ICT IN EDUCATION: CATALYST FOR ECONOMIC GROWTH IN THE CONGO

ICT in Education: Catalyst for Economic Growth in the Congo

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Abstract

The correlation between ICT-supported education system and economic development of a developing country has been documented by several studies (Anderson, 2009; Selwood et al, 2003; and Unwin, 2009). Today's Information and Communication Technology can significantly and positively impact the educational and economic landscape of the Democratic Republic of Congo (DRC). This paper investigates how ICT-supported education reforms can have the effect of increasing the efficiency of the economy of DRC. It also highlights some of the challenges that need to be addressed to implement a comprehensive ICT reform plan.

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1. Introduction

It is generally acknowledged that the education system of the Democratic Republic of Congo (DRC) is in dire need of reforms. In most primary, secondary, and tertiary level institutions across the country, education is not supported by ICT-based systems. Where ICT exists, it is marred by several challenges ranging from lack of stable electricity supply to scarcity of ICT qualified educators. Yet, there is hard evidence that ICT can play a major role in education. Wagner et al (2005) note that "ICTs *are* currently being used widely to aid education in many developing countries, and it appears that there is increasing demand for their use in education by policymakers and parents in developing countries…" (p. vii).

Revitalizing the education sector through the adoption of ICT is indeed a viable option for economic growth in the Congo. Unfortunately, as Bambanota (2006) observes, investing in national education has not been a top priority for different governments for many years. Whereas the government allocated on average 20 % of its budget to education from 1969 to 1975, it only spent 0.4% on education from 1993 to 2000 (Bambanota, 2006, p. 5). This is hardly enough to improve basic educational infrastructures in the country, let alone adopt new ICT infrastructures.

As can be noted, it is hard for the current government to deploy and implement its national ICT plan for education with this type of budget allocations. It is even harder for educational institutions to fulfill their traditional obligations. Investing in ICT requires considerable capital, vision, and political will on the part of government officials. But the key question, of course, is how serious is the current government about improving the education system?

Research has shown that adequate education can reduce poverty, advance technology, improve health care and education services, provide scaffolding for students, ensure sustainable development and empower underprivileged populations. Indeed, Information and Communication Technology plays a key role in enhancing the quality of education. However, successful implementation of ICT requires strategic planning. As Wagner et al (2005, p. 1) observe, "Research suggests that simply putting computers into schools is not enough to impact student learning. That said, specific applications of ICT *can* positively impact student knowledge, skills and attitudes, as well as teaching practices, school innovation, and community services".

The education system as a whole in DRC has not undergone enough reforms to part from the system set up by colonial rulers. But, as the 127 World Bank Report (2008) points out, old education systems in many African countries were not developed to empower Africans. There is urgent need for educational reforms in DRC. The meager results of 12th graders on national standardized tests and the lack of preparation of these youngsters to meet college challenges bear testimony to the urgency of educational reforms. As Unwin (2009, p. 207) notes, "ICT is certainly not a panacea for education, but it is a powerful tool that when implemented appropriately can catalyse and accelerate education reform and development".

Furthermore, a growing body of research supports that Information and Communication Technology (ICT) is a powerful tool for education in any country (Unwin, 2009). When appropriately implemented, ICT can increase student productivity and learner independence, can engage students in active learning, and can promote high-level thinking (Yelland et al, 2008). It can also accelerate education reform and economic development. The Democratic Republic of Congo (DRC) can greatly benefit from an ICT-supported education system. It is my view that

cost-effective use of information and communication technology will significantly and positively impact the educational and economic landscape of the Democratic Republic of Congo.

Given the need for education reforms to be grounded in information and communication technology, it is important that ICT and education reforms be intertwined. When education and its supporting ICT are properly synchronized, the outcome can only be cost-effective and efficient.

The purpose of this paper is to examine the direct impact that ICT may have on the education system, and subsequently, on the economy of the Democratic Republic of Congo. The paper considers the role of ICT literacy in education and examines some of the challenges that must be overcome for a successful implementation of an ICT-supported education reform plan in DRC. I begin by reviewing the key components of ICT.

1.1. What is ICT?

Information and Communication Technology (ICT) is widely viewed as a means of effecting change in education, which can translate directly to increased economic development. Tinio (2009, p. 4) defines ICT as a "diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information. These technologies include computers, the Internet, broadcasting technologies (radio and television), and telephony."

Torero and Braun (2006) offer a much broader definition of ICT which encompasses equipment and services. ICT "includes the computing industry (hardware, software, networks, the Internet, and related services); electronic data processing and display (such as photocopiers, cash registers, calculators, and scanners, as well as a myriad of less well-known machines specifically tailored to production and manufacturing); telecommunications and related services (such as fixed and cellular telephones, facsimile machines, instant messaging, teleconferencing,

and so on.); and audiovisual equipment and services (including television, radio, video, DVDs, digital cameras, compact discs, MP3 players, and so on" (p. 3).

What is meant by ICT in education? Kim (2009) provides a sensible definition that captures the essence of ICT in education. He defines ICT in education as a "Comprehensive approach to innovate education systems, methods, and management through Information Communications Technology" (p. 4).

Put simply, ICT is thought of as a reliable vehicle for education, a platform for communication, and a powerful tool for economic growth. Unfortunately, it has been observed that the use of ICT in education is still in its infancy in the Democratic Republic of Congo.

1.2. Scope of ICT in Education

Information and Communication Technology is regarded as a force that can advance and improve the quality of education services and the effectiveness of the economy of a country. Kim (2009, p. 4) describes ICT in education as a multifaceted variable. He delineates five components of ICT in Education:

- ICT as a subject (i.e. computer studies)
- ICT as a tool to innovate teaching-learning practice (i.e. digital content, multimedia, teaching-learning methods, learning environment)
- ICT as an administrative tool (i.e. education management information systems (EMIS)
- ICT as an expanding learning opportunity (i.e. distance learning, e-Learning)
- ICT as a facilitator of higher-order thinking skills (i.e. learner-centered, self-directed learning, tailored learning)

ICT-driven education is known to empower individuals, to enhance learning and teaching processes, to help individuals share and disseminate accumulated knowledge and best practices, information, experiences, and products and services, and to promote productivity.

1.3. Current State of ICT in Education in the Congo

The World Bank report (2008, p. xiii) describes the grim general state of science, mathematics, and ICT (SMICT) education in Sub-Sahara Africa. Its report reveals the following challenges: poorly-resourced schools; large classes; a curriculum hardly relevant to the daily lives of students; a lack of qualified teachers; and inadequate teacher education programs.

In 1996, I surveyed 90 schools in Kinshasa, the capital city, for a study about the lack of effectiveness of English Language Teaching in secondary schools in the Democratic Republic of Congo. None of the schools surveyed had a computer in the classroom. Of the 90 schools surveyed, 70 (or 77.7%) were public schools. Only 20 schools, or 22.3%, were private.

Three years ago, I had the opportunity to visit a few government offices, four secondary schools, three colleges, and two hospitals in Kinshasa. Not much has changed. Several services—medical institutions, educational institutions, judicial system, government—still rely heavily on paper-based records.

Recently, there has been general recognition by government officials that ICT can help the education system and the economy. In 2004, the government of DRC launched what seemed then a significant initiative: “computers in education”. To this day, it has not yet been materialized. In fact, the whole concept of “computers in education” is now outdated. Yelland et al (2008) argue that the preferred expression now is “Information and Communication Technologies in Education” usually abbreviated to ICT (p. 204).

The 2004 initiative was part of a National Information and Communication Infrastructure plan. The government of DRC teamed up with the United Nations Economic Commission for Africa (UNECA) to develop a National Information and Communication Infrastructure (NICI) plan. So far, this plan has achieved insignificant results in terms of e-government and national backbone ICT infrastructure. UNECA (2009) acknowledges the failure of this project. “Due to political situation, the process was stalled for several months, however with the new government swearing in around December 2006, it is expected that the NICI process will restart early 2007”.

To illustrate the lack of ICT systems in Sub-Sahara Africa and in D.R. Congo in particular, here are some hard figures. Unwin (2009) cites an ITU (2006a) report which states that “Africa averaged 1.74 personal computers (PCs) per 100 inhabitants in 2004, compared with 50.84 in Oceania”. The report goes on to argue that the special divisions within Africa itself are also very significant, with countries such as Burundi, the Democratic Republic of Congo, Ethiopia and Niger all having less than 1 internet user per 100 people in 2006, compared with 2.7 in Ghana, 7.9 in Kenya, 12.7 in Tunisia and 24.1 user in Mauritius (Unwin, 2009, p. 26).

As of June 2009, the population of the Democratic Republic of Congo, a country of 2,344,798 sq km was estimated to be approximately 68,692,542. DRC only had 290,000 Internet users as of June 2009, that is; 0.4% of the population, according to Internet World Stats (2009).

According to another report by International Telecommunication Union (2007) entitled “Telecommunication/ICT markets and Trends in Africa 2007”, only 0.02% per 100 inhabitants of Congo’s 59,320,000 citizens had main fixed telephone lines in 2006. D.R. Congo had 4,415,000 mobile phone subscribers and 180,000 internet users, that is; 0.30% per 100 inhabitants (p. 25). In 2006, the whole continent of Africa had an estimated number of 44 million Internet users or 3.8 percent of the world’s 1.1. billion Internet users (ITU, 2007, p. 2).

In short, DRC has allocated insignificant resources to ICT resources. The consequence is that the systematic use of ICT in education is still relatively low.

2. Role of ICT in Education?

ICT is increasingly becoming a more and more powerful tool for education and economic development. Unwin (2009) observes that "ICT is certainly not a panacea but when implemented appropriately can catalyse and accelerate education reform and development" (p.2006). He contends that "ICT can be a catalyst by providing tools which teachers use to improve teaching and by giving learners access to electronic media that make concepts clearer and more accessible" (p. 214).

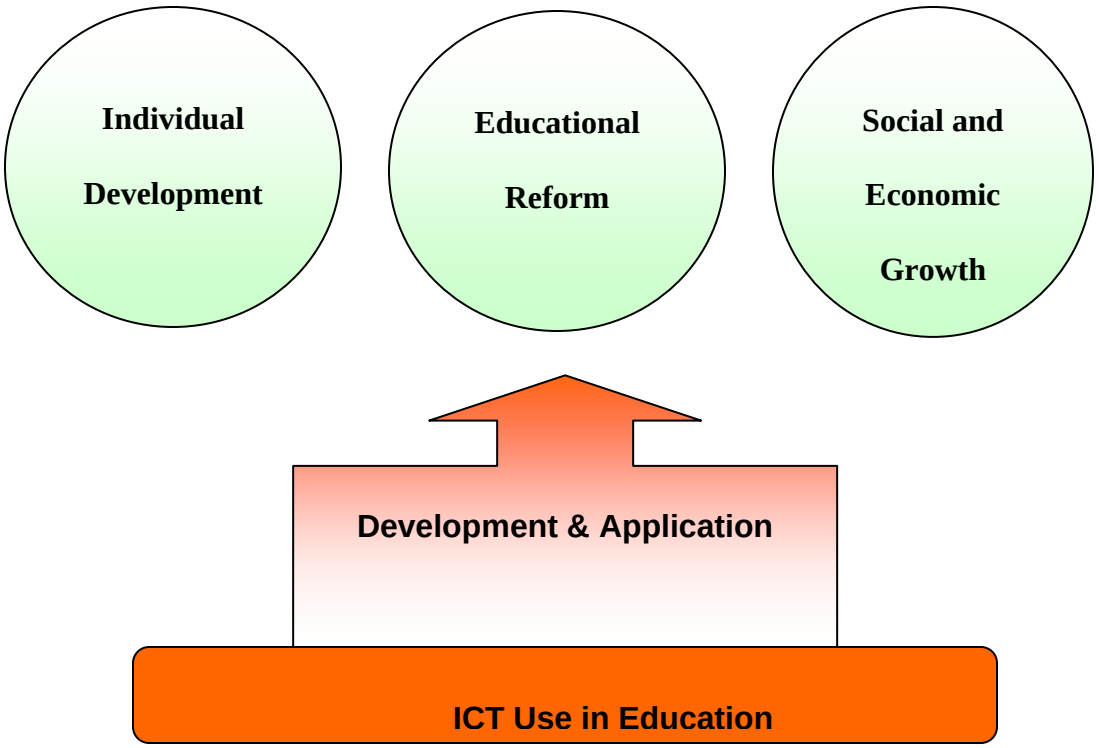
Thus, ICT is used for capacity development and citizen empowerment. Ultimately, ICT can enhance educational opportunities and outcomes for students, including students with intellectual disabilities (Anderson, 2009, p. 3).

According to Kim (2009, p. 4), ICT in Education can serve the following purposes: a) Restructuring education system, b) Diversifying teaching-learning methods and practices, c) Engaging all stakeholders of education and adapt rapidly to changes in society and the environment, and d) Enhancing education efficiency, effectiveness, and productivity.

Esque (2009, p. 3) sees three key investment components in long term economic growth: (1) Investment in knowledge leads to sustained economic growth, (2) Knowledge economy framework, and (3) Educational reforms to build relevant skills.

Song et al (2009, p. 5) think that ICT in Education has three main goals: (1) Individual development, (2) Education reform, and (3) Social and Economic growth.

Figure 1: Goal of ICT in Education



(Source: Song, 2009)

An infoDev (2005) review cited by Torero and Braun (2006) described the impact of ICT on education in developing countries as follows:

> "While impact on student achievement is still a matter of reasonable debate, a consensus seems to argue that the introduction and use of ICTs in education can be a useful tool to help promote and enable educational reform, and that ICTs are both important motivational tools for learning and can promote greater efficiencies in education systems and practices".
>
> (infoDev, 2005, p. 8)

There are several ways in which ICT can be a catalyst to educational development. Unwin (2009, p. 214) notes two ways: (1) by providing tools which teachers use to improve teaching and (2) by giving learners access to electronic media that make concepts clearer and

more accessible. He strongly believes that ICT can also remove inequalities particularly between urban and rural communities**.**

The introduction of ICT in the Congolese education system would call for a redefinition of the role of teachers. With ICT, teachers can no longer be "the transmitters of knowledge" but rather "the facilitators" of the learning process. Tinio (2009 , p. 22) notes that "As learning shifts from the "teacher-centered model" to a "learner-centered model", the teacher becomes less the sole voice of authority and more the facilitator, mentor and coach—from "sage on stage" to "guide on the side". The teacher's primary task becomes to teach the students how to ask questions and pose problems, formulate hypotheses, locate information and then critically assess the information found in relation to the problems posed". This may be easier said than done because of the nature of culturally-specific traditions that have characterized teaching and learning practices for years in the Congo. Teachers often view their role as "provider of knowledge" and regard students as empty vessels to be filled.

Clearly, classroom practices that simply embellish traditional modes of direct instruction with ICT tools have been repeatedly labeled as ineffective (LeBaron and McDonough, 2009, p. 22). ICT must hence be fully integrated into the curriculum. Lin (2008) cited by LeBaron and McDonough (2009) describes the integration of ICT across the curriculum as critical to learning how technology is productively applied in real-life situations.

A holistic transformation in teaching perspective is thus expected from a teacher-centered strategy of instruction toward student-centeredness. This is achievable but can be hard in the context of lack of basic school supplies and facilities (textbooks, chairs, computers, and so forth).

Consequently, the key role of ICT for development lies in its ability to handle and communicate information (Torero and Braun, 2006, p. 14). It should be noted that there is

convincing evidence of a link between good ICT provision in education and economic growth. Information and Communication Technology has the potential of helping set higher standards for the national curriculum in DRC and, hence, for revamping the whole education system of DRC.

3. ICT and Knowledge Transfer

While some countries invest enormous amounts of money in research and development of ICT, and recognize the importance of education and training to reap the benefits associated with technology, many citizens in other countries are left wishing they had any form of electronic communication (Anderson, 2009, p.2). The Democratic Republic of Congo is one of the countries that has yet to harness the benefits of ICT, especially in education.

Different reforms—of 1961, 1963, 1971, 1981, 1996, 2003—have not had much of an impact on the education system of DRC. True reforms must target three interlocking core areas: curriculum reform, teacher development, and knowledge transfer. Information and Communication Technology can be a key enabler of transformations in these areas.

More specifically, effective introduction of ICT in schools will facilitate knowledge transfer, enabling thereby educator development. With ICT in education, teachers and students can join online learning communities to acquire new skills. One of the most important equity areas that has emerged during the era of globalization is international knowledge transfer. Courtney (2009, p. 153) observes that “International knowledge transfer facilitated by ICT has the potential to improve conditions for people in all countries since knowledge transfer is a two-way process”. She argues that knowledge transfer involves access to information; and; information leads to opportunities that generate resources. Esque (2009) argues that Information and communication technology facilitates the effective creation, dissemination, and processing

of information; and knowledge is increasingly becoming the currency for business and countries need to focus on building up their capabilities to compete in this area

Indeed, access to ICT can allow educators and students in any part of DRC to share knowledge with the rest of the world and access resources which can enhance their learning experiences. Information being so valuable, access to information can ultimately lead to access to information leads to access to opportunities that generate resources. Students (even the most disadvantaged including women and children) and teachers in DRC will then be able to compete internationally.

ICT-supported education has the potential of creating learning opportunities that transcend the school walls. It would be a huge innovation in the Congo to see students in different parts of the country work together simultaneously. Using web applications and collaboration tools, students in Lubumbashi, Kinshasa, Kisangani, Mbandaka, and Matadi, for example, can take the same course from the same educator, share their experiences, and compare their notes. Indeed, many Congolese scholars (such as Yves Mudimbe, George Nzongola, Elikya Mbokolo, Ngandu Kashama, etc.) living abroad may share their experiences with the scientific community back home without having to travel. Geographical boundaries should no longer an obstacle with ICT.

Telecollaboration—an educational endeavor that involves people in different locations using Internet tools to work together—is one thing that ICT can make possible in the Congo, especially for subjects where there is scarcity of technical expertise. Telecollaboration will only increase students' educational performance. Educators across the country (even across Africa) may also collaborate through ICT and subsequently improve their teaching practices.

But there must be ways to evaluate the outcome of knowledge acquired through the use of ICT. For education systems and the actors within them to improve their effectiveness and efficiency, there need to be mechanisms in place to appraise performance and to provide incentives for continuous improvement (OECD 2009, p. 7).

Unwin (2009, p. 39) points out that "information and communication are central to the implementation of development, however we choose to define it". ICT-supported education has largely contributed to knowledge transfer, providing an enabling environment for innovation, economic growth, and in developing core academic skills. Such an environment is required to foster a strong knowledge economy. There is no reason why DRC cannot become a powerhouse of ICT innovation in Africa.

4. Impact of ICT on Economic Growth

Investing in education can lay the groundwork for transforming the economic landscape of a country. Several empirical studies have shown that an investment in education can have a direct impact on economic growth and development. Benhabib and Spiegel (1994) found that improved level of education positively affected growth in Chinese Taipei.

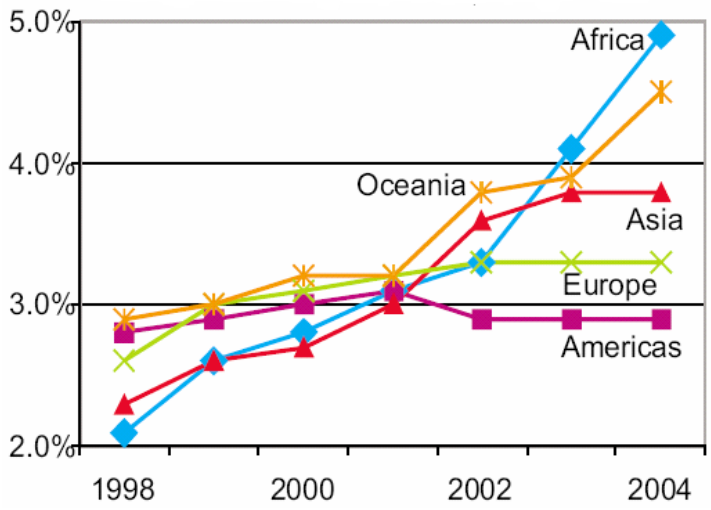
Torero and Braun (2006, p. 22) argue that a country's ICT infrastructure can make a direct contribution to gross domestic product (GDP) and also have pervasive impacts throughout the economy—for example, by reducing transaction costs, improving organizational functioning, and enhancing the spread and development of factor and product markets.

Furthermore, there is evidence of bidirectional causality between a country's economic development and the quality of its education, between education and a country's GDP (Francis and Iyare, 2006). The authors pointed out the cases of Jamaica, Barbados, and Trinidad and Tobago. ICT literacy development is contingent upon a country's education expenditures.

Torero and Braun (2006) believe that there is a link between ICT provision and GDP. "Estimates for 113 countries over a 20-year period show a positive link between telecommunications infrastructure and income, as well as between telecommunications infrastructure and gross domestic product (GDP). The estimates suggest that a 1 percent increase in the telecommunications penetration rate might be expected to lead to a 0.03 percent increase in GDP".

Materu (2009) illustrates ICT's contribution to economic growth between 1998 and 2004.

Figure 2: Telecommunication service revenues as a percentage of GDP, 1998 - 2004.



As Berthelemy and Vardoulakis (1996) cited by OECD (2009) observed, "Investment in education can enhance growth and development by encouraging activities that can help catch up with foreign technological progress" (p. 2). In essence, "Education has always been a critical investment for the future, for individuals, for economies and for societies at large" (OECD, 2009, p. 2).

Today, it is widely recognized that knowledge is increasingly becoming the currency for business and countries need to focus on building up their capabilities to compete in this area (Esque, 2009). As the author points out that "There is clear empirical evidence of a strong

correlation between the income of countries and their ranking on the Knowledge Index or their investment in knowledge. This is measured by investment in

- An economic and institutional regime which supports and promotes the creation of knowledge and entrepreneurship.
- An educated and skilled population to create, share, and use the knowledge well;
- An efficient system of firms, research centers, universities, who create new knowledge and
- Information and communication technology to facilitate the effective creation, dissemination, and processing of information"

Song et al (2009) note that "Countries with pervasive information infrastructures that used ICT applications possessed advantages of sustained economic growth and social development" (p.4). The authors argue that the adoption of new technologies is essential to survival and growth of economy in general, and that ICT in education has positive effect on individual empowerment.

In a study about the causal relationship between education and Gross Domestic Product (GDP) for Bangladesh over the period of 1976-2003, Islam et al (2007) demonstrated that income can cause education to grow and education can cause income to grow. The authors concluded that GDP growth and educational expenditure work in tandem. "It appears that Bangladesh is in the second stage where income and education are helping each other to grow. Our results show that there is bidirectional causality running from GDP to education and vice versa"(p. 6).

In other words, ICT interventions can potentially have transformational impact on the education sector, on the economy sector, and virtually on every sector of the Congolese society.

They can broaden access to education, enable learner-centered learning in a country where teacher-centered processes prevail, and improve the efficiency of education systems.

5. Case Studies: A Look at Promising ICT Practices in Africa

There is a host of countries that are integrating ICT into their national curricula. It is worth examining two case studies of promising practices in ICT education in Africa. Political leaders of the Democratic Republic of Congo can draw some useful lessons from these cases.

5.1. The African Virtual University

Headquartered in Nairobi, Kenya with a regional office in Dakar, Senegal, The African Virtual University (AVU) is a Pan African Intergovernmental Organization whose aim is to significantly increase access to quality higher education and training through the innovative use of information communication technologies. It specializes in tertiary education and training using Open Distance and eLearning methodologies. Core skills include i) Material Development, ii) delivery and Technology and iii) Governance, Management and Funding.

Established in 1997, The African Virtual University (AVU) is a higher education institution that operates without a conventional campus, but uses the facilities of conventional universities in 24 sub-Saharan African universities in 17 Anglophone, Francophone, and Lusophone countries to provide learners with facilities to access technology delivery systems.

It supports learners across the continent through videotaped instruction and/or live broadcast (via satellite or fiber optic connections), with learners participating in the discussion by e-mail, telephone, or fax. Additional reference materials such as books, journals, and course notes are also available for learners.

Courses currently offered by the AVU focus primarily on training and certificate programs, with more than 23,000 learners having completed at least one semester-long course. Though current fees per course are still out of reach of many Africans, they generally are much less than those of competitive programs offered by other international universities (Haddad, 2009). The AVU's website http://www.avu.org has additional information.

The Democratic Republic of Congo can very well pilot a similar experience. Solid ICT infrastructures in DRC can benefit Congolese students as well as students across the continent. This vast and rich country has the human capital for such an endeavor.

5.2. Cross-curricular Computer Awareness Program at Junior Secondary Schools in Botswana

The World Bank (2008) lists this program as promising on account of its wider and large-scale accessibility by students. It is reported to strike a balance between what could be considered as three primary and principal needs for 14-17-year olds. The interrelated needs are: a) student-related needs, b) inter-subject-related needs, and c) socioeconomic and political needs.

The Computer Awareness Program is not subject-based. Computer Awareness is taught across all subjects with diversity of aims, hence, fostering and enriching the intellectual experience and growth in students. Thus, the program is multi-disciplinary and enables selective use of computing skills by teachers to fulfill its aims and philosophy (World Bank (2008, p. 80).

In short, there are several other examples: Educator's Network in South Africa, Science Education in Secondary Schools (SESS) Project in Tanzania, Mathematics and Science Teachers Extension Programme (MASTEP) at the University of Namibia, and Association for Mathematics Education of South Africa (AMESA). Such projects should inspire leaders in the Congo.

The Democratic Republic of Congo has a few successful ICT programs at ISIPA, Université Protestante au Congo, and Université de Kinshasa. These programs rarely receive any financial backing from the Ministry of Education or the government. The government recently closed 147 institutions of higher education that were deemed not “viable”. Instead of closing, the government should support existing institutions and create new ones.

6. Challenges in Implementing ICT in the Congo

Analysis of the current socioeconomic situation reveals that deploying ICT infrastructure in the Congo can be quite challenging. Several challenges need to be addressed when planning ICT interventions in many parts of DRC. Those challenges include, but are not limited to, poor connectivity, unreliable electricity, inadequate educational facilities, scarcity of ICT qualified educators, inadequate teacher education programs, large classes, lack of educational resources and contents, a curriculum hardly relevant to the daily lives of students, little sustainability in education, high cost of ICT infrastructures, availability of textbooks, and lack of effective and efficient strategies. In fact, very few educational institutions in DRC have Internet access, computers, telephone lines, local area networks, mobile telephony, electricity, and educational radios or televisions.

Despite its vast mineral resources and various international aids that DRC has received throughout its 50 years of independence, this large country in the heart of Africa has low availability in ICT. Weak institutions—government, parliament, media, national bank, etc.—also constitute serious barriers to effective ICT adoption and implementation in the Congo. As Torero and Braun (2006) note, “Research shows that ICTs cannot be developed without strong institutions that overtly facilitate private investment. Many of the national telecommunications

monopolies in developing countries were privatized in the 1980s and 1990s, introducing them to competition".

In many Congolese schools, resources for science, mathematics, and ICT education are inadequate. Below are two tables that present budget allocations from 1995 to 1975 and from 1993 to 2000.

Table 1: Education Expenditures 1969-1975

Government Ministry	**1969**	**1970**	**1971**	**1972**	**1974**	**1975**
National Education (%)	21.9	19.7	22.5	22.6	15.5	21.9

Source : Bambanota (2006)

Table 2: Education Expenditures. 1993-2000

Government Ministry	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
National Education (%)	0.2	0.3	1.2	0.9	0.8	0.2	0.4	0.1

Source: Central Bank of Congo: Annual Reports. 1998 - 2000. Bambanota (2006)

The Democratic Republic of Congo is known to be one of the richest countries in the world in terms of natural resources. But why is it unable to adopt a comprehensive ICT plan for education despite its numerous mineral resources? Why does it need the United Nations' assistance? Countries without such resources (Senegal, Ghana, Botswana, Nigeria, Kenya, and Namibia) have succeeded in meeting many of the ICT-related challenges they faced. Although not successful on all fronts, they have, however, managed to respond to some of the increasing

demands of modern education. The Democratic Republic of Congo should not continue to use its troubled history of dictatorship, persecution, wars, and colonization to justify its failure to adopt and deploy modern technological tools to improve its education system and its economy.

7. Strategies for Overcoming Challenges

The barriers to change in the Democratic Republic of Congo may be summed up as follows: current thinking (willingness to control information and communication at all costs), lack of technical expertise, brain drain (too many qualified Congolese are leaving the country for greener pasture), risk aversion, isolated approaches, lack of ICT infrastructures, lack of technological leadership, and fear of change.

It is clear that the adoption and implementation of ICT in education requires huge resources. Expenditures on ICT resources are usually significant. However, understanding how ICT-driven education can positively affect the economy should be in itself the first incentive for adopting ICT tools. What seems to be holding the Democratic Republic of Congo back is the lack of vision and willpower on the part of policy makers. "One of the biggest threats to ICT-enabled projects is resistance to change" (Tinio, 2009, p.20).

It is thus essential that educational professionals and economists sensitize political leaders about the economic and educational benefits of ICT tools in education. They must take the lead and assume their responsibility. It is my view that cost-effective use of ICT-enabled education projects can be instrumental in ensuring long term sustainability—social, political, technological, and economic—in the country. It is surprising that the Democratic Republic of Congo still keeps student records on paper, still has thousands of schools without a single computer, and worse, still does not have appropriate buildings that can house ICT infrastructures.

O'Mahoney (2003, p.150) suggests a solid 6-pillar ICT effectiveness model. The 6-point plan encompasses resources, policy, departmental commitment, training program, evaluation or appraisal, and student learning. He argues that a pre-requisite to success with school ICT is the provision of sufficient resources. The curriculum ICT policy must articulate well with the school's business and strategic development plans. The department must commit to ICT professional development of staff. A robust and measurable professional development program must be in place. To drive home the message concerning the school's commitment to ICT, effective classroom use of ICT must become a performance indicator for staff. Finally, the ultimate aim of ICT in education is the improvement of student learning.

In order to implement ICT tools in education in the Democratic Republic of Congo, it is important that drivers and barriers be identified, including those related to curriculum and pedagogy, infrastructure, capacity-building, language and content, and financing (Tinio, 2009, p. 21). DRC needs a comprehensive strategy for the integration of ICTs across the entire education sector.

8. Conclusion

It appears that ICT use in education and economic growth are closely correlated. In today's interconnected world, information and communication technology in education is increasingly playing important roles in boosting the economies of many developing countries. ICT has become a key driver in education, economy, politics, and culture.

Virtually all countries are investing in ICT in education today. Several African countries now have access to ICT resources to join the global economy. The Democratic Republic of Congo is one of the few countries that has yet to benefit from ICT tools in education. Clearly, there are challenges to overcome before DRC can effectively adopt and implement ICT in

education. Any education reforms in DRC need to address the new ICT skills and tools required in today's global economy.

But, as Wagner et al (2005) observe, simply putting computers into schools is not enough to impact student learning. A well-structured ICT plan should be the backbone of the Congo's ailing education system. If properly implemented, information and communication technology has great potential for knowledge dissemination, sustained economic growth, effective learning and social development in the Democratic Republic of Congo.

I believe that this survey of literature will encourage decision-makers, ICT professionals, and education professionals in the Democratic Republic of Congo to give serious thought to the intrinsic value of ICT as a means of effecting change in education and in national economy. The literature reviewed suggests that there is a positive relationship between availability of ICT in schools and test scores. I hope that this study will trigger further research into the measurable impact of ICT on mobile learning, personalized learning, and exceptional education in developing countries.

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