

Key Issues in the Implementation and Integration of ICT in Education System of the Developing Countries

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Introduction

Although valuable lessons may be learned from best practices around the world, there is no one formula for determining the optimal level of ICT implementation and integration in the educational system. Significant issues/factors that policymakers and planners, educators, administrators, and other stakeholders need to consider include educational policy and planning, infrastructure and capacity building, language and content, attitude, financing and sustainability and transferability.

Attempts to enhance and reform education through ICT require clear and specific objectives, guidelines and time-bound targets, the mobilization of required resources, and the political commitment at all levels to see the initiative through.

Different studies reveal that the existence of a number of issues/factors that influence the implementation and integration of ICT in education. The intended presentation highlights these key issues/factors in brief.

Hoffman (2001) suggested that successful implementation of ICTs needs to address five interlocking frameworks for change: the infrastructure, attitude, staff development, support (technical and administrative) and also sustainability and transferability.

One of the key factors that contribute to the successful implementation and integration of any program related to technology is the availability of resource. Countries with large resource bases are obviously much better placed to take advantage of the educational benefits arising from the utilisation of technology in teaching and learning than countries with limited resources. However, even the countries with large resources experience problems in this regard, as continual technological change, combined with public education's limited financial resources, results in deployed educational technology that is often obsolete. This makes it difficult to use currently available resources to teach students about technology (United States National Research Council, 2000).

Fisser (2001) in her study identified environmental pressures, technology developments, institutional conditions, educational developments, cost reduction/cost-effectiveness and support facilities as issues/factors influencing the implementation and integration of ICT in education. Although Fisser's study was focused on higher education scenario, most of the factors/issues she identified/listed in her study are relevant to school environment too. Almost all works examined in her study also recognise the influence of environmental pressures on organisations.

Another study by Pelgrum (2001) qualifies insufficient infrastructure and lack of knowledge/skill as obstacles affecting the implementation and integration of technology in education. The former was confirmed by 70% respondents covered in the study; whereas the latter by 66%. The number of obstacles identified/listed in Pelgrum's work goes up 30. This shows that the implementation and integration of technology in education faces a lot of problems and challenges.

Like Pelgrum, the work of Baldwin (1998), also lists obstacles observed in the implementation and integration of technology in education such as insufficient or obsolete hardware and software, inadequate facilities and support services, lack of time and money, inappropriate reward system, lack of information about good practice, and underestimation of the difficulty in adopting new information technologies.

In the discussion above we saw infrastructure, attitude, staff development, support (technical and administrative) and also sustainability and transferability as main issues or factors influencing the implementation and integration of ICT in education. Let us now elaborate them in detail.

1. Infrastructure in technology implementation and integration

Collis (1996), defines infrastructure as the physical equipment (hardware and software) that enables a network to function. In order to have a teaching learning process or education system supported by technology, the availability of suitable infrastructure is essential (Law et al., 2000). This implies that it is very difficult to focus on implementation of technology to support learning unless schools and other educational establishments are provided with basic technological infrastructure and facilities. A study of good practices in using ICTs in Hong Kong schools shows that all schools have made remarkable effort to establish a reasonably good technological infrastructure to allow teaching and learning with information technology to take place (Law et al., 2000).

In relation to connectivity, a study by Pelgrum and Anderson (1999) disclosed the existence of huge differences between schools in different countries regarding the availability of ICT equipment and facilities and access to the Internet. Not only this but the study also observed that, over a four-year period many countries covered in the study developed rapidly in terms of equipping their schools with computer hardware and software. Although computers were widely distributed, and their number was increasing continually and significantly reports from many researchers indicate that shortage/lack of computers remain a problem at different schools and countries. Majority of respondents from most of the countries covered in the study considered/saw shortage/insufficient number of computers as a major obstacle.

The education system and policy support in the areas of budget, curriculum, professional development and research may facilitate or hinder the launching of a country's ICT program, as well as its expansion and sustainability in the future. The national ICT infrastructure (connectivity and accessibility) may also affect the implementation of ICT

in education policy. All these elements are within a larger environmental context that may include the need to develop a competitive workforce – regionally and globally, the economic cycle that a country or the world is undergoing, economic policies (budget cut or expansionary fiscal policy), political and social stability, the bureaucracy of the system, and so on. Evidence indicates that these policy investments around the world have resulted in a dramatic increase in the number of computers in schools and classrooms and the access that teachers and students have to the Internet (Pelgrum & Anderson, 1999). But Means (2000) argued that although so much has been done to increase the technological infrastructure in schools, institutions are “far short of providing a seamless, convenient, robust, and reliable technology support structure for all students and teachers”.

Some countries have successfully overcome budget constraints and are able to provide necessary infrastructure based on the needs of the school or region. Some other countries that have large budgets for ICT in education lack the expertise to identify appropriate hardware and software to purchase and, as a result, ICT implementation is not well-supported by adequate infrastructure.

2. Support in technology implementation

Putting ICT tools in schools alone is not enough to get instructors’ and students’ attention to use technology for teaching and learning. A study by Zaho, et al (2002) shows that a supportive school environment is important for successful technology implementation. Support facilities are one of things needed for the effective implementation of technology in education. Support in ICT implementation can be categorized in to two main groups.

2.1 Administrative support

Support from different levels of the school organization is one of the key elements needed for successful implementation of technology in education. Administrators can provide the conditions that are needed, such as school-wide policy, incentives and resources. Administrative support and involvement is critical to the successful integration of technology. The study by Bloemen et al., (1999) constantly shows that the commitment and interest of the principal is the most critical factor for successful implementation of any school innovation-especially technology. The provision of support for all of their personnel and involving them in various aspects of technology usage is critical both at schools and every level of office.

Leadership plays a key role in the implementation and integration ICT in education. Many teacher- or student - initiated ICT projects have been undermined by lack of support from above. For the implementation and integration of ICT to be effective and sustainable, administrators themselves must be competent in the use of the technology, and they must have a broad understanding of the technical, curricular, administrative, financial, and social dimensions of ICT use in education. Colleagues as well as school and district administrators must provide ongoing support for long-term change to be successful (Dwyer, Ringstaff, and Sandholtz, 1997). This shows that support and

encouragement from the school leaders and other concerned bodies is important in the implementation and integration of technology in education.

2.2 Technical support

As Voogt (in press) described “technical support is not always available, which implies that teachers need to be able to have basic troubleshooting skills to overcome technical problems when ICT is applied”. Technical support is one part of the implementation and integration of ICT in education system. It should be considered as integral part of a school’s overall ICT procurement strategy and responsibility for ensuring that good support systems are in place with school leaders. Effective technical support enables the implementation and integration of ICT to function effectively and efficiently. Without it teaching staff may not have the confidence to use ICT in their teaching. Such ICT support can range from installing hardware to setting up and maintaining the overall activity and even to providing support in the school to other colleagues.

Whether it is provided by in-school staff or external service providers, or both, technical support is essential to the continued viability of ICT use in a given school. While the technical support requirements of an institution depend ultimately on what and how technology is deployed and used, general competencies that are required would be in the installation, operation, and maintenance of technical equipment, network administration, and network security.

3. Staff development in technology implementation and integration

Although support may be a necessary condition for successful ICT integration in education, it is not an end by itself. The implementation of ICT in education should consider teachers training. As Farrell (1999) describes, training and workshops are needed not only to improve the skills of the instructors, but also as a means of getting them involved in the process of implementing and integrating technology in teaching and learning. This implies that teacher training is essential, if the technology introduced to schools to be used effectively.

Putting hardware in a classroom without training teachers or otherwise supporting the integration of technology into the classroom is not enough for the implementation of technology in education. Staff development at every stage can encourage teachers to collaborate in implementing technology in their teaching learning process. Teachers need training not just in the choice and use of appropriate technologies, but more fundamentally in how people learn and in instructional design (Bates, 1997). A study result which was conducted by Pelgrum (1999) in different countries shows most respondents saw lack of ICT related knowledge among teachers as a major obstacle to implement ICT in the school.

Ali (2003) argues that the best approach in implementation of technology is to focus on the ability of the faculty to use technology rather than simply providing machines, which might end up being idle. The teachers should be trained to be able to use technology

before it is provided. Ali stands against the current strategy of providing technology without concern for the end-user. He is emphatic in his conclusion that many teachers lack the opportunity, training, or motivation to use technology. He, thus, recommends that the most important thing for technology to be successfully used by teachers is the need to change the focus from providing technology first to training teachers first.

A study by Pelgrum (1999) looking into the wishes of teachers concerning teacher training showed that many teachers lack knowledge and a need for further training in line with innovative literature. This indicates that the implementation and integration of ICT is a complex innovation with considerable changes for the teachers. Most of the schools that participated in study need additional continuous staff development regarding ICT. So, training teachers should be a continuous process. They need regular update with the development of technology.

In some conditions teachers may not prefer just to use new technology in education, in this case it will be better to organize a systematic professional development program for them. This will ensure that they are prepared for the implementation of technology in education. Research findings and reflection on ACOT's experiences indicate that teachers go through several stages of development when attempting to implement fundamental changes in education. As they progress through these stages, they gradually replace traditional beliefs and practices with new ones, it is critical that their working environments be supportive (Dwyer et al., 1997).

We can learn from the work of Voogt, Gorokhovatsky and Almekinders (2003) that the implementation of technology is a complex attempt for the teacher, because many things in classroom and the teacher's role will change. So teachers need training to accustom and apply the new system they have to use in relation to the new situation in the classroom. Integration of ICT in teaching and learning does not only deal with getting used to new materials – hardware and educational software, but at the same time the teacher and the students have to adopt new roles. Therefore, the implementation of such an innovation in the classroom not only require from the teachers to use new materials, but also to change their behaviour and beliefs about education (Fullan, 2001)

While staff development is generally taken as an important dimension, the priority to this as an element in the implementation of training varies greatly in terms of the proportion of resources allocated and how this training is scheduled in relation to other elements in the system's implementation strategy (Plomp et al, 2003).

Regarding who needs to undertake staff development, teachers constitute the largest target group for the provision of staff development opportunities in any country that has an ICT in education staff development policy in place. However, they are not the only group that need professional development. One important aspect of staff development concerns the building up of leadership capacity at the school level. Leadership is important in this case, not just to support the introduction of ICT into the school curriculum, but also to determine the goals and directions of change. A study of 18 schools in China and Hong Kong that had made a head start in introducing ICT across the

curriculum found that the way ICT was used and its impact on learning and teaching was very much determined by the vision and understanding of the school principal and the prevalent school culture (Law et al, 2000).

Plomp et al (2003), described that the increasing presence of ICT in schools and multitude of ways ICT is being used in the educational process have led to the emergence of new roles and functions for education professionals in the school sector. Such roles and functions are sometimes not carried out by school-teachers (Law, in Press). In some countries, like United States, this has evolved into a computer-related personnel structure in the school system for the provision of technical, media, instructional, or administrative support. From the cross-national findings of the survey conducted in SITES-M1 (Pelgrum & Anderson, 2001), it appears that most schools have a “computer coordinator” to overcome or help manage their computer equipment. In some cases, these coordinators also play an active role in providing ICT-related staff development to other teachers in their schools.

These various specialised staffing positions need different staff development provisions, the content of which depends largely on the specific coordination role expected of them.

4. School leaders and teachers attitude towards technology implementation

A study by Bos and Visscher (1999) manifest that the successful use and implementation of technology depend on the extent to which school principals promote the use of ICT in their schools and the teachers positive attitude towards the technology. Positive teacher attitude toward technology is widely recognized as a necessary condition for effective use of information technology in the classroom (Woodrow, 1992). Though, the amount of confidence a teacher possesses in using technology may greatly influence his/her effective implementation in the classroom.

The same study by Woodrow, (1992) on teachers attitude towards the technology identified several teachers who said that ICT unquestionably raised standards cited, improved presentation of work and consequently increased self-confidence, while teachers in many other schools suggested that the same use might be considered as ineffective and time-wasting use of ICT - the production of ‘neat nonsense’. This highlights a discrepancy in approaches to teaching and learning from school to school. It does seem to depend largely on the expectations of the teachers, according to their opinion of the capabilities and attitudes of their students. On the other hand, in other schools, which were very confident in the ability of ICT to raise standards, teachers said that in their view pupils expressed themselves more clearly given ICT as a medium. Another teacher said that in her experience, pupils were more resourceful when working with ICT. Many others also observed that pupils worked more independently on computers.

A study by Christensen and Knezek (2000) reveals that the task of getting teacher’s positive attitude in the integration of technology in the classroom should begin with an assessment of teachers’ need. This enables initial training to be targeted at the most

appropriate level. Initial training should be followed up by focused sessions with smaller groups of teachers with return visits at regular intervals. Appropriate strategies for training any given group will be determined by factors such as teaching level, content area, and educators' stages of adoption of technology. Will, skill and access to technology tools are probably all the necessary components for the successful integration of technology into the classroom as well as to have positive attitude from those who implement any technology.

5. Sustainability and transferability of ICT implementation

A report of the second information technology in education study which was undertaken by a project team of the international association for the evaluation of educational achievement (IEA) (2003) identified two major categories of conditions for any innovation to be sustained and transferred in schools. These are: essential conditions and contributing conditions. Essential conditions (Teacher professional development, Student support, Perceived value of innovation, Administrative support and Teacher support) were defined as those that had conditions they found necessary, but not sufficient, for innovation to be sustained. Contributing conditions (Support within school, Support from outside school, Funding, Supportive plan and policies and innovative champions) were those that they found facilitated the sustainability of innovation.

Summary

A developing country's educational technology infrastructure sits on top of the national telecommunication and information infrastructure. The infrastructure should be developed for the effective implementation and integration. Various competencies must be developed throughout the educational system for ICT implementation and integration to be successful. Teacher professional development in relation to skills with particular applications; integration into existing curricula; curricular changes related to the use of IT (including changes in instructional design); changes in teacher role should be done. Support at different levels should be considered. Sustainability and transferability in ICT implementation and integration as one of the greatest challenges should also be addressed.

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