

## **Determinants of Information and Communication Technology (ICT) Integration in Tertiary Institutions**

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### **Abstract**

Proponents have put forward some factors that serve as the basis for Information and Communication Technology (ICT) integration to support education at different levels. This study was basically a critical review of the literature using multiple case study methodology to explore and understand the appropriate approach to the establishment of proper integrated ICT infrastructure and its applications in tertiary institutions. Several factors have been identified especially in the normal education environment, both enablers and hindrances together with an elaborate ICT infrastructure that serves as a backbone to the ICT integration into the education. The study reveals enablers and infrastructure aspects for ICT integration; and the managerial impact of incorporating the determinants as a paramount tool for a state-of-art educational environment.

**Keywords:** Information and Communication Technology (ICT), Determinants Integration, Tertiary Institutions, Critical Review, Framework

## 1. Introduction

Information and Communication Technology (ICT) has become an important tool of most organizations and businesses these days (Khalid, 2009). In addition, Yeun and Law (2003) observes that during the past decade there has been an exponential growth in the use of ICT which has made pervasive impacts both on society and on our daily lives. There has been increasing interest, attention and investment being put into the use of ICT, especially in education which raises concern of how best the ICT resources can be implemented and integrated to support the academic processes.

A number of master plans on ICT in education have been produced in many countries (Pelgrum and Anderson, 1999). Further, Pelgrum and Anderson (1999) notes that such plans reveal that educational innovations in ICT have been increasingly embedded within a broader framework of education reforms that aimed to develop students' capacities for self-learning, problem solving, information seeking and analysis, and critical thinking, as well as the ability to communicate, collaborate and learn.

According to Dawes (2001) new technologies have the potential to support education across the entire curriculum and provide opportunities for effective communication between teachers and students in ways that have not been possible before. Balanskat, Blamire, and Kefala (2006) argue that although educators appear to acknowledge the value of ICT in schools, difficulties continue to be encountered during the processes of adopting these technologies. Studies have been conducted to investigate barriers to the integration of technology in education and in particular in science education (Ozden, 2007).

This paper provides an intensive analysis of the literature that aims to explore the perceived determinants to ICT integration in the Tertiary Institutions to support both the Management Structures and Education Environments. Martin Oliver & Sara Price (2007) stated that understanding the impact of technology-enhanced learning for staff in higher education is important if better informed decisions are to be taken about how and why certain technologies can or should be adopted for teaching and learning.

Further, it is noted that by understanding these aspects the process of technology implementation and adoption can take on a form that is more likely to be successful for those that it is aiming to support. As noted by Price & Oliver (2007), recent technology innovations, have led to a number of claims about their potential for learning. The rapid growth of computing, networks and infrastructure offers not only an increase in available technologies for learning, but also a change in its potential use in education. In addition (Tondeur *et al*, 2007) observed the importance of studying the role of local ICT policies on actual ICT integration in education.

The researcher has made a number of observations as follows: first, proponents argue that technology can transform educational practice, typically as an element of wider organizational transformation such as the development of mega-

universities (Daniel, 1998) or as a consequence of competition in international educational markets (Hannah, 1998). Secondly, others have taken a less deterministic position, but see a link between technology and changing educational practices such as the creation of more flexible opportunities for learning (Boer & Collis, 2005). According to Henkel (2000), technology is associated with changes in practice but the nature of this association is complex and contested, not least because it forms just one influence amongst many upon academic identities.

The purpose of the study was therefore to carry out a critical analysis of the determinants of ICT integration into learning and management areas. Further, it was to evaluate the obstacles and enablers of ICT usage in learning and management environments which is important in highlighting the key factors to enhancing ICT integration. This study further investigates the key managerial aspects that will be influenced by a proper framework that is designed to effectively and efficiently actualize such strategic functions.

## 2. Literature Review

The rationale for using Technology has augmented by Qiyun Wang and Huay Lit Woo (2007), is that Technology should be used not because it is available or it has been shown effective in some cases but because Technology can enable the process and enhance learning. Further, inappropriate use of technology can lead to negative effects (Johnson & Aragon, 2003). Teacher-designers need to choose proper technology and justify the need for the technology, the values the technology can offer and the technology support for the instructional process.

Moreover, Roblyer, Edwards, and Havriluk (2004) suggested the following for rationalizing the use of technology: the high motivation, unique instructional capabilities such as helping students visualize data and problems or tracking learning progress; support for innovative instructional approaches such as collaborative learning and problem-based learning; and increased teacher productivity and student knowledge construction.

Goktas *et al* (2009) observed that a predetermined process is important for the integration of ICTs in the classroom, curriculum, school management, library, and any educational setting. Integration of ICTs enhances the quality of education by helping teachers to do their job and by helping students to learn more effectively. Additionally, the use of ICTs is complicated because it involves not only the use of alternative tools for dealing with old, conventional problems but also expectations that these technologies will help in meeting new challenges. A variety of action plans have been developed to effectively integrate ICTs in pre-service teacher education programs, but many barriers still exist. This study streamlines the cited problems for the best use and applications as well as simplifying the sophistry in the use of the ICT facilities.

In addition, Goktas *et al*, (2009) identified a number of barriers that need to be overcome, that included crowded classrooms, inadequate number of ICT-related courses, lack of computers and other presentation equipment in classrooms, lack of

computer laboratories for use in free time, lack of technology plans, lack of motivation of the teacher educators concerning the use of ICTs in their classes, lack of motivation of the prospective teachers concerning the use of ICTs in their courses and their future classes, lack of good role models for prospective teachers and lack of successful institutional models.

Further, Goktas *et al.*, (2009) raised a number of enablers that included having at least one computer in every classroom, having at least one free laboratory, supporting courses with an appropriate web page, offering more ICT-related courses, enhancing the motivation of the teacher educators and prospective teachers in regard to using ICTs in their classes, designing ICT-related courses based on applicable activities and being role models, as teacher educators for prospective teachers by demonstrating how to use ICTs effectively in teaching.

In the publication entitled “Barriers to the Successful Integration of ICT in Teaching and Learning Environments: A Review of the Literature” Khalid (2009) states that the classification of the barriers fall into different categories that have been used by researchers. The classified barriers are as follows: First is the lack of teacher confidence that has been cited by Dawes (2001) as a barrier that prevents teachers from using ICT in their teaching.

According to Becta (2004), much of the research proposes that this is a major barrier to the uptake of ICT by teachers in the classroom. Becta, (2004) also notes that lack of teacher competence is another barrier, which is directly related to teacher’s confidence and competence in integrating ICT into pedagogical practice. Resistance to change and negative attitudes has been cited by researchers as a barriers to the integration of ICT into education; and that teachers' attitudes and an inherent resistance to change were a significant barrier (Cox *et al.*, 1999a; Watson, 1999; Earle, 2002; Becta, 2004; Gomes, 2005; Schoepp, 2005).

Studies also indicate that Lack of time for teachers who even have competence and confidence in using computers in the classroom, still make little use of technologies because they do not have enough time. A significant number of researchers identified time limitations and the difficulty in scheduling enough computer time for classes as a barrier to teachers' use of ICT in their teaching (Al Alwani, 2005; Becta, 2004; Beggs, 2000; Schoepp, 2005; Sicilia, 2005). According to Sicilia (2005), the most common challenge reported by all the teachers was the lack of time they had to plan technology lessons, explore the different Internet sites, or look at various aspects of educational software.

Lack of effective training is another barrier most frequently referred to in the literature (Albirini, 2006; Balanskat *et al.*, 2006; Beggs, 2000; Ozden, 2007; Schoepp, 2005; Sicilia, 2005; Toprakci, 2006). In addition, several research studies indicate that lack of access to resources, including home access, is another complex barrier that discourages teachers from integrating new technologies into education and particularly into science education.

Finally, is the lack of technical support in the classroom and for the whole-school resource; as Lewis (2003) observes that teachers cannot be expected to overcome the barriers preventing them from using ICT without the necessary technical support. Pelgrum (2001) found that in the view of primary and secondary teachers, one of the top barriers to ICT use in education was lack of technical assistance.

In the publication entitled “teaching in a wireless learning environment” by Tzu Chien Liu (2007) states that Wireless learning environments offer many educational possibilities that is not easily achieved in other learning environments. Mobile devices enable both the teacher and students to employ computing power without time or location constraints, while the Internet and wireless technologies enable mobile devices to interconnect seamlessly with each other or with other computing devices.

In addition Tzu (2007) observes that Wireless learning environments has the following features based on seamlessly linking various computing powers with mobile learning devices at hand, including: enhancing availability and accessibility of information networks; engaging students in learning-related activities in diverse physical locations; supporting group work in projects; improving communication and collaborative learning in the classroom, and supporting quick content delivery (Gay, Stefanone, Grace-Martin, & Hembrooke, 2001).

Liang *et al.*, (2005) and Zurita, Nussbaum, & Salinas, (2005) states that wireless learning environments are regarded as more suitable than ordinary classrooms or computer classrooms for supporting teaching and learning based on learner-centred teaching methods. Further it is noted by Liang *et al* (2005) that the educational application of mobile and wireless technology raises rapidly, but empirical studies on learning activities involving these technologies are still rare.

In the ICT integration in the classroom: Challenging the potential of a school policy Jo Tondeur, Hilde van Keer, Johan van Braak, Martin Valcke (2007) observed the following factors that determine the extent of the ICT integration in the classrooms.

Principals as leaders need to see their role mainly as a catalyst and facilitator of ICT integration in the classroom. The use of ICT in education is not yet part of the formal curriculum, but teachers are encouraged by the educational authorities and policy developers to adopt computers in their classroom, but this is yet not a compulsory instructional activity. The Principals reported that it would be advisable to establish and appoint a teacher as a ‘change agent’ in order to maintain and sustain innovation when the direction of the ICT coordination is no longer available. Further, majority of principals reported that ICT coordinators mainly perform as technical experts.

From the proponents interviews with the respondents it became clear that the implementation of ICT in schools is hardly ever submitted to any kind of evaluation. Again, it appears that the evaluation emphasis is mostly related on the infrastructure (hardware and software); and in some schools, the evaluation centres on the actual use of ICT for learning and instruction.

In the publication entitled “ICT implementation and school leadership - Case studies of ICT integration in teaching and learning” by Allan H.K. Yuen, Nancy Law and K.C. Wong (2003) observes that there has been rapid evolution of technology that has necessitated a change of approach to corporate technology management. Wiseman (1985) identified three eras in terms of objectives for information system use: to improve business efficiency by automating information processing; to improve management effectiveness by satisfying information needs; and to improve competitiveness by affecting the business strategy.

Mooij and Smeets (2001) suggested five successive phases of ICT implementation within schools, representing different levels of ICT transformation of the educational and learning processes. These phases include: the incidental and isolated use of ICT by one or more teachers; increasing school awareness of ICT relevance for the school at all levels; emphasis on ICT co-ordination and hardware within school; emphasis on didactic innovation and ICT support; and use of ICT-integrated teaching and learning that is independent of time and place.

The findings of the previous studies highlight on the factors that serve as barriers and not enablers to the actual integration of ICT in the educational and managerial environments. A number of barriers as identified by Goktas *et al*, (2009) included crowded classrooms, inadequate number of ICT-related courses, lack of computers and other presentation equipment in classrooms, lack of computer laboratories for use in free time, lack of technology plans, lack of motivation of the teacher educators concerning the use of ICTs in their classes, lack of motivation of the prospective teachers concerning the use of ICTs in their courses and their future classes, lack of good role models for prospective teachers and lack of successful institutional models.

The observation concentrates on the high schools education environment and has not mentioned the situation eminent in the tertiary institutions. The proponents also have not elaborated on the technological infrastructure necessary to support most of the functions, as well as being silent on the level of integration of the ICT services to enhance the academics and managerial activities.

According to Khalid (2009) issues raised focused on the perceptions and the training capabilities of the teachers that serves more as barriers rather than enablers. In addition Goktas *et al*, (2009) cited hypothetical enablers that are expected to have a positive impact towards ICT integration; and the enablers included, among others, having at least one computer in every classroom, having at least one free laboratory, enhancing the motivation of the teacher educators, designing ICT-related courses based on applicable activities and being role

models. Further the scholars propose that successful ICT integration depends upon the development of a shared vision and policy especially by the teachers (Hughes & Zachariah, 2001; Otto & Albion, 2002).

The study points out perception issues as stated by Kennewell *et al.* (2000) that teachers need to share the values expressed within the school policy and understand their implications. However, the success of ICT integration can be anchored on more practical matters that include management support, state-of-art ICT infrastructure, enhanced educational service delivery platform, effective communication using ICT facilities among others.

### **3. Discussions**

According to Lai and Pratt (2004), the main responsibility of the ICT coordination is especially to guide ICT integration in teaching and learning. It follows that the technical support by the relevant personnel is necessary to have effective ICT integration. Building on the positive effect for ICT services requires professional development through training to match the technological changes.

From the literature there is notable lapse on the management support for the ICT utilization; but this study stresses the importance of leadership in developing a commitment to change. The capacity to develop and articulate, have collaboration with other stakeholders in educational sector points the extent of ICT use and integration.

Havruluk *et al* (2004) that there is need for the unique instructional capabilities, support for the instructional approaches and collaborative learning and problem – based learning. These aspects when launched as networked or online features enhances greatly on the instructor or teacher productivity and the knowledge acquisition by the students. The proponents pointed out that resistance to change, negative attitudes, lack of effective training and lack of technical support as barriers to the effective applications of the ICT communication facilities.

The wireless technology when configured to support the learning environment provides for enhanced availability and accessibility of information networks; engaging students in learning-related activities in diverse physical locations; supporting group work in projects; improving communication and collaborative learning in the classroom, and supporting quick content delivery.

The managerial component can utilize the ICT facilities not only for enhancing educational service delivery but also to realize a number of organizational objectives that include improved business efficiency by automating information processing; improved management effectiveness by

satisfying information needs, and improved competitiveness by affecting the business strategy.

The ICT implementation within an educational environment requires a thorough understanding of the technology trends in addition to continuous training for the ICT applications, creating and upholding awareness for the ICT relevance in education, drawing a strategic plan for the ICT infrastructure coordination, continuous ICT innovation and support and the alignment of ICT-integrated platform to the teaching and the learning environments.

#### **4. Conclusion**

This study underpins the importance of proper assessment of the determinants of ICT integration that are relevant in the tertiary education environment attested on the inferential model that reflects more than the perceptions of the stakeholders for the ICT integration.

The findings of this study indicate that there is no concrete reference or framework for the integration of ICT into education but only that numerous barriers are encountered in the attempt to realize the ICT integration strategy.

However, the study also reveals some of enablers for ICT integration but none of the components has a quantifiable measure to show the extent to which it can influence or contribute towards the ICT integration process; but only suggests the likelihood of excellent integration of ICT in learning and teaching opportunities.

In addition, the managerial and ICT infrastructure aspects have not been given much weight as to point out the possible impact of incorporating the determinants in the integration of ICT as a paramount tool for a state-of-art educational environment.



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