



ICT in Education and its Barriers

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Abstract— *Information and Communication Technology (ICT) is a potentially powerful tool for extending educational opportunities both formal and non-formal. Proper implementation of ICT especially computer and internet enable new ways of teaching and learning. Effectiveness, cost, equity, sustainability are various issues which must be addressed when considering the overall impact of the use of ICT in education. ICT play a vital role in education. ICT improve efficiency and effectiveness in education. Although ICT has the potential to improve the educational system to a great extend developing counties are far from reaping these benefits because of certain barriers. Here we are suggesting some recommendations for implementing some of ICT in education and it is our hope that those recommendations will provide a road map for long term success in bringing ICT to all the people around the world. It is expected that some of the ideas providing in this study will be contributing factors towards the attainment of the education for sustainable development.*

Keywords: *ICT, Implementation, Issues, Impact, Barriers, Recommendation*

I. INTRODUCTION

Education is a powerful tool by which economically and socially marginalized person can lift themselves out of poverty and participate fully as citizens. Education is central to development. It empowers people, strengthens nation, and is key to attaining the millennium development goals. We live in a technological world where technology is fundamental to most of the activities. No nation could generate the progress unless it promotes technical aspects in field. Technical education plays a vital role in human resource development of the country by creating skilled manpower, enhancing industrial productivity and improving the quality of life. Technical education is one of the main key for economic and social development of a country. Considering this, it is necessary to find ways for quality education, accessible and affordable to all using the latest technology available. Information and Communication Technology (ICT) is a potentially powerful tool for extending educational opportunities both formal and non-formal. ICT help expand educational opportunity, enhance the quality of teaching and learning. ICT improve efficiency and effectiveness in education. Using ICT as a tool for learning enable student to have the opportunity to become competent, discriminating, creative and productive. They develop better knowledge, skill and capacity to develop new understanding and communicate with others in order to participate effectively in society. The introduction of learning through the use of ICT is not only creating interesting task for learner but to depend their understanding requiring the use of higher order thinking skill, and taking learner beyond recall, recognition and reproduction of information to evaluation, analysis, synthesis and production of agreements, ideas and performance. A major gap has always existed between affluent people living in developed societies with access to modern information technology and underprivileged people living in impoverished and rural communities. ICT provide a means for overcoming historically intractable problem of isolation and lack of access to information and knowledge, crucial impediments to educational and socioeconomic development. ICT can enhance educational reform by enabling teacher and learner to move away from traditional approaches to teaching and learning. ICT has great potential in changing the way the teacher teach and the student learn. In a class room education teaching and learning environment is teacher-centred, task-oriented, memory based. Integrated ICT help learner to work collaboratively, develop shared practices, engage in meaningful contexts and develop creative thinking and problem solving skill.

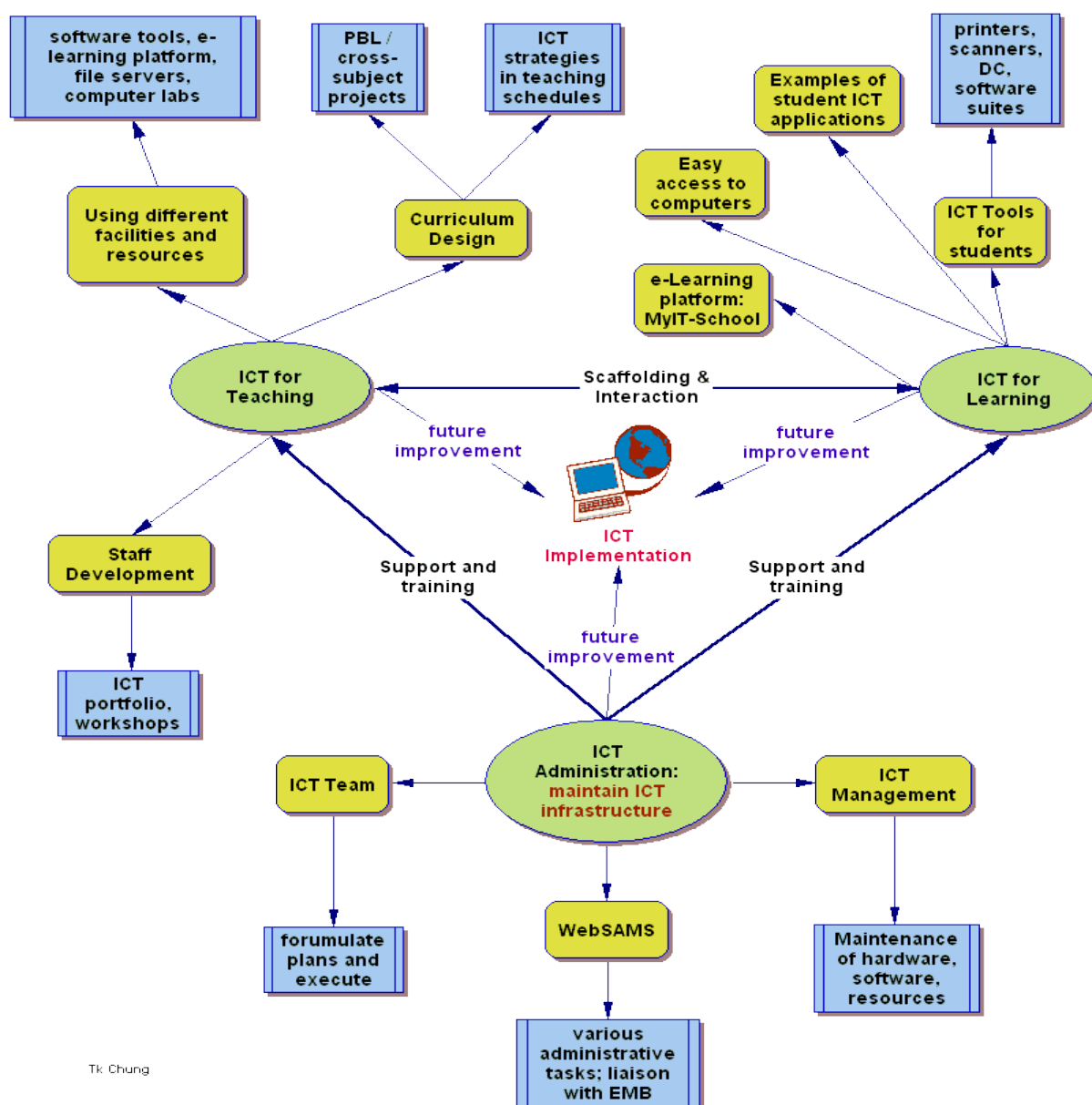
II. IMPLEMENTATION

The term, information and communication technologies (ICT), refers to forms of technology that are used to transmit, store, create, display, share or exchange information by electronic means. ICT is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network, hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning. Proper implementation of ICT especially computer and internet enable new ways of teaching and learning. ICTs are often spoken of in a particular context, such as ICTs in education, health care, or libraries.

This is a list of information and communication technology (ICT) tools that can be used in Education.

- Radio
- Television

- Mobile phones / SMS
- Digital cameras
- Photocopiers
- Scanners
- Computer-based interactive educational games
- Internet: Web quests or Web Challenge
- Internet: search engines
- College or class websites
- Email
- Computer-based presentation tools, such as power points, video, audio files images photos, computer-generated art .
- Spreadsheets and related tools (displaying data/findings effectively with graphs)
- Online collaboration and sharing of teaching and learning resources
- Microphones and recording software such as Audacity (free download)
- Blogs
- Wikis
- Podcasts and Vodcasts
- Learning Management Systems (e.g. Model)
- Online forums
- Online communication tools (e.g. Skype)
- Virtual trips online



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Fig 1: ICT implementation scenario

III. ISSUES

Effectiveness, cost, equity and sustainability are four broad intertwined issues which must be address when considering the overall impact of the use of ICT in education.

1. Does ICT enhance learning really work?

Education should offer conditions needed to optimize learning and promote the transfer of knowledge and skills. ICT may contribute to creating powerful learning environment in numerous ways but what is the evidence that ICT can have a positive impact on pupil's learning in education? The educational effectiveness of ICT depends on how they are used and for what purpose. And like any other educational tool or mode of educational delivery, ICT does not work for everyone, everywhere in the same way. It is difficult to quantify the degree to which ICT has helped expand access to basic education since most of the interventions for this have been small scale and under reported. There is evidence from research that ICT can help pupil to learn and teachers to teach more effectively. However, there is not a simple message in such evidence that ICT will make a difference simply by being used. In contrast, assessments of the use of computers, the internet and related technologies for distance learning have been equivocal. Russell in his comprehensive review of research, claim that there is no significant difference between the test scores of learner taking ICT based distance learning course and those receiving face-to-face instructions. However, others claim that such generalizations are inconclusive; pointing out that the large number of articles on ICT based distance learning does not include original experimental research or case studies. Other critics argue that dropout rates are much higher when instruction is delivered at a distance via ICT. Research shows that the use of computers as tutors, for drill and practice, and for instructional delivery, combined with traditional instruction, results in increases in learning in the traditional curriculum and basic skills areas, as well as higher test scores in some subjects compared to traditional instruction alone. Students also learn more quickly, demonstrate greater retention, and are better motivated to learn when they work with computers. One of the most critical problems in trying to assess the effectiveness of computers and the Internet as transformational tools is that standardized tests cannot capture the kinds of benefits that are expected to be gained in a learner-centred environment. Moreover, since technology use is fully integrated into the larger learning system, it is very difficult to isolate the technology variable and determine whether any observed gains are due to technology use or to some other factor or combination of factors. Research indicates that ICT can make a difference of pupil's learning .In large studies there is a positive link between the use of ICT resources and pupil attainment, but this link is weak. Analysis of targeted interventions using ICT shows a more positive picture, but not as effective as other educational innovations. More sustainable gains in pupil attainment are achievable where the use of ICT is planned, structured and integrated effectively.

2. How much does it cost?

Computer learning and online learning are more expensive then television broadcasts and radio broadcasts. Whether ICT is cost effective in educational settings, a definitive conclusion may not be possible for a variety of reasons. However, when considering the alternative of building more physical infrastructure, the cost saving to be realized from sharing resource, and the societal price of not providing access, ICT as a means of enabling teaching and learning appears to be an attractive and necessary alternative. A common mistake in estimating the cost of a particular ICT educational application is to focus too much on initial fixed cost-purchase the equipment, construction or retrofitting of physical facilities, initial materials production etc. But studies of use of computer in classroom, for example show that installation of hardware and retrofitting of physical facilities account for only between 40% -60% of the full cost and another 30% - 50% are variable cost, for example maintenance, support, professional development etc. For computer based approaches the total cost of ownership therefore includes:

Fixed Cost

1. Retrofitting of physical facilities.
2. Hardware and networking
3. Software
4. Upgrades and replacement.

Variable cost

1. Professional development.
2. Connectivity, including internet access and telephone lines.
3. Maintenance and support, including utilities and supplies.

In order determine cost efficiency, fixed cost must be distinguished from variable cost, and the balance between two understood. If the fixed cost of a technology project is high and its variable cost is low, then there will be cost advantage to scaling up. Another dimension of cost is location, or who will pay for what. In project that involve computers connected to the internet, either the institute or students or both bear the variable cost related to operations such as maintenance, internet service charges, and telephone line charges.

3. Is there equity of access to ICT in education?

Ideally, one wishes for the equal opportunity to participate. The introduction of ICT in education, when done without careful deliberation, can result in the further marginalization of those who are already underserved and disadvantaged. For example women have less access to ICT and fewer opportunities for ICT related training compare to men because of illiteracy and lack of education, lack of time, lack of mobility and poverty. Boys are more likely those girls to have access to computer in college and at home. Not surprisingly, boys tend to enjoy working with computers more than girls. A complex of economic, organizational and socio cultural factors account for these differences: high student-to-computer

ratio, first come- first serve policies do not favour girls. Girls have earlier curfew hours and domestic chore responsibilities which limit their access time and local patriarchal beliefs tend to allow boys to dominate the computer lab environment. Measures proposed to address this gender bias include encouraging institute to develop “fair use” policies in computer labs, conducting gender sensitivity sessions, and advocating for reducing the after school duties of girls to give them more time to use the computer lab. Girls also need to have female role models to inspire them to participate in technology related activities. Providing access to ICT is only one facet of effort to address equity issues. Equal attention must be paid to ensuring that technology is actually being used by the target learners, and in way that truly serve their needs.

4. Is ICT enhancing educational projects Sustainable?

One aspect of development programs that is often neglected is sustainability. The long history of development aid has shown that too many projects and programs start with a bang but all too soon fade out with a whimper, to be quickly forgotten. This is true for many ICT based educational projects as well. According to Cisler, the sustainability of ICT enabled program has four components: social, political, technological and economic.

Economic sustainability refers to the ability of an institute and community to finance an ICT-enabled programme over the long term. Cost-effectiveness is key, as technology investments typically run high and in many cases divert funds from other equally pressing needs. Planners should look to the total cost of ownership and build lucrative partnerships with the community to be able to defray all expenses over the long term. The need to develop multiple channels of financing through community participation ties economic sustainability closely to social and political sustainability.

Social sustainability is a function of community involvement. The institute does not exist in a vacuum, and for an ICT-enabled project to succeed the buy-in of parents, political leaders, business leaders and other stakeholders is essential. Innovation can happen only when all those who will be affected by it, whether directly or indirectly, know exactly why such an innovation is being introduced, what the implications are on their lives, and what part they can play in ensuring its success. ICT-enabled programs must ultimately serve the needs of the community. Thus community-wide consultation and mobilization are processes critical to sustainability. In short, a sense of ownership for the project must be developed among all stakeholders for sustainability to be achieved.

Political sustainability refers to issues of policy and leadership. One of the biggest threats to ICT-enabled projects is resistance to change. If, for instance, teachers refuse to use ICTs in their classrooms, then use of ICTs can hardly take off, much less be sustained over the long term. Because of the innovative nature of ICT-enabled projects, leaders must have a keen understanding of the innovation process, identify the corresponding requirements for successful adoption, and harmonize plans and actions accordingly.

Technological sustainability involves choosing technology that will be effective over the long term. In a rapidly changing technology environment, this becomes a particularly tricky issue as planners must contend with the threat of technological obsolescence. At the same time, there is the tendency to acquire only the latest technologies. However, planners should go with tried and tested systems; stability issues plague many of the latest technologies. Again, the rule of thumb is to let the learning objectives drive the technology choice and not vice versa—the latest technologies may not be the most appropriate tools for achieving the desired educational goals. When making technology decisions, planners should also factor in not just costs but also the availability of spare parts and technical support.

IV.IMPACT

ICT may contribute to creating powerful learning environment in numerous ways.

1. **Anytime, anywhere:** One defining feature of ICT is its ability to transcend time and space. Online course materials can access 24X7. With the internet and world wide web , a wealth of learning materials in almost every subject and in a verity of media can now be accessed from anywhere at any time of the day and by ultimate number of people. ICT based educational delivery (i.e. educational programming broadcast over radio and television) also dispenses with the need for all learners and the instructor to be in one physical location. ICT like teleconferencing enable instruction to be received simultaneously by multiple, geographically dispersed learner, this type of learning is called synchronous learning.
2. **Increase Access to education and remote learning resources:** ICT is used worldwide to increase access to, and improve the relevance and quality education. Geographical distance is no longer an obstacle to obtaining an education. Teachers and learners no longer have to rely solely on printed books and other materials in physical media housed in library for their educational needs. ICT provides opportunities to access an abundance of information resources and viewing information from multiple perspectives. Thus fostering the authenticity of learning environments. ICT may also make complex process easier to understand through simulation that again contributes to authentic learning environments. It is no longer necessary for teachers and students to be in the same space due to innovations of technologies such as teleconferencing and distance learning which allow for synchronous learning. Using internet anyone can access any information from anywhere at any time where learners get online learning materials, covering a wide range of subject that are up-to-date and produce by cutting edge technology. This is particularly significant for many institutions those have limited and outdated library resources. Application and process of e-learning include web based learning, computer based learning, virtual classrooms and digital collaboration where content is delivered via the internet, intranet, extranet audio/video tape, satellite TV etc. ICT also facilitate access to resource persons: mentors, experts, professionals, business leaders and peers all over the world.

3. **Motivating to learn:** ICT such as video, television and multimedia computer software that combine text, sound and colorful moving images can be used to provide challenging and authentic content that will engage the student in the learning process. Interactive audio and video enable the students to listen and become involved in the lesson being delivered. ICT with internet connectivity can increase learner's motivation and provide opportunity to connect with real people and to participate in real world events.
4. **Enhancing teachers training:** It is necessary to focus on teachers and instructor's training to use ICT to develop their own teaching support materials. This approach assures ownership by teachers and instructors and enhances the usability of products. ICT has also been used to improve the quality of teacher training. ICT with internet provide opportunity in teacher's professional development in service. ICT offers self-directed, self-paced, web-based courses for teachers. Online tutorials ALSO AVAILABLE. Now a days Govt. also conducting so many radio and television based teacher training educational program. Satellite based ICT like audio or video conferencing allows teachers to interact with remote lecturers by telephone line. ICT enable new way of teaching and learning rather than simply allow teacher and student to do what they have done before in a better way.
5. **Active learning:** ICT supported education can promote the acquisition of the knowledge and skill that will empower students for lifelong learning. ICT can use as a tool for analysis of information, to create new information and develop creative ideas. Learner therefore learns as they do, work on real life problem in depth, making learner less abstract and more relevant to the situation. ICT enhanced learning is also just-in-time learning in which learners can choose what to learn and when to learn.
6. **Collaborative learning:** ICT supported learning encourages integration and cooperation among students, teachers and experts regardless of where they are. Apart from modeling real-world interaction, ICT supported learning provides learners the opportunity to work with people from different cultures, thereby helping to enhance learners learning and communicative skills as well as their global awareness, even learners get chance to communicate with mentors and experts from different fields.
7. **Creative learning:** ICT supported learning promotes the manipulation of existing information and the creation of real-world products rather the regurgitation of received information.
8. **Integrative learning:** ICT enhanced learning promotes a thematic integrative approach to teaching and learning. This approach eliminates the artificial separation between the different disciplines and between theory and practice that characterizes the traditional classroom approach.
9. **Evaluative learning:** ICT enhanced learning is student-direct and diagnostic. Unlike static, print based educational technology, ICT enhanced learning recognizes that there are many different learning pathways and many different articulations of knowledge. ICT allows learners to explore and discover rather than merely listen and remember.
10. **Improve quality of education:** ICT can enable to transform their practices by providing them with improved educational content and more effective teaching methods. Continuous teachers training in updating and enhancing their methodologies are critical to effective educational policy and practice to keep pace with the constant advancement of technology. Through online teaching resources and other interactive educational materials, teacher's development can be greatly improved. ICT can improve the learning process through the provision of more interactive educational materials that increase learner motivation and facilitate the acquisition of basic skills. The use of various multimedia devices such as television, video and computer software can offer a more challenging and engaging learning environment for students. Education leadership, management and governance can also be improved through ICT by enhancing educational content development and supporting administrative process in institutions. There is a great potential for ICT to enhance education around the globe going forward.
11. **ICT as a tool:** ICT can also be used as a tool in the process of education. ICT provides vast amount of data in various formats such as audio, video, document etc. It is use to manipulate the and generate analysis. ICT creates situations, which the student experience is real life, thus simulation and virtual reality is possible. ICT also allow for the creation of digital resources like digital libraries where the students, teachers, and professionals can access research material from any place any time. ICT can be used to remove communication barriers like space and time.
12. **Discipline in thinking :** While access to multiple resource of information can enrich thinking, it can also debilitate it, and educator have a critical responsibility to ensure that they foster the ability to learner to be able to concentrate, to retain coherence in constructing arguments, and to be able to think with discipline. Further, the ability to integrate different disciplinary way of thinking - which will grow in importance - should not be confused with pastiche.
13. **Encourage learners to become creators:** A flaw in much educational practice is the tendency to treat learner as recipients of knowledge, and education as a process of information transmission. In environment where learners have ubiquitous access to web platform, a natural tension will arise, as learners will want increasingly to become active members of communities of practice and it is the most powerful way in which academics can encourage their learners to become creators in the educational environment, who derive benefit by sharing the result of their intellectual endeavors with their peer online

V. BARRIERS

The act of integrating ICT into education is a complex process and one that may encounter a number of difficulties. These difficulties are known as barriers. A barrier is defined as any condition that makes it difficult to make progress or achieve the goal. The barriers are categorized as external barriers and internal barriers. External barriers include lack of resources, lack of knowledge, lack of technical support etc. Internal barriers include both organizational factor a teachers level factors. How those barriers negatively influence the use of ICT in education is describe below

- 1. ICT supported infrastructure and lack of resources:** India is one of the developing countries that lack the resources and appropriate infrastructure for implementing ICT in education. The effective use of ICT would require the availability of equipment, supplies of computers and their proper maintenance including other accessories. In most of the rural areas, due to lack of electricity supply no one can run a computer in the first place. Implementing ICT demands other resources, such as computers, printers, multimedia projectors, scanner etc which are not available in most of the educational institutions. Beside, ICT require up-to-date hardware and software which is not available. High speed internet connection is another prerequisite for integrating ICT into the education field. But unfortunately internet access is very poor.
- 2. Insufficient funds:** Effective implementation of technology into education system involves substantial funding, that is very hard to manage for the institute. ICT supported hardware, software, internet, audio, visual aids, teaching aids and other accessories demand huge funds. Due to lack of funds to obtain the necessary hardware and software is one of the reason teachers do not use technology in their classes?
- 3. Vision and mission:** A vision gives us some guidelines to start a plan and show the path to reach our goal. Many researchers have pointed out that institute's vision is essential to effective ICT integration. But most of the educational institutions are far away from implementing ICT into teaching and learning situation. Also, there are some higher educational institutions that have ICT facilities but cannot integrate it effectively due to lack of proper vision and plan.
- 4. Lack of teacher's confidence, skill and knowledge:** Several researchers indicate that one barrier that prevents teachers from using ICT in their teaching is lack of confidence. Some studies have investigated the reasons for teacher's lack of confidence with the use of ICT is "fear of failure" and that caused a lack of confidence. Lack of ICT knowledge and skills make them feel anxious about using ICT in the classroom and thus not confident to use it in their teaching. Another barrier, which is directly related to teacher's confidence, is teacher's competence in integrating ICT into pedagogical practice. Research found that many teachers lacked the knowledge and skills to use computers and were not enthusiastic about the changes and integration of supplementary learning associated with bringing computers into their teaching practices.
- 5. Teachers attitudes and belief about ICT:** Teachers attitude have been found to be major predictors of the use of new technology in instructional settings. Teacher's beliefs about teaching and learning with ICT are central to integration. To be successful in computer use and integration, teachers need to engage in conceptual change regarding their beliefs about the nature of learning, the role of the student and their role as teacher. ICT is not going to replace the teachers. With the introduction of ICT in the classroom, the teacher's role in the learning process becomes more critical. The role of students in turn also expands. As learning shift from the teacher-centered model to a learner-centered model, the teacher become less the sole voice of authority and more the facilitator, mentor and coach from sage on stage to guide on side. And since ICT enhanced learning is a new experience even for the teachers, the teachers become co-learners and discover new things along with their students. Hence the successful use of ICT into classroom largely depends on teacher's attitude and belief.
- 6. Lack of time :** Several recent studies indicates that though some teachers have competence and confidence in using computer in classroom, but they still make little use of technologies because they do not have enough time, and they are already burdened with heavy workload. Some of the institutions have already introduced two shifts, without increasing the number of teachers. In most of the institute teacher's work from about 9 a.m. until 5 p.m. and the average number of class session taught by teachers is 18-20 hours per week. Moreover, most of the teachers are also responsible for administrative tasks. In these circumstances teachers do not have time to design, develop and incorporate technology into the teaching learning situation. Teachers need time to learn how to use the hardware and software, time to plan and time to collaborate with other teachers. Some teachers are unable to make appropriate use of technology in their own classroom, while others are unwilling to try because of anxiety, lack of interest or lack of motivation.
- 7. Lack of effective training:** There is not enough training opportunity for teachers in the use of ICT in a classroom environment. The issue of training is certainly complex because it is important to consider several components to ensure the effectiveness of the training these are – time for training, pedagogical training, skills training and an ICT use in initial teachers training. Poor administrative supports, lack of qualified coordinator who can assist teachers to integrate ICT in class are directly or indirectly influence the effective implementation of ICT in education.
- 8. Lack of technical support:** Without good technical support and technical resources, teachers cannot be expected to overcome the barriers preventing them from using ICT in classroom. Technical problem is found to be a major barrier for teachers. These technical barriers include failing to connect to the internet, low speed of internet, waiting for website to open, printer not printing, malfunctioning computers and teachers having to work on old computers. Good maintenance of hardware and software help teachers to use ICT in teaching without losing time through having to fix software and hardware problems. If there is a lack of technical support and poor maintenance in an institute, then for teachers it is not possible to integrate ICT in their teaching environment.

VI.RECOMMENDATIONS

Effective implementation of ICT in education is impeded by a number of constraining factors. This paper suggested the following recommendations for improving on the current situation.

1. Effective implementation of ICT in education requires commitment from the government, administrators, teachers, parents, students and the community. All the stockholders are responsible authorities including teachers and other

staff should be aware of the importance of technology in developing student's learning and should strive to overcome the barriers which prevent the use of technology in classroom, so that students can benefit effectively from this ICT. Govt. should increase the capacity and cost effectiveness of education and training system. They should ensure the connection of educational institutions and curriculum to the emerging networks and information resources.

2. Lacks of resources within educational institutions are another major hindrance to the implementation of ICT. Lack of computers, hardware, software and other ICT supported tools in the classroom can seriously limit the use of ICT by a teacher. The stockholders and college authorities need to be provided with adequate facilities and resources for effective implementation of ICT.
3. Strategies and proper policies should be formulated for encouraging young minds to the adaption of ICT. Policy makers must pay attention to accommodate all sectors like rural communities, women and disabled while planning for adoption of ICT. Policy makers should encourage women and girls to adoption of ICT, without proper empowering of women it is not possible to implement ICT in education.
4. Local software companies should be encouraged to work together with teachers to produce software program suitable for the teachers and students. Software designers and teachers should work together to develop appropriate form of software supporting different teaching and learning skills for better development of teachers and students.
5. Effective implementation of ICT in education largely depends on teachers, who require in-depth professional development due to lack of knowledge and skills. Vigilant attention need to be given to in-service teacher training for teachers and pre-service teacher training for newly appointed teachers before joining their regular classes to train them on how to prepare and use ICT competently. During teacher training programs teachers should get enough opportunities to practice using technology more practically so that they can see ways in which technology can be used to augment their classroom activities.
6. To implement ICT in education, teachers should feel confident and comfortable using computer in classroom. Teachers must understand the value of computing in education to be able to benefit their students and to support meaningful learning. So changing teacher's negative attitude is essential for increasing their computer skills. Therefore if teachers want successful use of technology in their classroom, they need to possess a positive attitude to the use of technology. Such an attitude is developed when teachers are comfortable with technology and are knowledgeable about its use.

VII. CONCLUSION

In conclusion, the ultimate aim of ICT adoption now is to facilitate effective transformation of learning. The adoption and use of ICTs in education have a positive impact on teaching, learning, and research. ICT can affect the delivery of education and enable wider access to the same. In addition, it will increase flexibility so that learners can access the education regardless of time and geographical barriers. It can influence the way students are taught and how they learn. It would provide the rich environment and motivation for teaching learning process which seems to have a profound impact on the process of learning in education by offering new possibilities for learners and teachers. These possibilities can have an impact on student performance and achievement. Undoubtedly, ICTs are potentially a useful tool both for managing education and for teaching. But getting the best from ICTs depends on several variables, including the appropriate design of software and hardware; the training and attitude of teachers. ICTs are most likely to be cost-effective when used to reach very large numbers of students. The overall literature suggests that successful ICT integration depends on many factors. National policies as well as institute policies and actions taken have a deep impact on the same. Similarly, there needs to be an ICT plan, support and training to all the stakeholders involved in the integration. There needs to be shared vision among the various stakeholders and a collaborative approach should be adopted. Care should be taken to influence the attitudes and beliefs of all the stakeholders. Finally, technology is never a substitute for good teaching. Without skilled instructors, no electronic delivery can achieve good results. Integration of ICT with learning should be curriculum driven instead of technology driven in view of future curriculum reform.

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