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AN OVERVIEW OF BARRIERS IN TECHNOLOGY INTEGRATION IN SCHOOLS AND THEIR INTERRELATIONSHIPS



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Abstract: Influence of ICT for effective classroom teaching has been the research focus for the past two decades. In spite of the efforts made by the government and private agencies to promote use of computers in the classroom, the outcome is not satisfactory. Teachers are unable to integrate technology in their instruction for various reasons. Researchers have been trying to find out the barriers that affect successful integration of technology in the classroom. Barriers are classified as teacher level, school level and system level barriers. This paper studies various levels of barriers impeding the use of computers in the classroom and their interrelationship. Studies conducted in various countries on factors preventing the use of computers by the teachers have been reviewed. The recommendations for those responsible for integration of computers in teaching were provided.

Keywords: ICT , Barriers To Technology Integration

INTRODUCTION

Technology in the field of education has changed the way the teachers used to teach and how the students learn. The role of a teacher has changed from knowledge giver to that of facilitator of learning. Teachers need to be versatile to accommodate to the changing needs of the society which affects education. Use of information technology allows teachers and students to have an easy access to vast amount of information available around the world. It is expected that teachers can make use of technology and create an environment to promote higher order thinking and analytical skills among students. Research studies from different countries indicate that, when used effectively, the advantages of technology are unlimited. It has been proved that in the hands of a skillful teacher technology can be used in a variety of ways: for collaborative learning, problem solving and critical thinking. However, the advantages of technology are not fully exploited due to the difficulties faced by the teachers during implementation in the schools. Balanskat, Blamire & Kefala (2006) contend that though teachers appear to acknowledge the advantages of ICT, difficulties are encountered by the teachers during the process of adopting these technologies. Here an attempt has been made to review select research studies to identify the barriers in integrating technology in classroom teaching.

DEFINITION OF THE TERMS

Barriers:

The term 'Barriers' can be defined as “. . . any factor that prevents or restricts teachers' use of technology in the classroom” (The British Educational Communications and Technology Agency, BECTA, 2003)

Technology integration:

There is no standard definition of the term technology integration in schools. Some consider technology integration as the way teachers used technology to carry out regular teaching activities productively (Hennessy, Ruthven, & Brindley, 2005). Still others consider technology integration as the way teachers use technology to develop students' thinking skills (Lim et al., 2003).

Classification of Barriers:

Barriers in use of technology have been categorized differently by different researchers. Ertmer (1999) categorized barriers hampering teachers' ICT integration efforts as: external barriers (first-order) and internal barriers (second-order). The first order barriers include time, access, support, resources and training where as second order barriers are cited as attitude, beliefs, practices and resistance to change.

BECTA (2004) grouped barriers based on whether they are related to the individual (teacher level) or to the institution (school level). Lack of time, lack of knowledge, lack of confidence, resistance to change in using technology are kept under teacher level barriers and lack of periodic training, lack of technical support and lack of access to computers are included under school level barriers.

Balanskat, Blamire & Kefala (2005) divided barriers into three categories: teacher-level barriers (micro), school-level barriers (macro) and system-level barriers (macro). Hew & Brush (2007) classified barriers into six main categories: resources, knowledge and skills, institution, attitudes and beliefs, assessment, and subject culture.

ChanLin, Hong, Chang, & Chu (2006) conducted a study to identify the factors affecting teachers' use of

technology in creative teaching practices. They have identified factors that play a major role in technology integration: environmental, personal, social and curricular issues.

OBJECTIVES OF THE STUDY:

- 1.To review various research studies on barriers in technology use
- 2.To analyse the inter-relationships among various barriers
- 3.To suggest strategies to overcome the barriers in integration of technology for classroom teaching

REVIEW OF LITERATURE:

Numerous studies have been carried out to identify factors facilitating or prohibiting use of technology in the classroom. Research studies indicate that quite often teachers have encountered various difficulties in using computers for classroom teaching. Insufficient number of computers, teachers' lack of knowledge, difficulty to integrate technology in instruction, scheduling of time (Pelgrum, 2001); computer competence, computer access (Albirini, 2004); computer experience and competency (Ma, Andersson & Streith, 2005); teachers' negative attitude (Yildirim, 2000; Isleem, 2003; Albirini, 2004; Zaidiyeen, Mei & Fook (2010) are found to be some of the reasons for non utilization of computers in the classroom.

According to the National Council for Accreditation of Teacher Education, USA, lack of training and knowledge or familiarity leads to teachers' inability to independently integrate subject matter software with necessary computer hardware (NCATE, 1997).

Mumtaz (2001) in the review of literature on factors affecting the use of ICT in the classroom reported that lack of access to resources, lack of quality software and hardware, easiness to use, lack of incentives for teachers, lack of support from the school, lack of school and national policies and lack of formal computer training as main obstacles for using technology. The research identified three interconnected factors involved: institution, resources and the teacher.

Butler & Sellbom (2002) in their study reported that malfunctioning of the equipment, lack of time, knowledge of how to use technology, institutional support as some of the significant factors in adopting technology. The British Educational Communications and Technology Agency (BECTA) published a literature review on identifying the factors which hinder or promote the effective use of ICT by teachers (BECTA, 2004). It reported that lack of confidence, lack of access to resources, lack of time, lack of effective training, technical problems, lack of personal access and age as the barriers, in the decreasing order of occurrence, for the use of technology by teachers.

Pulist (2005) in an exploratory study on secondary and senior secondary level schools of Delhi has identified that lack of computers with Internet connection, pressure of curriculum on teachers, lack of teacher motivation, lack of technical expertise, regular power cuts were seen as barriers for the use of web based technology in the classroom.

Jamieson-Proctor, Burnett, Finger and Watson (2005) in their study in Queensland state schools found that

teachers' confidence as a major factor determining teachers' use of ICT. Teachers' resistance to change for transformation and influence of age and gender are the other factors evident in their study.

Balanskat et al. (2005) in a review report on Impact of ICT on school in Europe indicated that on the micro level, lack of ICT skills of teachers influence the capacity of teachers to embrace new pedagogical practices with ICT. On school level, ICT infrastructure and access to ICT were found to be major issues. The other barriers at school level are organizational structure, leadership issues and a strategy for ICT use. Prevailing assessment and evaluation methods which do not take into account the new competencies acquired by the students using ICT in learning were identified as system level barriers. Teachers are apprehensive to use technology to full extent for the fear of performance of their pupils using ICT compared to the students of traditional examination pattern.

A study conducted by Kumar, Che Rose and D'silva (2008) in Singapore reveals that though technology related infrastructure facilities are available in schools, the teachers are not able to successfully integrate in the classroom. They found that attitudinal characteristics of the teachers play a greater role in integrating technology. Other studies also support that attitudes and beliefs of teacher are important for successful implementation of ICT (Wahab, 2008; Jegede et al., 2008). A study by Lau Bee Theng, and Chia Hua Sim (2008) on secondary school mathematics and science teachers from Malaysia found that factors such as lack of time, lack of technical support and limited knowledge to integrate ICT in teaching have been hindering uptake of ICT in classrooms.

Kotrlik and Redmann (2009) in their study in USA reported that non availability of computers to all students, lack of technical support and shortage of time for preparation were found to be the barriers to technology adoption.

Binjimlas (2009) in the review of literature finds that lack of confidence, technical support, access, competency as the barriers for use of computers in classroom. Sang, van Braak, Tondeur, & Valcke (2009) conducted a study on primary teachers of China. In their study they report that general computer attitude, traditional beliefs and computer motivation as factors coming in the way of using technology in the classroom.

In a survey conducted by Education, Audiovisual and Culture Executive Agency (Eurydice, 2011) inadequate technological infrastructure, software, internet connectivity and shortage of technical support staff were found to be the key barriers among the European Union countries for integration of ICT in instruction. The findings of Emhamed and Krishnan (2011) on secondary school English teachers in Lybia show that most of the teachers quote poor administrative support, lack of time, as the most common problems followed by lack of training, 'lack of access to equipment' for non integration of technology in schools.

Bhalla (2012) conducted a study on technology barriers in the Kendriya Vidyalaya Sanghathan schools in Delhi. The findings suggest that insufficient time for planning, preparing, and presenting computer-based instructions is the most important barrier. Various other

barriers listed in order of descending importance were as follows: access (hardware), access (software), support, training and competence. In addition, important barriers related to characteristics of students and attitude of teachers are also prevalent.

Neyland (2011) conducted both quantitative and qualitative research on factors influencing the integration of online learning in high schools in Sydney. The study indicates that it is an added responsibility to the teachers who are already overloaded. Abuhmaid (2011) investigated the conduct and effectiveness of ICT training courses in the Jordanian education system with a sample of 115 teachers and 12 school principals. In the study school principals felt that teachers find it difficult to cope up with the pressure of ICT use and training. One of the teachers stated that “teachers are overloaded to learn, prepare and practice what they learn”

Barriers to integration of technology into education

The technology integration into the classroom is perceived as a challenge by the teachers due to various reasons. Based on review of literature, the present study attempts to classify the major factors that affect successful utilization of technology in classroom into three levels: teacher level, school level and system level barriers.

Teacher Level Barriers

- **Lack of confidence:** Teachers lack confidence in using computers in the classroom because they were not competent in using it. According to a study of BECTA (2004) lack of confidence is a major barrier to uptake of ICT. Balanskat et al. (2004) found that teachers' limited knowledge makes them anxious to use computers in the classroom.
- **Lack of ICT competence:** Lack of competence is a barrier linked to lack of knowledge and skill in integrating ICT. Teachers are reluctant to use computers for the fear of making mistakes which they cannot rectify.
- **Teachers' attitude:** Application of any innovation depends on the acceptance of it by the users. Studies reveal that teachers attitude towards technology is an important factor to be considered in the utilization of technology. Unless teachers are convinced of its uses they may not willingly embrace it. Teachers' attitude and inherent resistance to change were barriers (Cox et al., 1999; BECTA, 2004) in using technology.
- **Lack of training:** Literature shows that training is important to improve the confidence of the teachers leading to use of computers in the classroom. Training facilitates teachers' use of technology by improving their efficiency in using it. There have been instances where even when the other conditions are satisfactory, due to lack of training or insufficient training teachers were unable to use technology.
- **Limited access:** In most of the schools computers are located in the shared or centralized locations like the audio-visual rooms or computer laboratories. Teachers find it difficult to access the facility because it requires extra time for arranging the class. Becker (2000) found

that teachers who have computers in their classroom were twice as likely to give students frequent computer experience during class compared to their counterparts who used computers in a shared location.

- **Lack of time for preparation:** It is obvious that new user requires time to understand the technology and use it. Teachers feel that they don't get sufficient time to prepare for the class. Searching for the relevant material in the internet, selection, preparation for the class needs extra hours. Due to heavy work load teachers hardly find time to work with computers.
- **Lack of technical support:** Without good technical support and resources it is hard to expect the teachers to overcome the barrier of using technology (Lewis, 2003). Teachers are apprehensive to use computers because of the technical problems that may possibly arise during presentations. Teachers who are incapable of rectifying the problem try to avoid using it. Repeated technical failures disappoint the teachers as well as students. Moreover it disturbs natural flow of classroom activity. Valuable teaching time also is lost in this process.
- **Non perception of benefits:** Many teachers' are unable to realise the advantages of using ICT and how it will benefit them and their pupils' learning. Because of this they are not making serious effort to learn and use technology. Snoeyink and Ertmer (2001) in their study felt the importance of teachers seeing purpose of using computers in their teaching. They suggested that focused training helps teachers how technology can help them in their own individual situations.
- Cox et al. (1999) found that teachers who are not interested a change in their professional practice is unlikely to make use of technology. They believed that the perceived usefulness of computers to teaching is an important factor for teachers to integrate technology.

School Level Barriers

- **Insufficient number of computers:** availability of technology alone is not a necessary factor for successful integration of ICT, but its absence is an obstacle. Schools with large student strength are unsuccessful in providing sufficient number of computers for teachers to practice/ lesson preparation/teaching-learning purposes.
- **Resistance to change:** It was reported that not only the teachers, the school management is also resistant to changes needed for successful integration of technology. School management still believes that traditional system of teaching is more appropriate to ICT mediated teaching. They are not ready to take the challenge of applying and see the results because of apprehension of the parents and outcome of the implementation if it is adverse.
- **Advance Scheduling of computer lab:** In most of the schools the teachers can use computers only in the computer laboratory or multimedia room. Teachers who are interested in availing the computer room have to reserve it in advance. The advance scheduling of shared computer laboratory for student use requires

careful planning by the teacher and also involves the cooperation of other teachers. Coordination among teachers is essential to share the computer labs.

- **Lack of support from management:** Lack of support from management de-motivates the teachers to try new and innovative techniques using technology. Provision of suitable resources, changes in the time table which helps in optimum utilization of available resources, incentives to the teachers and periodic training encourage teachers to take efforts to use technology. Without appropriate measures from management in providing the above mentioned pre requisites it is difficult to make teachers embrace technology. Cuban et al. (2001) in their study in the United States of America reported that organization of the school, strict time schedules, coordination and communication between the departments led to under utilization of resources.
- **Non-availability of Teaching-learning material:** It is apparent that ready availability of educational materials encourages people to use them appropriately. Scientifically presented content based on psychological principles makes the content delivery convenient for the teacher and easy for student to understand. The material used for the class must be suitable to the needs of the students. Some of the teachers though wanted to use computers have to hold up due to lack of suitable educational resources. The teachers have no option but to use conventional method of teaching.
- **Absence of ICT mainstreaming into schools:** Schools face the problem of non implementation of ICT because ICT is not seen as a part of the general strategy at school level (Balanskat, 2005). Though strategies are developed in some schools these are not integrated into the school's overall strategies. It is an issue not given a serious thought /consideration. Integration of ICT is not taken as a goal and it remained as an isolated phenomenon where only a small group of interested teachers use as and when time permits. Instead, it should be a part of whole school development plan.

System Level Barriers

- **System of examinations and evaluation:** The system of education emphasizes the strict examination pattern. Although the teachers are ready to use technology, the system of education prevents them from doing so. A study on 'innovative learning environments' it was reported that including the developed countries like the UK, the parents are nervous about the capacity of new methods. Balanskat et al. (2005) says "Teachers are under pressure in reaching the standard objectives and fear that schools using ICT will be less performing than traditional schools." Further, the study also found that existing assessment and evaluation methods primarily focus on content and neglect social abilities. The exams fail to cover the new competencies acquired by the pupils such as problem solving, cooperative learning and creativity.

- **Curriculum Load:** teachers of academic subjects strongly believe in transmitting large amount of information or skills during the academic year (Becker, 2000). The teachers of English, Mathematics and science are pressurized by the school administrators for training the students for higher grades. Computers are often seen by the teachers as factors inhibiting the coverage of content. Abuhmaid (2011) and Neyland (2011) in their study also supported the view that curriculum load is an important reason for integration of technology in the classroom.

The interrelationship of barriers

It is difficult to categorize barriers into groups and analyse because there exists relationships between many of the identified barriers to ICT use; factors influencing one barrier are likely to influence several other barriers (BECTA, 2004). Figure 1 shows how one barrier influences the other. For example, teachers' confidence in using ICT is directly affected by the amount of personal access to ICT they have at home or school, training in using computers and availability of technical support in the school.

Lack of accessibility to computers is a barrier which is closely related to other barriers. Regular access gives the teacher time to practice what they know and increases the confidence to use computers. Due to lack of access teachers are unable to use computers regularly which may reduce competence and confidence of the user which intern leads to non-utilization.

In some situations though resources are available to teachers they are unable to access them due to lack of sufficient time. It is possible that lack of access reduces the technology use even if the teacher is proficient and interested to use technology.

Another barrier related to non-accessibility is lack of technical support in the school. Teachers are unable to use technology because they are not confident of operating ICT tools. Technical support allows teachers to be up to date with technology. It also gives them confidence in using the technology.

Lack of competence is one of the important barriers because of which teachers are unable to use technology. Lack of competence is linked to lack of training, limited accessibility and lack of time to practice. Lack of training may lead to lack of competence which in turn leads to lack of confidence. At the same time limited access to computers in school may also lead to lack of practice which in turn leads to lack of competence. Lack of competence leads to lack of confidence which ultimately leads to non utilization of resources.

Non-availability of enough time is a limitation in using computers. Lack of sufficient time turns out to be a constraint due to several reasons; curriculum load, system of evaluation, scheduling of time, and shared computers labs for use by the teachers. Curriculum load and system of examinations influence technology use because a heavy work load and examination schedule leaves only little time for the teachers to use computers for instruction. Teachers struggle to complete heavy syllabus in a short duration of

time. Teachers find lecture method as a faster way to transact the content.

Sharing of computer lab poses problem because teachers need to adjust their classes along with their colleagues, and a chunk of time is lost while availing the lab as students have to move from classroom to computer lab and vice versa.

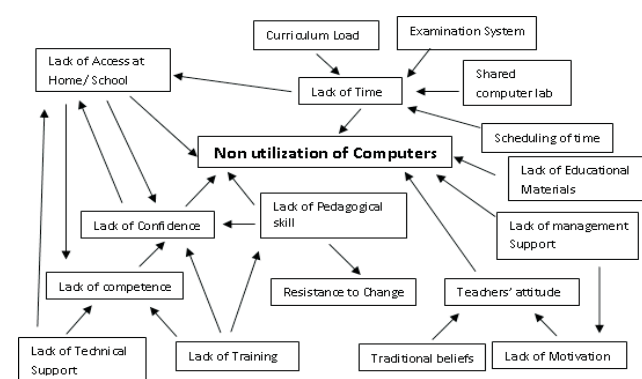
Lack of training in computers affects the utilization of technology in two ways. Firstly, the teachers are not equipped to use technology and secondly, they are not aware of using technology for pedagogical purpose. Lack of pedagogic skills also comes in the way of enthusiastic teachers to access technology. Since teachers are trained only computer operations they are not aware of how the classes can be conducted using computers. Due to lack of technological pedagogical content knowledge teachers are unable to access the educational resources available in the schools.

Lack of suitable study materials dampen the spirits of the teachers who wants to use technology. Compatible software and educational resources motivate the teachers and encourages them to move towards technology. Teachers who are not skilled to prepare the lessons on their own due to lack of sufficient training or lack of enough time will give up their intention to use technology though they are interested and believe in technology.

Teachers' attitude is considered as one of the important reasons for avoiding use of technology in classroom. Traditional beliefs prevent teachers from adopting technology. It is a well known fact that teachers tend to teach how they were taught. Teachers tend to follow the practices which they experienced years ago. Teachers who are not aware of the developments in the field of educational psychology, science and technology and the influence of ICT in student learning tend to follow the traditional methods of teaching. The traditional belief, resistance to change and lack of motivation could probably arose due to lack of training and not realizing the advantages of using technology and lack of exposure to the ICT mediated teaching.

Keeping in view the available literature in the field, the present paper has suggested a schematic representation of interrelationship of barriers for further research and improvement.

A schematic representation of interrelationship of barriers



Strategies to overcome the barriers of technology integration

It is possible to remove the barriers once the reasons for the occurrence and the relationship among barriers are identified. Educational administrators, school principals and teachers work together and resolve the problem to make ICT an integral part of school curriculum.

Teacher level barriers

- Giving training to the teachers in a way that apart from learning basic operations in computers teachers should also learn pedagogic skill for effective integration of technology in the curriculum.
- Making ICT facilities available and accessible to the extent possible
- Providing opportunities for the teachers to practice what they learnt.
- Preparing a flexible time table where teachers handling the same subject and grade can coordinate and avail computers in the classroom.
- Seeking cooperation of teachers for optimal utilization of available resources by coordination
- Providing technical support in the school by appointing competent persons to help teachers rectify the problem and helping in smooth running of the class.
- Arranging for periodic training programmes for teachers to get up to date with technology.
- Encouraging motivated teachers to support other teachers in use of computers.
- Giving incentives to teachers who are adopting technology successfully.
- Making computers available in the classrooms rather than in centralized locations.
- To challenge the beliefs and convince the teachers of the advantages of technology they should be given an opportunity to experience the richness of technology mediated classes.
- Reducing the work load for teachers in order to free up some school time
- Rescheduling time table to make a double period session so that teachers get enough time to use computers to teach.
- Appointing full time computer technology trained support staff
- Giving time for the staff to communicate and share among peers for technology to be an effective tool in the classroom curriculum.
- Providing opportunities for teachers to experiment with technology. Schools can support this initiative by creating a culture that allows teachers to try out new practices, while making technical and pedagogical support readily available.
- Allowing the teachers to witness how the shift from traditional method to technology mediated method benefits their students.
- Encouraging the teachers to collaborate and work together while preparing technology-integrated lesson plans and materials so that time required is shortened and ideas are shared.

School level barriers

- Using of computers should be made as mainstreaming into school activities.
- Providing necessary infrastructure.
- Capacity building of the teachers through workshops.
- Changes in structuring of Time-table.
- Providing opportunities for teachers to engage in active learning.
- Providing training on technology-supported pedagogy skills, and technology-related classroom management skills.
- Developing a model by school management that would include a shared vision of entire school.
- Involving teachers in the decision making process for teacher participation is one of the important factors for technology acceptance and use
- Seeking support from parents and involving them in decision making regarding the use of technology
- Providing school administrators, head of the institutions with technology training, giving exposure to methods and procedures of integrating technology into the curriculum
- Making the technology use compulsory by teachers. Fixing minimum number of technology integrated classes by the teachers puts pressure on the teachers and there by increases the use
- providing training facilities on incorporating technology use in classroom and giving them the experience of technology mediated learning which would convince them to use the technology
- Organizing available resources in such a way for best possible utilization

System level barriers

- Reconsidering assessment methods
- Including qualitative assessment of students' work
- Allowing teachers to experiment with technology mediated within given boundaries

CONCLUSION

The effort by the governments to make technology integration is not completely successful because of the barriers experienced by the teachers and school administrators. Barriers experienced by teachers are at different levels. Beginners face the problem of lack of skill and technical support and regular users experience accessibility and time as barriers. School managements find the provision of ICT facilities as a major challenge and system level barriers like method of evaluation and coverage of curriculum as other barriers. This paper intends to provide information on barriers affecting the integration of computer technology in different countries. This information enables us to take decisions and bring in desired changes which help in technology integration in education. Availability of resources, time available for using technology and teachers' competence were found to be major barriers for using computer technology in the classroom. Shared vision in administration, ICT policies can resolve the problem and increase utilization of resources.

The training programmes designed must ensure that teachers are convinced of the value of using ICT in their teaching. Teachers should be made aware of the range of uses in adopting ICT in teaching. Training in basic skills alone will not suffice the problem. Specially designed training classes focusing on the methods of integrating technology will benefit them. Coupled with basic skills, training in integration of technologies in classroom teaching will help the teachers to apply their ideas and derive benefits of technology.

To conclude it is important to understand how each barrier is linked to other barriers to understand the reasons for non utilization of ICT resources. This problem need to be understood thoroughly because addressing one barrier doesn't produce expected results. However, by attempting to resolve all the interconnected problems it is most likely that technology integration may be included in schools. Though barriers exist in every educational set up they may differ from country to country and school to school. It is essential to identify the critical factors in that particular context so that necessary changes can be made to resolve the problem.

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