (Hooper & Rieber, 1995). Hence, technology shares the teachers' responsibility that they can be little free of workload, otherwise, they will be frustrated with the job responsibility.

In students learning situation developed by the technologies, they can access the study material anytime from anywhere through e-sources. The whole pedagogy turns to be student-centered rather than teacher-centered one and the main intention of all these activities is that students can learn better for their development. It creates a new opportunity for them that they can feel the learning rather than being the passive listeners (Haddad & Jurich, 2002). Therefore, students' priority, established by the technology, reforms the whole educational development for their need.

Students feel that technological insertion in education helps them to learn more deeply but it is not a substitute process for conventional teaching style. They feel only technology cannot express all the components of specifics; they need description also to understand properly (Li, 2007). It says that tradition and technology need to work together for educational development; neither can omit the other's role in education.

There are varieties of opportunities for implementing IT in management education. Technology can be used to facilitate the display of information, to increase access to external explicit information, and to increase the sharing and construction of knowledge. Technology is not suggested as a panacea for educational problems; in fact, many problems in education are social rather than learning related. Yet, technology can enable the effective application of constructive, cognitive, collaborative, and socio-cultural models of learning (Leidner & Jarvenpaa, 1995).

Technology drives the education system headed for student center rather than teacher center, which establishes students' identity that everything we do for students learning in education. All these literatures helped me to realize the broader zone of technological benefits for the education system. These opportunities helped me to think deeply to find out the new scope of technologies for students.

Technology and Learning

Technological combination in schools is ongoing, unstoppable, and necessary. More schools are using new and current technologies for establishing better technological environment for students, teachers, and administrators (Fox, 2005). With the help of technology, students complete their schoolwork more quickly; overcome the obstacle of knowledge constraint among the materials; their papers and projects are drawn with up-to-date sources and knowledge; and they are better at

juggling their school assignments and extracurricular activities when they use internet (Levin & Arafeh, 2002). Therefore, technology changes the learning environment of students by giving access to different advanced resources.

Teachers from many countries are beginning to use ICT to help change classroom pedagogy and integrate techno-pedagogy into the curriculum. Students are working together in teams and using computer tools and resources to search information, publish results, and develop products. In addition, teachers are using ICT to change their role from dominating player to facilitator, who provides students' with advice, monitors their progress, and assesses their accomplishments (Kozma, 2003). Technology changes the classroom pedagogical process and associated role of the teachers and students.

Technology assists to solve different learning problems. Different technologies are used to engage students to personally and socially construct meaning that they can address the internet for fostering community building; videos to feel the real fact behind camera; and multimedia for innovative ways of interaction (Jonassen, Howland, Moore, & Marra, 2003).

Technological use in education is not always helping for learning if we cannot use it properly. We need to consider 'when and in which' situation technology will be appropriate for the students otherwise it can hamper students' own capacity to develop. The use of calculator in education definitely helps for learning but if we use this device in the early phase of learning, then students will not learn calculation without it and they will be very dependent on it. We need to give this device to students after having strong knowledge and skills of calculation (Brunette, 2001). Brunette further mentions that we need to take the support of technology in life but only after having the strong basic knowledge of it.

Limited access to technological devices and not efficient stuffs to maintain these along with limited resources and other barriers are working as obstacles for getting technological benefits in learning (Wisdom et al., 2007). These authors mention that we are not getting technological benefits in learning due to the shortage of resources and skilled people that ultimately work as barriers for technology based learning.

In the traditional teaching learning process, technology fosters new learning for both teachers and students. It creates diversity of learning among them. However, without a wise and appropriate use of technology in education, it can hamper the whole learning process. These literatures guided me to think about the contrasting relationship between teaching and learning that helped me to discover a new scenario in my research.

Technology and Educational Performance

Students' achievement becomes better with e-learning system than any other format of learning because it can provide us with interactive videos; it has significantly better learning performance and creates higher level of learner satisfaction than other formats (Zhanga, Zhou, Briggs, & Nunamaker, 2006). Therefore, technology helps the students for higher educational achievement.

In schools, as techno-pedagogy laptops are being used vastly. It is found by researches that as compared to non-laptop counterparts, students who have laptops for personal use in classrooms spend more time being involved in collaborative work, participate in more project-based instruction, produce writing of higher quality and greater length, gain increased access to information, improve research analysis skills, and spend more time doing homework. It is also found that these students direct their own learning, report a greater reliance on active learning strategies, readily engage in

problem solving and critical thinking, and consistently show deeper and more flexible uses of technology than other students (Gulek & Demirtas, 2005). As a result, technology creates a sharp gap between those who have access to technology and those who do not have.

Technology has a strong liaison with educational output. Misuse or overuse of technological devices in education can reduce the educational performance of students because technology is a sophisticated device that appropriate use of this helps for better understanding of the students but if we can use it appropriately then the whole education system can face serious problems (Dede, 1998). Dede further tries to explain the opposite side of technological use, which hampers the educational performance.

Technological influence in learning is very prominent because it changes students' learning acquiring style and motivates them to learn by self-learning but not having proper access to all and misuse of technologies can create digital gap among them along with other educational problems. This information helped me to think both ways of technological assistance and hindrances in education for the research. It also opened my mind to be neutral in the educational performance.

Students, Technology and Science

In the contemporary society, the relationship between the domains of science and technology has never been stronger because they have different purposes, ways of viewing and knowing the world, and thus their relationship is often tense and complex. However, they serve to inform and extend each other in both intended and unexpected ways. Moreover, students can learn both through mutual study to enhance them. It is important to learn both scientific and technological literacy for developing

informed citizenship (Compton, 2004). Thus, to develop a knowledgeable society, students need to have knowledge about science and technology.

Recently in Turkey, ICT has been widely used in classrooms for teaching and learning purposes, it has helped students to be familiarized with the ICT, and their exposure toward technology has helped to explain science achievement gaps between individuals and schools. Ultimately, they thought ICT is an important factor that should be taken into consideration when designing the classroom environments (Delen & Bulut, 2011). Therefore, technological use in education system is very important for creating a proper pedagogical environment.

Technological development helps in the teaching learning process, which directly affects student achievement in the science classroom performance. All these records assisted me to develop my research based on these three components, which are the major indicators in my research.

Techno-pedagogy in Nepal

Conventional methods of teaching and learning are still dominant in Nepal. Therefore, professional development in modern pedagogical practice is an admirable area of close attention. Information and Communication Technology (ICT) has a minimal to nonexistent role at the secondary school level in Nepal because of the lack of both resources and investment along with other reasons (Mainali & Key, 2012). The Government of Nepal has initiated a school reform project in which ICT-assisted and “child-friendly” teaching learning are encouraged in all schools (MoE, 2007) but there is no clear vision regarding the use of ICT in the classrooms by either teachers or students. Nevertheless, some private schools and some public schools do have computers, and in such settings, they attempt to motivate students to use this

advanced technology and use technology for their small-scale works (Mainali & Key, 2012).

Pudasinee (2009) stated that ICT can influence the education system greatly but due to different types of problems, it is not possible to add ICT properly in education. Among the problems, he defined adaptation of new technology and financial problem are more prominent in both private and government schools.

Ghimire (2011) stated that until now Computer Education (CE) is used as an optional subject in the lower secondary education. Curriculum Development Center (CDC) did not include computer education in the main line of curriculum though computer education is essential for every student.

Making science education socially relevant has been a crucial issue in developing countries like Nepal where science education is strongly tied to the objective of achieving modern economic development, technology, political and social outlook. Currently, the poor economic conditions, the problematic curriculum intents, and the social and cultural contexts of education make these goals difficult to achieve. In science education, for example, (partly due to the lack of suitable facilities and laboratory equipment) the teaching of science has remained very much textbook-bound and remote from students and teachers' lives (Bajracharyaa & Brouwerb, 2007).

Technological use in the Nepalese context is very low due to different constraints where policy plays a vital role to include technology properly in education but until now, there is no proper ICT policy and practice for technological use in the classroom. A few segment works are continuing with the additional support or personal interest but the overall situation is poor. All these previous research

documents guided me to be more focused on the previous status of techno-pedagogy in Nepal and to find the present status of education system.

Theoretical Review

Teaching – learning is an interactive process. Teachers and students both need to be engaged to get the best output from education. Technological incorporation in education increases the involvement with education boldly. Therefore, engagement theory can describe the situation best. Along with that active learning theory will also describe the situation better because without actively participating, learning will not be acquired. Therefore, these two theories gave me the guideline for this research work.

Engagement Theory

Engagement theory has emerged from the authors' experiences of teaching in electronic and distance education environments. The fundamental idea underlying engagement theory is that students must be meaningfully engaged in learning activities through interaction with others and worthwhile tasks. While in principle, such engagement could occur without the use of technology, but technology can facilitate an engagement in different ways, which are difficult to achieve otherwise. Thus, engagement theory is intended to be a conceptual framework for technology-based learning and teaching (Kearsley & Shneiderman, 1999).

By engaged learning, all student activities involve active cognitive processes, such as creating, problem-solving, reasoning, decision-making, and evaluation. In addition, students are intrinsically motivated to learn due to the meaningful nature of the learning environment and activities. Actually, it focuses on the experiential and self-directed learning; which is similar in nature to the theories of adult learning (Kearsley & Shneiderman, 1999).

In my research, this engagement theory supported me to understand the teacher and student condition in technology based classrooms as, “How they incorporate technology to daily classroom situation with theoretical knowledge along with other classroom activities and ultimately motivate themselves for better learning.”

Active Leaning Theory

Whenever experiences stimulate mental activities that lead to meaningful learning, this is active learning. Mentally active learning of ideas-and-skills can occur in a wide variety of thought-stimulating activities, ranging from direct learning (of ideas that are explained in a web-page, book, lecture, video, TV or radio show,...) to learning by discovery or in design projects and other kinds of problem-solving where the learning cannot be defined as either direct or discovery (Rusbult, 2007).

These two theories were very helpful for my research because my research was mostly based on application. Therefore, in the classroom while technology would be used for teaching purpose, the students need to engage themselves within this to know more in detail and feel the situation. While they will engage themselves, then it will turn to an active learning process. By actively participating in the learning process, students will get the knowledge.

Previous Research Studies

Technologies have been used in education for a long time and they give better output than any other educational tools. All the previous studies guided me to find the right track for this research.

Teachers have the belief that educational technology enhances student learning and integration, which is both desirable and needed. Yet, they do not perceive that sufficient support structures are in place to enable them to achieve the

outlined technology education standards (Czerniak, Lumpe, Haney, & Beck, 1999). Therefore, an appropriate learning environment is essential for assimilation of technology in the education for getting the best output from it.

For the pre-service teachers technology was integrated in Pedagogical Content Knowledge (PCK) development program. This integration was for describing technology as a multi-dimensional entity for science teachers. Students' and teachers' views on the integration of technology and the nature of the discipline were identified as important aspects of the development of teachers' pedagogical content knowledge (Niess, 2005).

In USA, studies suggest that instructional technology is growing increasingly effective in elementary and secondary school applications. This growing effectiveness should not come as a great surprise. Today's computers are faster, friendlier, and more visually and aurally sophisticated than yesterday's models for technological improvement. In addition, students are more computer-literate today than they were in the past years, and many teachers have become sophisticated users and designers of instructional software in recent years. Recent evaluation studies suggest that instructional technology can also make teaching more effective in the elementary and secondary schools (Kulik, 2003). Hence, the development of technological devices can create curiosity among the beneficiaries to involve them for using more technology in daily life.

All these previous research studies guided me to think closely for my research because how, when and what ways all these researches were conducted and what were the outcomes of those studies helped me to develop my research methodology section and others related sections to conduct my study.

Policy Review

There is an absence of consolidate 'ICT in Education policy' in education in Nepal. It has only a few policies, which consider ICT in education in different circumstances. IT Policy (2010) considered the expansion of access to internet in all schools; coordinate and collaborate with national and international institutions for developing human resources for continuous, relevant and quality education; promotion of Industry-Academia Collaboration (IAC); and formation and implementation of special IT program for students, teachers, and schools for developing human resources. SSRP (2009-2015) stated ICT assisted teaching learning will be implemented and expanded in all schools. It made the policy provision to develop ICT infrastructure in education and provide alternative modes of schooling with ICT. Recent plan (Three-year plan, 2011-2013) of the GON (Government of Nepal) has included that schools will be encouraged to use ICT in education to increase access to quality education in rural areas, digital divide will be reduced and ICT will be integrated in all levels of education (MoE, Nepal, 2013).

The Gap

Technological use in classroom has benefits for the teaching learning process; it was well understood by the teachers but to apply technologies properly what support we need was not mentioned or ignored in these researches. Specially, benefits of using technology were more focused by these researches. For getting continuous support from technology for education what we need to do, it was not mentioned in those researches.

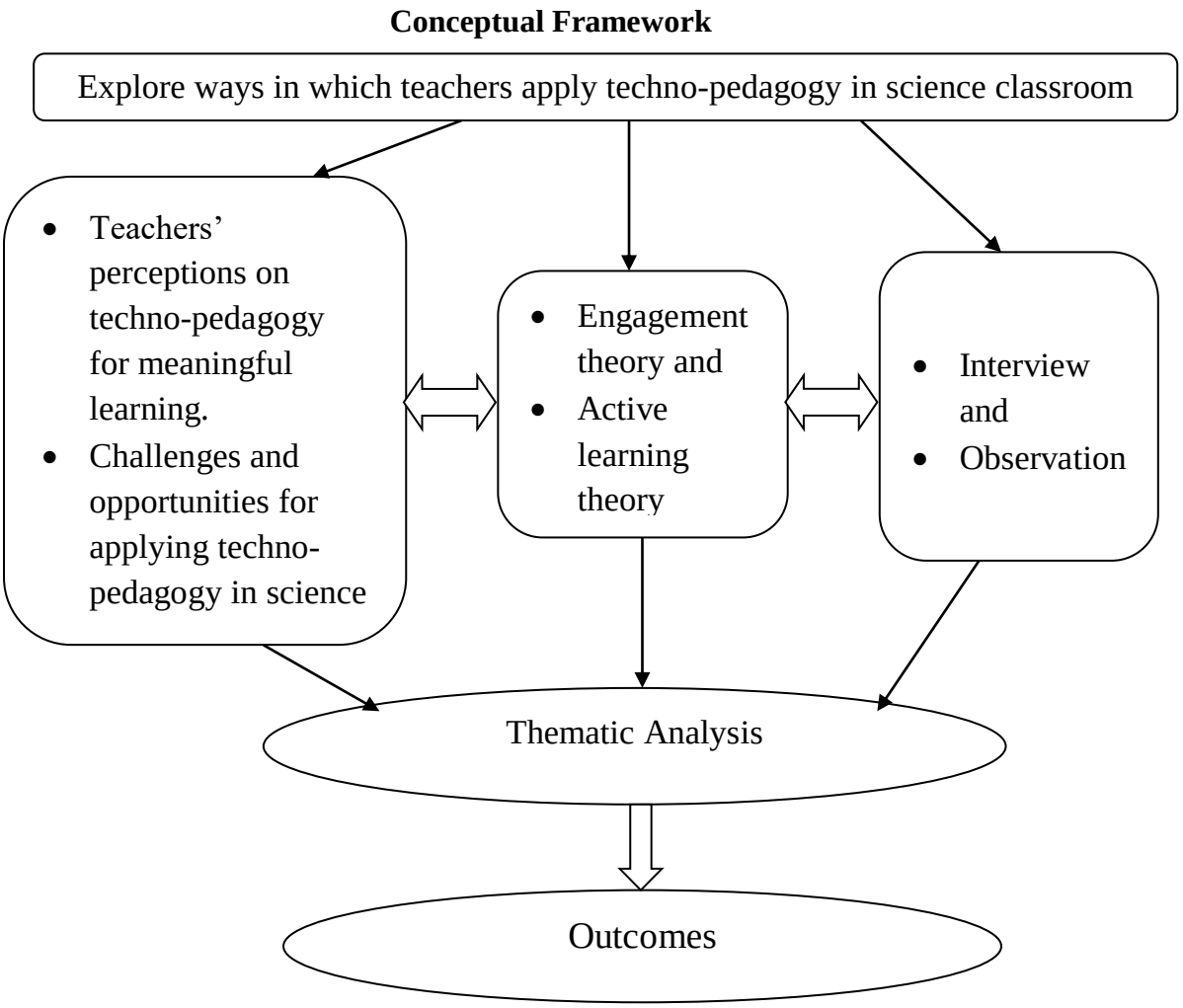

Figure 1: Conceptual framework

This conceptual framework is directed by the objective of this research. Initially, according to the objectives; research questions, theories and tools were designed. However, research questions were guiding the next two steps, and there is a parallel relationship between all three stages because modification of any portion affects the whole process. Reviews of related literature were guiding all these sections of the research to validate the research academically. After collecting the data from the primary sources then they were systematically analyzed based on the research questions, theories and tools along with the support of literature. After analyzing the whole data, I concluded my research outcome on the basis of the research objectives.

Every section of the research is validated by the previous studies, documents, reports, journals and the like documents deemed necessary and relevant for this study.

Chapter Summary

This chapter has discussed the status of technological contribution in educational use with related examples from the national and international contexts. Some theories related to techno-pedagogy have been included to get more ideas about this. The present status of Nepal about technological use in education is also described to picture the existing practices among schools. The existing policies are discussed to compare the gap between policy and implementation. Therefore, literatures have contributed a lot to validate my research work academically.

CHAPTER III

RESEARCH METHODOLOGY

Chapter Overview

Methodology is a very important and essential component of any kind of research activity because it works as a bridge between research intention and possible output. If methodology is not appropriate with its research design then definitely the outcome will be unexpected. In an academic research, methodology plays an important role as per the nature of the study. Therefore, selecting an appropriate method to gather information, categorize number and types of the respondents and possible ways to approach them and other related issues should be considered well. This research has been designed under the qualitative research method and all necessary methodological stages are discussed here to give the clear portrait of this whole research plan.

Philosophical Considerations

Philosophy helps in the research to develop critical reasoning and moral improvement and increase knowledge in person's mind, which are most important because while conducting a research, the researcher needs to improve these issues for better research output (Gray, 2012). In a research, philosophy also gives guidelines for short listing, interpretation and analysis of the data harnessed in the study. Easterby-Smith, Thorpe, & Jackson (1997) identified three reasons for the exploration of philosophical significance in particular research methodology: research strategy, research methods and researcher development. Every research is driven on a certain philosophical ground since the dimension of research is always guided by the

philosophical instance. Philosophical ground gives the researcher a standpoint to pave the way for methodology while designing the research, selecting research instruments, collecting data, presenting and interpreting the data and so on, and leads the researcher to new knowledge (Pring, 2012). In my research too, philosophy gave me the stand to think critically what I wanted to find out from this research and for that, what I did. With regard to the philosophical stance, I would like to put floodlight on the three broad branches of philosophy as ontology, epistemology and axiology.

Ontology

The word "ontology" is derived from the Greek word 'ontos' which means 'exists'. Therefore, philosophically, it means 'theory of existence'. It is the body of knowledge describing some domains, typically general sense knowledge domain. It is about clarification of the qualitative researcher's position about the nature of existence (Watkins, & Mohr, 2010). It concerns the very nature or essence of the social phenomena and for the ontological authenticity, the researcher needs to understand the situation very sophistically (Cohen et al., 2007). Since humans are different by nature, they perceive and practice the knowledge and consequences differently and interpret them based upon their experience and knowing. Thus, during observation and interview, I tried to find out their perceptions, opinions and sharing about the current situation of using technology in the science classroom in schools.

Epistemology

Epistemology is the study of the 'theory of knowledge' in philosophy: the study of knowing. It concerns the clarification of the qualitative researcher's approach about knowledge creation (Watkins, & Mohr, 2010). To gain knowledge, it concerns from its bases – its nature and forms, how it can be acquired, and how to communicate to other human beings (Cohen et al., 2007). In my study, I believe that

the knowledge and information about using technology in the science classroom brought out through research was not physically visible but was scattered among respondents' experiences.

Axiology

Axiology is the 'theory of value' that refers to the value of people. Axiology includes ethics and aesthetics (Watkins, & Mohr, 2010). People are different from one another from every aspect. Axiology deals with how people think and determine the value of different things. This study tried to put values on the research participants so that I could have realization in empowering teachers and students alike for using technologies. To be more specific, I was guided by the question: how did technology in classroom bring their inherent power to explore the lived situation to adopt and explore them?

Interpretive Research Paradigm

In most of the qualitative research works, interpretive paradigm is the most prominent one because it sees the world as constructed, interpreted, and experienced by people in their interactions with each other and with wider social systems (Maxwell, 2006; Bogdan & Biklen, 1992; Guba & Lincoln, 1985; Merriam, 1988, as cited in Tuli, 2010). The interpretive paradigm is to understand the subjective world of human experience by day-to-day experience. To retain the integrity of the phenomena being investigated, efforts are made to get inside the person and to understand from within and action is more important rather than causes (Cohen, Manion, & Morrison, 2007). Interpreting human's own language is very important factor for this research because language is an essential part of social life (Carballo, 2003). For educational technology-based research, interpretive paradigm is very helpful (Villiers, 2005). Therefore, I have chosen interpretive research paradigm to

conduct this research because I also wanted to interpret the respondents' feelings about techno-pedagogical issues. I interviewed the respondents and observed the situation personally. Then, I interpreted all the information as per my research concern.

Case Study Method

Case study research excels in bringing us to an understanding of a complex issue or object and can extend experience or add strength to what is already known through previous researches. Case studies emphasize a detailed contextual analysis of a limited number of events or conditions and their relationships (Yin, 2011). Soy (1997) stated that a case study research generally answers one or more questions, which begin with "how" or "why"; and my research questions also start with the same types.

My research aimed to know the present condition of applying technology in the science classroom, it is more specifically a single case issue in research which is related with the case study approach (Soy, 1997) and it was conducted on a group of school students which fulfills the another condition of case study (National Center for Technology Innovation, 2007). For gathering the data, I used interview and observation, which are used in case study approach (Berkenkotter, Huckin, & Ackerman, 1988; Emig, 1971, as cited in Palmquist, 1993).

My research questions also tried to find some ‘why’ and ‘how-related’ answers. To get this answer, I was involved closely with the field level activities and interpretation process. Therefore, according to my research structure and the process guiding me, it was a case study approach. I believe that I was able to find the real situation in the schools on my specific area, which helped me to find the research outcomes.

Study Site

This study was conducted in the selected four schools of Nepal, which claimed techno-pedagogy is a regular pedagogy in their secondary classrooms. Purposively, I took all these schools, which have almost defined their technological use in education.

Research Participants

In qualitative research, when samples are chosen in a deliberate manner known as purposive sampling, it is helpful to get the most relevant and plentiful data (Yin, 2011). Purposive sampling is used in order to access 'knowledgeable people', i.e. those who have in-depth knowledge about particular issues, may be by virtue of their professional role, power, access to networks, expertise or experience (Cohen et al., 2007). Therefore, to get my research data, I took the purposeful sampling method because it helped me to get the exact information. Purposive sampling, one of the most common sampling strategies in qualitative research to get the groups participants according to preselected criteria relevant to a particular research question, time and resources (Northeastern University, 2013). Sample sizes in case study should not be too large that it is difficult to extract thick, rich data (Palmquist, 1993). I took four teachers from four different schools who are using technology in their science classrooms because Creswell (2003) recommended that 3-5 participants can be used for such a case study research.

Data Collection Approaches

In case study approach, data come largely from documentation, archival records, interviews, direct observations, participant observation and physical artifacts (Yin, 2011). Interview and observation can be effective tools for data collection (Soy, 1997). In order to collect the data to find out the answers to my research questions and meet the purpose of my research study, I used in-depth interviews and observation as

my data collection tools. In-depth interview brings the inside story of any situation. Respondents' personal views came out by this (Cohen et al., 2007). Observation is another important tool for gathering information from a case and it is vastly used for qualitative researches (Tuli, 2010). It gives the opportunity for gathering live data and makes relation between human and context (Yin, 2011).

While observation and interview were to being conducted in the field, all collected information and data thus far were first recorded in the note book then on the computer; after that all the information was analyzed and sorted in terms of truth and validity, and explained in detail in an interpretive way.

Interview

Kvale (1996) remarked that interview is an interchange of views between two or more people on a topic of mutual interest, sees the centrality of human interaction for knowledge production, and emphasizes the social situations of research data (as cited in Cohen et al., 2007). Interview is not exclusively either subjective or objective, it is inter-subjective; and it is not simply concerned with collecting data about life, it is part of life itself (Cohen et al., 2007).

There are different types of interviews as structured interviews, semi-structured interviews, open-ended interviews, etc. In qualitative research, it is preferable to do interview more open-ended rather than closed ones because close-ended interviews cannot give the full aspect of qualitative research (Yin, 2011). Therefore, I used semi-structured interview schedule, because it helped me do my research within my timeframe and according to the set objective.

Observation

Observation is a unique tool in research, because it will give the researcher to see the situation that what respondent says and what s/he really does. According to

different timeframes, it will also be noticed how respondent's behavior changes, and every new day can give new information (Cohen et al., 2007). School classrooms present a common opportunity for making systematic observations. Borman et al. (2005) did the systematic observation for study of mathematics and science education in four public school systems across the country (as cited in Yin, 2011). Likewise, I observed and compared the information with interview to justify the situation.

Quality Standards

In qualitative research, maintaining trustworthiness is a very important issue. To achieve this, a researcher has mainly to be concerned with establishing credibility, transferability, dependability, and confirmability in a research (e.g., Krefting, 1991; Sandelowski, 1986, 1993, as cited in Baxter & Jack, 2008).

Credibility

To ensure the credibility of the data, triangulation and member checking are the effective tools for research (Baxter & Jack, 2008).To triangulate the answer, I asked the same question to the other teachers and this way I triangulated the answer. For the member checking I used the transcribe interview documents to check their opinion about the respective issues.

Transferability

It is difficult to transfer one situational output to another situation appropriately. But if we can explain the whole research context in a research then it is possible to transfer the situation to others (Shenton, 2004). To make it transferable, I have explained every condition of data collection procedure.

Dependability

To achieve this, I mentioned the research design and its implication style like data gathering properly which way it becomes dependable to all (Shenton, 2004).

Confirmability

To achieve confirmability, researchers must take steps to demonstrate that findings emerge from the data and not from their own predispositions (Shenton, 2004). For this, I presented all documents in front of the research committee.

Data Analysis and Interpretation

Data analysis is a systematic process of segmenting the data into meaningful units. The qualitative data has less number of participants than quantitative data but qualitative data gives detailed and deep information than the quantitative data. Therefore, data analysis is a process of dividing the data into different meaningful parts.

When I got all the field data, then I checked and rechecked for the accuracy of the data because it is essential for a researcher to get the appropriate data for the research. Along with that, a researcher needs to keep field notes, observation list, interviewing data along with him (Yin, 2011). There are not any specific formulas to analyze the collected information in qualitative research. However, normally for the analysis of data we follow the theories, systematic analysis, previous research study and own narratives (Cohen et al., 2007). All the data are interpreted according to the research questions, theories, previous studies (Yin, 2011). For my study, I wrote field notes for recording the data, reflections as my affective images of the classroom and did use semi-structured interviews for confirmability. Finally, I interpreted the observed behaviors, including my reflection in the light of different theories, reports, policy and literature and compared and contrasted or argued accordingly as felt with the previous research studies.

Ethical Considerations

Ethical considerations are the most important issues in research. Here the researcher needs to be strongly ethical about his own work and for the respondents' personal issues (Yin, 2011). Therefore, for data collection I never forced my participants to tell me the answer. I only incorporated the answer I got from them for my research purpose. While doing this I did not disclose these data without their permission. Similarly, I used the pseudonyms for presenting the data in the research respecting the ethics of the individual right to privacy.

Chapter Summary

This chapter has described the whole research methodology portion which has begun with the philosophical standpoints, than research design and tools, and ultimately concluded with quality standards and ethical considerations. It has also included the data analysis and interpretation procedure to provide the guide line for the next steps of the research. All these stages have supported with literature which has made this section academically reliable and authentic. This section has given guidance for primary data collection which have been analyzed in the next two chapters.

CHAPTER IV

PRESENTATION, ANALYSIS AND DISCUSSION ON TEACHERS' PERCEPTIONS ABOUT TECHNO-PEDAGOGY

Chapter Overview

In the research, after getting all the data, it is very important to present all these according to the research demand, analyze and discuss them with the support of literature. All data were acquired through in-depth interviews and frequent observations. The participants' voices, feelings and views regarding various themes have been concisely evaluated in relation to my first research questions as proposed in the previous chapters. Similarly, themes are drawn applying to relevant theories and critical analysis with literature reviews.

Teaching Learning

Generally, education utilizes knowledge, subject and a process senses together (Kumar & Ahmad, 2009). Teaching and learning are the major process of education, these come under the term of "pedagogy" (Cogill, 2008). Along with time, education is developed and has marched a long way from the traditional to the present situation. In the traditional context, the teacher is the sender or the source of information or message, and the student is the receiver of the information (Damodharan & Rengarajan, 2007). However, this whole process has been changing gradually and we are more concerned about students rather than just transmitting knowledge (Shaw, 1937; Damodharan & Rengarajan, 2007). Now, pedagogy has become the essential component for all teachers before delivering the knowledge (Cogill, 2008). The

discussion under this theme concentrates on seeing how teachers evaluate pedagogy and teaching and learning process to their practices and context.

Teaching Learning for Teachers

Rajib shared, *"Teaching means sharing of knowledge and ideas. We have to share the ideas through teaching. Someway students also teach and share their ideas with us. Learning means how we can achieve our targets in life. It is not only incorporating academic matters."*

Tania said, *"Teaching is guiding the students, how they can gain knowledge and utilize it rather than transforming information. Learning is a set of skills rather than information. When students' have the skills then they can move forward with it."*

Musfiq answered, *"Teaching is delivering knowledge and everything can be done with it. Learning is an interacting process."*

Sakib replied, *"I think, teaching and learning are similar processes. By teaching, we give knowledge to them how to behave with seniors, love the juniors, do behave in the society, and teach moral education. It is like holistic development approach for students and by learning, they use it in practical life. It is not only to give curriculum to students'; it is about to know what is happening in the country, world, political situation, etc."*

The teachers (all) using ICT while delivering their courses explained that sharing knowledge and ideas with the students is the central concern of teaching, but it is not always rectilinear rather Rajib evaluated it as a two way process and found "*No human being is 100% perfect*". He also believed, *"Learning is a continuous process or lifelong process",* which paralleled with Musfiq's experience, *"Throughout the life, we keep on learning and receiving knowledge".* Teaching and learning is a process as all accept but the early practices were different. Traditionally

it was only one-way interaction where teacher was the solely responsible to teach in the classroom and students were ‘passive learners’ in the classroom (Cogill, 2008). As teacher and respondents’ experience, the present teaching learning is about sharing ideas, knowledge, views, life skill experiences, so forth with each other, and gain knowledge from it. Lott (2008) did not completely agree that the conventional setting favors one way learning only; students gather information from the teacher and in a broader context, the wise teacher is also learning as a student. However, the two-way interaction in teaching learning is not very new, but its spread across all classrooms is a recent one.

The common goal of teaching is always the same: learning. In few cases, students are taking the central role in the pedagogical process because they are gaining experiences, information, skills from different sources and they interchange these issues with teachers and enrich both sides. However, teachers play the vital role in this whole process because they are mainly responsible persons to deliver knowledge and guide the students to acquire learning. The scene brings teaching and learning as a process; a conventional practice and in addition, the practicing teachers evaluate to add dynamism and continuation to early practices, to make it truly productive teaching and learning. This equally applies in the Nepalese context. The early classrooms were highly dominated by the teacher in the Nepalese classes, which is not the scene at present (Tuladhar, 2012). I witnessed the students were interacting freely and sharing different opinions and suggestions with the teachers and they were welcoming their views and involving them in different issues for discussion, exchanging information, share life experiences that all students have the idea about life circumstances. However, the culture carried is manifested during observation; it is quite often the teachers show their coercive control to the learners’ activities.

Teaching. Teaching is a process of facilitating the students rather than merely transferring information as Tania felt "*Information is everywhere and children have more information than us*" and Sakib also addressed that students should appear from bookish knowledge to understand the world surrounding him. Students are gathering more information by watching TV channels, listening to radios, searching on internet, reading newspapers, journals, exchanging information with friends, family members and in many other ways than teacher can have information. Teaching plays a crucial role to guide students for acquiring information from different sources because not all the information is authentic, reliable and correct, they may be misinterpreted/ misleading and so forth. Ramsey and Fitzgibbons (2005) stated that teacher in a student-focused classroom needs to play the role as a guide by relinquishing some control of his (as cited in Hannay, Kitahara, & Fretwell, 2009). Students will take their own responsibility for learning and achieving goals along with other works (ibid).

Present education system of Nepal is changing the role of a teacher than traditional concept. It wants to provide quality education in a way that the student can develop themselves as a modern workforce where teacher will play the guiding role than dictatorship (Neupane, 2013), which I also observed in the classrooms. The traditional role of teacher is modifying with the help of modern educational psychology. We can compare the teacher's status with the concept of 'servant leadership', which was introduced by Robert Greenleaf in 1977. The theme of servant-leaders is driven to serve first, rather than to lead first, always striving to meet the highest priority needs of others (Hannay, 2009). The whole section tries to explain that the process of teaching is not only bound with giving knowledge, it also works as

a hidden guide along with the students who always give them proper direction to explore around them.

"Holistic" development of students can also be done by teaching because it can guide them 'how to behave with seniors, juniors, parents, relatives, friends, teachers, and so forth; teach moral and behavioral education, develop appropriate social person for the nation'. It provides the realistic knowledge to survive in daily life rather than bookish knowledge as Rajib felt, *"Many things we have to do in life beside the academic works* as *a learning application"*. Hannay et al. (2009) also argued that teaching process will ultimately develop students' skills, knowledge, attitudes, modify behaviors according to the social customs, leadership quality and so forth. We expect that this whole educational system will produce proper future generation with adequate social knowledge. To achieve sustainable education for Nepal, teachers need to play different roles in the classroom for modifying students' learning outcome that will ultimately generate moderate students for future, which I also felt with observation and interview with the respondents (Pokharel, 2012). However, teaching modifies its conventional role to develop students as a perfect social member who can contribute to the society as well as to the nation.

Learning. Tania thought, "*Learning is a set of skills rather than information because when, where, what, how and other situational knowledge will be appropriate for students to solve the problem, is determined by skills. By solving all problems, we will step ahead to achieve our targets and goals,"* which Rajib also agreed with. Educause Center for Applied Research (2004) stated that to get the IT's potential contribution in learning, we need careful thoughts and efforts for using it. Jenkins et al. (2006) noted that in the classroom we develop research skills, technical skills, critical analysis skills and traditional literacy which are jointly known as social skills.

World illuminates new capacities and skills from this (p.19, as cited in Klopfer, Osterweil, Groff, & Haas, 2009). In our daily life, we have to use different skills to support ourselves and through learning we acquire these and know how to use them. Joshi (2010) stated that traditionally in Nepalese education, teachers did not generate critical thinking skills on the students' mind but now they are focusing to do so. Teachers are trying to teach students with 'how to think, not what to think' method. This skill will develop students' analysis, synthesis, reflection and so forth capacity of a situation, which will help them to manage their life properly. However, learning is a skill which we have to use for our daily survival, to achieve targets and to get better future.

Interacting between two persons could be described as learning because when we interact with others we interchange knowledgeable information, manner, social customs, cultures, and so forth issues between us that enrich our knowledge on both sides. Haddad and Draxler (2002) stated that technology can be used as a powerful drive and management approach for learning that involves more teacher and student interaction for collaboration. Therefore, communication makes the bridge between technologies and learning outcomes.

In education, teaching and learning moves a long way from conventional practices to present one where a teacher adds dynamism and continuation in practices. S/he modifies his role as a hidden guide to develop appropriate social personality in the students where the former plays the servant leadership role for the development of the latter. Moreover, learning works as a bridge to develop skills, communication and technologies to achieve better future for students as well as for the nation.

Techno-pedagogy

As I found, traditional pedagogy was dominated by teacher, which gives the indication that the methods of those period were also influenced by teacher. Broughton, Broughton, Brumfit, Pincas, and Wilde (1994) claimed that the feature of traditional methodology is "teacher-dominated interaction" (as cited in Boumová, 2008). Actually, teaching was deeply teacher-centered that made students passive listeners in the classroom who could play little part in their learning process (Orlich et al., 1998, as cited in Damodharan & Rengarajan, 2007). This technique can be compared as "jug-to-mug" method where the teacher is pouring the contents to the students like jug pouring water to mug (Weerasinghe, 2008). During the pre-technology period of education, the educator could deliver the message via the "chalk-and- talk" method (Damodharan & Rengarajan, 2007). Although the idea of technology use in education has generated substantial interest only in recent years but development has been spanned for a century. John Dewey was one of the first educational thinkers in the United States who considered the role and place of technology in the school curriculum (Raizen, 1997). It helps both teachers and students for better educational prospective (Fairman, 2004). Discussion of this theme concentrates on seeing how teachers evaluate technology and its contribution to the teaching and learning process. Teachers' understanding of (about technological contribution to) pedagogy is presented here.

Rajib replied, *"Technology makes learning process easier. In school, we especially manage the digital board in the classroom what we call it 'digitally'. According to the subject matters, everything is displayed on the board. We are also making different animations, footage, life skills and experiences from YouTube and with own camera for a support in the learning process. We use explanation to make*

them yet it also cannot explain everything properly. With the help of digitally when we show animations or footage, they understand very easily."

Tania said, "*Technology is a set of new systems and ways that we can use in different ways. Previously, the process of teaching learning was based mainly on textbooks. Now, we are using computers, labs, internet in different ways in classroom. We use PowerPoint, videos, pictures because it makes everything to understand easily. Even children have different types of technical devices, which they can use for learning processes. Usually, we use the lab facility for experimenting something but not all things are possible to explain and share in lab like- climate change.*

It is widening the resources, making learning interesting and convenient. Communication has become faster. Information becomes easier for children. It is moving the fingers and you will get everything. It is easier to remember anything if you can visualize it. It has disadvantages also like- students are not going to the textbooks at all. They do not want to go to the library. They search in the internet and find it."

Musfiq answered, *"Technology makes life easier and comfortable. I use technology in classroom as per students' level and understanding capacity. Using technology we can show the items, like nuclear reaction, which cannot be shown instantly through experimentation in labs. Such cognitive processes can be shown through the animated videos, PowerPoint slides, MS-Words and images. This makes the concept clear for the students. One can use apparatus and kits made using technology in the classroom for the better understanding of the students.*

Before teaching the subject matter, I download the related videos, photos in my laptop. It is to make the concept clear for both students and teachers. Different learning examples can be shown instantly which needs practical experience."

Sakib reported, *"Technology means what brings changes in existing concept of work. It makes teaching learning more interesting; students become attentive, curious and come to know many new things than in traditional lecture method. Many computer-supported education systems are arising. Teaching with scientific microscope, technical instruments, web pages are helping education process. I search in the internet and download the videos from different websites."*

Technology

All teachers felt that technology is a system that makes life easier, comfortable and brings changes at present. Tania found, *"Technology is bringing the world closer"* because she realized with the help of computer and internet service we can find anything. Whatever we need, it is a way to bring everything towards you. Technology is the modification of devices that are helping to do our work within a short period. It reduces physical workloads and gives more comfortable, leisurely time and these devices, when maintained, always follow the guidelines of how to work. Rajib realized *"We are now in the age of technology"* because if we evaluate ourselves then we will realize that whatever things we are using now, actually it is the gift of technology because technology modifies everything for human benefits. Treacy (2012) stated that technologies have improved our lives in many ways, not just through making things faster and more convenient. Now, we are better connected and better informed. It assists us to consume less from environment and lighten our environmental footprints. Especially, after the invention of internet facility, the world has become closer to everyone (Kincaid, 2004). Nepali citizens are properly using and getting benefits of technology after the 1950s. Currently, technology is influencing every sector of Nepal and the world is open for them (Bajracharya, Bhuju, & Pokhrel, 2006). Along with the time, technology changes the state of human beings' lifestyle

and living standard. The present status of human in the world is all possible with the contribution of technology.

Technological Use in Education

Technologies are applied in education in different ways and things can be divided in two major sections. These are ‘devices’ and ‘applications’. I found that teachers realized the use of technological benefit in the teaching learning process and all were using at least computer and projector facility in the classroom to give lessons but the pattern of using these devices were different due to various circumstances. Rajib and Tania had more advanced technical devices in classroom, i.e. ‘digital board or interactive white board [4]or smart board’ and they mostly used them to deliver the lessons. Rajib said that digital board contains more than 99% of subject contents and he only needs to filter these before showing the students because not all contents are suitable for them due to their age and knowledge capacity. Tania’s experience was the same as Rajib’s. Besides these devices, everybody mentioned that they were using different scientific instruments like kits, apparatus, microscopes, and so forth in the school labs-the blessing of technology. Blurton (1999) stated that technological use in education is being modified along with the time. In earlier times, the use of film, radio, telephones, and television were the major contribution of technology but in recent times, technology is not only a single issue; but is the combination of hardware, software, media, and delivery systems. We use a computer (desktop, notebook, and laptop), multimedia devices, digital cameras and internet as major technological devices in education.

On the other hand, all teachers agreed that they were using videos, animations, pictures, and PowerPoint slides as applications of technology in the classroom. As I

[4] This large interactive display connects to a computer. A projector projects the computer's desktop onto the board's surface where users control the computer using a pen, finger, stylus, or other device. The board is typically mounted to a wall or floor stand.

found, Musfiq and Sakib used MS-Word files as an application in the classroom activities but others rarely used it because they had adequate materials in the interactive white board. However, the teachers, who did not have interactive white board facility, had crisis of either limited resources or other constraints. For that, they used MS Word files as a symbol of using technological application and tried to attract students' attention in the classroom. The reasons behind limited resources could be shortage of time, no adequate support of internet facility, limited knowledge about availability of materials, economical hurdles for fetching the payable materials and so forth. Blurton (1999) also stated that as a technological application in education, we use word processors, spreadsheets, tutorials, simulations, electronic mail (email), digital libraries, computer-mediated conferencing, videoconferencing, and virtual reality. Karmacharya (2008) stated that technological use in education is at the very minimum level in Nepal. Mostly private and some public schools in the cities boast a meaningful incorporation of computer courses in their curriculum, while we may listen that in many rural and remote parts of the country nobody has ever seen a computer. This situation indicates that education can explore technology in various ways but Nepal is not in the state to explore it properly.

As I observed that Tania used more technological applications in daily classroom activities but her interactive white board had not been working for two and a half months [5]though it was the most modern to others. The reason behind that the spare parts of the board are not available in Nepal. Rajib could not use the digital board more in delivering the lessons in order to secure pass rate and good marks in the SLC exam, which is more important for him than using technology in schools. Musfiq's classroom did not have a fixed projector for that he used his personal laptop

[5] The board is not working from second week of May 2013 until first week of August 2013 (as I get the information from teacher).

in the classroom activities. Sakib did not have more time to use technology in the classroom because he had been working for four different organizations a day.

Therefore, economy constraints, physical facilities, policy implementation, demand of schools and so forth reasons are pushing backward technology use in education in Nepal. Technological uses enrich and open new dimensions in education system but lack of resources and facilities there are obstacles to get the best output from it.

Why Techno-pedagogy?

All teachers were using technology in the classrooms and they felt it was very much helpful for them to deliver the lessons since it enriched the resources; made classroom communication faster, they could control and motivate students' mind and explain critical issues easily, students understood well with it and so on. They were getting these advantages as compared to traditional pattern of teaching. Rajib said, *"Science cannot be taught by only saying or speaking. Students need to understand in the real life scenario."* With the help of technology, students can relate the issues with their own life, which is not possible by bookish knowledge only because in a few situations, we find that students understand the topic but in real life application, s/he fails to use their knowledge. Rajib and Tania argued that in lab, they usually do the practical but all topics cannot be carried out there and thus, have to be explained. In this circumstance, technology helped them explain and make the issue clear to students.

Musfiq said, "*It is helping to understand and make other understand because both teacher and student understand the topics clearly through technology*." Sakib's experience was that students became more curious when he used technology in the classroom activity and it was helpful for him to control their minds. Blurton (1999)

found that technology affects students' performance and they become more fascinated for the learning matters, and these changes are more prominent between traditional and technology enhanced education. Technology helps those teachers who are not professionally sound in their work or may have a lack of knowledge but with the proper use of technology students can get sufficient knowledge from them (Mumtaz, 2000). Through technology students get motivation, have depth knowledge, can learn in their convenient time, use the sources apart from class time and so forth; and the teacher is empowered more, could manage the classroom properly with in time, can take contents preparation fully and so forth. Ministry of Education of Nepal (2007) has initiated a school reform project in which ICT-assisted and 'child-friendly' teaching/learning are encouraged in all schools but no noticeable implementation is yet visible because the roles of student and teacher are not clearly mentioned in the project (as cited in Mainali & Key, 2012). Although Nepal has higher appreciation for technological use in the school level, but due to lack of policy and its implementation issues, these concerns are not getting benefits from it. Technological use in education helps both teachers and students to enrich them and changes their present status of teaching learning situation for further development, which creates more eagerness for technology.

Experience with Techno-pedagogy

Teachers experienced that technology is helping in the teaching learning process and it is far different from the traditional method. Teachers can have a relaxed and comfortable time while students become more attentive, supportive, learning from their heart with the use of technology in the classroom. Rajib explained that technology reduces the chance of having accidents in lab works than traditional ways that make students happier to interact freely. Tania felt that students have different

modern gadgets in their own hand and they can use them to capture clips, photos, videos by them, which help later in their own learning. It works as a self-guide for them. She also mentioned, "*Learning becomes funnier, informative and it grabs students' attention properly because nowadays children become restless within 10 minutes".* She indicated that due to the present socio-cultural situation and classroom environment, students are not attentive as before. Sakib felt that *"Teaching with lecture method is very tough".* He was also aware that most of the schools of Nepal do not have proper technological facility, not even proper practical lab instruments.

Technology is helping both teaching and learning sections strongly. In one way, teachers get proper training, motivation, knowledge, skills to develop them and on the other hand, it is helping students to acquire more knowledge through technology (Blurton, 1999). As we know, teaching learning is a mutually inclusive process. Therefore, if the teacher knows something, then s/he will ultimately disseminate to students and all educational technologies are designed in such a way that both teachers and students can get benefit from it. It is visible that technologies are helping in teaching learning process in various ways and they are enjoying its benefits. In a greater scale, the whole nation gets benefit from it. Socio-cultural situation and classroom environment are affecting a lot for proper use of technology in the classroom because classroom is a miniature of the society.

Challenges in Techno-pedagogy

Though technological use in the classroom is beneficial for us, but to apply them properly in the classroom is challenging, too. I observed this and Rajib said later that in his school, two sections of grade 9 had to share one classroom equipped with interactive digital board on alternative days, because they had limited resources. It created psychological dissatisfaction among the students and they were blaming

school authorities for that because in spite of paying more tuition fees than other schools they were not getting proper technical facilities. While the school authority said that the digital boards were very costly for that they could not afford to buy for every single classroom. All over the school, except pre-primary sections, both sections of each grade (grade1-10) were sharing one digital board. I also found that Musfiq's school had only two projectors in school; one was fixed in the computer lab which was shared by all (grade 1-10 and A level sections) and the other one was portable but classrooms were not suitable to use it properly. Musfiq also believed that every content do not need technical support for teaching; this is also another reason for the less use of technology in education because teachers' personal belief was holding the need and demand of students. Cairncross and Pöysti (2011) stated that it is very costly for the schools to incorporate ICT in education and not every school can bear it properly.

Tania found that students were making excessive use of technology in their daily life; that's why they did not want to read the books, everything they collected from the internet and in few cases they copied and pasted all assignments from there, which ultimately reduced their skills of reading, learning; the main essence of education. Kennedy (2006) stated that 'Internet' is the most advancement in modern technology but its purposes have become altered and used for other nefarious acts because due to it plagiarism and academic dishonesty have been increased noticeably in education. The Internet has created new opportunities for students to become better cheaters and as a result created new challenges for educators. We can compare this issue with the 'internet addiction disorder' because more using internet making students' psychologically sick that they become favoritism for internet (Walton, 2012). Recently, we found the problem of Facebook Addiction Disorder (FAD)

among the social network users because of continuously using this social media (Fenichel, 2013). All these are hampering students' educational environment. Proper maintaining and guidance are essential to reduce the negative impact of technologies in education. Shen (2006) stated that due to technological use in education, students' reading habit from books has decreased. During my data collection process, I interviewed one student among these schools and he replied, "*Technology is like our organ".* This indicates how much students are involved with technology. Usually, due to lack of physical facilities and economical supports, students were not getting sufficient technological inclusion in their study, along with teachers' perception and efficiency to handle technological devices and consequences in educational issues are important factors for decreasing technological benefits among the students. Technologies are helping in education in various ways but no wise use and different constraints are causing problems to comprehend them properly in education.

Technologies are being modified along with time and at present, we are having the most advanced technologies for our comfortable life. Technological use in education also gives more comfortable, enjoyable, entertaining and reliable teaching learning situation for both teachers and students. It enriches them and changes their present status of teaching learning situation for further development; but lack of resources, economic problems, socio-cultural situations, teachers' perception and other factors are working as obstacles to use technology in education. Plagiarism increases in education system due to technology that is the worst effect of technology in education. Appreciation for technological use in education is very high among the students and teachers but without removing the constraints, we cannot get proper output from it for education.

Techno-pedagogy in Practice

There are many technologies available all over the world and not everything is appropriate for the classroom education. Education industry only incorporates those technologies, which can change the scholastic landscape of classroom activities. Now, the computer and the internet are the most influencing technologies in classroom (Astuto, Inman, Dover, & Lieneck, 2013). Actually, while new technologies emerged throughout history, educators tried to find meaningful ways to incorporate these technologies into the classroom – be it the typewriter, the television, the calculator, or the computer (Klopfer et al., 2009). We can think this way that Confucius' attribute is focused on the technology use in education because he described more visual things to remember for the students. This portion will try to find out which technological devices and applications are mostly used by teachers in the classroom. Teachers answer about mostly usable technologies in their daily works -

> *"I hear and I forget*
> *I see and I remember*
> *I do and I understand"*

Rajib said, *"In the classroom I use digital board, computer and projector as a technology. Among these, I mostly use the digital board. Students are generally excited and attracted with the technology because of the less risk factor, understanding deeply through animations, clips, videos and so forth. These technologies are working well for those who are academically poor or middle-level ones; we can say the needy pupil. Those who are good students understand from the teachers' explanation and books. I use 70-75% of class lecture with traditional method and rest of technology base."*

Tania reported, *"In the classroom, I use the active board and the computer, but mainly I use the former one. I prepare PowerPoint slides, presentations, audio-visuals, interactive games, quizzes, etc. for the classroom activities. With technology*

students are always more enthusiastic and attentive. They are listening more attentively and understanding well from videos. It makes teaching and learning more interesting, interactive, and visual. It also helps to grab and hold children's attention."

Musfiq answered, *"I use computer, projector as a technological support. In classroom, I mostly use computer (laptop) because I do not have a projector in my classroom and it is portable, too. Generally, when I teach in a traditional way, they only listen and follow me. When I show something, they feel the difference, become happy and enjoy it. Not all students of class are having the same capacity and level. Some understand very easily and other needs explanation."*

Sakib replied, "*In classroom, I use computer (laptop), projector, microscopes and other materials. Mostly, I use the computer and the projector. Obviously, students are interested, curious about technology. When I teach with the lecture method, they start gossiping, making noises and do not want to listen carefully but when I use technology, they understand from it very well."*

Techno-pedagogy in the Nepalese Classrooms

All schools I visited for my research had the variation in technological devices and their usage. Among them, two schools had hi-tech interactive white boards with computers and projectors support. I observed that the digital board of Rajib's school did not have the sound box built in, that's why sound boxes were spread all over the classroom to transmit good acoustics for all. The digital board of Tania's school was more modern than Rajib had because it had built-in sound box and the projector facility. Musfiq used only the laptop in classroom without having additional sound box. Sometimes, he also used the projector facility which was installed in the computer lab. Sakib used the laptop and the projector in the classroom without having

any sound facility. Frequently used devices in schools were varying according to the facility at schools but all used ‘computer’.

The schools that had the digital board facility mostly used it. Sakib said that he mostly used the computer (laptop) and the projector in the classroom. Musfiq answered that he mostly used the computer in the classroom but according to the content needs, he used the projector also. He mentioned that “*concentration*” demand would define the technology use for students. Lack of resources always gives pressure to the teachers for their professional works and if the teacher has not adequate knowledge to understand one’s students' status, then the output will not be good for the society. Haddad and Draxler (2002) stated that among all the technologies we use in education, the computer takes the lead role. Computer-aided programs are developing continuously in the world yet it does not replace the contribution of other technologies in education. It depends on the location and working pattern for the specific use of technology in education. Interactive and collaborative learning can be best achieved by networked computers and connectivity to the World Wide Web (WWW). James Kulik (1994) found that students usually learn more with computer-based education system (as cited in Blurton, 1999).

Digital board users are actually getting more benefits than other schools because these boards have two ways to work. One way the teacher can save whatever they do in the daily classwork activity and use it later for revision, e.g. they can input different files, clips, videos, animations and so forth from outside sources and the other way is some fixed contents, the ones made by experts, are installed in the board according to the topic of the course and more than that huge volumes of relevant sufficient sources are also in it. Teachers just need to use these contents and files properly. But those who are using mere computers, do not get these installed contents.

For that, they need to make their own contents and search the relative issues in the internet. It takes relatively more time to manage all the things which decrease the use of computer materials in the classroom. Preston and Mowbray (2008) stated that the digital board is enhancing the teaching learning in a very innovative way than other materials. It is working with the support of a computer and has more facilities than a computer has. In Nepal, mainly the computer and the internet facility in classroom are known as the technological inclusion in education. Apart from these, different radio stations and programs are running to disseminate education in rural parts of Nepal (Reddi & Sinha, 2003). Under OLPC project, few students of Nepalese schools are getting laptops for classroom activities that they can get hands-on experience to work with technology (Karmacharya, 2008). Therefore, few private schools use digital boards to their own classroom activity in city areas which is different from traditional concept of using technology in Nepal because the computer and the projector are the common usable technology in the Nepalese classrooms and all applications are mostly based on computer. Economic status of the school determines the usage of technology in classroom activities.

Learners' Response to Techno-pedagogy

All teachers strongly agreed that students' response about the use of technology in classroom is very positive and they demand it more frequently in the classroom because they understand very well from animations, videos, clips, colorful PowerPoint slides and so forth. All these things make students enthusiastic, attentive, happy, curious and much more about education, which is very important for such education system that students enjoy to learn more. Rajib said, for the *'Needy pupil'* it worked very effectively. He tried to indicate the middle and backward students in the classroom who needed more attention and care to learn. In his perception, good

students did not learn many things from the classroom technology because they learned and read from different books, the internet and such sources with their own interest. It did not create more changes in their eagerness of learning. Tania found that technologies Grab-and- hold students' attention more strongly with its video contents specially because it represents the reality, which attracts the students more. Musfiq felt that in traditional way, students only followed him, which was monotonous but technologies replaced the situation with pleasure and happiness to work. He also mentioned that not all students understood the same way from technology; few of them needed guidance from him to understand because such students had differences in gaining knowledge. Sakib understood, "*It is many times better than tradition way or lecture method because students do gossip, talking, not careful in class in traditional way*." Proper use of ICT in classroom can increase students' learning capacity, make them more engaged to learn, and their attitude will move ahead towards further learning and they will develop their own skill with it (Blurton, 1999). Technologies create curiosity inside students for new knowledge, which can destroy the traditional schooling system (Haddad & Jurich, 2002. p. 35).

The differences between traditional and technology-based education is that students can bloom with their own potentiality through technology and it assists students to grow up but traditional education system had no such doors open to go out and let the students discover themselves. Preston and Mowbray (2008) claimed that with the digital board, learning becomes more powerful because it has various dimensions of learning style. I also observed that students are giving more concentration on the technology-enhanced classrooms rather than traditional classroom situations. In the traditional classrooms, few students would be absent-minded, some would have been gossiping with others or doing other works

underneath rather than listening to the teacher. Teacher gave a lot of efforts but the outcome would not be satisfactory while the technology-enhanced classroom situations are very constructive. Therefore, technological devices develop new dimension in the education system and raise the students as they should be. Like all other countries, Nepali education system also has the benefit of using technology in the classroom. Previously, Nepal government planned and currently it has been planning to infuse more technology in education for better learning environment. Teachers and students are both getting more benefits from technology enabled learning rather than in a traditional way. Students' responses and understandings are far different between the two mediums.

Challenges for Using Technologies in the Classrooms

Rajib said that securing good marks in the SLC was the first priority of the school authority where he only took 25% of the whole of syllabus with technological support but he understood that students wanted more than this in the classroom. We know that the average pass rate in SLC exam is not good enough in Nepal. Moreover, the pass rate of private schools is higher than that of public schools. Maintaining good pass rate in the SLC is very important for the schools because if the pass rate is not good, then the present and future students will feel insecure and may not continue with the present school. As a result, it will create such situations that schools will find it hard to maintain even their regular activities in the society. Socially and economically, they will be in awkward situation. Therefore, the quality of education is deteriorating in the name of maintaining the pass rate.

Except Tania's school, others were using only 20-25% of technological support in school though they understood that it helped in the teaching learning process. When I first went to Sakib's school, I found that all the projectors of the

school were not available in the classroom due to different reasons. One projector was taken by the school teacher for his personal use. Blurton (1999) claimed that technological use in education changes the standard of education system. Haddad and Jurich (2002) stated that education is influenced by the different social factors. Therefore, if we compare the world situation, then we will have the idea that we are not capable to give proper education to all the students for different social factors. We need to remove all the social factors to ensure equal and accessible education system for all.

All schools are trying their best to use technology at the most advanced level in the classroom though various factors affect this intention but at least the computer and the projector facilities are used for disseminating education there. Animations, videos, clips and internet facilities are common applications for all to use and disseminate technology-based education in the classroom. Students' response and understanding using technology were well appreciated than traditional methods. However, different social factors, teacher perceptions and other influencing sectors are creating obstacle to use technology properly in the classroom.

Techno-pedagogy and its Prospects

The use of technology shifted teacher and student role in education, where students often became the "teachers" of technology skills and teachers were "learners" but teacher is authoritative implementer or user of technology in the classroom (Fairman, 2004; Astuto et al., 2013). Teacher's perception, feedback, understanding, and suggestion about using technology in the classroom are very essential to implement or disseminate technology properly in education (Educause Center for Applied Research, 2004). They can analyze the students' performance, learning, curiosity and so forth to determine technological influence in education

(Astuto et al., 2013). Teachers and students can create a reciprocal situation for using technology properly (Winthrop & Smith, 2012). This portion is trying to describe teachers' view about technological support base teaching- learning. Teachers' understandings about technological contribution for support education are mentioned below.

Rajib said, "*Technology has both advantages and disadvantages in classroom activities. Advantages are obviously very useful for teaching learning process; helpful for students' understanding, create enthusiasm in learning, durability of materials, addressing the current demand of time and generation in compliance with technology. While the disadvantages are expensive nature, arousing technical problems (hardware, software), load-shedding and power-related problem-the generator sometimes gives trouble, problems in level specification of materials, difficulty in handling for teachers.*

Technology has very nice impacts for all levels of students and we have to do little time management, and better work so that everybody can get the benefits properly. In the traditional method, it was difficult for us to complete the chapters within the given time because contents are heavier to understand in science."

Tania replied, *"Advantages are more information, visual, feeling the real things, easy to search anything through internet, create joyful learning situation. Disadvantages are students are not working enough, do not want to read textbooks, download everything from different sites, do 'copy and paste' in assignment works, load shedding cause distraction in classroom smoothness, socialization becomes less with students and create digital gap.*

I think everybody is getting the equal benefit for technology. With the technological support in classroom, we can mix both traditional and technological methods."

Musfiq shared, "*Advantages are effective teaching, good comprehension on the part of students, learning while teaching for teachers, fostering inspiration at work, creating positive learning environment in classroom, bringing more concentration on the part of students. Actually, I did not find many disadvantages. The very serious one is the misuse of technology, which might create problems. The other is power-cut that creates a chaotic problem, especially when I use the projector. Students learn and understand better from technology because it is more effective for both average and backward level students."*

Sakib answered, "*Advantages are that students learn more easily and smoothly, become familiar with technology, can consult their friends, family etc, helpfulness in teaching, helpful to collect students for school and many more. Disadvantages are takes more time to prepare slides which difficult for me, cost, maintaining properly, students may want to see the use of it every class, burden for family, search or automatically open unwanted sites from internet which is harmful for them.*

Students achieve more with the technology, which make them academically sound. However, I do not have time to do use these things. I am very busy from early morning to late evening. Only practical issues I try to cover by the projector. It affects weaker students more than middle or higher-level students. As I found that technology does not affect the higher level of students very much because they search by themselves, read book. Differences as I found that students are getting more knowledge, information, active, and enthusiastic by using technology."

Advantages of Techno-pedagogy

Using technology is beneficial in the classroom activity, which all teachers agreed. Both teachers and students are getting advantages from it. Teachers' benefits are professional development, arousing interest in teaching learning milieu and so forth. Student benefits are good comprehension, interesting learning, digital enrichment and much more. Rajib defined, technology is useful for "*Teaching, reading, writing and learning"* which covers the main pillars of education system. He added saying, technologically made materials could be used for several years. Therefore, the preparation of materials can reduce the workload and cost which is economically valuable. Tania expressed that through technology; anything could be searched in the internet and one would be able to harness the information about it. Musfiq found that technology motivated students, which was helpful to understand subject matters for them. Sakib said little differently that through technology students could consult with friends, family member for any information. He added that schools could get more students if they installed technology in classroom because people had the fascination about technological devices about how it worked in education.

Actually, how technology helps in education can be understood from different angles- inside and outside the classroom. Inside the classroom, especially teachers and students get the benefit; teachers can develop themselves, make it easier to present documents, create appropriate teaching learning environment, can give life related examples and many more. Students' benefits are an engagement with modern technologies, arousing more concentration for learning, comprehension at ease relating the life, a tool to motivate the learning, visualize the scenarios, know any information through the internet and so forth (Haddad & Jurich, 2002; Preston & Mowbray, 2008; Herzig, 2004; & Fairman, 2004). Outside the classroom, it helps for

communication, distance learning, explores new things, reduces the cost of educational expenses; spread the education in remote areas (Haddad & Jurich, 2002; & Vi, 2005). For continuous and lifelong learning and improvement of teaching materials, technology helps (Blurton, 1999). All these consequences are the same for the Nepalese education system, too.

I observed that technological use is changing the classroom scenario, students are more motivated with the learning through technology, teachers are getting help from technology to make students understand well. Geographically, Nepal has the disadvantages that not all places are suitable for better education environment but through radio, TV stations and in few cases distance education system, people get the touch of education (Reddi & Sinha, 2003; & Pokharel, 2012). Therefore, technological blessing helps for classroom pedagogical process as well as outside education system. It opens the scope for both teachers and students to enrich them with modern educational process. Development of the latest technologies and their inclusion will enrich the whole educational process for producing knowledgeable human resources who can compete with the modern time.

Disadvantages of Techno-pedagogy

As we know everything has two faces-pros and cons, likewise, technology has a few disadvantages when we cannot use it properly and wisely in education. Disadvantages are load-shedding problem, unaffordable cost of devices, technical problems, misuse of technology and so forth. Load shedding is a common and major problem for using technology because all technological devices run on electricity. Load shedding stops all technological devices unexpectedly. In a school, the load shedding stops all technological devices and equally hampers the smoothness of the classroom environment. To restore the power, it takes about 5-10 minutes according

to the backup system, which is 25% time of the whole class time. If there is no proper power backup system, the technological use in the classroom is to be postponed for the day. I found that load shedding created problems for every school but Musfiq did not face any major problem by it because usually he used the laptop in the classroom; and his school had a good generator backup for power supply. When I was in his school, I observed that school restored the power within 5 minutes. Sakib's school had also the generator but when I went to see a class for the second time, I found that his generator was not working because of the scarcity of oil in the school. Tania and Rajib's school also had good generator system which restored power with in 2-3 minutes but Rajib's school authority said that due to the scarcity of oil they sometimes cannot run the generator properly.

The cost of technology is another disadvantage of technological use. Every school authorities said to me that devices are costly but not everybody shared with me that they had the economic problem. The school authorities of Rajib and Sakib agreed that they had the economical problem and students had to share the technological materials because they could not buy adequate technological tools for all. However, Musfiq's school authority did not agree with me that they had the economic problem though in their school, they had only two projectors. Sometimes repairing or spare parts were also costly for the schools. Technology opens the entrance where we can explore everything through computer and internet facility but if we cannot use it properly, then students can misuse the technological advantages.

Rajib found that in the digital board contents depth is not always suitable for students because contents were made by experts and for one topic they had made only one video or animation or clip but in current education system we disseminate one content in different grade books. Therefore, if we had one clip that explained

everything could not be understood by lower class students clearly and could create knowledge problem for the students. Another problem he found was that a teacher would face difficulties if they did not have proper skills on how to manage everything. Tania realized that technology could decrease the socialization because students spent more time with computer but did not care who was next to them; and created a digital gap between the technological haves and haves not in the society, resulting problems to communicate with each other.

Sakib expressed that the technology use in education created problem for him, students' families and the society. As he said earlier, he worked for four organizations at a time that is why he could not make enough preparation to take class with technological support but students wanted technological use every day, which created awkward situation for him as well as for the students. In my observation days, he only made some words file documents to present in the class. He also said that students liked to use computer and wanted the same thing at home but not all parents were economically sound who could afford a computer for their children, which created family problems. Another thing he said was that some students misused the technological advantages and created social problems like sexual harassment to girls, abusing fellow classmates, vulgar gossiping in the classroom and so forth. Misuse of technology, load-shedding problem, not adequate skills to manage technological devices, cost, less socialization, digital gaps between students and so forth are the negative consequences of using technology in the classroom (Blurton, 1999; Haddad & Jurich, 2002; Herzig, 2004 & Vi, 2005).

In Nepal, load-shedding problem is the major problem for technological use in education because the country is facing severe power supply shortage all the year round. Economical condition is also another problem for the country because Nepal is

one of the underdeveloped nations in South Asia for that they cannot afford to spend more money in school level for using technological devices with proper maintenance and power back up system in all institutions. The Government distributed two computers and one printer in 3078 schools and is planning to give more to schools. With the support of different NGOs, the government is hoping that all over Nepal technology will be used in education and the nation will get proper human resource (MoE, Nepal, 2013). It is clear that technology can improve the whole education system but different constraints work as a disadvantage of using technology in education. Physical, technical, economical and social problems affect the proper use of technology, which ultimately turns to be disadvantageous use of technology in the school level.

Technological Influence on Students' Learning

All teachers confirmed that technology affected students' learning and it had various impacts on different levels of students. Learning influences were creating curiosity, giving motivation, increasing understanding capacity and so forth. Good, average and low level students had different kinds of influence of technology according to their demand. Rajib said that in his digital board, he could save, edit the daily classroom activities and could give the notes to the students through email. He realized that technology has influenced all levels of students but middle and low level students got more benefits from it because they did not want to study more and visualization helped them to engage with learning strongly that ultimately helped for their improvement. Musfiq and Sakib also agreed with Rajib but Sakib mostly emphasized that it is the lower level students who are getting more benefits than others. Tania felt that in the classroom all levels of students get the equal benefits from technology but considering the personal situation, students having gadgets found

to be getting more benefits in education than those who did not have. Musfiq said that good students learn from books, the internet and other sources for their personal interest about learning and thus, technological support in classroom did not affect them. Rajib and Sakib also supported his view.

Blurton (1999) stated that technology affects students learning strongly. Saba (2009) claimed that students' learning is influenced by technology very much because it draws the students' attention and make them follow it. Technology helps all levels of students who want to learn more, so it is very helpful for them (Haddad & Draxler, 2002). Hasselbring and Glaser (2000) stated that technology helps the children with special needs, along with the normal students because students understand better with technology than with the traditional methods. In Nepal, the situation is similar that students' learning is facilitated by the technology and students learn better with technology (Karmacharya, 2008). I also observed in those classrooms that students were more eager to learn from technology. Technology had different levels of influence on different grade students but all had the positive impact on their learning demand. Average and low-level students were always the concerned section for the teacher to make them study well. In this portion, technology is doing a great job for teachers. We can have different opinions on how technology works for education but ultimately it works well for education.

Techno-pedagogy vs. Conventional Teaching Learning

Students and teachers are getting benefits by using technology in the classroom and every teacher had one stand that technologies improve teaching learning situation in the classroom. The teachers mentioned different benefits of technology by describing how technology is helping in changing the classroom situation. Rajib said that technology helps for time management in the classroom

because in a traditional way it is very tough to manage the full contents. Tania felt that technology makes the things more visible in front of students, which make them understand better. She also added that the combination of traditional and technological methods is very effective in the classroom as when students watch some videos, and we can give some works to write notes or memorize a few things that students need to do. These are the ways, which would keep students more engaged with learning matters. Sakib expressed that the styles of technological education and traditional education are very different. Technology attracts students to learn more, motivate them towards learning so forth. Blurton (1999) stated that technology and traditional classroom have differences in every aspect. Students and teachers both get better learning opportunity with technology than with the traditional one. Fairman (2004) claimed that technology opens the doors for new learning environment. These differences are forcing to shift educational system from traditional to technological era though it is not easily possible for the developing countries like Nepal but initiatives have been taken to change the classroom environment.

Technology has both positive and negative consequences in education due to physical, economical, social, technical and so forth issues. Education is getting great support from technology because all levels of students are getting benefits from technology but lack of maintenance and proper support work as obstacles to get the maximum benefit from it. Collaborative support from teacher, student, school authority, family and society members can reduce all the problems and create better educational situation. Though we know that technology is doing the best for education, but we can use the technological and traditional education system side by side in our context.

Technological Influence on Learning

Due to technological use in education, mode of teaching is shifting toward more student-centered and inquiry-based approaches, where students take more responsibility for their learning and teachers serve as facilitators. Technology creates more interaction and cooperative work across all groups of students and between students and the teacher (Fairman, 2004). Proper use of technology can improve the student's learning achievement but without efficient and appropriate use of technology, it cannot change any outcome of student's achievement (Winthrop & Smith, 2012). Merrill (2007) claimed that instructional technologies influence educational environments for interaction, which provoke interests and stimulate learning to encourage students for study (as cited in Erişt & Kurt, 2012). Along with learning, students develop personal confidence or self-esteem, interaction capacity, friendly relationship with fellow classmates; reduce fear of learning and so forth. Many teachers used the word "empowering" to describe the impact on students (Fairman, 2004). This section will discuss how technology can influence students' learning. Participants' perception about technological influence in education are also included along the subsequent paragraphs.

Rajib said, *"Students want to have this technology and desire it but we are not able to give this regularly. Both teachers and students were very excited while it was first introduced in school. I have discussed it earlier and more than discussion, they used to come and ask about technological issues. They are not getting it regularly. They understood very well from technology-based materials."*

Tania replied, *"I did not ask them for their opinion but I observed their feeling and realized that they wanted it. My board is not working and students are*

complaining about this, asking what happened to it, when it will come back, they are actually missing the thing."

Musfiq answered, *"Students take the use of technology in classroom is a positive way. If we do not use, then they have a redundant complain that the teacher is always using lecture method. We do not use technology regularly in the classroom. I take the feedback from them and they feel very good about technology."*

Sakib shared, *"Most of them are taking it positively but maybe some students take it negatively, too because some students backbite that "The teacher could show other pictures, like restricted sites, girls picture" while I am showing something in classroom. I discussed with them and they said it was very fantastic for them also. I like that students are using technology to learn something new because at least they are reading."*

Student's Experience with Technology

Despite some constraints of using technology in the classroom, all the students took the use of technology in a very constructive way. They were more eager to use technological devices in their daily classroom activities and they felt passionate about it. Rajib felt that when technology was first introduced in school, both teachers and students were very excited about it because they got a new hope that education would get a new dimension with the use of technology. Fairman (2004) claimed that technology creates a sense of excitement among students and teachers. Rajib also mentioned students would desire to use the technology, which indicates how much they were devoted for this technology. This reflects the motivation at present about the technological advantages in education. Tania said that her digital board was not working and students were continuously asking when it would be fixed. This gives the

idea how much students liked it in their daily education. Musfiq expressed that students filed complaints in case he did not use technology in the classroom.

Sakib stated both positive and negative learning influences he got from the students' side. A few students of his class were not taking the use of technology in a very positive way because some of their friends used technology as negative reinforcement for their life. It could be because of not having proper guidance, restriction from family, elderly people, teachers or others sectors of influencing life since they were getting information from every angle. The positive aspect he found was that students became more conscious for education and getting motivated to study more and search many things in different sources to know more. Therefore, they actually wanted to develop a sense of technological awareness inside students. Fairman (2004) stated that technology increases students' motivation to learn, and giving students more opportunities to control different aspects of ownership in their learning and schoolwork. I observed that when teacher said that he would show videos or clips, then total concentration of students would be on the display board but before that they were not fully concentrated in the class. However, a few students used the technology in their life as a negative reinforcement but most of the students took technology as a supporting material for their educational development.

Students' Perception and Attitude

Not all the teachers took the feedback from students to know their feelings about using technology but those who had taken got well appreciation from the students' side. Students said that they liked the use of technology in the classroom and felt fantastic about it. Rajib said that more than his inquiry the students came to him for asking different things. Sakib felt, *'Students do not want to read study materials, books; they only want to listen and watch in classroom'.* However, Tania did not ask

but she felt that students really liked it because she got positive feedback at the beginning of using technology. Fairman (2004) found that students became more comfortable with technology in the classroom with more eagerness inside them, especially to be engaged with technology in education. However, it is not fair, not to take students' opinion about technological use in education because everything we use in education is for their improvement. Nevertheless, the students were feeling about technology very affirmatively. After getting all students' feedback, perhaps we could open new sides of technological impact on education that might be better for the whole educational process.

Challenges for Learning

Rajib found that students felt the problem to express what they had seen in videos but they understood it. Content depth was the reason for this problem. Another problem Musfiq mentioned was that he showed videos on only one day for the whole lesson because he could not use technology regularly, which indicated that learning was not equal for everyday lesson. Students had to wait for weeks to complete the whole lesson then they would get a chance to see something on technological application. It was not a good learning environment. Resource, time, materials were the main reasons for these challenges.

For learning, technology was helping very much and students felt it in their daily classroom activities while different constraints were not giving opportunities to use it vastly. Though teachers understood the students' feeling, they should ask students about their own feelings about technology because many unknown things could be arisen from them which we can consider for further development of technology.

Science Classroom and Techno-pedagogy

The relationship between science and technology is complex because one-way science begets technology or hierarchical relationship and another way relationship is symmetrical, within a larger context of relationships (Moxley, 1989). In the classroom, though technology has been used since long time back, there has been a rapid use of technology for the last few decades with the invention of new technological devices. Haddad and Draxler (2002) stated that though technologies were used in education in different formats more than a century ago but modern computer-based technologies began to make inroads 30 years ago in education. Now we have virtual high schools, virtual universities, and virtual programs provided by campus-based universities and so forth. Technologies are included in science education and it is working for the betterment of the education (Bosch, Rhodes, & Kariuki, 2009). This part is trying to explain the teachers' opinion about what the contribution of technology in science classroom was for them. Some of the typical teacher responses on the use of technology in the science classroom are presented below.

Rajib said, "*Technology has changed classroom situation positively. It is affecting teaching learning process very deeply because demonstration, explain, example etc. can do very well by technology. It engages students more strongly through different games and question answer sessions. It also works as active learning process in classroom because by applying these devices, students become more attentive, curious in classroom and it makes the active learning environment in classroom."*

Tania expressed, *"I think technology changes classroom situation very positively. To present graphs, pictures, files, power points, word files, etc. in science;*

it is quite useful. With this technology, I can play games, puzzles, quiz for the review or revision rather than only asking question, it crates interactive situation. For the active learning, I give project work, group work, research work and they search the idea in internet for doing the works and writing."

Musfiq felt, "*Technology is changing the classroom environment as it creates excitement among students. There are many things in science course, which we can easily present and explain with technology. It engages the students. They like to see and watch which needs better concentration. Technology clears their concepts but for active learning process, they need to go to the field."*

Sakib answered, "*It has both positive and negative impacts in the classroom. It engages more students in classroom. They start to work with new charts, draw microscopes, reading more books from higher-level books, searching things in the internet, asking always new things, sometimes they ask something what I do not know, too. In active learning process, students start to think more, become curious to learn, carry out discussion about different topics, which creates interactive learning situation."*

Teaching Science with Techno-pedagogy

Technology changes the science classroom environment in a positive way. It influences the teaching learning process with the help of videos, clips, power point slides, animations, word documents, pictures and so forth. We can easily explain, demonstrate, do simple experiments of different contents inside the classroom and students learn from it. Rajib said, "*Science and technology are as mutual as two facets of a coin."* Musfiq said that what we could not do in science labs could be easily done in the classroom with the prime support of technology. Among other teachers, only Sakib mentioned the negative influence of technology along with positive influence in

the classroom. It was because few students showed disturbing behavior inside the classroom; which made him feel irritated and he could not concentrate well.

Kozma (2003) stated that technology use in science classroom had a positive impact on learning because presentation methods made it easy for the students to understand easily. Richards, Barowy, and Levin (1992) claimed that using different software in science classroom activity makes learning process and presentation patterns easier. Haddad and Jurich (2002) expressed that science demands more empirical knowledge to understand. For that we need to give proper training to the teachers so that they learn appropriately and make other people learn accurately. Preston and Mowbray (2008) said that proper technological support can make the science classroom effective, which will be very much beneficial for the students.

Technology has both positive and negative impacts on the classroom, which is also same on the science classroom. How we use technology in education, learning will mostly be dependent on it. Like other countries, Nepal also considers all the positive aspects of using technology in its education system and for that in the master plan it includes science education improvement plan with the help of technology (MoE, 2013). Science as a subject demands proofs for what you are saying, in that concern, technology helps to give the replica of that situation through videos, animations, pictures, clips and so forth. The proper use of technology definitely creates appropriate science learning situation for all but misuse can create a contrasting scenario.

Engagement and Learning Environment through Techno-pedagogy

By playing different games, puzzles, quizzes and so forth; technology engages students in the classroom through different pair works or group works, project works, question answer sessions and many more way of activating the students in the

classroom. All teachers agreed about this. Rajib said that active learning process made the students more curious and attentive for learning. Tania said that for active learning process, she used the internet for searching documents and made students involved in it. If they found something new through the internet, then the whole class would try to understand it via active participation. Musfiq gave note taking activities while they watched something in the classroom for active learning. Sakib felt that more engagement with learning provokes students to search one issue in different high level books, internet, friends and at last ask him for confirmation. I saw that, for active learning process Tania and Musfiq gave works to the students before showing videos and animations. Haddad and Jurich (2002) said that ICT engages students in classroom activities through videos, clips, TVs, radios that they can learn better for their future life and can implement in their own work. Preston and Mowbray (2008) claimed that technological instrument engages student more with education and they learn better. Herzig (2004) also realized that in modern education system, the use of technology engages the students with learning more than the traditional method.

For the active learning process, ICT promotes interaction between students and teachers through peer group or sharing method (Dhanarajan, 2002). Technology provides teachers and students with a whole new interactive learning environment to share ideas, information, images, animations, audios or videos (Preston & Mowbray, 2008). Cohen (1997) claimed that when a teacher integrates technology for developing the subject matter, then the whole classroom situation will be changed and teacher–student will go for interactive learning (as cited in Herzig, 2004). Students' involvement for learning in the classroom with the technological support is a fundamental idea of engagement theory because it stated that the education system could engage teacher- student through meaningful learning activities with or without

technology but technology can facilitate engagement strongly than any other ways. The reason behind it is that technology removes all barriers in education than others (Kearsley & Shneiderman, 1999). Rusbult (2007) stated that in the active-learning process, students learn different things with activities. This process is very different from other modes of learning.

In the field schools, I observed that students were learning and involving in different activities to develop their learning which indicated that students were learning with the combination of engagement and active learning theory. All over Nepal, the government has taken initiatives to include ICT in education to improve the classroom situation with more engagement and active learning and for this, the master plan is undergoing (MoE, 2013). Engagement and active learning are two theories that create the proper learning environment for the students. In the classroom, technology does the same thing what both theories want to do in the practical level. More engagement creates better active learning process and develops students for future.

Challenges for Learning

Sakib said that while he taught more carefully for the engagement and active learning process, then load-shedding created the problem in the whole process and hampered it. He had 40% or less chance in the classroom to carry out other activities rather than following the lecture method. If load-shedding occurs, it is easily understandable that the whole class shifts towards the traditional method. I observed in Sakib's school that when he told the students he would use videos for this lesson then they became quiet and diverted themselves towards the projector to see but suddenly there was powercut and devices were not working anymore and the students were suddenly distracted and never concentrated properly in the classroom.

In the science classroom, technology is a very useful tool to use for the better engagement and active learning process where students have more chances to learn more. Different activities and techniques can be applied through technology which is not possible in other methods. But without removal of the constraints, it is not possible for us to get the highest benefits from ICT.

Chapter Summary

Teachers' perception is very important in the education system to understand the root level response because if they are satisfied that indicates the education system has approaching the right way. The whole chapter describes the teachers' view about techno-pedagogy and its impact on different scales of the teaching learning process. Both sides of impacts are discussed here with supportive literature and theories.

CHAPTER V

PRESENTATION, ANALYSIS AND DISCUSSION OF CHALLENGES AND OPPORTUNITIES OF TECHNO-PEDAGOGY

Chapter Overview

For implementing new things, it is essential to understand the challenges and opportunities of that respective issues because without realizing the constraints and possibilities, there will always be knowledge gap for proper implementation. This whole chapter has discussed the challenges, opportunities of techno-pedagogy and possible overcome strategies for that from teachers' opinion. The second research question is answered here.

Challenges

As we know that technology is helpful for the classroom instruction but its use in the classroom is a challenge for those who are operating or getting benefits from it. Klopfer et al. (2009) stated that without any doubt, we can say there will be challenges to implementing these technologies in the classroom. There are many challenges for using technologies in the classroom because we focus more on devices rather than application process (Winthrop & Smith, 2012). Sjøberg (2002) also argued that for using technologies in the classroom we have to face problems from different angles. This portion of my research would try to explain the challenges observed by the teachers. Teachers' experiences about technological challenge are presented below.

Rajib answered, "*I face few challenges to use technology in the classroom. They are need of higher knowledge, more time consumption for preparing a class, no*

complete digital learning system, lack of proper manual of the digital system and balance between the classroom syllabus and technological information.
I feel that there are no problems of physical facility in school besides few technical problems. To name few, there are few, such as possibility of parental problems despite the sound economy on the part of school and lack of clear policy and its clarification on the part of the government. However, some positive aspects are people's acceptance to the digital learning socially, no visible psychological problems in classroom, etc."

Tania reported, "*The challenges I am facing are- mainly technical in nature. They are both efficiency, hardware & software and power-supply problems. Yet economically the school is solvent; psychologically and socially there is no challenge. In the meantime, she does not know about any policy."*

Musfiq said, "*I face the challenges such as, inability of fetching learning videos from the virtual world, risk of opening unwanted sites while using the internet and lack of ample physical facilities. He has enough technical knowledge and psychologically and socially, there is no problem. However, he is not aware about policy and does not have such ideas about economical situation of the school."*

Sakib replied, *"My challenges here are lack of personnel in handling the tools bearing the prospective obligation of reimbursement in case of any malfunctioning , unethical use of technology by some students, unregulated power cuts, classroom facilities, complaints from family and no sound economy of school, having proper guidance of policy and visible psychological problems."*

Teachers were facing different types of problems to implement technology in the classroom like physical, technological, economic, psychological, social, policy, etc. yet not all were having the same problem. The problems they were facing

depended on which devices they were using and their understanding on challenges analysis. Given below are the challenges accordingly.

Physical Challenge

All teachers were saying that their schools had the physical facility problem but actually, every school had a few problems. Musfiq and Sakib said that they had the physical facility problem. Musfiq shared and I, too, observed that in his classroom there was no place to put the table for displaying the content using the laptop. For this reason, to watch content on the laptop students needed to sit in two rows rather than the four rows and it would not create proper classroom environment. I also observed that the classroom size was modest for the students ratio. A gigantic white board was visible to all in the classroom. No curtain and projector were in the classroom. In the hall, the projector was fixed which was big enough to see for all. However, the teacher's writing on the board was not visible from every side. I observed and Sakib also said that his room was congested to the ratio of students' capacity since 40 students needed to sit on 12 benches. He needed to move with the devices and it increased the chance to cause damage of them; and he also assumed that for the damage of devices authority could scold him and might impose reimbursement for . I also observed that he could not do any work in the classroom with technology for different physical problems within my observation period.

I observed Rajib's school that had one white board along with the digital board. No curtain was in the room for that the students at back faced some difficulties to observe the board properly. All teachers agreed at one point that proper power supply was one of the major challenges they were facing currently in using technology. The class paused for 5-10 minutes during the class hour causing students more distracted. Sakib said that when there was power cut in the classroom, he left the

use of technology for that day because it would take 15 minutes or more to restore everything which turned out to be a wastage of time. Tania shared and I also observed that she managed the classroom with a white board because digital board was out of service. Sometimes, she took help of other teachers to show something important for the students. Haddad and Jurich (2002) stated that physical facility is a major problem for the proper use to technology. Not having proper classroom, ratio of students and teachers, scarcity of technical devices, not getting the access of technological instrument, constant power supply, internet connection and so forth effect the classroom situation. Physical setting of classroom is effecting vastly on students learning achievement. Proper classroom situation is very essential to maintain education standard (Saat & Bakar, 2005).

In Nepal, along with other problems load-shedding problem is the main problem for the continuous power supply in schools. Not all places are accessible to proper educational physical facility which hampers the education system. Few institutes have computers but they do not have proper power supply to use it (Bajracharya et al., 2006). Without having the proper physical facility, it is not possible to deliver quality education. Physical facility is the base of any development work. If we want to establish proper technological support-based classroom, then first we need to establish proper physical facility. Other things also comply with the physical facility available in the school.

Technical Challenge

To maintain the technological devices, we must need the technical knowledge, capacity and efficiency. Apart from Sakib, others said that they needed proper technological skills to use those devices properly and there was the lack of efficiency about it. For that, they could not use all those devices to the fullest to get the best

utilization. Rajib said that in the digital board, many things were left which he needed to know for classroom activities, but up to now, he did not know all the functions properly, even all contents. To take one class, he needs to prepare for at least two hours, which was a challenge for him. He complained that the experts having depth knowledge about the contents made all those education materials, but teachers were not in such a condition which created the knowledge gap between materials and the teacher. Tania said that she was not efficient enough to use all devices; but students helped her or she needed to go to technological support department at school in case of any problem. Musfiq said that for maintaining the laptop, he had sufficient knowledge but when the school introduced the smart board, then he had to undergo the technological training to maintain it. Giving devices or putting technological instruments in the classroom will not be effective enough if there is no proper man power to handle it. Without proper technical skills, all these things will be counted as a waste. Haddad and Jurich (2002) stated that we need technically-efficient human sources who can control the devices for the maintenance of technologies in schools. Blurton (1999) claimed that the proper use of technology depends on how teachers are capable to use these in the classroom.

Nepal is at the stage of implementing technological devices in schools. For that the government wants to give proper training to the teachers that they can maintain the devices properly (MoE, 2013). Without proper technological knowledge, all these technologies are scraps in the classroom. For that, we need to develop proper human resource who can control and use it properly for delivering quality education.

Economic Issues

All said that technological devices were very costly. Annually, it needed a huge amount of money to buy, repair, replace and modify technological devices.

Without proper economic solvency, no institute can afford to buy it. Rajib's and Tania's schools were economically more solvent than that of Musfiq's and Sakib's schools as showed by the devices they used. They felt that schools did not have any crisis of money. Actually, all teachers did not have proper idea about economical condition of the school. Everybody said that school management committee could say better about it. I talked to every school authority and collected information about it. Tania's school did not have any economic problem; they could spend money when needed. In Rajib's school, the authority had monetary crisis. For that they could not install the digital board in every classroom. Musfiq's school authority said that they did not feel the economic problem but due to lack of proper physical facility in the classroom, they could not install the digital board in the school. Sakib and his school's authority said that his school had economical problem because they could only afford a few devices, not all. He also mentioned that the school family was facing the problem of economic crisis to buy the devices. He got complaints from parents' side that students were demanding to buy the computer at home but they were not capable to buy, which created problems in the family.

Fairman (2004) stated that using technology in the school level is a very expensive strategy because a huge amount of money is needed to install devices in school. Winthrop and Smith (2012) stated that installing technological devices are costly but in the a long run, it will be cheap. In Nepal, the government cannot afford technological devices to all schools because of their costly nature. Whereas after getting funding from different organizations, the government is planning to provide technology in schools (Reddi & Sinha, 2003). Haddad and Jurich (2002) stated that economy works as a major factor for social development. Not having proper

economic support to establish technological system in school and proper maintenance are major problems in Nepal for technology use (Reddi & Sinha, 2003).

Among the social development factors, education is one component which needs economical support for development. Without proper economic support, education cannot be disseminated or expanded properly in all sectors of the society. Technological tools are very costly, which need more economic support to install in schools. Development depends on different factors, where economical constraints work as a major factor for implementing technology in education.

Psychological and Socio-cultural Issues

People and societies thinking about using technology is a very important issue for implementing proper education system. Besides Sakib's school, other school teachers,students, parents, guardians were taking about the use of technology very well and they wanted to use those technologies more in education. Rajib, Tania and Musfiq said that they did not hear any complaints from any side that they did not like these technologies but Sakib said that all parents were not happy with the use of technology in the school because of economical problem which created psychological pressure for them and ultimately it diverted them not to have technology use in school. He also said that students, teachers and school management committee all were in psychological pressure because they could not use technology properly. Students wanted it but did not get it; the teachers wanted to use it but they were not capable, the school wanted to install it but had no sufficient financial resources and the authority knew that if they could not be up-to-date with new devices, then new students would not come to the school.

Haddad and Jurich (2002) stated that the technological use in education develops cognitive psychology because when students use technology more, then they

will gain more knowledge which helps them to develop their own psychology. Culture is also affected by education because education develops society which affects the culture. Lifelong and continuous education affects culture strongly. Means et al. (1993) suggested that technological use in classroom creates the opportunity for different cultural issues to include in education because many things we can explore with it (as cited in Herzig, 2004). Changes in educational pattern always affect the society strongly because we belong to society and the society lives with education.

Policy Status

Without proper policy and implementation, we cannot hope that something will change from its originality. To use technology in education, we need proper educational policy and implication of it because without proper guidelines, we cannot go forward. We need strategy, work plan, guidelines and such other activities to implement one policy in the root level. No teacher is aware about the government policy vis-a-vis technological use, which means in the root level, there is no practice or dissemination of knowledge on how to use technology. All schools are using it for their own need and demand. Sakib said that the government always says so many things but in practical level there is no implementation about anything. Rajib also shared the very thing. We need proper policy to use technology otherwise, someone will use, others not, which can create digital gap in the society. For that the government takes the master plan for ICT in education (2013-2017) which will create proper technological use-based structure for the society (MoE, Nepal, 2013). Policy is an essential indicator to use technology in education because when policy is implemented, then everybody will obey the rules and aligns with the technology.

Apart from these challenges, teachers mention more challenges; as like Rajib said managing time for preparing materials is hard for him. Tania said that finding

authentic websites and data is a challenge for her. Musfiq felt that the sudden appearance of unwanted websites in the classroom hampered the classroom environment. Sakib said that sexual harassment could increase through the misuse of technology in education. All these problems are the parts of technological use consequences. We need proper training, guidelines, family and societal awareness which can reduce the problems and better behavior among the students to use technology.

To install new things will definitely face problems from different angles. Technology use in education also faces many problems which we need to overcome to use technology properly. By removing physical, technological,economical, psychological, socio-cultural, policy and such problems, it will create the path to install technology properly in education. Challenges work as objectives to overcome for the better result of using technology.

Scope of Techno-pedagogy

Besides the challenges in technology uses in the classroom, different opportunities for both teacher and student are available. Fairman (2004), and Klopfer et al. (2009) found that technology creates the scope for both teachers and students for exploring more things than before inside and outside the classroom. Educause Center for Applied Research (2004) concluded their findings that both teachers and students were having benefits from technology but comparatively students were getting more. Technologies created professional and personal development opportunities for teachers and students (Dhanarajan, 2002). It means technologies are creating scopes for those who are applying it in the classroom. This section would try to explore all the scopes for technological use in education on teacher perception. Respondents evaluated different opportunities of techno-pedagogy to their settings.

Rajib said, "*It is more than opportunity because I learn so many things with technology. Students can feel what they are learning. For the society, it opens the link of development, which ultimately develops the nation. Economically, it is also beneficial because at a time, it may be costly but for the long run, it saves different educational costs. It has also the health benefits if compared to other means."*

Tania replied, *"It gives me the scope to teach more interestingly and develop myself. Students get more opportunity to explore their knowledge from different angles. Society and nation get benefits from it because they will get proper human resources. Economically, it is costly yet saves money from others angles and is helpful for health, too."*

"Both teacher and student get the benefit from it, they can explore, share, exchange their knowledge with different countries experts, teachers, students and develop themselves. When students get the benefit then it ultimately affects society and nation because students come from there and will return there. Economically, it may be expensive, but will save money in many other ways. Chalk and marker are harmful for health but it will save from all these." shared Musfiq.

Sakib had to say*, "Technology opens the opportunity for the teacher and student to develop them. It ultimately affects society and nation because they earn money, which will be used for its development. It is expensive but will save money and return it in a different way. There may be some radiation problem, but helpful from chalk- or-marker-oriented respiratory problems."*

All practicing teachers agree that technology opens the door for the different opportunities, which will definitely be helpful for all who are directly and indirectly involved with the education system- like teacher, student, society, nation, economical, health and many more.

Teacher Benefits

It is still important to get deeper on how teachers evaluate the benefit with techno-pedagogy. This is more important as the practices clearly indicate that teachers are the main persons who are implementing technology in the root level. Using technology, it opens the avenue for teachers to develop, modify, and improve themselves and to help the whole education system for further development. Rajib said that technology opens the avenue for different opportunities that could be helpful for the teacher to do one work, at least, differently, and thus, understand the depth of knowledge. Tania asserted that technology makes the learning more interesting; teachers have more option to do one work more effectively and develop themselves. For Musfiq, technologies help in teacher development by giving more knowledge from different books, exchanging knowledge through internet with the teachers and educational experts of different countries, giving access to different experimental outputs and much more. Sakib was saying, technological influence moves from one teacher to another, develops education system with handsome salary for the teacher and technical skills.

I found that teachers were displaying and explaining the subject matter very easily in front of the students and the latter understood it easily. Teachers comprehended vast subject matter within short period. Vi (2005) stated that through technology teachers get skill, knowledge, and attitude to use technological devices in classroom for the benefit of student as well as education system. Fairman (2004) also expressed that teachers improve in knowledge, skills, classroom management, evaluation process and so forth by technological support. Actually, the teacher has knowledge on the overall development about pedagogical procedure, i.e. how to incorporate technology and get the best benefit from there for the education system.

Winthrop and Smith (2012) claimed that teacher can develop skills, professionalism, technical capacity and so on through technological support. In the Nepalese context, technology develops teachers to take the class more moderately than traditional method (Mainali & Key, 2012). Technology gives the benefit for whole education system, where teachers and students are the two major components. Teachers will develop themselves for the better delivery or guide or transfer of knowledge to students for future development.

Student Benefits

Students are the heart of education system; the whole education process is working for the student development. Student development and comfort in education system are the major reasons to include modern technology. Rajib stated that now students can feel learning what they are getting from the teacher. Tania felt that technology influences student's knowledge level because they have many things explored for their learning and if they can use it properly, then they can develop themselves. Musfiq said, "Technology helps those who want to learn and motivate them for more learning." For Sakib, "Students will learn and motivate for learning and in future, they will get good salary in the job." He relates the education development with economical value. I found that during the technological classroom session, students were very attentive and were asking many questions to teacher on subject matter. However, I found it was different in Sakib's school; he did not use any technology in his class lecture, rather was speaking fluently. And in the beginning, not many of the students could move along with him. Students were not very attentive in the classroom but just followed him. I did not find any proper communication in the classroom.

Fairman (2004) stated that technology develops students self esteem, confidence, peer and group work capacity, communicate with adults, increase learning capacity individually and so forth. Saat and Bakar (2005) stated that technology makes the student ready for accepting everything. Different types of situations can arise in our life, which can give different experiences; technology helps to develop ourselves for such consequences. Haddad and Jurich (2002) claimed that technology develops student in overall. In Nepal, educational technology develops students' understanding capacity, skills and motivation education, which will build them for better human for that nation (Karmacharya, 2008). Education can do holistic development of a student, which is very essential for a nation to get proper human resources. Technological inclusion in education gives a new dimension in education system, building a student with more lived and practical experiences.

Society and National Benefits

All students belonging to different families of the societies and societies are the part of nation. When any students get proper learning, it affects society and nation accordingly. All teachers agree that society and nation get the benefit of using technology in the classroom. As per Rajib, "*Today's students will be tomorrow's leader"* and the society will get benefits for further development. Musfiq believed that students can work on the social development, awareness program, which will ultimately cater one of the ways to develop the nation. Sakib felt that for the technological benefit, the society, teachers and students would have some strong relationship, which would be helpful for developing proper human resources. With the help of ICT in education, both teacher and student will get benefit, which will ultimately develop the society and nation for the better future (Haddad & Draxler, 2009). Vi (2005) stated that technological advantages affect the society ultimately

because students development means societal development. Saba (2009) stated that technology develops the student for future because they will be the national leader or developer which will affect the whole world.

Changes of Nepalese education scenario will definitely work for the development of nation. The Government of Nepal understands that the society will get appropiate human resources for the development of nation if they can include technology in education (MoE, 2013). When the students belonging to different families in the societies will be well educated through technology, then it will definitely develop the society and above all, the nation, accordingly.

Economical Benefits

All teachers agreed that installing technological devices are costly but for the long-term situation, it has benefits that will be helpful for students, teacher, society and nation. According to Rajib, technology reduces the cost of stationery materials of education and available resources of internet reduce the financial burden of buying books, traveling and fetching non-virtual matters. Tania and Musfiq had to say that we cannot calculate all economical values of technological use in education but it has many benefits. For Sakib, economical benefit is less because it increases the cost for education but helps in education.

Winthrop and Smith (2012) stated that technological education will develop proper human resources for national economic development. Education has a strong impact on economy, with proper development of students have strong impact on economy. Haddad and Jurich (2002) claimed that proper technology has the long term economical benefits though we have to spend every year for the maintenance. Blurton (1999) stated that to include ICT in education is costly because it needs more money to build the whole system but from stability prospect, the cost will be minimized

because everything is in it. Karmacharya (2008) expressed that e-resources reduce the cost of buying books and travel, we can collect required pieces of information in our convenient time and place; which is very helpful for the Nepalese context. Technology has a strong impact on economy because to develop it, we need to invest a huge amount of money and when it gives return, we cannot measure all because how students develop the countries economy is not totally measurable as such.

Health Benefits

All teachers faced the problems of using chalk and marker in their teaching experience and found that technology use reduced those problems and it helped for their health benefits. Rajib says that teacher becomes more relaxed in the classroom because all materials were in the boards. Musfiq and Sakib said that technological devices may have some radiation problems for health but it helps in many ways. Haddad and Jurich (2002) stated that technology affects human health because students get chance to learn many things from different sources which can lead better health situation in the nation. In the classroom, teachers and students do many works which may be harmful for health like dust particles but technological use reduce the dust particles in classroom. Winthrop and Smith (2012) claimed that technology uses have many health benefits because we can be aware of many issues through technology. We get knowledge from technology which helps us to develop teachers and students mind to be aware about health and devices reduce the different materials use in the classroom, which is very helpful for the health.

Different types of development activities can be done by using technologies; education is also a part of development. Teachers, students, society, nation, all are getting the benefits of using technology in the classroom. A few benefits are visible

directly and others will be visible in future. We have to count all these benefits for the better development of educational situation in any country.

Addressing the Barriers

Every obstacle has ways to remove or overcome. As we know that we have different challenges to implement technology but we have to find the ways to overcome it. Education system has many obstacles but we can remove all the barriers for proper educational situation. Blurton (1999) stated that technological use in education is not easy, it needs to cross many barriers for proper implementation at using technology. This theme will discuss how we can overcome all the challenges. Teachers' perceptions about overcoming the challenges are herewith.

Rajib said, *"We are in the initial stage of implementing technology and it has many problems which we are facing. The government is working in different sections of the country for technological knowledge dissemination. Private sectors are also working with their own style to implementing the technology. The society can play a vital role for implementing technology in school level and psychological education can assist along with it."*

Tania felt, *"To overcome the challenges, teachers and students need to be honest that they will not do any illegal activity; self-motivation is needed, the government needs to reduce the load-shedding problem, private sectors have to move ahead with proper support, societies can develop e-library for the support of technology use in education. Psychological education will also help for this."*

"In order to overcome the challenges, we need to be passionate about it. The government needs to implement proper rules and regulation, private organizations can assist it; the society can play a vital role to motivate people to use and psychological education will develop technology-based learning." Musfiq answered.

Sakib reported, *"Without technology use in this period of the world, we will be handicapped. The government needs to implement proper policy: how, where, when we have to use technology; the private sector, the society can help school by donating money to use more technology; and for that psychological education will motivate all use technology more in education."*

Teachers understand the current situation of using technology in the school level. They know that many constraints are holding the situation tightly but they are optimistic about removing all of these and will move forward to a great promise for the whole nation.

Government

For any development, the government is a leading agency for a nation to take initiative and create guideline how to proceed further. For using technology in education, Nepal is in the initial stage for the vast inclusion of it. The government works in different parts of the country not as a whole to include ICT in education. Rajib believed that the government is not working as a whole; they need to work as a whole. Tania shared that it is government responsibility to reduce load shedding because constant power is the pre-condition of using technology. Musfiq and Sakib said that the government should implement the proper policy: How, When and Where technology will be used in education because policy is the guideline that shows us what we have to do for including techno-pedagogy in education. Policy will force the government to take proper initiative to include technology all over the country. I found that Tania's school did not find the spare parts of digital board in Nepal. Here, the government can take initiative to ensure proper technical devices and parts in Nepal.

Fairman (2004) stated that we need proper policy to use technology in education because it will work as a framework how to proceed further. Winthrop and Smith (2012) claimed that without policy different state of nation will have different level of development. Policy will make everything in a parallel way that everybody can get equal share of everything. They also stated the previous lack of educational policy works as a barrier for educational development. Education policy is essential to include technology in education properly (Blurton, 1999). In Nepal, government had different policy for implementing technology in education but all those things were not properly implemented due to lack of policy implementation. Now, the government implements new policy as a master plan to include ICT in education all over the country (MoE, 2013). For any kind of development work, we need the policy first to guide how everything will proceed further and the government is the lead agency of implementing policy and practices. Therefore, they need to take the lead to add up technology in education properly.

Private Sector

Private sector is the helping hand of government because government alone cannot do all the things for better development. Government needs the support from other private organizations for further development. In Nepal, the private sector is the most promising sector for any kind of development. Different NGOs are working with the government to include ICT in education. All teachers say that private sector's work can be very healthy to incorporate technology in education. All the schools I chose for my research were private schools and they were implementing technology in a modest way because not every school had sufficient economic status and nor did they have facility either. Winthrop and Smith (2012) stated that different private organizations, private schools and firms were working to include technological

assistance in education. In a few cases, they are doing better than the government. Nunes and Gaible (2002) claimed that different schools, universities, educational materials, multimedia materials, etc. are developed privately. For the development in education, the private sectors are working well.

In Nepal, private sectors are working for the educational development but their work is profit-oriented (Tuladhar, 2012). Currently, different organizations are working with the government for including ICT in education like Open Learning Exchange (OLE) Nepal. They are giving laptops to school children, training teachers for using it, building e-library and related activities which can assist education. Current master plan of ICT in education government wants that private sector will work with government collaboratively for technological inclusion (MoE, 2013). For the development of any nation, government and private organization need to work collaboratively because without joint work, it is very tough to achieve targets within time frame for anyone.

Social and Psychological Support

To change anything or development in education, we need support from the society because without social support nothing will be sustained for long. For motivating the society to include techno-pedagogy, psychological support is essential because every one of the society does not have proper knowledge about technology or they may not be aware of the negative sides of technology. A few teachers, students and even administrators will not make the use of technology properly because they do not have proper idea about it. Teachers (all) agree that society can play a vital role for using technology in education and psychology can assist it for further development. Tania says that society can develop e-library where students can go and have vast knowledge on different issues. Blurton (1999), Haddad and Draxler (2002) stated that

with the help of technology we can build ‘knowledge society’, where society needs to take part for better development. Government of Nepal is aware about that we need proper societal support to spread technology all over the country (MoE, 2013). Psychology is including education for the proper educational environment. If we want to include technology in education we must need the support from society and build some proper mental setup among all the beneficiaries.

We are facing various challenges in implementing technology, however, we cannot solve everything in a day. It needs time to solve everything. Rajib said that technology has many problems along with new opportunities. Tania said that teachers and students need to be honest and self-motivated to get the best benefits from technology. Musfiq felt that we need to be passionate about getting the best benefit from technology. Sakib believed that without technology, education is handicapped now. All teachers believed that with the proper policy, implementation, collaboration work with government, private organizations, society, we will get the best output from technology.

We are facing challenges to include techno-pedagogy in education but we know how to overcome all these issues, too. Collaborative work between and among the government, the private sectors and the society will overcome most of the challenges. Before starting any work ,we need the proper policy to guide us; the government is working with it along different stackholders’ opinions.

Chapter Summary

The data were presented, analyzed with literature and discussed according to different themes that were collected from the participants. All themes were represented different aspect of techno-pedagogy. Every theme was concluded with small conclusions that represent the present status of technological use in the

Nepalese situation. Theoretical standpoint also helped to conclude the themes according to research intention. The conclusion of all the themes will help the next chapter to conclude the research outcome appropriately.

CHAPTER VI

SUMMARY, CONCLUSION, IMPLICATION AND REFLECTION

Chapter Overview

Appropriate closing is very important for any kind of work because with this every move reaches its destination. Without proper ending, any work seems to be a waste because nobody ultimately gets any output from that hard work. Academically, exam represents all hard work consequences. In research, conclusion represents the new knowledge which can be used for societal benefit. This chapter contains the information of the whole research outcome and its future implication. 'How was it started; what was the intention to find; how were data collected and analyzed, and what is the overall outcome of this research and how could it be used for other researchers' all these are included in this final chapter.

Summary

In education, the term 'pedagogy' describes the whole teaching learning process with equal consideration but this concept was not well established earlier because learning was dominated by teaching. Medium (tools) of instruction is always important in pedagogical process for better outcome, which is strongly dominated by technology in recent times all over the world. Liu (2012) stated that technological inclusion of education started 200 years earlier as a distance education tool but massive use of technological devices started in 1970s when computer becomes economical for the personal use. Along with internet facility, technology gets enormous speed for educational development as well as human development.

"In 2011-2012 fiscal year, the budget allocation for education was 17.1 per cent of the total national budget and its increment was 24.5 per cent compared to the education budget of the previous year" (Sedhai, 2011). "In Nepal, technology in education has been incorporated since 1970, started with radio program but the government implemented ICT policy in 2000. Still now, different government and private organizations are running different programs to infuse technologies properly in education; recently, the government has planned one master plan for 'ICT in education (2013-2017)' (MoE, 2013). Considering the whole situation, I planned to find out the real picture of using technology in schools and teachers' perceptions and practices about it.

Specifically, I observed the science classroom situations of schools as Moxley (1989) stated that in larger context, relationship between science and technology are symmetrical. Similarly, Narin and Noma (2005) claimed that in recent times, science and technology are closer than earlier. In Nepal, Holmes (1990) stated that the government had bitter experiences in science classes because of instruction styles and instruments. Bhatta (2008) asserted that in the SLC exams, students mainly failed in the science subject.

Technological use in Nepal is settled with different barriers, but in contrast, World Bank (2010) found that Nepal has good appreciation of technology. The government wants to give at least two computes and a printer to every school (MoE, 2013; UNESCO, 2007). OLE and OLPC programs are running for developing technical skills among the students and teachers (GRID, 2012). Likewise, SSRP is working for improving teaching learning situations and qualities with ADB (ADB, 2012). All these things strongly motivated me to find out the present status of using technology in schools.

This research had been conducted with the case study design and qualitative approach within interpretive inquiry taking information from teachers about the practice of using techno-pedagogy in schools in the classrooms.

The study found out that there are serious challenges to implement techno-pedagogy in the Nepalese classrooms regularly. The constraints ranged from physical, technical to professional aspects in the field schools. The major indicators for lack of physical facilities were lack of specific classroom, instruments, devices and other facilities. The irregular and inconsistent power supply challenged to use techno-pedagogy as a regular support for classroom delivery. Teacher's skills, knowledge, efficiency, discomfort and so forth about using technology were the signs of professional challenges. The teachers, on one-hand, reported lack of techno-pedagogy-friendly classroom/infrastructure and on the other, claimed for the need of proper training and other supports for using it more continuously. The displacement (educational psychologist) made by the teacher indicates the existence of professional challenges. In a few cases, accessories were not available in Nepal, which also created the technical barrier. During my observation, I realized that the schools were facing economical constraints to incorporate technology properly, since it was not well understood by all because of different perceptions about the need of technological devices among teachers. As Sakib and Rajib themselves and their school authorities, too said that they were facing economic problems to add more technological devices in school but others did not have the same perception although they were also in crisis to maintain those devices properly where economy played the major role.

Usually, the society plays the positive role for including technology but due to economic problem, not all society members were appreciating the use of technology in education as Sakib found. Moreover, teachers' own intention and motivation about

using technology was also a vital part for including technology in education because due to technical problem and fluctuating proper power supply diverted teachers towards the conventional practices of education and all these constraints blocked the utilization of available technologies in schools.

In contrast, everybody agreed that technology changes teaching learning situation completely; students become more motivated towards education because they are getting the replica of live experiences through technology. Educational materials are accessible anytime from anywhere, which helps students to explore more knowledge; internet gives the opportunity to find any related study materials apart from bookish knowledge. Different project works, assignments, group works and so forth are well managed and guided by technology, which engage students more for the active learning process. Not only students, teachers are also getting the benefits of technology to deliver the lessons because teachers can make students understand deeply through different clips, animations, audio-videos and so forth applications. They also can utilize the different sources to develop their resources for delivery in the classroom.

Appreciation about technology among teachers and students was high but different obstacles were holding the path of development where physical, technical and professional constraints were more prominent. Economy, society and self-motivation were also the influencing factors for technological inclusion in education. In addition, there are plenty of examples of public and private organizations, which can work jointly for the benefit of the society. Having this concept in mind, the government and private sectors are working jointly to get the highest benefits from technology and to use the optimum level of technology in the Nepalese context.

Conclusion

Conventional teaching learning process is still dominant in Nepal where technological addition modify the roles of teachers' and students' giving more comfort, joy, entertainment and other pleasurable components with the use of computer and projector in the present day classrooms.

In the science classroom, teaching learning process gets more support from technology supporting students' learning. Along with the positive impacts of technology, it effects negatively as well. Plagiarism, less socialization, misuse of technology, create social gaps and load shedding problem are the prominent problems along with more usual physical, technical, economic and social problems especially noted in the developing country- Nepal.

The experiences show that techno-pedagogical addition in conventional pedagogy faces different challenges where 'physical, technical and profession lacking' are creating strong barriers along social, physiological, economical and policy issues. On the other hand, it opens new scope for both teachers and students, who can explore knowledge, motivate to learn, get access to different types of applications, which provide information and empower the learners.

The cases reflect a need of synergy in between the government, private sector and immediate society to overcome the constraints and bring about acceptable changes.

Implications

For any development, technology plays a major role. It is also true for educational development. Earlier I had believed that due to physical and technical challenges we had not been capable to use the potentiality of technology, which really matched with my research findings. However, I found that only lack of self-

motivation among the teachers could work as a prominent obstacle for using technology even after having every facility, which is a new learning for me because I thought everybody would want and feel comfortable with the technological devices to teach. I also thought that the society would always accept the new technological devices to use in the daily classroom activity. However, I found that due to economical constraints, not all society members would accept the technological devices and not to include these things more in the classrooms. This study entails how economy is the root of all forms of development.

The outcome of this study will be helpful for the policy makers to think deeply to incorporate technology in education properly because every issue related with education is important. Policy needs to be developed in such a way that everybody can understand the policy properly and social awareness programs need to be conducted immediately to disseminate policies outcome for social benefits before its implementation. The education experts need to think deeply to incorporate techno-pedagogy because age, perception, and knowledge level of students have to be aligned while developing the contents. The researchers who want to do further study about technology and education relationship in different components could get help from this study. The findings of this research also can open new windows for other researchers who want to work in the same field.

The output of any research always helps in the social development; my research will also do the same because it deals with the educational development, which is the main pillar of social development. How different societies perceive technological use in education comes out in this research, which will be very helpful for creating new policies for social progress.

Reflection

The intention of this research was to see the present status of technology in classroom education as it creates dynamism in the teaching learning processes. Teacher are reported enthusiastic, motivated, relaxed and so forth with the use to technology in the classroom teaching because technology opens the doors for the teachers to acquire more knowledge using different tools, create variation in daily classroom activity more than in the traditional teaching system. On the other hand, traditionally students' role was to be passive in the classroom activity because everything was controlled by the teacher. Students get freedom of learning with the help of technology because more knowledge sources are available. Moreover, students can visualize the real situation, develop own skills about technology use, get more motivation for learning because it reduces the boredom of the class.

Literature marks technological inclusion of education started 200 years earlier as a distance education tool but massive use of technological devices started in 1970s when computer becomes vastly available in every sector of life. Along with the internet facility, technology gets the speed to boast educational as well as human development. Technological inclusion changes the educational system and makes education livelier for both teacher and student. All the developed countries include the technology in their education system strongly and widely long time ago but development countries are not efficient enough to include technology in daily classroom activity. Like all other development countries, Nepal also wanted to include technology in the classroom. They started with radio support for education and slowly they included different devices and tools in education but due to economic condition, geographical constraint, physical facility, technical skill and so forth, the government could not make proper scope to include technology properly in education.

Nepal has introduced IT policy in 2000 and after that the government distributed computers and internet facility along with different necessary devices in different schools of Nepal but output of these works were not appreciable because they did not create any proper policy on how technology will be included in education. Therefore, in city areas, only a few private schools and public schools are using technology in education whereas others are not doing anything. This creates the social divide in the society. This year the government has formulated one master plan to include ICT in Education (2013-2017) so that education system can benefit from technology.

In this context, I was willing to see the present status of using technology in schools of Nepal as a tool for daily classroom activity. I took the science classroom as a focus point of my research because different environmental issues were directly included in the science textbooks. I took the data from teachers of different private schools who were using at least projector and computer facility to deliver lessons in their classrooms. I used interview and observation as data collection tools for my research.

I have realized that among these schools, economical condition of schools were impacting every sector of using technological devices for daily classroom activity because to buy technological devices, to maintain it properly, to ensure proper classroom situation, generator back up and so forth things needed proper economic solvency. Two of schools were using modern interactive white boards and others two schools were using only projector and computer for delivering the lessons. The economic status of those schools using interactive white boards was better than other schools because these boards were expensive devices and they needed more money even in maintenance. The classroom situation of these schools were good enough because they had powerful generator to mitigate the load shedding problem,

appropriate sound system, curtain facility, technological wings for instants support, sufficient material to teach students properly to give the concept and so forth. On the other hand, other schools did not have proper classroom facility, were facing the shortage of resources, had no curtain and were not having proper generator. Their economic status created the difference of schools in terms of both physical and technical facilities.

Whatever the resources are available in schools, proper use of these are essential to get the best benefit from them. But except one school others were not using the resources properly because of their focus mainly on the SLC exam, teacher skills about using technology, teacher's own personal thinking and personal activity, and load shedding problem. All these schools were private schools, and maintaining the standard ratio of pass rate in the SLC was very important for them because without it they will not get enough students for the long run of the school. Except one teacher, all others were saying that they were not efficient enough to maintain these devices properly which indicates they were not capable of using the full potentiality of all resources because of lack of technical skills. Another issue was teachers' personal beliefs about activity because they thought that they did not need to show everything to the students. In some cases, they gave priority to their own work over students' demand because till now, our education system is dominated by teachers. It could be due to the lack of resources and less technical efficiency. I have found that load-shedding problem along with oil crisis for generator causes problem for the smooth operation of the technological devices in all schools. Load shedding takes over at least 5-10 minutes of regular class time before the light system could be operated with the generator back up. In this way, load shedding has remained a problem for smooth functioning of the technological devices in the classrooms.

Apart from these problems, I found that not having sufficient spare parts of the technical devices, proper policy for using technology in education, in a few cases social constraints etc. work as negative reinforcements in using technology in education. No teacher was aware about the policies, even the school management authority did not know much, but they claimed that government always creates good policy. However, in implication, there is nothing. They blame the government for not having proper policy and not providing logistic support to use technology in the classroom.

It is easily understandable that different constraints are not helping for using technology properly in education but on the other hand, every teacher realizes that technology brings about changes in the classroom situation. Students become more attentive, curious, search more things in the internet and do many more activity with the help of technology. Teachers give the students different assignments, group works, project works, research works and similar activities with the help of technology because they want that students should learn to engage with technology. In a few cases, teachers mix the traditional and modern teaching learning process together. In modern education style, the teacher's dominance is reduced but anyway they are leading the students to get proper education. Teacher's role is smarter than earlier times.

The role of technological in education is crucial to give the better, modern and most up to date information to students but physical, technical, policy, social, economical issues are holding back the technological use properly in education. Teacher perceptions and mentality are also working as the hidden obstacles in using technology. If we can eradicate all these problems, then we can ensure the best use of technology, which will ultimately lead to better future for all, especially for the

students who are the future leaders. We also need to consider that a few students may use technology as a negative reinforcement in their life, for that, teachers and other related persons need to be more careful about the technological incorporation in education because positive output always comes with a negative shadow. To overcome the barriers we need to work together with the government and private organizations together because alone nobody can achieve the target; it will only increase the gap in the society. In a few cases, lack of knowledge and wrong concepts about technology demoralize the society to use technology at a personal level. For that reason, we need to promote proper awareness among the stakeholders of the society that they understand the impact of technology in everyday life and assist in its expansion.

Chapter Summary

The output of this whole research work has been presented in this chapter; which can add up to the new knowledge for the development of the society, especially for the development of educational knowledge and system for the whole nation. How this research can contribute to develop a modern society is also described here. This research will open new scopes for the researchers and educational experts to think in a different way to incorporate techno-pedagogy in the Nepalese education system. Any ending creates the new begging for others; therefore, I hope this research conclusion will start a new techno-pedagogical era in education.

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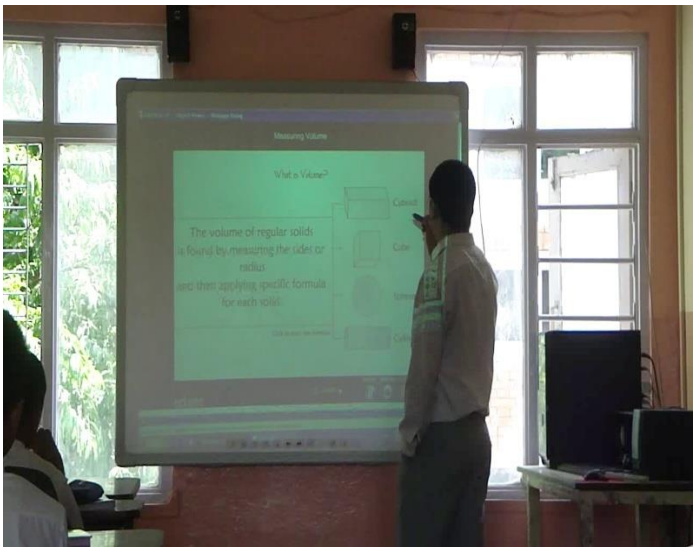
ANNEX-I

CLASSROOM PICTURES



Picture: Musfiq teaching

Picture: Rahim teaching

Picture: Sakib teaching

Picture: Tania teaching

ANNEX-II

TEACHER PROFILE

Topic	Name			
	Rajib	Tania	Musfiq	Sakib
Teaching subject	Science	Science	Science	Science and Computer
Experience of teaching	14 + years	10+ years	10+ years	7+ years
Teaching science	11+ years	10+ years	10+ years	3+ years
Current school	6+ years	5+ years	3+ years	3+ years
Job Status	Part time	Permanent	Permanent	Part time
Education Qualification	Doing post-graduation in Organic Chemistry	Graduate in Chemistry and Post-graduation in Finance	Post-graduation in Zoology	Double graduation in Chemistry and Computer
Having B.Ed Degree	One year B.Ed degree	No	One year B.Ed degree	No
School introduce technology	3+ years	5+ years	4+ years	4+ years
Devices use in classroom	Interactive white board	Interactive white board	Computer and projector	Computer and projector
School having generator	Yes	Yes	Yes	Yes

ANNEX-III

RESEARCH QUESTIONS FOR INTERVIEWING TEACHERS

Research Question	Guiding Question	Proving Question
1. How do teachers' perceive techno-pedagogy and its contribution to enhance learning in science classroom?	1.1. What is pedagogy/ teaching-learning?	1.1.1. What is teaching? 1.1.2. What is learning?
	1.2. What is technology enhanced teaching learning?	1.2.1. What is technology? 1.2.2. How technology can use in education? (both device and application patterns) 1.2.3. Do you use any technologies in classroom? Why? 1.2.4. How technologies help in teaching? 1.2.5. How technologies help in learning? Why?
	1.3. Which technologies are mostly used in the classroom?	1.3.1. What are the names of all technologies? 1.3.2. Which are mostly used in classroom and why? 1.3.3. How do the students' response to it and why? 1.3.4. How students understand from these technologies in classroom?
	1.4. How teachers' think about technology based teaching learning?	1.4.1. What are the advantages of using technologies in classroom? 1.4.2. What are the disadvantages of using technologies in classroom? 1.4.3. Does technology influence student achievement or learning outcome? How? 1.4.4. Does technology help all level of students to achieve learning? 1.4.5. Do you feel any differences for using technology in classroom? Why?
	1.5. How students learning is influenced by technology?	1.5.1. How do they students take the use of technology in classroom? 1.5.2. Have you ever thought to discuss about it with the students' either? 1.5.3. How students explain their experience from technological learning?

	1.6. How do technologies influence the science classroom learning?	1.6.1. What are the influence sections in science classroom? 1.6.2. How technology change classroom environment? 1.6.3. How technologies are engage students with the learning? 1.6.4. How technologies create active learning environment?
2. What challenges and opportunities are there for implementing techno-pedagogy in science classroom and why?	2.1. Are there really challenges for using technology in the classroom?	2.1.1. What types of challenges are there? 2.1.2. How physical facility is a challenge for implementing technology in classroom? Why? 2.1.3. How technical facility is a challenge? Why? 2.1.4. How economical condition is a challenge? Why? 2.1.5. How psychological situation is also a challenge? Why? 2.1.6. How socio-culture situation can be a challenge? Why? 2.1.7. How policy can create a challenge? Why?
	2.2. Are there opportunity for using technology in the classroom?	2.2.1. Ways of getting benefit from technology. 2.2.2. How teacher gets benefit from technology? Why ? 2.2.3. How student gets benefit from technology? Why? 2.2.4. How society gets benefit from technology? Why? 2.2.5. How economical benefit from technology? Why? 2.2.6. How nation gets benefit from technology? Why? 2.2.7. How health gets benefit from technology? Why?
	2.3. Are there ways to overcome the challenges?	2.3.1. What are the possible ways to have effective teaching learning, with technology or without technology? Why? 2.3.2. How government can support to overcome challenges? 2.3.3. How private sectors can support to overcome challenges? 2.3.4. How society can support to beat challenges? 2.3.5. How psychological education can help to overcome challenges?