

# Improving teaching and learning in Polytechnics with ICT

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## Introduction

Technological innovation, automation, and rapid global spread of telecommunication have greatly contributed to economic growth in the world over the past fifteen years, although the advantages of the information age have not been divided equitably. Rich and industrialised countries and several countries in transition have obtained high economic growth, whereas the benefits of the information era have been significantly less for developing countries, which generally lack favourable conditions, i.e. human and financial capital for deployment of new technologies. The implementation of ICTs in developing countries is seen as an important step to development and poverty reduction. Good education is generally seen as the major driving force in development. If the quality of education can be enhanced through the innovative use of ICTs, this is the best justification for its use. Many educational scientists have acknowledged the role of ICTs in education. To cite a few: ICTs in education are needed to raise the kind of graduates and citizens required for the job market of the information society (Department of Education, 2001); ICTs improve educational outcomes, and enhance quality of teaching and learning (Wagner, 2001; Garrison & Anderson, 2003); ICTs provide a catalyst for rethinking teaching practice (Flecknoe, 2002; McCormick & Scrimshaw, 2001).

From all ICTs, a connection to the Internet might be the most important aspect for tertiary education. The internet represents the world's largest knowledge data base, as access to relevant information is possible through powerful search engines. Access to the internet can substitute for expensive hardcopy libraries, which are often difficult to obtain, especially by educational institutes in developing countries.

The internet has become globally the most important means of remote communication, and has literally cut distances, frontiers and barriers, and has contributed to the virtual shrinking of the world. For tertiary education an asset of the internet has been the ease of collaboration and interaction between educational and research groups and peer institutes in different regions or countries of the world. Global research has taken off since the introduction of the World Wide Web in the early 90s.

Given the above considerations, there is a need for tertiary education in Ghana to catch up with global trends and adopt ICTs in education. It is a challenge for polytechnics to take advantage of existing practices, and apply them into the local context. In this paper we will zoom in on the current status of ICTs at the polytechnics in Ghana, and we will discuss how existing opportunities can be taken advantage of.

## Some background information about Ghana

Ghana, situated in West-Africa, on the Guinea coast, sharing borders with Côte d'Ivoire to the West, Togo to the East, and Burkina Faso to the North, has an area of approximately 238,533 km<sup>2</sup>, and is subdivided into ten administrative regions. Ghana's population is about 23 million, concentrated primarily south, along the coast and in the southern cities of the capital Accra and Kumasi. Ethnically, Ghana is divided into many small groups. There are more than fifty different languages. English is the official and commercial language and is taught at school as the prime medium of instruction.

Ghana has a national adult literacy rate of 58 % and ranks nr. 114 on the ICT Development Index measured from 2002 to 2007 (ITU 2009). GDP per capita is about US \$ 1,500 and economic growth rate is currently 6 % per year, making Ghana one of the fast growing countries in West-Africa.

There are about 650,000 internet users in Ghana, which represents an internet penetration of 2.8 % (i.e. number of internet users per 100 inhabitants). This penetration figure is quite low in relation to the internet penetration in the whole of Africa (5.3 %) and in the whole world (21.9 %) (Source: Internet World Statistics 2009). In contrast, the mobile telephony business is growing very fast. The number of mobile phone subscriptions grew from 191,000 in 2000 to more than 7,6 million subscribers in 2007, making the market penetration 33 %.

Tertiary education in Ghana is provided by six public universities, ten public polytechnics and numerous private institutes and pre-service training centres. Despite a steady economic growth, the quality of tertiary education is still far below that of most developing countries. Qualified staff, adequate facilities and appropriate educational policies are needed to improve tertiary education.

### **Status of the ICT at polytechnics in Ghana**

Although differences exist in availability of ICT facilities amongst the ten polytechnics, there are many similarities in the way ICTs are deployed. Facilities may differ in quantity amongst the ten; the challenges, opportunities and threats related to the introduction of ICTs in education are comparable for all polytechnics. In terms of availability of computers and the internet, the polytechnics of Accra and Kumasi are best equipped, while the two most remote polytechnics, located in Bolgatanga and Wa, respectively in the least populated north and northwest regions, are still very much underserved both in terms of facilities and support staff. All ten polytechnics own a certain number of desktop computers, either located in dedicated computer rooms (usually referred to as *PC-labs*) for educational purposes, or in offices for use by administrative staff and management. We will now describe the status of ICTs in the primary and secondary processes of polytechnics. The primary process within higher education is teaching and learning. The secondary processes consist of all services that support and enable the primary process of education. Secondary processes refer to management, administration, finances, and facilities. ICTs can theoretically enhance both the primary and the secondary processes of an organisation.

#### *ICT in the primary process: Teaching and Learning*

Computer education has become very necessary in higher education in developing countries such as Ghana. Basic *computer literacy*, defined as the ability to apply computer for daily administrative routines, like sending an email, reading and writing a document, is an important asset for a student, when applying for a job after graduation. Currently, ICTs for teaching and learning at polytechnics consist mainly of basic ICT-literacy training in office applications such as MS-Word and MS-Excel. Although this type of training means a good start, a tertiary educational curriculum at polytechnic HND level should offer more, such as software packages specific for each specialisation: accounting software, engineering software, statistical software, databases etc. Courses to obtain these skills should therefore be included in polytechnics curricula.

When considering the status of ICTs at polytechnics, the observation can be made that all polytechnics are in need for more computer and networking equipment and peripherals such as projectors and printers. Moreover, the present number of equipment at some of the polytechnics (e.g. Koforidua, Sunyani, Bolgantanga, Wa) is hardly sufficient to give each student a very short basic computer training per year.

At the end of the NPT-project, as from December 2008, at least all ten polytechnics owned an internet connection, and are now able to send and receive e-mails at the campus. The download speed of the internet, and the number of computers which access the internet are the variables that differ from one polytechnic to another. This difference is due to the availability of internet service providers in the area of each polytechnic, the available

budget for ICT and the number of available ICT staff members and their individual ICT skills.

*ICT in the secondary process: Management and Administration*

Management information, such as financial data and student registration at polytechnics is administrated on either stand-alone, single-user computers or processed manually. A more flexible management information system, where financial and human resource information can be processed, and management information can be accessed adequately, was frequently requested by the management of polytechnics, but has not been implemented yet. The secondary processes are at the same level of necessity of ICTs as the primary process.

*Communication infrastructure: the campus network*

Although one link to the internet is available at all polytechnics, not all buildings at the campuses have access to this internet. Recently, almost all polytechnics migrated from a small campus to an extended and new, modernised campus in the course of 2006 – 2008, funded by the GetFund project (GetFund 2008). The increased area for the new campuses makes it more expensive and difficult to build and maintain a campus wide communication network consisting of glass fibre connections between all premises. Such a local campus network is needed, so all offices and classroom blocks on the campus can share information. With the existence of a good campus local area network and a functioning *intranet* at each polytechnic, course information, syllabi, school announcements, and other valuable information would theoretically be accessible from every computer within the campus.

*The NPT project*

The NPT project, aimed primarily at strengthening managerial capacity at the ten polytechnics, was not focused on the implementation of ICTs as an educational tool. Only a relatively small NPT investment budget was deployed to implement facilities. Therefore only four out of ten institutes were selected, i.e. the polytechnics of Bolgatanga, Wa, Koforidua and Sunyani, which were identified as being in highest need of ICTs. Beside these investments which accounted up to 20 % of the project budget, a series of ICT information policy planning workshops were held throughout the project period. ICT coordinators from all polytechnics attended these workshops. Together all participants carefully analysed their polytechnic's information needs and subsequently set up a joint policy plan for further development of ICTs in their institutions.

The aim of implementing a management information system at all polytechnics, as envisaged in the initial NPT project plan, was abandoned during the project period, as it showed to be non-achievable within the given project time frame.

### **Opportunities and potentials**

Global and regional trends in ICTs can be favourable for polytechnics education, as for any higher education institute. The polytechnics are now starting to embrace the global information era, relatively late, in a period where many technologies and methods have grown mature and have proved useful for education; at a time when collaboration between peer institutes has become a possibility, and when information on the internet is more reliable than a decade ago. When higher education first adopted ICTs, in e.g. the Netherlands in the early 90s, many technologies were still in their startup phase, so much time, money and effort was spent on not fully formed technologies. Polytechnics have skipped those early development phases of ICT in education and can now start by leapfrogging many stages of technologic developments (Szirmai 2005).

An important point for polytechnics is the *contextualisation* of ICTs within the African and especially the Ghanaian context of higher education. Global trends might be very useful, but will have to be properly adjusted or reinvented locally, to fit local needs

and practices. An example of an ICT which has been entirely adapted into the local African context is mobile telephony. The growth in mobile telephony penetration in African society over the past few years has beaten any expectation or economic forecast. This example shows us how a new technology can be successfully implemented and applied within the African context. The rapid expansion of mobile telephony in Africa also illustrates the capacity of adaptation of a society to modern technologies, which only occurs when technologies bring real advantages to the community. In the case of mobile telephony, its success is due to its accessibility and affordability for people with low-income and low-education.

Will the internet and ICTs be successful in higher education in Ghana as well? Contextualisation into African education might be of great importance. It might be a task for an educational *think tank* of African scientists, to find an answer to this question. A few examples can be found in educational literature, where ICTs were deployed locally in an original and effective manner. E.g. Turkington & Frank (2005) describe a journalistic experiment of collaborative teaching and learning at the Durban Institute of Technology (DIT) in Durban in South Africa, where a daily news website was set up and run by students, for students. The website was a collaborative project, emanating from blended teaching and learning environments in the university's journalism department. It was launched in August 2003, in response to a need for a credible student publication which would be an independent and reliable news source and which would provide a training ground for student journalists. By June 2004 more than 100 students had contributed to the site, which now attracts thousands of hits each day. Student collaboration in the cyclical context of action research was a very important aspect of this successful project in collaborative e-learning.

Another example from educational literature is an e-learning experiment using international online discussions about the effects of globalisation between African students of the University of Botswana and American students of the University of Georgia, described by Giannini-Gachago & Seleka (2005). The method described was useful after making the necessary adjustments in order to meet the local needs at both sides.

### **Challenges**

The implementation ICTs at polytechnics confronts us with several challenges. A main challenge is how to cope with the discrepancy between the available funds and human resources on one hand and the ambitions to apply ICTs in education and administration on the other hand. Ambitions of many development projects, to introduce ICTs, have been formulated unrealistically. The aim to implement a management information system in polytechnics within the given time frame of four years, without the availability of sufficient human and financial resources, and without experience with complex information management practices, has shown to be too far-reaching. Ambitions have therefore to be adjusted to the local situation. Advanced ICTs should be introduced more gradually.

Another challenge, faced by Ghanaian polytechnics and universities is the lack of good and affordable internet connections. Poor internet is a daily reality, hampering the use of new electronic educational tools and e-learning. Downloading documents from the internet can take several hours. The price of the monthly subscription to have such an internet connection is still very high, and almost unaffordable for the polytechnics. The high cost of internet usage in Africa is still a general problem. An African consumer pays on average 200 or 300 times as much for the same internet connection as a person in Europe (Bon 2007). These excessive high prices for internet connections in Africa are caused by market mechanisms beyond control of the users. The internet infrastructure in many African countries is dominated by a few private telecommunication companies

or by monopolistic state companies, due to existing economic and political structures. Many universities in Sub-Saharan Africa are connected to the internet via a satellite dish, and are thus forced to pay a high price for a poor service, by lack of an alternative (Drouot 2005).

Another major problem hampering the introduction of ICTs into polytechnics is the level of computer literacy of the teaching staff themselves. Most of the staff members have never received in-depth ICT education, and if they have, they are unprepared to catch up with the ongoing speed of technological developments. It is difficult for most of the teachers to switch to new educational methodologies, when they themselves lack experience with ICTs in teaching and learning.

The global introduction of *electronic learning environments* and *Web 2.0 tools* in educational practice has been described by many educational scientists as being a great improvement to traditional standards of teaching and learning. These ICT tools, which were developed over the past five to ten years, fit very well into educational practice and are now referred to as e-learning tools and are being deployed more and more in education worldwide. Web 2.0 tools on the internet like *wiki's*, *blogs*, *social networks*, *podcasts*, the use of multimedia ICT tools such as video and audio in the classroom, have shown to be useful as new educational instruments. It would therefore be good to apply these tools in polytechnics education as well. However, the present quality of the internet connection at polytechnics is still insufficient for the deployment of *Web 2.0 tools*. Many international conferences on the introduction of ICTs for development, and Web 2.0 tools in development have already been organised worldwide, the past few years (e.g. E-learning conferences for Africa, International Conference on Web 2.0 for Development and many other events). The underlying *conditio sine qua non*, i.e. a broadband internet connection is usually disregarded by the many e-learning scholars, in their enthusiasm to introduce these tools in African education. This underlines the challenge of having good internet at polytechnics and universities in Ghana.

Fortunately, some electronic learning environments do not need an internet connection to work with, but they do require a good local area network i.e. a campus network. This is another condition which is also still lacking at most of the polytechnics, but which could be solved easier than the "poor internet" problem.

Finally, many there are ICT tools, such as specific educational software, e.g. SPSS for statistical analysis, AUTOCAD for engineering, and TOPAZ for accountancy and business administration which are also important for polytechnics education, including Power Point for presentations, just to mention a few applications which are widely used for professional purposes. These applications can run stand-alone, without the necessity of a large intranet. Nevertheless, good ICT management and support are required when deploying these software packages in an educational setting.

### **Developing an ICT strategy at polytechnics**

Three major infrastructures can be distinguished when considering a new implementation of ICTs in any organisation: the data infrastructure, the knowledge infrastructure and last but not least the management infrastructure.

The data infrastructure refers to the hardware and software platforms comprising cabling systems, the fixed and wireless networks, computer equipment such as servers, workstations, routers, and switches, projectors, printers, including all necessary system software and application software.

The knowledge infrastructure consists of technical staff to manage and maintain the network, the hard- en software, but also helpdesk staff, trainers, end user technical and application support staff and all users themselves.

The management infrastructure consists in the first place of a strategic decision unit, i.e. the management of the institution, including the availability of financial resources. In second place are the institutional ICT strategy and the ICT policies. The establishment of an ICT coordinating unit as an organisational entity reporting directly to the top management of each organisation is also part of the management infrastructure.

A main financial problem with the implementation of ICTs in an organization, are the extremely high costs involved. Investments in ICT equipment are high, but especially daily maintenance and replacement costs are high, in relation to the total budget of an organization. In the case of many of the polytechnics, a replacement plan for the data infrastructure is still non-existing. When polytechnics invest in ICT equipment such as computers and networking equipment, it is funded by projects. Since a computer's life is no more than three or four years, a replacement plan including a daily hardware and software maintenance is necessary to ensure sustainability. Funds for investments in technical ICT facilities, and even software licenses and subscriptions to the internet, become available sporadically, from project budgets. The problems arise when it comes to the availability of support staff. The set up of a network increases the complexity of the work flows, and the growing number of users requires enough support staff to maintain a certain level of support given by the ICT staff. The costs of the hardware are usually just a small percentage of the maintenance and support costs involved. Often, in development projects investments are only aimed at the data infrastructure, and effectuated even before the implementation of an information policy plan, or a good ICT strategy, or a functioning knowledge and management infrastructure for ICT.

Currently, all polytechnics are in need of more ICT staff, not only at the technical level, but also at managerial level. The polytechnic needs human resource development in ICT and the acquisition of ICT-staff in several areas and levels of expertise. One of the serious problems is the absence of funding for the assignment of dedicated high level ICT staff. ICT support tasks at polytechnics are usually carried out by lecturers and other educational staff members. Since these staff members have their educational obligations as their main duty, ICT support will not receive priority.

Governmental policies on human resource management at polytechnics still do not provide an organisational structure and sufficient financial means for polytechnics to have an adequate ICT staff unit. This is, however, crucial for deployment of ICTs in both the primary and secondary processes.

### **Players and stakeholders**

Players and stakeholders of ICTs in Ghanaian higher education are, in the first place, the polytechnics and universities themselves, in the second place the government, the international donors and NGOs who are often implementing or financing ICTs within higher education, the national and international ICT markets, represented by the national telecommunication sector and other ICT service providers. In the last place we mention the community at large which can benefit from ICTs.

When looking at the Ghanaian governmental program and policy, committed to a rapid deployment, utilisation and exploitation of ICTs within the educational system aimed at ICT oriented curriculum for primary, secondary and tertiary education, it becomes clear that, although amongst the three sectors, the tertiary sector is the most advanced in ICT deployment, primary and secondary education can be empowered through collaboration with tertiary education, especially polytechnics, so all can overcome certain challenges mentioned in this paper.

### Strategic implications

Education in Ghana probably represents the largest and most advanced consumer base in terms of ICTs and the internet. In Ghana recently the Ghana e-Schools and Community Initiative, together with the Ministry of Education, and two ICT multinationals (CISCO and Oracle) implemented ICT at twelve Secondary schools in six of the ten regions in Ghana. 400 desktop computers were installed in 38 teacher training colleges for the UNESCO. Public-Private Partnerships installed computers and internet in 80 e-learning centres at primary schools. Collaboration between these education institutes could lead to the formation of educational consortia, as described by Stanton & Stöver (2005). There are examples from consortia of collaborating educational institutes in Europe and Latin-America, which have successfully influenced the ICT markets and exerted political pressure at governmental levels to lower prices of internet connections and software licences (Bon 2007).

On the level of developing an institutional strategy for ICT, polytechnics could benefit from collaboration amongst the whole educational sector in Ghana. Collaboration is a key to a good ICT implementation, although practices and purposes may differ considerably. With the formation of bandwidth consortia, the whole educational sector in Ghana should join hands to form a user based grassroots lobby group and demand affordable market prices for ICT software licenses, internet connection prices and ICT services. Collaboration between polytechnics and the community at large can be done e.g. when polytechnics become practically involved in ICT by incubating telecentres. A telecentre is a public facility in the community that affords people the opportunity to use computers, networks, copiers, scanners, telephone, community, printed materials, and audio and video resources for information searching, communication, training, and entertainment. The services are free or available at an affordable cost. The primary mission of a telecentre is community service as compared to a cybercafé whose primary mission is profit. A telecentre has staff that actively assists the public in solving information and communication problems. The telecentre management also collaborates with other institutions such as those in agriculture, health, government, and education to mobilize information, training and distance learning resources (Colle, 2005). Collaboration between polytechnics and telecentres could be a way for polytechnics to empower themselves, and to perform an important function of outreach to the society at large.

### Conclusion

From the above sections we can conclude, despite all the existing challenges, ICTs for polytechnics will become indispensable. In the first place ICTs are needed for the training of students and to prove them with the necessary computer skills. Computers and the internet have become indispensable worldwide, and have frequently aided to the creation of jobs and in consequence to economic growth.

In Ghanaian polytechnics ICTs can do much more than is occurring now. The current situation is due to many internal and external circumstances which are still hampering use of ICTs in education. Innovative adaptation of global ICT practices into the local educational context is needed to make better use of the opportunities.

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