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Technologizing Africa: On the bumpy information highway

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Abstract

Although the microcomputer and the Internet continue to advance rapidly in Western cultures, developing nations, especially those in Africa, are lagging behind—a situation that continues to widen the gap between the haves and the have-nots of the world. This article offers the rare opportunity to get a glimpse of Africa on the information highway and documents the use of computers in the educational systems of three African nations: Ghana, Kenya, and Egypt. It documents the progress these countries have made in exposing their citizens to information technology and reveals the challenges they face in closing the digital divide that Africans continue to experience. In presenting how these countries adapt to technological change, one may better understand why Africa's ride on the information highway is rutted.

Keywords: Computers; Africa; Information highway; Ghana; Kenya; Egypt; Developing countries; Composition; Writing instruction; Integration; Technologizing; Technology

1. Introduction

In *Education in the 80's*, Richard S. Powers wrote, "As the 1970's came to a close, computers were clearly inevitability. . . . Education by way of a terminal is already widespread in colleges and high schools" (1981, p. 108). More than two decades after Powers penned this statement, the call for papers (2005) of this special issue stated:

> In 1994, Ilana Snyder guest-edited a special issue on global perspectives for *Computers and Composition*. Since then more than a decade has passed, during which time computer-based information and communication technologies have been introduced into educational settings more widely around the world. . . . However, there have been few opportunities to share what people in different parts of the world have been doing with regard to research and practice in computers and writing.

When Powers penned his statement in 1981, he obviously was making reference to educational institutions in Western cultures where computers are now considered ubiquitous. Powers' claim can be easily verified because there is an extensive body of literature describing

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the process of institutional adoption, teachers' and students' experiences, and the promise of computer use in the West. On the other hand, the call for papers made the assumption that educational systems in non-Western cultures *have* similarly exposed their students to computers. This claim is difficult to substantiate due to the limited research describing the merging of computers and education and the unavailability computers for writing instruction in non-Western societies.

A close look at the literature on computers in non-Western cultures reveals that microcomputers, mostly used and refurbished, were not introduced into most developing countries until the 1990s. Although most of the available research on information technology outside of the West focuses on the digital divide (Norris, Bennett, & Entman, 2001; Wresch, 1996) in non-Western cultures, a seminal research described the uses of microcomputers in secondary schools in developing countries such as China, Egypt, India, Jordan, and Kenya. In the preface of their book, *Computers in Third-World Schools: Examples, Experience and Issues*, David Hawkridge, John Jaworski, and Harry McMahon (1990) wrote, "Because microcomputers are reaching classroom in significant numbers there is much to be gained from drawing together and analyzing the experience of developing countries" (p. ix).

The call for papers emphasized a discussion of the blending of writing and computers, which is generally foreign in many non-Western cultures. On the one hand, composition "for all its huge growth and institutionalization... remains largely restricted to the United States and Canada. Copies of *CCC*... find their way abroad only by accident, or when ordered by some obsessive expatriate" (Murchiri, Mulumba, Myers, Ndoloi, & Deoscorous, p. 175). On the other hand, a majority of the people in developing countries cannot afford computers nor have access to the Internet. According to Dan Simmons (2005) of *BBC Click Online*, a new computer could cost more than a year's earnings. Additionally, a majority of people in developing lands live on less than $2 a day (Human Development Report, 2006). In most cases, governments lack the resources to equip educational institutions with the technology.

Internet World Stats (2007) reported that only three developing countries, India (with 3.6% of the world's users), Brazil (2.9% users), and Mexico (1.8% users), are among the top 20 countries with the highest number of Internet users. Not one of Africa's 54 countries, even Nigeria (2.5% of world's population), which is almost as populous as Brazil (2.8% of world's population), made the top 20 list. It is not surprising that Africa has been referred to as the continent that "suffers the most from... the digital divide in a world that has increasingly become wholly based on knowledge" (Olowu, 2004, p. 81). Recent research suggests that in Africa, a continent of over 900 million people, only about 33 million people are Internet users, which translates into 3.6% penetration on the continent; this figure shows a 3.6% usage growth from 2000 to 2007 ("Internet Usage Statistics for Africa" 2007). It is important to note that educational institutions are not responsible for this growth. Rather, this advancement is attributed to connectivity through dial-ups, leased lines, cyber cafés, and mobile services. Even with such growth, African Internet Service Provider's Association (AfrISPA) warned that Africa, which is "only on the periphery of expropriation of internet" (2005, p. 3), claimed only 1.8% of the global user base, 0.2% of the global Internet hosts, and 0.2% of the generic Top Level Domains (AfrISPA, 2005).

Given that not one African nation made the top 20 Internet user list and the continent's low level of connectivity, one wonders how many computers are available in academic institutions

and how many of these institutions use computers for writing instruction. These concerns are not specifically addressed in this article due to a lack of substantive research conducted on non-Western cultures regarding the blending of computers and composition. But this article *does* offer a rare opportunity to get a glimpse of Africa on the information highway. This article documents the use of computers in the educational systems of three African nations—Ghana, Kenya, and Egypt. Educating African youths by integrating computers into traditional education is necessary for Africa's economic growth. Richard Larson (2001) pointed out that a nation's wealth is no longer buried in the earth; rather, its most precious asset is in the education of its people. In examining how these countries adapt to technological change, one can be better informed about Africa's participation and survival in this rapidly advancing technological age.

2. The Republic of Ghana

2.1. Internet connectivity in Ghana

In 1995, Ghana became the first sub-Saharan African nation to have "full Internet connectivity," a service that provides users complete Internet access along with one or more static public addresses (The Internet Society, 2004). In the last few years, the Internet, wireless technology, and freer radio broadcasts have vastly expanded communications and information in Ghana: "Once mired in information poverty, [Ghanaians] now face the challenge of using information and connectivity to their best advantage" (Zachary, 2004, p. 1).

Paul Budde Communication Pty Ltd. (2006) offered the following current information concerning Ghana and the information highway:

> National and international public data services are provided by more than 20 companies and there are more than 50 VSAT networks operating in the country. The rapid growth in this sector in recent years is set to continue in 2006. Almost 100 new Internet Service Providers (ISPs) were licensed in 2004 alone, bringing the total to more than 140. Broadband ADSL services were introduced in 2003. (n.p.)

In 2000, only 0.2% of Ghana's almost 19 million people were connected to the Internet; in 2006, with a population of almost 22 million, Internet users have grown to 1.9% (Internet World Stats). The government's commitment to Ghana's technological advancements will offer more Ghanaians the opportunity to experience a smoother ride on the information highway. The ride will certainly be less bumpy as more Ghanaians develop literacy skills. Clement Dzidonu, Ghana's technology adviser to Ghana's President John Kufour, points out that "no information-rich country. . . is poor" (qtd. in Zachary, 2004, p. 8).

2.2. Ghana's literacy and technology initiatives

With approximately 10% of its work force being high school or college graduates, Ghana, like most African countries, continues to struggle to bridge two traditional literacy and computer literacy. In terms of traditional literacy, the most recent research places Ghana's youth (ages 15–24) literacy rate at 70.7% and its adult (ages 15+) literacy rate at 57.9% (UNESCO,

2006). Such statistics have prompted Ghana to take some important steps to make education and information accessible to its citizens. Basic education in Ghana is tuition free, and the Ghanaian government is now operating under the key assumption that one way to educate its people is through technology. The government believes that the digital divide is not just about hardware and software but more about education and skills.

In 2002, Ghana along with India, South Africa, and Mexico partnered with the Bridges to the Future Initiative (BFI), a global collaborative program that aims to bridge the global literacy divide through education and technology. BFI-Ghana is a collaborative effort of the Kwame Nkrumah University of Science and Technology (KNUST); the School of Engineering and Applied Science (SEAS) and the International Literacy Institute (ILI) both at the University of Pennsylvania; and the Community Services Foundation (CSF), a nongovernmental organization in Ghana (ILIUP, 2002). In 2002, much of the Information and Communication Technologies (ICT) hardware and connectivity was achieved at KNUST. That same year KNUST and Penn received $1.12 million from Hewlett-Packard to purchase equipment and services. This grant "laid the foundation for a high-speed ICT infrastructure at KNUST and for community learning and technology centers" aimed at providing inexpensive access to the Internet (ILIUP, 2002).

After becoming a member of BFI, Ghana sent representatives to conferences such as the 2004 Colloquium and Consultation on E-Governance where Francis Agble (2004), vice president of Ghana's Public Services Commission (PSC) (2004), reported that the government had partnered with Microsoft for funds to support teacher training up to 2009 and to provide computer-literacy training in schools via the Microsoft Academy.

2.3. Ghana: Basic education

A UN Integrated Regional Information Networks (UNIRIN) report dated October 11, 2006, pointed out that school enrollment in Ghana is on the rise since Ghana abolished basic education school fees in 2005. In the 2004–2005 academic year, primary school enrollment was 59%, and in the 2005–2006 academic year, primary school enrollment rose to 69%. This increase has led to a need for 17,000 teachers and 13,400 classrooms. Private properties such as churches and community centers are being used to house the growing numbers of student; conducting class under trees has not been ruled out. Bannarman Mensah, deputy director general of the Ghana Education Service, reasoned, "We will certainly have the children study under trees. Which is better, a child who doesn't go to school or one who has the chance to be taught under a tree?" (UNIRIN, 2006). Meeting under trees may be a last resort for Ghanaian youth because a World Bank grant of U.S. $11 million will provide 150 new three-unit classrooms, renovate 100 existing classroom blocks, purchase new textbooks, furniture, and hire teachers to meet the pupil-to-teacher target ratio of 35 (UNIRIN, 2006).

Students who are promoted to secondary schools face many of the same problems they faced in primary school. Also short on buildings, secondary educational needs compete for limited governmental funding. Available buildings support only one-third "of the 60 percent of the junior high school graduates who pass a national examination" (Zehr, 2004, n.p.). The shortage deprives promising youngsters of a decent education and may end their hope of being university educated.

In partnership with the British government, the Ghanaian government has constructed science centers equipped with computers at 108 of Ghana's 477 secondary schools, but maintaining these centers has been difficult because of insufficient funds to maintain the equipment and a lack of teachers qualified to teach with computers. Many teachers, who gain on-the-job computer training to teach in public schools quit for more rewarding positions outside of the school system (Zehr, 2004).

2.4. Ghana: Tertiary education

Students at the higher education level face much of the same shortages as students at lower levels face: "Prodded by a new government, universities are opening their doors to a wider number of students" (Zachary, 2004, p. 24), a situation that is over-tasking the universities' limited resources. A 1991 report showed tertiary school enrollment at 12,000; in 2004, more than 30,000 students were enrolled (Zachary, 2004). It is hoped that private universities would accommodate those students who cannot get into public institutions; however, private schools are "too few, too small and too specialized" (qtd. in Zachary, 2004, p. 25) to make an impact.

Students who do get into public institutions encounter an outdated curriculum that does not provide students sufficient exposure to the new technology. A close look at the Computer Science Department of the University of Ghana gives us some idea of what higher education in terms of technology is like in Ghana, specifically, and Africa, generally. The department, which serves 400 undergraduates, runs a computer laboratory with only 12 working PCs—none with Internet connectivity. Some students write programs manually and type them into the computer later. Determined students pay to use the Web café on campus, but most students cannot afford the café price of 50 cents an hour. Aside from a lack of computers, departmental teaching materials are dated, professors are ill-prepared, and, on many occasions, miss class due to outside employment. The department's resources are so extremely limited that even the department head referred to the department as "a poor stepchild to older academic disciplines" (Zachary, 2004, p. 24) upon which the bulk of the university's resources is spent.

Unlike the University of Ghana where traditional disciplines are highly valued, the Kwame Nkrumah University of Science and Technology at Kumasi (KNUST-Kumasi), recognizing the shortage of trained computer literate educators, is gradually shifting from traditional offerings such as mechanical and civil engineering to electrical engineering and computing in order to increase enrollment. Available data show an increase from 24 students in 1997 to 76 in 2002. Ghana's goal is to make KNUST-Kumasi "the finest technical school in Africa" (Zachary, 2004, p. 26). But before that can happen, the road between Kumasi and Accra where the bulk of technological businesses exist, must be repaired. Because of poor road conditions, the trip to Kumasi takes five or more hours (Zachary, 2004). With better roads, travel time would be about two and a half hours. Thus, the need for better roads to get more students to campus is vital.

Besides the contributions of foreign governments and organizations, private citizens are also contributing to Ghana's educational advancement. In 2002, Patrick Awuah, a native Ghanaian and former programmer at Microsoft, launched Ashesi, which means "beginning" in Twi, a dominant Ghanaian language. Ashesi, a small four-year baccalaureate university located in

Accra, is poised to offer the type of technological program that many state-run institutions in Ghana cannot offer. Ashesi blends software engineering and business studies based on a liberal arts core curriculum. One of this institution's goals is to train its students in the use of information technology to help them bridge the digital divide between advanced and developing countries. Students use technology for activities including writing papers, running simulations of economic and market strategy games, and programming (Ashesi University Foundation, 2006). Although Ashesi's students are expected to use computers to write papers, so to speak, it is not clear how the process works.

Ashesi's core curriculum consists of an interdisciplinary liberal arts program that includes courses in the humanities and social sciences as well as mathematics and preparatory business and computer science courses. Specifically, the core consists of the following humanities courses: Text and Meaning, Written and Oral Communication, and Research Project. These teachings are similar to Western (or U.S.) curricula, and we can assume they may use computers to write in some of the core courses. Ashesi spends about U.S. $1,800 a month to maintain Web access for its faculty and students. Soon the university will have to build its own infrastructure because the public infrastructure is not dependable.

In an effort to provide more educational opportunities for its people, Ghana in August 2006 inaugurated its newest institution of higher education, Ghana Telecom University College (GTUC). President Kufour told attendees at the inauguration that his government "expects the university to enlarge access to distance education and to create new avenues for employment and wealth" (Yankson, 2006). The University's mission "is to extend education in engineering and in information and communication technologies to students at the main campus in Tesano-Accra and across the nation via distance learning" (GTUC). The university welcomed its first class of about 350 students in September 2006. Although not much information is available, it is worth mentioning another private educational initiative, *mycoursemate.com* , "an indigenous Internet-based helpline for students where they have access to tutorial services to enhance success in their academic work" (Mycoursemate.com, 2006). This site is probably the subcontinent's first online tutor for African students.

2.5. Ghana's future

The Ghanaian government, conscious of its obligations to provide quality education for its citizens, believes such education can be achieved through ICT (Yankson, 2006). The Ghanaian "government is committed to the deployment of requisite tools and strategies to achieve the broad goal of every Ghanaian learner to be able to use ICTs confidently and creatively by 2015 because of the present information society and the global knowledge economy" (Yankson, 2006). To make this possible, the government signed an agreement with the ICT Education for Africa (IESA) Foundation for 70,000 refurbished computers for schools from 2006 to 2010 (Yankson, 2006). Furthermore, the Ghanaian Ministry of Communications (2006) with Intel and Deon 2000 are making computers affordable for teachers and other government employees. Teachers can buy Discover Personal computers for as low as 3.5 million cedis (U.S. $377.36) "payable over a period of 12 months after making an initial deposit of 10 per cent of the cost" (Yankson, 2006, n.p.).

3. The Republic of Kenya

3.1. Kenya: Basic education

The demand for school reform and accountability is an ongoing project in Kenya. After the country's independence in 1963, the British 7-4-2-3 school model—seven years of primary school, four years of lower secondary, two years of upper secondary, and three years of university education—was no longer effective for Kenyans. Subsequently, in 1985, Kenya restructured its educational system based on the current 8-4-4 model: eight years of primary school, four years of secondary school, and four years of higher education. When students complete secondary school, they must sit for the national examination, a highly competitive exam necessary for college admission. It is not unusual that less than half of secondary students who take the exam are admitted to college in Kenya. Therefore, nothing else takes precedence over preparing for the examination (Hawkridge et al., 1990).

Having introduced computers to secondary school youngsters in the 1970s, computer integration for learning instruction continues to be a major step to reforming the Kenyan school system. As is the case with the introduction of any new technology, the move to computers for learning instruction continues to be met with some resistance: Some believe that using computers would deprive students of the time needed to study for their national examination, their ticket to higher education, that the computer disrupts the traditional structure of the classroom, and that the recurrent costs of using computers is an expensive endeavor. It is important to note that of all teachers across the disciplines in Kenya, humanities teachers are the most resistant (Hawkridge et al., 1990) to computers for instruction. In the early days of the introduction of computers in English studies in the United States, there was and still is some resistance to the technology (Ford, 2003).

In January 2003 when Kenya instituted free education for primary school students, primary schools experienced a surge in enrollment, for "[i]n a matter of weeks, 1.3 million new pupils had poured into the country's schools, overwhelming school infrastructure and surprising ill-prepared teachers" (United Nations Girls' Education Initiative Website, 2006). The increase in student population created new challenges for the educational system: overcrowded schools, high teacher-student ratio, shortage of teachers in many subject areas, and expensive educational materials (Kenya Ministry of Education, 2006). The Kenyan government believes that these challenges can be met by integrating ICT into education. Will Kenya be able to provide the ICT resources for its increasing student population? Yes, if international organizations and donor countries continue to partner with the Kenyan government to invest in the educational system.

3.2. Kenya: Tertiary education

Much like for K-12 education in Africa, research at the tertiary level in Kenya is sparse. Many professors have limited resources and time to spend on research due to low salaries, which compel them to take wage-earning jobs that offer ready cash. Joanne Coburn noted the following: "Attracting and retaining well-qualified staff and researchers. . . poses the most serious problem for African universities" (qtd. in Hoffman, 1996, p. 85). ICT integration and

research on such integration suffer the same fate as other types of academic research. Maurice Amutabi argued that "ICT is not well spread and utilized in Kenya's institutions of higher learning, mainly because of poor communication network, limited access to ICT hardware and software" (2004, p. 4). However, he believed that many universities in Kenya have considered embracing ICT through the nudging of international agencies and donor countries. These organizations "exerted significant pressure upon many governments, institutions of higher learning and other recipients of their aid, in developing countries to adapt the extensive use of ICT to improve their workforce performance and organizational management" (p. 21). As a result of donor pressures as well as the rapid infusion of ICT in nonacademic settings in Kenya in the past several years, Kenyans began looking to higher education to provide the needed technological leadership (Amutabi, 2004). Hence, a number of Nairobi schools, including four state universities—Nairobi, Kenyatta, Moi, and Egerton—gradually began introducing computers in their classrooms (Makau, 1991). However, the task has been a difficult one for public universities because "on average each public university in Kenya has about 2,000 PCs of various makes, types and capacities scattered over several campuses, in various facilities and/or departments, in administrative offices, computer laboratories and centers" (Amutabi, 2004, p. 19). With computers scattered across various campuses, management has been a problem because only a few PCs are connected to form local area networks (LANs), and others form a virtual collection of machines. On the whole, these computers are not used for teaching and learning; instead, some are used to process grades and to write business correspondences and others, displayed like trophies, go unused. Oftentimes, unused computers are upgraded or replaced with newer models that get little or no use.

In Kenyan universities, most of the ICT staff hired to run computer centers lack the theoretical knowledge and practical experience to efficiently manage the centers. Without proper client policy on access and use of computers in the centers, the staff experience difficulties establishing optimal use of the facilities. Upon examination of university documents on ICT, Amutabi (2004) discovered that "hardly any policy framework exists to guide the development, adoption and management of information and communication technology" (p. 23). Such inadequate managing of the centers often results in the institutions' inability to substantiate how donations are being used. Thus, financial supporters are reluctant to offer, renew, or extend their support. Without donors' assistance, recipient institutions are left with problems that threaten the advancement of their ICT programs (Amutabi, 2004). These, among other problems, contribute immensely to the slow integration of ICT into Kenyan university curriculum.

3.3. Kenya's future

Since computers entered Kenyan schools on an experimental basis almost 30 years ago, the Ministry of Education continues to believe that ICT can play a critical role in the nation's educational system. However, Kenyans must be traditionally educated to take full advantage of computers. With the Ministry's continuous efforts, Kenya's literacy rate is improving. In 1980, the adult illiteracy rate was at 43.9%; in 2003, it was 14.9%. Youth literacy rate in 1980 was at 78.0% and rose to 95.8% in 2004 (U.N. Common Database, 2006). There is no evidence that this improvement is due to computer use.

Much of the skepticism about computers remains in the past as the use of computers intensified in the 1990s (Amutabi, 2004). With more Kenyans getting an education, the nation is paying greater attention to ICT. In October 2006, George Godia, Education Secretary released the following statistics:

- Kenya now has approximately 19,890 primary schools; most are in rural areas, and 15% have electricity. Approximately 500 primary schools have computers, but Internet access is limited.
- Kenya has a little over 4,000 secondary schools country-wide; 85% of these schools are in rural areas, and about 65% have electricity. Approximately 750 of secondary schools have computers; each school has about 10 PCs with limited Internet connectivity.
- Kenya has 22 teacher-training colleges with ICT curricula and required ICT integration. Most of these colleges have a computer laboratory of 20–60 PCs with limited Internet connectivity through dialup. Most of the tutors are ICT trained.

Godia believed that ICT can greatly facilitate the learning process. However, the current state of ICTs in Kenyan's education is uncoordinated; status of ICT in schools are generally unknown; instead of initiatives that complement each other, many of them are competitive; and there are unsustainable programs where schools are full of PCs that don't work (Godia, 2006). The Ministry is intervening at a number of levels.

Although the computer was introduced in Kenya almost 30 years ago, the Internet was not introduced until 1993, and full Internet access was not established until two years later. Kenya's population in 2000 was a little over 30 million people; at the time, only 0.7% of the population was connected to the Internet. Today, with a population of almost 35 million, only 3.1% of the population use the Internet. The main users of the Internet in Kenya are government employees and those employed with private organizations. Outside of these entities, cyber cafés are the major providers of Internet service for the masses since fixed phone lines, computers, and electricity are sparse (Internet World Stats, 2007).

Although the microcomputer was introduced on a small scale to Kenya's secondary school children in the 1970s, the country's inadequate infrastructure—limited access to electricity, limited access to computers, lack of ICT teachers, and a high poverty rate—has kept Kenya from making massive advancement in ICT. Digital International reported that the "proportion of schools without electrical power range from 58% to 96% in some rural areas" (Kenya Ministry of Education, 2006, p. 2). According to the limited literature, Kenya has made some progress in ICT, from students' acquisition of basic computer skills to obtaining computer-aided training in the sciences but not in the humanities. These skills are being "accelerated by convergence of the computer and telecommunication technologies, particularly email and Internet" (Kenya Ministry of Education, 2006, p. 1).

It may be too early to know what impact ICT has had/is having/might have on Kenya's education. However, the limited research on the Internet has talked about "the rapid expansion of knowledge, improved examination outcomes, enhanced communication and technical efficiency [and] greater decentralization in the delivery of education services" (Kenya Ministry of Education, 2006, p. 1). But for Kenya, like for many other African countries, the digital divide is still a major challenge: "In Kenya, the ratio for university and colleges is one computer to 45 students, one computer to 120 students at secondary school level while access at the primary

school level remains much more limited at one computer to 250 students" (Kenya Ministry of Education, 2006, p. 1).

4. The Arab Republic of Egypt

4.1. Egypt: Basic education

Egypt, which has for centuries focused on agriculture, came to the realization in the 1950s that industrialization would greatly contribute to its economic growth. Egypt recognized that its progress to industrialization meant that its citizens must be educated; therefore, in 1923, Egypt instituted a free basic education system (Egypt, 2004; Egypt education, 2007). The noncompulsory levels include general secondary school and two types of technical secondary schools: one for technicians and another for high-level technicians (Arabian Campus, 2006). According to Microsoft (2006), Egypt's 36,332 schools of over 15 million students (which is 21% of Egypt's population) with 799,000 teachers make Egypt's educational system the largest in the Middle East and one of the largest in the world. Like in many Islamic countries, Egypt has two types of academic systems: the secular run by the Ministry of Education (MOE) and the Islamic run by the Ministry of Islamic Affairs (MIA) (Hawkridge et al., 1990).

In the 1980s, Egypt began experimenting with computers to advance its educational system. Hawkridge et al. (1990) believed that computers entered Egypt's schools with the aid of Changing Perspectives Limited (CPL), a U.K. company. At the initial planning meeting, CPL outlined the following objectives:

> T[o] advise the Ministry of Education on the implementation of Computer Education Project in secondary schools; to offer assistance to the Ministry to prepare a project proposal document for possible submission to aid agencies and to advise the UK Overseas Development Administration on future involvement in limited pilot activities. (Hawkridge et al., 1990, pp. 115–116)

At the beginning of this initiative, Egypt relied heavily on CPL because Egyptian computer experts—scientists/professors—seemingly the would-be obvious leaders in the innovation, were not familiar with using computers for educational instruction. According to Hawkridge et al. (1990), computer science professors having had experience teaching students at the college level about mainframe computing lack the training necessary to teach school-age children.

4.2. Egypt's current literacy status

Since the 1980s, Egypt has been moving full speed ahead in the technological arena. In 2000, 0.7% of Egypt's nearly 67 million people were Internet users; in 2006 when the population has risen to approximately 71 million people, 7.0% are Internet users (Internet World Stats, 2007). This rise is due to the government's commitment to ICT: To promote Internet service, the government provided free Internet access to governmental agencies in Cairo, NGOs, and other organizations. Furthermore, under its e-Access initiative, the government and a number

of private organizations have organized a number of programs including free PCs for citizens and free Internet service nationwide to promote computer literacy.

In 2003, the country became 1 of 190 developing countries involved in the United Nations Millennium Declaration. Egypt's Ministry of Communications & Information Technology (MCIT, 2005) reported that the country had adopted the Plan of Action of Information and Communication Technology (ICT) in order to modernize its ICT infrastructure, close the digital divide, and allow the country to move forward into the 21st century, believing that "[u]sing this foundation of infrastructure will allow a solid education base and opportunity to the population to adapt and use for themselves ICT developments" (MCIT, 2005, p. 4).

The Smart School Network (SSN) launched in 2003 aims at helping Egyptian students to begin computer literacy training after completing preparatory school to enhance their creativity and enable them to be successful in the modern workplace. The Smart School in Siwa, an oasis town inhabited mainly by the indigenous Berber people, is an excellent example of what e-Access is doing in remote communities. With the aid of special multimedia CDs and high-speed Internet connections, illiteracy eradication classes for women were held in schools and homes. This SSN project "gradually mobilized the community to take an interest in opportunities for socio-economic development using ICT" (MCIT, 2005, p. 16).

4.3. Egypt's future

Like many educational authorities around the world, the MOE has seized on technology as a way to better prepare the workforce for a competitive economy. A special unit within the MOE, the Technology Development Center (TDC), was formed shortly thereafter to coordinate the MOE's effort to infuse technology into schools (Warschauer, 2003). According to MOE, infusion of technology implies development in thinking, deducing, arranging of information, improving the performance of students, and increasing capacities of information exchange.

In 2003, the MOE and Microsoft launched the Junior Developer Program "to enhance the Egyptian workforce and advance the country's IT industry. This skilled workforce will enrich the economy and turn Egypt into an international IT hub" (Microsoft, 2006). The program, which offers basic programming concepts and creative thinking, caters to young people between the ages of 12 and 15, who are in their second preparatory level of public school. Only young people with proficiency in mathematics and English are selected. Over a thousand students were selected for the Microsoft program during the 2003–2004 school year; by the 2007–2008 school year, the program is expected to have trained over 5,000 students. Moreover, it is hoped that this program will help reduce unemployment and improve the economy.

Besides Microsoft, the MOE has partnered with Intel® to launch the Teach Essentials Online (TEO) program "to address the Egyptian teachers with methodologies and tools to help them integrate technology in their regular national curriculum" (AME Info, 2006). Egypt, the first country to launch the program, "serves as a pilot for other emerging markets world-wide" (AME Info, 2006). The TEO program inspired by the Egypt Education Initiative (EEI) in which Intel® pledged a donation of 8,000 computers for Egyptian schools. The company will also install two Wi-Max stations for more effective Internet connectivity in schools and an offer to train 650,000 teachers by 2010. Since May 2004, the Intel® Teach Program has trained

54,000 teachers in Egypt. With trainers and technical support from Intel U.S., "the program will run the first Train of the Trainer (TOT) for the TEO, so that there will be 25–30 Senior Trainers to train 200 Master Teachers who will cascade forward the learning process" (AME Info, 2006).

A Microsoft (2005) flyer, "Egypt Plants the Seed that Will Grow into a Flourishing ICT Community," described the Egyptian's government belief concerning information and communication technology: "Egypt's government believes that connectivity and technology need to be translated into economic activities in order to generate growth. . . [and] to see ICT being used to offer services, applications, and content that create new markets, reduce costs and increase productivity." Egypt's latest technology partner in education is Google. In December 2006, Google, in partnership with the Egypt's Ministry of Education, pledged to offer three million university students and eight million preparatory students, free email, instant messaging, and calendars (Daily Star Egypt Staff, 2006). Specifically, Google is offering each student two gigabytes of email storage, powerful search capabilities, improved filtering, and calendars. To this, Yousry El-Gamal, Minister of Education, said that this initiative "will encourage all preparatory school students to use the Internet as well as give them a sense of belonging to an online student community" (Daily Star Egypt Staff, 2006).

5. Conclusion

While much of the current research on educational technology is centered on its use in the industrial world, "instructional technology had a special allure in the developing world, where it holds the promise not just of improving schools but also hastening modernization" (Warschauer, 2003).

Higher education institutions, which are often shut down in civil unrest, lack the physical infrastructure to conduct programs and necessary research. Furthermore, computers and basic supplies like books are in short supply and worse, outdated. "In many African states, the research function has been seriously retarded. . . . When measured in terms of research and development outlays, Africa ranks last in the world with a total contribution to world research of 0.2 percent" (Hoffman, 1996, p. 85). Due to these factors and others not mentioned, educational institutions in Africa have paid little, if any, attention to computers and writing. What limited computers are available are used to train computer scientists and programmers. It is also not surprising that computers would be reserved for use in the hard sciences given that in the United States in the early 1980s the computer was new to the Humanities, and English teachers could not imagine the possibility of ever using the new technology for writing instruction. In the United States, many people in academe at the time erroneously believed that the number-crunching machine, the computer, was designed for computer scientists and mathematicians and not for those in the humanities, especially not for writers (Hawisher, Selfe, Moran, & LeBlanc, 1996). In developing countries, with large segments of the population living in extreme levels of poverty, it seems reasonable that new technologies would be relegated to the hard sciences for tangible development. Whether or not new technologies are relegated to hard or soft science, computer research must be conducted to determine how the technology can benefit developing countries.

There is no argument that Africans need life's basics, but technology is also necessary if Africa is to make advances toward bridging the digital divide. Africa's future economic independence and prosperity depends on its exposure to science and technology, and education is the medium through which science and technology can reach communities. Knowing this, a few developing African countries like Ghana, Kenya, and Egypt are making every effort to enter and make rapid advancement in this technological age. K.Y. Amoako, Executive Secretary, Economic Commission for Africa believes that with new technologies Africa "can leapfrog through several stages of development; cut the cost of doing business; and narrow the [digital divide]" (qtd. in AAU Report, 2000), but these thoughts will not materialize unless Africa invests greatly in the development of ICT in educational settings, especially at the higher education level.

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