TEACHER FACTORS INFLUENCING CLASSROOM USE OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN NIGERIA AND OTHER SUB-SAHARAN AFRICAN COUNTRIES

Solomon Iheonunekwu
Director Academic Planning,
Abia State College of Education (Technical),
Arochukwu.

Augustine Okereke Ogwudire
Department of Educational Foundation,
Abia State College of Education (Technical),
Arochukwu.

And

Robert N. Ukpai
Department of Science Education,
Abia State College of Education (Technical),
Arochukwu.

Abstract
This paper synthesises the research literature on teachers’ use of Information and Communication Technology (ICT) in primary and secondary schools in Nigeria and other sub-Saharan African countries, with a particular emphasis on improving the quality of subject teaching and learning. We focus on the internal factors of influence on teachers’ use, or lack of use, of technology in the classroom. The paper’s discussion attended to perceptions and beliefs about ICT and their motivating effects, technological literacy and confidence levels, pedagogical expertise related to technology use, and the role of teacher education. The teacher factors influencing the classroom use of ICT are discussed in the light of significant infrastructure and other external issues. The paper concluded by drawing out a number of pedagogical implications for initial teacher education and professional development to bring schooling within developing contexts into the 21st century.

There is substantial evidence that, in the right hands and when used appropriately for specific purposes in specific contexts, ICT can be an effective tool in supporting teaching and learning. However, it is now firmly established that its
introduction into schools does not by itself improve the quality of education or raise attainment. Governments in Nigeria and other sub-Saharan African countries are emphasising teacher development as the key to effectively implementing policy and curricula, to using ICT to enhance teaching and learning, and to raising educational standards. In many African countries, however, a major impediment is the lack of qualified teachers. This problem is further exacerbated by growing poverty and lack of funding for their salaries, and the exponential rise in student population in the last two decades (National Universities Commission, 2005) – that ironically relates to the admirable Millenium development goals concerning free universal primary education. The crisis is worsening further as increasing numbers of teachers become afflicted by HIV/AIDS. Indeed it has been observed by many that meeting the desperate need for more qualified, competent teachers is the most persistent and daunting challenge facing the Nigerian and other African countries education system in general, and the integration of ICT in particular (Afe, 2002; Olakulehin, 2007).

Effectively introducing technology into schools is also largely dependent upon the availability and accessibility of ICT resources (e.g. hardware, software and communications infrastructure). Clearly if technology cannot be accessed by the teacher, as in so many educational settings in Nigeria, then it will not be used. Our extensive review of the literature on developing use of ICT to enhance teaching and learning in East African schools (Hennessy & Onguko, 2010) shows that while the process has previously been painfully slow (Liverpool, 2002), the situation has been improving in the last few years. Schools are increasingly being equipped with computers for teaching, learning and administrative purposes, connectivity is improving and students are enthusiastic about using computers for learning, despite the lack of equipment available. Some countries are developing digital content for use across the curriculum. Nevertheless, access and usage of ICT, like the electricity supply itself, remain rather sporadic. The undersea cables currently being installed to run around the entire Sub-Saharan African coastline by 2011 are already in position to bring the promise of widespread access to broadband connectivity for the first time. However, it will undoubtedly take time for funding to connect schools to materialise.

A major obstacle arising is the tendency for national policies and school curricula in most countries in SSA to treat ICT as a discrete subject in the form of computer science or information technology when assessed by the national examination boards. There is an almost universal emphasis on teaching basic skills for software use and information gathering, whereas research indicates that integrating ICT into subject learning is far more effective for students. The skills emphasis is reinforced by the lack of technology located in classrooms and a corresponding concentration on purpose-built computer labs. This is a model that countries like the UK, with a high penetration of ICT in schools, are now abandoning, especially as mobile and classroom-based technologies such as portable devices and interactive whiteboards increase in prevalence.
Our review indicates that further challenges include the optional status of ICT within the curriculum, and negative attitudes among school leaders towards computers and the internet. The lack of contextually appropriate course content for either teachers or learners also needs to be addressed (Hennessy & Onguko, 2010). In sum, despite a great deal of recent progress and optimism that many more learners can benefit from access to ICT, the infrastructures necessary for deploying technological resources are lacking in low-income countries. Furthermore, many teachers are working in conditions that are not conducive to supporting ICT use.

There are further, important, teacher-related factors influencing classroom use that become apparent. These are predominantly ICT literacy and confidence among teachers, and education of subject teachers to assist them in integrating ICT into learning areas. This paper focuses on such issues, exploring both teachers' skills and experience with using technology, and their personal beliefs and perceptions about ICT gained through teacher education. These factors are considered in relation to classroom practice – how and why teachers use ICT in the classroom and what prevents its use – throughout primary and secondary schooling. While our synthesis focuses on Nigeria and other SSA countries, some messages also emerge from research exploring the widespread integration of ICT into schools in developed country contexts. We now move to teacher conceptions of technology, and its benefits for schooling.

Why Teachers Use ICT

A range of studies have looked at why teachers choose to use ICT. These typically involve conducting case studies of classroom use in a particular setting or from a longitudinal perspective. They portray the use of ICT in teaching as being inherently advantageous. Only a few reports adopt a quantitative approach exploring access, and the reasons why teachers in schools choose to use ICT in their classrooms. Tella, Toyobo, Adika & Adeyinka (2007) examined Nigerian secondary school teachers' uses of ICTs and implications for further development of ICT use in schools using a census of 700 teachers. The findings showed that most teachers perceived ICT as very useful and as making teaching and learning easier. It was recommended that professional development policies should support ICT-related teaching models, in particular those that encourage both students and teachers to play an active role in teaching activities. Additionally, emphasis should be placed on the pedagogy underlying the use of ICTs for teaching and learning.

A Research Consortium (EdQual) of educational institutions in the UK, Ghana, Rwanda, South Africa and Tanzania on Educational Quality typically indicate two main reasons why teachers use ICT. Firstly, they feel that their own use of computers benefits their learners, and secondly, teachers feel learners benefit from using computers themselves. Teachers see ICT as kindling students' interest and
learning in the subject. ICT promotes a positive attitude towards information technology as an essential part of a lifelong interest in learning. Teachers also perceive the use of ICT as enhancing recall of previous learning, providing new stimuli, activating the learner’s response, and providing systematic and steady feedback. It is further perceived as sequencing learning appropriately, and providing access to a rich source of information. For example, Tella, Tella, Toyobo, Adika and Adeyinka, (2007) found that computer use by teachers was driven by intentions to use it, and that perceived usefulness was also strongly linked to those intentions. The implication is that teachers will be inclined to use technology if they perceive it to be useful. Furthermore, ICT needs to be linked to specific needs of learners, desisting from the ‘one size fits all’ approach (Leach, 2005:112). It is most effectively used as a learner-centred tool, instead of within a more traditional pedagogy. The real challenge for educationists is, therefore, how to harness the potential of ICT to complement the role of a teacher in the teaching and learning process. There is an understandable apprehension, even fear, as to the role of a teacher in an ICT-equipped classroom (Futurelab, 2003). Teachers who lack the chance to develop professionally in the use of modern ICT feel under threat. The relevance of a teacher in the 21st century is determined by their willingness to develop in this way, a discussion to which we return later.

From the aforementioned, we can conclude in concurrence with Cox, Preston & Cox (1999) that the factors contributing to ongoing use of ICT by teachers include: Making lessons more interesting, more enjoyable for teachers and their students, more diverse, more motivating, and supportive of productive learning. Overall, it is clear that the psychological factors of a teacher’s own beliefs and attitudes to ICT and pedagogical innovation are both primary facilitators and barriers to teacher use of technology in the classroom. Those facilitators have been elaborated above, and we now take a closer look at the barriers that impede successful ICT classroom use.

**Barriers to ICT Use by Teachers**

Across Africa and most developing countries there are many challenges in bringing ICTs into the education process in general. Anderson (1997) and Hennessy & Onguko (2010) have identified a range of physical and cultural factors that affect ICT use by teachers, including lack of reliable access to electricity, limited technology infrastructure (especially internet access, bandwidth, hardware and software provision), language of instruction and available software; geographical factors such as country size, terrain and communications; demographic factors such as population size, density and dispersion. The issues of access are further exacerbated by extreme poverty, growing prevalence of HIV/AIDS, and a lack of political will to alleviate the situation through proper planning. In addition, educational factors including levels of teachers’ own education and literacy rates, and access to professional development play an important role. Indeed many studies indicate that it is teachers’ attitudes, expertise, lack of autonomy and lack of knowledge to evaluate
the use and role of ICT in teaching (or technophobia in teachers) that are the prominent factors hindering teachers’ readiness and confidence in using ICT support. There is also a general inadequacy of learning resources, course curricula and other learning materials that incorporate ICT use.

It is a common misconception that access to technology on its own motivates teachers to apply it in their teaching. The biggest barriers to the use of computers identified by teachers participating in the 1998-1999 survey assessing the World Links schools programme were the lack of time available in classes, and in their own schedules for planning; and the lack of a national policy on the use of computers in schools (Kozma, McGhee, Quellmalz, & Zalles, 2004:76). Relatively few teachers identified infrastructure problems, such as the lack of computers in working condition, unreliable electricity or lack of access to the internet, although these varied by country. According to Tella et al. (2007) as less technologically advanced countries joined the programme in 1999-2000, the major barriers to ICT classroom use became the lack of computer hardware (60%), software (56%) and reliable internet connections (52%), particularly in African countries such as Mauritania, Ghana and Zimbabwe. Lack of access to technology is inevitably a major barrier in its application, but availability does not necessarily translate into use. However, in the study of Nigerian secondary school teachers Tella et al (2007) were of the opinion that lack of technical support in the schools, and teachers’ lack of expertise in using ICT, were the prominent factors hindering teachers’ readiness and confidence in using ICT.

The lack of incentives and support for teachers are other factors hindering their use of ICT. The SRI-World Links evaluation (Kozma et al., 2004) shows that teachers enthusiastically engage in collaborative projects and often portray constructivist pedagogy. However, school administrators offer very little structural support and few incentives to use the technology effectively in the classroom. Too often the curriculum in developing countries is rigid and overloaded, leaving little time for innovative classroom practices. National policies need to make more commitment to helping teachers effectively integrate computers and internet technologies into the classroom by aligning curricula, exams, and incentives with the educational outcomes that they hope to gain. In the end, computers by themselves bring very little to the learning process – they are only tools for teaching and learning.

ICT Skills Needed by Teachers Today

Many school leaders still perceive the lack of ICT-related knowledge of teachers as a major obstacle to the realisation of their ICT-related goals (Pelgrum, 2002). The literature describes the kind of skills teachers may need when integrating ICT in new student-centred learning approaches. However, identifying which competencies each teacher needs to acquire is far from simple, as this depends very
much on the circumstances of their particular school. Personal teaching styles also play a major role. Again, ‘one size fits all’ does not usually work (Davis, Preston, & Sahin, 2009). We also need to recognise that substantial learning can take place while teaching, and even learning, from students.

The UNESCO (2008) ICT competency standards for teachers go further, describing three approaches: technological literacy, knowledge deepening, and knowledge creation. These approaches are seen as part of a development continuum, and each approach has different implications for education reform and improvement, plus different implications for changes in the components of the education system: Pedagogy, teacher practice and professional development, curriculum and assessment, and school organisation and administration. ICT plays a unique, but complementary role in each of these approaches, with new technologies requiring new teacher roles, new pedagogies, and new strands to teacher education. The successful integration of ICT into the classroom depends on the ability of teachers to structure their learning environments in non-traditional ways, merging technology with new pedagogies. This requires a very different set of classroom management skills to be developed, together with innovative ways of using technology to enhance learning and encourage technology literacy, knowledge deepening and knowledge creation. At the knowledge creation end of the continuum, the curriculum goes beyond a focus on subject knowledge to explicitly include 21st century skills that are needed to construct new knowledge and engage in lifelong learning – the ability to collaborate, communicate, create, innovate and think critically. Teacher development is seen as a crucial component here. It ideally coordinates teachers’ sophisticated professional skills with the pervasive use of technology. This in turn supports students who are creating knowledge products, and who are engaged in planning and managing their own learning goals in a school that is a continuously improving, learning organisation. Teachers model the learning process for students, and serve as model learners through their own ongoing professional development, both individually and collaboratively.

**Impact of ICT Use on the Teacher**

Research studies and initiatives such as the Digital Education Enhancement Programme, (DEEP) carried out by an Open University team over two years in 12 primary schools in rural, disadvantaged areas of South Africa report that ICT use enhances teachers’ professional knowledge and capabilities in very specific ways enabling planning and preparation for teaching to be more efficient (Leach, 2008; Leach, Ahmed, Makalima, & Power, 2005); In the DEEP studies, teachers were provided with a ‘professional ICT toolkit’ comprising high-quality, multimedia materials including classroom resources and planning tools (centred around a handheld computer, a laptop, digital audiovisual equipment and accessories). The nature of the uses made of these ICTs varied according to context, particularly with respect to teacher access to adjacent technologies, geographical location, local educational and cultural practices, home language, and teacher subject specialists. Yet ICT consistently facilitated new forms of teacher-to-teacher cooperation that
addressed their challenging circumstances: Large class sizes, lack of electricity and telephone connectivity, heating and other resources. Despite these challenges the majority of teachers were shown to be highly motivated to succeed in using ICT for their own development and for their students’ learning. There was wide-ranging evidence of positive outcomes in terms of improved literacy, numeracy and science learning by students. The most successful uses of ICT were strongly grounded in educational and pedagogic principles (from teachers, school and the education system), employing quality resources (not necessarily the most expensive as demonstrated through the use of accessible, mobile technologies) and ensuring that appropriate local professional support was paramount to the school and system.

In addition to these broad policy implications, teacher confidence is another key element determining the quality of any ICT-enhanced school-based teacher education in developing contexts. According to Leach, Ahmed, Makalima and Power, (2005) teacher confidence is found to have been boosted in programmes like DEEP that featured use of a personal computer, a project partner, joint evaluative activities and strong initial technological and pedagogic training. Curriculum activities that progressively built up ICT skills and knowledge also played a role. Other confidence-boosting features of DEEP included few prior expectations (including ICT-literate peers) to live up to, a commitment by school, students and community to support project partners in their efforts, clear overall programme management structures to ensure ongoing support, and affirmative feedback from peers, school principals, students, parents and the project team.

The Impact of ICT Use on Classroom Teaching and Learning

Bringing ICT into the classroom can have a considerable impact on the practice of teachers, in particular when ICT is conceptualised as a tool that supports a real change in the pedagogical approach. Not only do the teachers need to change their roles and class organisation, they also need to invest energy in themselves and their students in preparing, introducing and managing new learning arrangements. Some need to acquire basic ICT skills. Teachers also need to determine which applications have added value for learning in their subject area. While doing this they need to be aware that this is not a one-time activity, as the information environment is continuously changing. Perhaps most important and challenging for teachers is determining which basic subject, social and management skills students need to function in such environments. The change can impact on assessment tasks, with new learning environments moving away from summative methods of assessment to formative approaches and open-ended products (such as reports and research papers created by groups of students). These different aspects are time consuming, and result in an increased teacher workload.

Some things can be done to reduce the workload. Teachers can be encouraged to share resources with others, locate good practices on the web (where available) and
adapt these to their local circumstances. In a number of cases the high workload is caused by teachers wanting to control all the activities of their students, which means answering many questions and running from one student to the other all the time. Teachers can take time to discover that computers do not mean extra work – rather they actually make their work easier. Again, more competent students themselves can be a useful resource, this time for their peers.

There is no doubt that teachers who use ICT in classrooms have to demonstrate high levels of energy, hard work and perseverance, often in the ‘face of considerable odds’ (Lankshear & Snyder, 2000 : 110). If they are early adopters then they are required to be resourceful and overcome many barriers to make things work. Planning lessons involving computers can take considerable time and demands complex scheduling and resourcing. Therefore, teachers using computers in the classroom should not act in isolation from each other. They need access to resources which will supply ideas and material for different classroom applications, including peers who are also developing their own pedagogies and resources (Leach et al., 2005). For while computers have great potential in education, they also present teachers with additional obstacles to overcome.

**The Role of Teacher Education in Facilitating Integration of ICT**

The discussion above indicates that the changing landscape of communications and information exchange in the 21st century requires teachers to be at the cutting edge of knowledge production, modification and application – rather than consumption. They need to be prepared for this by being educated to use ICT effectively and creatively. In many developing countries, however, most teachers have minimal or no ICT skills themselves and therefore cannot develop these in learners. Two of the most important supports for ICT integration into teaching and learning are effective Initial Teacher Education (ITE) and Continuing Professional Development (CPD). Both have the greatest impact on the beliefs and practice of teachers, and yet professional development time in particular is often not budgeted for (Venezky, 2004). Moreover, research into teacher learning in northern hemisphere contexts suggests that traditional, one-off external in-service workshops tend to be of limited value in developing sustained transformation of practice (Glazer & Hannafin, 2006; Muijs & Lindsay, 2008). In recent years, there has been an encouraging emphasis on in-service development, supported by enlightened national ICT policy initiatives, examples of seemingly successful CPD programmes have included the Connectivity for Educator Development programme in Uganda, Schools OnLine programmes in Senegal and Tanzania, World Links programmes in Ghana and Uganda, Digital Bridge Institute in Nigeria, and the Commonwealth of Learning Southern Africa Teacher Training Programme. Such programmes focus on helping teachers to use technology as a tool, and to transform their classrooms into interactive learning. For example the Intel Corporation ‘Teach’ programme is currently supporting Kenya’s transition from traditional teaching methods through educating
teachers in the integration of ICT into primary and secondary school education (Panafrican Research Agenda on the Pedagogical Integration of ICTs: Karsenti, 2009). Using a ‘train the trainer’ model, the 25 selected participants from teacher training colleges, Centre for Maths and Science and Technology Education in Africa, Kenya Institute of Education and Kenya Education Staff Institute, are working on the development of online material to then orient 250,000 teachers nationwide. Anecdotal evidence suggests, however, that teachers experiencing national and international training programmes falter after their initial learning success if they do not receive follow-up support in schools.

The paper earlier discussed the pedagogical changes necessary to make most effective use of ICT, and it is here that ITE and CPD can play a major role. Transforming traditional classrooms in Nigeria and other SSA countries from static environments, where a one-way flow of information from teacher to student typically occurs, into dynamic, learner-centred environments in which learners interact with peers in teams and teachers take a more facilitating role, is a major challenge for practitioners and teacher educators. Many teachers are intimidated by technology and are very comfortable with their established teaching styles. To effect change, the pedagogical and educational gains that use of the technology might bring need to be made explicit. Teachers need support, and leadership from their school managers and necessary time for their own professional development and trialling of new approaches. Many initially feel threatened by the perceived loss of control in the classroom as students, who are usually more adept at using technology, can quickly access information and challenge the teacher’s role as the primary source of knowledge. Teachers who engage in appropriate professional development, however, learn how to manage their classrooms more effectively and to use the technology to create a more stimulating learning environment (Olakulehin, 2007).

Conclusions
Recent research shows that new digital technologies in Nigeria and other SSA countries have the potential to revolutionise the quality of subject teaching and learning when carefully integrated into the classroom. The role of the teacher is utterly critical here. Yet a primary barrier to teachers’ readiness and confidence in using ICT, despite general enthusiasm and belief in benefits for learners, is their lack of relevant preparation, either initially or in-service. Research indicates that, until recently, training opportunities have remained limited in availability and inconsistent in quality. This has resulted in demonstrably low proficiency in using ICT, and a general lack of knowledge about technology in teaching and learning. There are some recent examples of successful practice in developing ICT use in schools through its integration in teacher education. However, according to Unwin (2005:122), provision has often been characterised by ‘well intentioned, but misplaced, supply-driven initiatives’ across the continent to provide teachers and students with ICT skills.
These have proved ‘wasteful and inappropriate’ with limited impact. Moreover, the recent global economic downturn has amplified the shortage of public funds to devote to the already expensive business of training teachers to use ICT (Commonwealth of Learning, 2004). Increasingly, large school classes and the designation of ICT as a discrete subject, lead to a dire lack of subject teachers trained to integrate technology into learning in their areas. These are fundamental challenges to be overcome before ICT capacity building can become a reality in African education.

Finally, this paper identifies a need for teachers and teacher educators to integrate ICT into subject teaching and learning using contemporary pedagogical approaches. Ideally teachers will be assisted to work collaboratively over time with peers, and to learn from one another’s innovations and experiences. This requires prioritisation of ICT programme that is pedagogically sound and aligned with wider policy interests, and means offering sufficient support and time for teachers to get to grips with new technologies. Underpinning these recommendations is development of locally produced, contextually relevant course content for both teachers and learners.

**Recommendations**

Pedagogically ICT use should be integrated into subject teaching rather than as a discrete subject in school. There should be infusing of technology use into an entire teacher education programme, not providing a separate ICT topic within a course.

There should be developing of confidence with ICT and awareness of its potential through a hands-on workshop approach. There should be modelling interactive and participatory, rather than transmission-based pedagogy, in teacher education programmes. There should be offering of sustained, collaborative and active learning opportunities for teachers working together within a supportive professional community of practice tailored as far as possible to individual teachers’ attitudes, knowledge levels, subject disciplines and pedagogical approaches.

Finally, the reported growing gap between the numbers of qualified teachers in Nigeria and other SSA countries and funded places in institutions offering full-time, centre-based and ICT computer-supported teacher development might be part of the solution. Such programmes, already operating in Kenya, Uganda and Tanzania and Nigeria allow teachers to learn independently and at their own pace.

**References**


