Chapter: 3

Literature Review
3 LITERATURE REVIEW

It was good to know about many experiments carried out on technology usage in academia world-wide. Such experiments were varied in nature, its application as well as scale. Most of them referred to technology use in practical aspects of teaching, some also studied its use by educators in delivering knowledge. At the same time, not much literature and experiments were found from Indian context and that too from the perspective of higher education sector. Much of the literature came from the world and government organizations like UNESCO and MHRD, which was specific to the target market of the study. At the same time, we correlated experiments and their review conducted in foreign countries with our target market and tried to draw some learnings. Especially literature from emerging world could well be applied to Indian sector on some aspects. This review also includes some basic terminologies commonly used in ICT adoption by academia as well as the industry.
ICT intervention meets an educational need, and that it adds value to an educational activity.\textsuperscript{14} Rosenberg and Steinmueller advocate for ensuring that it is the most appropriate intervention for the given context, and that it would be sustainable in the long term. Further, they argued in their examination of the economic impact of a development in electronics - Very Large Scale Integration (VLSI) that the diffusion of a technology (VLSI diffusion in their case) depends on knowledge, costs, and its value-added capabilities. Their point was that there was a strong link between social (consumer) needs, value added capacities of a technology, and its cost efficiency relative to all thought alternatives if the intervention is to be worthwhile.

According to Alavi (1994) many educators, students, and employers intuitively felt that the integration of the computer into the teaching would enhance learning. This would increase the student’s ability to apply knowledge and skills to future problem solving situations.

Hawkins, R. J (1998) \textsuperscript{15} outlines “Ten Lessons for ICT and Education in the Developing World”. Technology, according to Hawkins, motivates students and energizes classrooms, and it also “empowers girls”. Hawkins argued for the development of computer laboratory in higher education institutions in developing countries. They may take time and money, “but they work” well in improving access and usage. But “technical support cannot be overlooked...” he added.

UNESCO (1998) observed that the rapid breakthrough in new information and communication technologies would further change the way knowledge was developed, acquired and delivered. It was also important to note that the new technologies have offered opportunities to innovate on course content and teaching methods and to widen access to higher learning.

\textsuperscript{14} Rosenberg and Steinmueller (1982)
\textsuperscript{15} Hawkins RJ at World Bank Institutes
Thomas Roswell (1999) said that ICT enhanced Higher Education in a number of ways. It enabled the effective storing/sorting of information, and offered new and fast ways of communication; the reduction of information quantity towards a higher quality and better structure; and integrated into teaching and learning strategies and used to support relative learning theories.

Bowen, William G. (2000) observed that "Many walls created by distance, time zones, and the need to work directly with physical objects were breached, and there was much more to come as new technologies emerged and the costs of hardware, software, and connectivity continued to fall." An example would be research – which was essentially one of the leading Higher Education functions and which benefitted immensely from electronic journal archiving whose access defies distance, time, and space. The facility further improved library administration as manual controls were reduced, and enhanced distant learning.

Gallivan (2001) argued that organizational adoption and assimilation of technological innovations only can be fully understood when an organizational, managerial and an individual perspective is combined in a study of the change processes. The three main actions such as selection of technology, adaptation of the technology and change of teaching and learning practice are interrelated and are not to be regarded as discrete steps following each other in a distinct order. Even though teachers, in an overall perspective, move towards a change of practice, there seem to be dynamically shift between considerations concerning selection of ICT, adaptation of ICT and change of practice with ICT throughout the implementation process. Each of the three actions has been analyzed using the basic structure of an activity as a framework.

Brown, David G. (2002) argued that computers enhanced teaching and learning by providing opportunities for presentations, practice and analysis, and by providing more access to source material via Internet. Computers and Internet connectivity was
found to enhance communication and interaction between colleagues, within faculties, between classmates, and between faculties and students.

Collis and Van der Wende (2002) conducted a survey on the use of ICT in higher education and it was found that, in general, institutions were changing from a period of mostly bottom-up experimentation to institution-wide encouragement of the use of ICT. With the help of a three-stage model, it explained that in many analyzed cases the first stage of institution-wide ICT implementation, i.e. the establishment of institution-wide technological infrastructure, was in place. The second stage, i.e. rich pedagogical use of this infrastructure, was still in development. The third stage, to be labeled as strategic use of ICT with a view to the different target groups of higher education, was not considered explicitly yet.

The reasons for this low level of diffusion and integration of new technologies are many. As a consequence, the need for an institutional e-Strategy was moved into the limelight of current discussion on e-Learning in the higher education sector - a strategy to integrate ICT in a sustainable way into the work structure of the universities. The strategic use of ICT in the teaching and learning process as one core task of universities requires explicit reflection and decision-making at the institutional policy level.

Keats, Derek (2003) found that when used wisely, ICT, such as, Internet can help unite people and create powerful and synergistic partnerships at local, regional and global scales. The use of Internet has enabled the formation of various forms of virtual universities within and between countries across the globe. The point here was that as a communication medium that cannot be limited by time and space, Internet was enabling new local and global education synergies on teaching and learning -- for enhanced Higher Education to unlimited audiences, beyond time and distance boundaries, easily and conveniently.
Frances Cairncross and Kaija Pöysti (2003) conducted a study on ICTs for education and building human capital. They found that universities fall into three broad categories. Many conventional universities in rich countries used computers in the ways that schools do—as a teaching tool or to improve the efficiency of communicating with students and of administration. For developing countries, one of the most important uses of ICTs in universities was one that also applied in schools: as an inexpensive way to gain access to teaching materials, which were expensive to create. In rich countries, ICTs were now widely used in university classrooms. In the United States in particular, university students frequently had access to computers in classrooms. Sometimes, the university provided personal computers (PC), but increasingly, the installation of wireless loops allowed students to use their own laptops for access to the Internet anywhere in the university buildings, including in classroom. Although these were widely used for teaching scientific subjects, anecdotal evidence suggested that they were less useful for teaching other courses. Instead, lecturers were growing used to the idea that they have to compete with the Internet and e-mail for their class attention.

3.1 Global Trends in Educational ICT Practices

Dalrymple and Harvey (2002) found that there is a close nexus in the fundamental roles between education in Universities and knowledge management. Taking view that quality in higher education is about transforming the students, the opines that higher education should provide students with a transformative learning experience. Nelson (2002) observed that Universities would fulfill significant functions of the society. They value learning throughout life and promote the pursuit, preservation and transmission of knowledge.
Globalization together with ICT developments breaks the boundaries of nationhood, geography, ethnicity and culture. Universities have the opportunity to develop in global markets and join the world-wide communities. For example, the global market for international students has grown strongly and rapidly over the last 20 years.

Major challenge to universities was the emergence and growth of knowledge based economy and society, in which technological and scientific developments play a key role. ICT, networks, international competition and knowledge intensive products and services dominate economic activities (Berjerse, 2000 cited in F. Zhao, 2003). Knowledge is replacing the infrastructure and networks are replacing hierarchies in society (McShane& von Glinow, 2000). Therefore, a significant goal of universities is the development of students as competent knowledge workers.

3.2 ICT in Teaching

University faculty are now using computers in teaching taking advantage of the power of the computer in manipulation of words and symbols. Introduction of eLearning or on-line learning is also on the increase in universities. However the role of ICT in teaching and learning is more pronounced in institutions which have adopted Learning management Systems (LMS). LMS generate and manage various
student support services and products such as course outlines, digitally recorded classroom material, discussion groups, lab. Assignments, lecture notes, live lectures for later viewing and re-viewing, links to specific websites, on-line tutorials, supplementary readings and virtual office hours for teacher student consultations. Virtual library and open course ware allow students to get content at no or low cost instead of acquiring expensive text books, reference materials or journals. On-line content has in fact allowed Institutions to co-own content which they can use when and if a particular faculty who created it leaves the Institution. In general terms ICTs have been credited with improving quality, widening access and cutting costs in the teaching function.

3.3 Use of ICT in Teaching and Learning

Use of ICT in Teaching and Learning perhaps is the most neglected area. Bates (1991) had highlighted that there are two very different types of interactivity in learning: social and individual.

Sambrook Sally (2001) reviewed the concepts of life long learning, work-related learning and electronic learning. Learning could also be enhanced by information and communication technologies (ICTs), including new educational and training technologies. A recent survey of employers highlighted the generally positive attitudes to electronic learning, as it was convenient and manageable (Training Zone, 2000). Benefits included greater access, reduced contact time between trainer and learner, and reduced time spent off the job. Findings from the British project highlighted that, from the learners’ perspective, the most significant factor influencing attitudes to electronic learning was user friendliness.

One of the most important studies on this aspect of HE is that of Nyvang Tom (2003) that found that implementation of ICT in higher education learning environments was
a complex task. Teachers, students, management, Review of Literature, Role of ICT in Pursuit of Academic Excellence: A Comparative Study of Indian Universities administration and ICT support were affected by the implementation of ICT.

To facilitate the study of the changing processes, the first step was to understand what problems and challenges implementation of ICT lead to and how it affected practice. His focus was on teachers and from that perspective implementation of ICT consisted of three interrelated processes: Selection of ICT, adaptation of ICT and change of practice with ICT. Each process presented its own challenges and goals. With the motivation for implementation of ICT by the teachers it was expected to improve quality in student learning based on a social constructivist understanding of learning.

Muse jr. (2003) felt that there was just too much hype about Web-based Learning, but less was said of technical difficulties students face, and ultimately high levels of technically motivated dropouts. The investigator interviewed a number of students who dropped out of Web-based courses; and found that most students could not obtain, access, or install all the required learning materials in a timely manner due to ICT literacy constrains, and had to drop the courseware they still had a chance to do so.

While concluding it was suggested that research need to adopt a more "heads up" (Kling, 2001) approach to integrating ICT into the universities under study. This meant a careful, considered, and planned approach, which supported changes and improvements to teaching, and learning as well as providing administrative support at both university and faculty levels. A balance needed to be established between using ICT to supplement current practice and using ICT to replace certain existing practices.
Sheard and Lynch’s (2003) study on learner diversity indicated that different students did experience and react to an online environment in different ways depending on their previous experience and that no one format met needs of all students. Therefore, constant challenges for online learning were students’ familiarity with the learning environment and their skills and confidence with the Internet and information technology. Van Soest, Canon, and Grant (2000) strongly suggested that using a Web forum could encourage dialogue among students as well as between students and the professor and thus could enhance learning within a safe environment.

Demb et al. (2004) emphasized that gaining sufficient experience with a new computer system to achieve “teaching fluency” required a substantial investment of time and attention on the part of the instructor. Online distance learning provided answers to the problems of availability (such as accessibility and cost) and the demand for flexibility (such as time, place and pace) of higher learning, and technology-mediated learning and online distance education were becoming major vehicles for fulfilling the needs of life long learning (Beller, 1998).

Bob Fox (2007) conducted a study on teaching through technology. However his study examined the use of ICT in teaching and learning contexts in two Universities in two countries and focused on teaching staff perceptions how ICTs provided benefit to learning and teaching. The study raised a number of issues that needed to be addressed before such technologies could be successfully integrated into sustainable and transferable mainstream teaching and learning practices. Further, the pressure on higher education from outside as well as inside to incorporate information and communication technologies (ICT) would continue to grow. Society expected graduates to emerge from their university experience with appropriate technology skills and abilities irrespective of the relevance of such technology to individual disciplines.


3.4 Use of ICT based Resources

Adams and Bonk (1995) found that the most common barriers in the use of electronic information resources were lack of sufficient resources, the absence of information about specific resources and lack of training.

Hewitson (2000) showed a direct link between electronic information resources used and perceived Information Technology competency. It was found that the Internet was the most widely used service and electronic indexes; abstracts and electronic journals were not heavily used (Hewitson, 2002).

Moorthy and Karisiddappa (2001) found that a good number of the libraries in India were subscribing to CD-ROM databases and were willing to migrate to online journals to satisfy the demands of their users. Vicente et al. (2004) reported results of a study on the use of electronic information services by staff at Glasgow Caledonian University. It was found that the freely available Internet was the most widely used source, which some respondents viewed as a more appropriate source of vocationally oriented information than pass worded databases. They stated that the non-use of electronic information sources was rarely due to difficulty of access or use.

Ali (2004) observed that there was a need of training library professionals to make use of the ICT based resources and services optimally. Rehman and Ramzy (2004) investigated the use of electronic information resources at the health science centre of Kuwait University and found that time constraints, lack of awareness, and low skill levels were among the primary constraints in the use of electronic information resources.
3.5 Use of ICT in Organization and Management of Higher Education

Collis Betty & Marijk Van Der Wende (2002) conducted survey on Models of Technology and Change in Higher Education an international comparative survey on the current and future use of ICT in Higher Education, and the findings reveal that, Change is slow, and not radical. In nutshell it seems that higher education institutions do not expect revolutionary change as a result from or related to the use of ICT. In general, there is not really a concern about being forced to change by external forces or developments. Rather, a "business as usual" approach is taken, without anticipating any real dramatic changes in mission, profile or market position. They suggested that institutions that have a clearer view on their mission with respect to serving different target groups (e.g. lifelong learning or international students) with ICT and on their position in that/those particular markets demonstrate higher levels of use of ICT and influence of ICT on general teaching practice. Use of ICT in Organization and Management of Higher Education

3.6 Potential Drawbacks-cum-Challenges to Using ICT in Education

While using ICTs in education has some obvious benefits, ICTs also bring challenges. First is the high cost of acquiring, installing, operating, maintaining and replacing ICTs. While potentially of great importance, the integration of ICTs into teaching is still in its infancy. Introducing ICT systems for teaching in developing countries has a particularly high opportunity cost because installing them is usually more expensive in absolute terms than in industrialized countries whereas, in contrast, alternative investments (e.g. buildings) are relatively less costly (UNESCO, 2009).

The four most common mistakes in introducing ICTs into teaching are i) installing learning technology without reviewing student needs and content availability; ii)
imposing technological systems from the top down without involving faculty and students; iii) using inappropriate content from other regions of the world without customizing it appropriately; and iv) producing low quality content that has poor instructional design and is not adapted to the technology in use (UNESCO, 2009). Although ICT offers a whole lot of benefits there are some risks of using ICT in education which have to be mitigated proper mechanisms. They are:

- It may create a digital divide within class as students who are more familiar with ICT will reap more benefits and learn faster than those who are not as technology savvy.
- It may shift the attention from the primary goal of the learning process to developing ICT skills, which is the secondary goal.
- It can affect the bonding process between the teacher and the student as ICT becomes a communication tool rather than face to face conversation and thus the transactional distance is increased.
- Also since not all teachers are experts with ICT they may be lax in updating the course content online which can slow down the learning among students.
- The potential of plagiarism is high as student can copy information rather than learning and developing their own skills.
- There is a need for training all stakeholders in ICT.
- The cost of hardware and software can be very high.

This study report talks about enabling teachers to use ICT. It also stresses upon the expansion of existing efforts in ICT initiatives and form a standard model to educate the educators and implement ICT in the institutes.

One of the major findings from the survey by UNESCO is the need to train educators on using education technology. ICT adoption goes beyond fund availability,

---

16 ICTs for Higher Education – Background Paper Commonwealth of Learning, Paris, UNESCO
procurement of software and hardware. It is the openness of educators to implementing ICT effectively. It also indicates that there are various challenges faced by educators that are very much region specific. UNESCO being a global organization, it focuses on Indian scenario in detail while conducting this survey. The report also states that there may be numerous variables – demographics of educators and stakeholders, government initiatives – that are decisive in adopting any technology in any education system.

One of the studies tried to understand factors affecting diffusion of technology in education by the faculty members of China Agricultural University. The report showed that advantages, complexity of tools, trialability are more important and decisive factors than gender, professional area, experience of the faculty. Though the study was specific to Chinese university, we found out these variables interesting and decided to consider some of them in our study. (Li, Y. 2004). Faculty Perceptions About Attributes and Barriers Impacting Diffusion of Web-Based Distance Education (WBDE) at the China Agricultural University, doctoral dissertation, Texas A&M University, USA.) Another important finding from the study was that the faculty members with participation in decision making process showed more willingness in diffusing the ICT in general.

Demonstration of results was found to be an important attribute in technology adoption. This finding came from a study by Yi, Jackson JD, Park JS, Probst JC on their study of Technology Acceptance Model. (Yi, M. Y., Jackson, J. D., Park, J. S., &Probst, J. C. (2006). Understanding information technology acceptance by individual professionals: Toward an integrative view. Information & Management, 43, 350-363.) Whenever educators would get to view and find results of technology use in teaching, its acceptance was more seamless or it had lesser resistance to change. While enhancing the model for Indian scenario, we considered the factor further and studied from Indian scenario view point. Hence we included aspects like –
best case scenario, success stories and institution specific proposals and tried to simplify it further.

While funds and money could be major hurdles in ICT adoption in Indian higher education institutions, it was not the case everywhere. Many research studies and research articles mentioned that funds was not the major hurdle at all but factors like disbelief in use of technology, willingness to unlearn, self-motivation are more complex to address. A study by Bennett and Bennett found out that faculty were not believing in instructional technology’s benefits in integrating it in their teaching. Most of the faculty were resisting acquiring any knowledge about instructional technology due to lack of the awareness and belief on its advantages. In spite of having facilities in place, ICT adoption had so many challenges! Again, the study referred to altogether a different scenario, it certainly gave us insight into various softer attributes to dig deeper into while carrying out our study. (Bennett, J., & Bennett, L. (2003). A review of factors that influence the diffusion of innovation when structuring of faculty training program. *Internet and Higher Education, 6*, 53–63.)

Though funding, equipment, lack of time, and knowledge are known obstacles to successful technology integration (Hardy, 1998; Lam, 2000; Simonsen & Dick, 1997), a critical component in meeting teachers’ technology needs is responding to teachers’ beliefs toward technologies. In fact, teachers’ beliefs are essential in considering how a teacher teaches, thinks, and learns (Richardson, 1996). Hope (1997) wrote, “Teachers basically had to contend with two factors [with technology adoption]: (a) the psychological effect of change and (b) learning to use microcomputer technology. Understanding teachers’ beliefs toward technology plays an essential role in successful technology adoption.
3.7 Education and ICT use

Previous studies employed a variety of methods and perspectives to assess in-service teachers’ technology beliefs. These methods included: Likert-scale questionnaires\(^{17}\); case study methodology\(^{18}\), Concerns-based Adoption model\(^{19}\); in-depth interviews\(^{20}\), as well other methods. Several of these technology studies reported that teachers who received laptop computers increased their technology confidence and skills and were more likely to remain in teaching\(^{21}\). Germann and Sasse (1997) found that teachers who participated in a two-year technology integration program improved their technology self-efficacy and their interest in learning more about how technology could impact the curriculum. Ross, Hogaboam-Gray, and Hannay (1999) reported that access to technologies increased teachers’ “opportunities for successful teaching experiences, thereby contributing to greater confidence in their instructional ability” (p. 87). In addition, they also noted, “teachers who interpret their interactions with computers as indicative of high ability grow in self-confidence, regardless of their experience” (p. 93). Research reveals also that before teachers use technology for instruction they must be personally convinced of its benefits and must see the utility of using a particular technology (Lam, 2000).

Before technology is used in the classroom, teachers focused attention on their students. They want to know what impact it will have on students’ learning outcomes\(^{22}\). Teachers use technology because it motivates students and offers a different mode of presentation. Instead of using computers for drill and practice, more confident teachers use technology as an instructional tool to enhance students’ learning (Lam, 2000). Successful technology adoption in teachers’ classrooms is

\(^{17}\) Ross, Hogaboam-Gray, & Hannay, 1999  
\(^{18}\) Ertmer, Gopalakrishnan, & Ross, 2001  
\(^{19}\) Germann & Sasse, 1997; Hope, 1997  
\(^{20}\) Simonsen & Dick, 1997  
\(^{21}\) Falba, Grove, Anderson, & Putney, 2001  
\(^{22}\) Higgins & Moseley, 2001
dependent upon school administrators providing an individualized, differentiated process of training and implementation (Gray, 2001). Glenn (1997) commented, “often districts rely upon a ‘one size fits all’ approach that meets the needs of only a few participants” (p. 126). Teachers must see how technology fits within their localized classroom setting (Stein, Smith, & Silver, 1999).

Teachers’ technology beliefs are influenced by their teaching philosophy. Resistance to adopting new technologies stem from teachers’ existing teaching beliefs. For technology adoption to be successful teachers must be willing to change their role in the classroom (Hardy, 1998). When technology is used as a tool, the teacher becomes a facilitator and students take on a proactive role in learning. Niederhauser and Stoddart (2001) noted a “consistent relationship between teachers’ perspectives about the instructional uses of computers and the types of software they used with their students” (p. 7). Often, this change of teaching philosophy and methods focuses on learner-centered teaching and constructivist teaching practices (e.g., Rakes, Flowers, Casey, & Santana, 1999). In fact, Ertmer, Gopalakrishnan, and Ross (2001) found that exemplary technology-using teachers exhibit more constructivist teaching practices.

Successful integration of technology into teaching depends on transforming teachers’ belief and philosophy concurrently. (##)

There is another body of research probing the ways of which teachers’ social, demographic, and personal characteristics influence technology acceptance within educational settings. Bayhan, Olgun and Yelland (2002) found that 82% of teachers do not use computers by any means in classrooms. They assert that teachers’ low level of confidence and lack of professional development opportunities substantially contribute to this outcome. In another research using Woznew, Venkatesh and Abrami’s (2006) framework, Aypay and Özbaşi (2008) investigated teachers’ attitudes towards computers. They found that demographics, motivational factors,

23 Norton, McRobbie, & Cooper, 2000
24 Windschitl & Sahl, 2002
experience, teaching methods, and other in-school factors influence teachers’ use of technology. An interesting finding of the same study pointed out that two-thirds of teachers whose computer literacy level is very low do not use computers in classrooms at all in comparison to teachers with a medium level computer literacy use computers commonly, indicating that the level of computer literacy directly relates to technology integration into educational settings. (##)

Another significant initiative by the Indian Government in last decade was in the form of National Mission on Education through ICT (NMEICT). While allocating thousand of crore of rupees to make education system infrastructure ready, NMEICT spelled out a clear cut need for infrastructure to succeed in ICT adoption. NMEICT’s vision document has detailed out scope for various technology providers from government and corporate sector. Its efforts began a few years ago though it was finding it difficult to achieve any significant targets it had set out for initially. Its vision document mentions that - “It is obvious that emphasis on ICT is a crying need as it acts as a multiplier for capacity building efforts of educational institutions without compromising the quality.25” Though it found funds and infrastructure as one of important challenges in ICT adoption in India, our study found out that other aspects too were equally important if not more important for successful ICT adoption.

Fred Davis and Richard Bagozzi developed renowned Technology Acceptance Model (TAM). It built on the theory of reason action, which focused on attitude measures. While Ease of Use and Usefulness happened to be major focus in TAM, it was complex to apply TAM to education sector holistically, more complex to apply it to Indian education scenario. It did not consider hurdles faced by educators in adopting a new technology. With Indian scenario with diverse intricacies on numerous fronts, it definitely was a big drawback of the model to consider as a framework for ICT adoption. Of course, main advantage of TAM remains that it is specific to technology

adoption scenarios. But its limitations in the form of ignoring practical challenges and softer areas like attitude make it irrelevant in today’s Indian education scenario. Many models of technology acceptance have been developed over the years, like Motivational Model, Theory of Planned Behaviour, Combined Theory of Planned Behaviour/Technology Acceptance Model, Unified Theory of Acceptance and Use of Technology etc. The key dependent variable in all of these models is intention and/or usage. While some of them were more focused on technology acceptance in general and at individual level while others were more relevant to early stage institutions. With such limitations, it was necessary to identify exact hurdles faced by education in Indian scenario so that a model could emerge. A model that was more relevant and implementable in today’s system.

Renovation and Rejuvenation of Higher Education – Report submitted to MHRD talks about scope to improvise various aspects of higher education institutes. It is a study conducted to advice the MHRD to enhance systems at higher education institutes.26

An Introduction to Open & Distance Learning – By Commonwealth of Learning online version at www.col.org promotes distance and open learning all across the world. It emphasises on the inevitability of distance learning and its integration with regular learning modes. This gave a good insight into various developments in the field of learning technology and its implementation in various countries.

The critical review of available literature resulted in the following –

1. While the publications like MHRD and UGC reports cover data and facts about Indian HE, its initiatives like NMEICT, its Vision Document are a good starter to know about Government’s seriousness about technology use in 

education. Nevertheless, it was only in 2008, when ICT started figuring in Indian HE when NMEICT was established. It was also in 2007 when AICTE’s program of Modernization of Technical Institutions paved the way to ICT awareness.

2. UNESCO and World Bank too contributed in spreading ICT awareness at all levels of education in India through their projects and studies. It was the part of their initiatives in developing nations in the world.

3. We also found an array of study reports, research articles and survey outcomes published in the developed countries especially USA and UK. While they served the local education system, they helped us understand challenges faced by researchers while conducting studies on ICT and its adoption in education sector. Some of ICT initiatives in developing nations from Africa and Europe too were inspiring from the perspective that many nations are paying most of their attention to technology spread in education sector world-wide.

4. Many research articles and web resources talked about specific gadgets and hardware. They were useful from the perspective to know trending technologies in education sector.

5. Some of the studies also pointed out how knowledge management and HE were stringed through ICT. They talked more from KM perspective and how ICT can be a facilitator to achieve quality in HE.

3.8 Conclusion
Emergence of knowledge economy has been a boost to the global education sector. This has also encouraged many researchers to conduct experiments on technology use in education at various levels and scales. Most of the experiments have been specific to the sectors, departments, locations, institutions etc. And rarely has been conducted in Indian education sector.

We also tried to review literature on technology use in teaching and by teachers. Many times, using technology tools or technology resources in teaching depends on individual teacher. Factors like interest, capability and resource availability have been critical in ICT adoption, especially by individual teachers. At the same time, we also found out that institution-wide use of ICT happened to be equally critical for its optimum use and desired results.

One of common features in failed ICT adoption has been unplanned implementation. Certain factors like training, existing readiness, ICT awareness among educators, study and analysis of technology options etc. Are very crucial for successful ICT implementations.

Literature review gave us good insight into the current research work done on the subject matter and how certain areas need to be covered from Indian education sector perspective.