

Getting ready for higher education: the role of ICT in secondary schools

Être prêt pour l'Université : le rôle des TIC dans l'enseignement secondaire

*Educational Research Network for West and Central Africa (ERNWACA) /
Réseau Ouest et Centre Africain de Recherche en Education (ROCARE)
www.ernwaca.org / www.rocare.org*

*Therese TCHOMBE, ERNWACA and University of Buea, Cameroon
Mohamed MAIGA, ERNWACA-Mali
Kathryn TOURE, ERNWACA
Moses MBANGWANA, ERNWACA
Mamadou Lamine DIARRA, ERNWACA
Thierry KARSENTI, University of Montreal*

for 2008 Biennale of the
Association for the Development of Education in Africa
www.adea-net.org

ABSTRACT

This paper brings theory and empirical evidence to bear on the integration of information and communication technologies (ICT) in education in Africa. New technologies are finding their way into schools in Africa and educators are experimenting with them with little support. The benefits of ICT for deepening the quality of learning are very real, as international research demonstrates. However, little research has been undertaken on the process of integrating ICT into African education systems and on training teachers to use ICT effectively. This paper describes one effort to fill this gap. The Educational Research Network for West and Central Africa (ERNWACA) and the University of Montreal researched the integration of ICT in education with students, teachers, school directors, and parents in 36 schools in Benin, Cameroon, Ghana, Mali and Senegal.

Results show that the use of ICT can help secondary school students develop the cognitive skills necessary for higher education and for life when accompanied by appropriate pedagogies in school. However, teachers need access to ICT and opportunities to learn how to use them and integrate them in their teaching. When teachers integrate ICT into their teaching and into student learning, they tend to adopt more active and interactive pedagogical approaches that better prepare youth for a world of instability and mobility in which it is not how much we know that matters but how well we are able to learn, to adapt and to create. The use of ICT can support inquiry-based learning in ways that thin or inaccessible textbooks in Africa cannot. These trends in learning and teaching need to be understood and guided by educators and those responsible for education systems in general and teacher education in particular. This paper seeks to inform them and the processes they manage in order to maximize the benefits of ICT for pedagogical reform and improved quality of education.

1. Introduction

The African Union made revitalization of higher education one of seven focus areas for the second decade of education in Africa (African Union, 2006). Higher education, research, and innovation are paramount to the development of the continent (Muchie, 2004), yet unemployment has become a disincentive to the pursuit of education in Africa (Obanya, 2004: 145). What is to be done? Emerging knowledge societies and dynamic economies require new competencies. Obanya (2004) stresses the need to expose students to different ways of knowing before introducing specialization (p. 145). Today's learners need to build core generic skills that include analytical power, communication, adaptability, interpersonal skills, creativity, team spirit, IT fluency, the spirit of inquiry, and learning as a way of life (Obanya, 2004: 145; Obanya, 2007: 12).

When should IT fluency begin and how does it help build other skills required in the 21st century? How does engaging with it help learners transition from secondary school education to higher education? What potentials and dangers do information and communication technologies (ICT) represent for African education systems? This paper draws on education theory and empirical evidence from classrooms in Africa to discuss how the pedagogical use of ICT in secondary schools can contribute to learning critical thinking, problem solving and research skills and thus contribute to better articulation from upper secondary to higher education.

2. Context of ICT in education in Africa

Secondary school gross national enrolment rates on the continent are around 30% and for higher education around 5%. (UNESCO, 2007). While there is the need to diversify education and make it more widely available, there is the need to ensure it reflects the aspirations of African peoples (Nyamnjoh, 2004) and to improve the quality of teaching and learning, which could in turn increase access rates. The education sector in many African countries is so "aid" dependent that dependency is internalized and there is little looking "inwards" for assistance (Obanya, 2007: 28). While ICT use can increase dependency, it can also open new horizons and provide pathways for learners and teachers to acquire skills needed to benefit from and contribute to society in the 21st century. The way the integration process is managed is determinant and we should be aware of the issues as we integrate ICT into education at all levels.

Need for a move from Teaching to Learning

Education is all too often "bench" education in which teachers try to "transfer" knowledge to passive students. This does not encourage students to actively engage and to build their knowledge in socio-constructivist ways. Numerous scholars have shown the need for a shift from teaching to learning (Matchinda, 1999; Tchombe, 2006). In student-centered pedagogies there is a shift from teaching to learning and students are not only active learners but assume responsibility for their learning. ERNWACA (2006) and other research results have shown that ICT can support this shift to a focus on learning and to the socio-constructivist teaching methods the shift requires.

Factors that limit integration of ICT

In African contexts, several factors limit the scope of the integration of ICT into education. First, there are access issues. Learners in urban areas are favored over those in semi-urban and rural areas. This discrimination is due both to inadequate policy and practice to ensure equitable access and to the inexistence of electricity in many rural schools. When there is access to computers and Internet in schools, it can be limited to a mere 2 to 3 hours per week for each student, for example in Mali (PanAf Edu, 2008: 2), and students are often favored in access over teachers, yet students need some guidance in order to use ICT for pedagogical purposes (Ndoye, Dione, & Kane, 2002; Noudogbessi, Azonhe & Lodjo, 2002). The integration process is often focused on technology rather than human resources development and can be wrought with dependence on partners outside the school. Rather than helping schools move toward more autonomy in equipment maintenance, software configuration and ongoing human resource training, some partners, in the interest of financial profits, prefer to keep control of these areas and lock schools into dependency relationships (ROCARE, 2006: 15).

There is still a focus on teaching ICT and only sporadic success in moving to teaching and learning the pedagogical use of ICT. ICT are taught rather than used to enhance the quality of teaching (ROCARE, 2006: iii). There is growing consumption of Web content by teachers and learners in Africa and limited efforts to reform the curriculum accordingly and to develop digital content by Africans for African educational contexts.

Teachers are insufficiently involved in the integration process and their realities and concerns insufficiently considered. An excellent teacher can learn to use ICT to enhance teaching but the reality is that most teachers have insufficient time and support to learn the pedagogical use of ICT, and they find themselves in overpopulated classrooms and sometimes less than desirable working conditions. Teachers who do have access to computers use them to prepare their lessons, to type exams, and to calculate grades (ROCARE, 2006: 16). Teachers who have used ICT for pedagogical purposes have attested to the benefits in communicating abstract concepts, for example in the sciences. Teachers confirm that using ICT or having students in their classrooms who use ICT makes them begin to question and even transform their pedagogical approaches. In the process, students become more active in their own learning.

3. Theoretical framework on competences for succeeding at University

To succeed at University learners need to know how to learn. University is not a place to sit and wait for learning to be delivered. Students must develop a sense of intellectual autonomy in which they discover and deepen their centers of interest. They must know how to ask good questions and where to go for answers. They must be able to solve a variety of theoretical and practical problems. They need a critical spirit to engage in higher order thinking that involves analysis and evaluation. With such skills, students will be prepared for the thinking, research and writing required of them at University level, especially within the context of reforms toward BA-MA-PhD tracks (“LMD” in French). An appropriate use of ICT in secondary schools can help foster development of these very skills.

The use of ICT can help develop complex cognitive skills when students are taught to apply the process of problem solving and given the opportunity to use technology to resolve problems. Group work using the computer to resolve problems helps develop higher level

cognitive skills as does student use of communication tools to edit, present and share results of a project (Barrette, 2005).

What do we mean by higher cognitive skills? Anderson and Krathwohl in 2001 adapted Bloom’s Learning Taxonomy, to show that higher cognitive skills like analyzing, evaluating and creating are built upon the lower levels in the taxonomy that include remembering, understanding and applying. Below is a figure illustrating progression from one qualitative level of thinking to another.

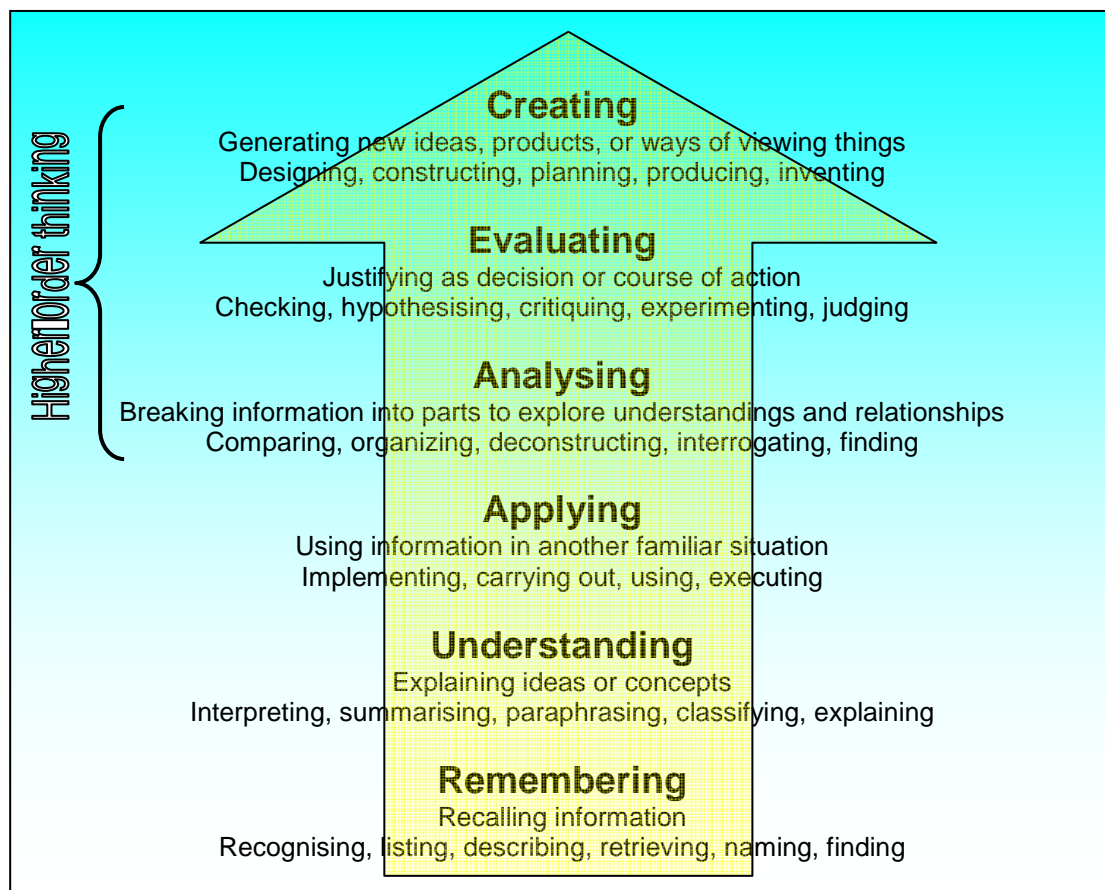


Figure 1: Learning Taxonomy of Bloom (1956) as revised by Anderson and Krathwohl (2001); adapted from representation by Tarlinton (2003)

Teachers can use ICT to help support each level in the taxonomy. For example, information can be stored and displayed on a computer to help with or test remembering. Internet can be used when encouraging understanding of new concepts. Using particular software could allow students to apply understanding to new situations. Continuing to move to higher cognitive skills, students can use the computer to help them organize materials or ideas and to foster analysis as well as evaluation and problem solving.

“At the highest taxonomic level is the deep processing that is promoted by the design or construction of integrating projects. Most of the processes represented at the lower taxonomic levels are brought together in the design of projects, for example, perceptions are built through sensory inputs. Such inputs stored as information for further manipulation should start with understanding and comprehension. In the development of powerful projects,

students must explore ideas and resources, and analyze and evaluate information in a final synthesis” (Karsenti, Tchombe, Toure, Ngamo, & Maiga, forthcoming).

4. Multi-case study methodology

Qualitative and quantitative methodologies were used to gather and analyze data from primarily secondary and a few primary schools in Benin, Cameroon Ghana, Mali, and Senegal. The case study approach was used in which researchers explore a single entity (“the case”) limited by activity (i.e. a process) and collect detailed information by using a variety of data collection methods during a sustained period of time (Stake, 1995). The study took place in 2004-2006. Because there were 36 “cases” in five countries involved, the study was a multi-case study. Case studies are valuable in the sense that they provide qualitative explanation consistent with the inductive model of thinking. Cases are selected in relation to their potential to contribute to reaching the research objectives as opposed to a statistical model of representation. Cases for this study were selected based on criteria such as the presence and pedagogical use of ICT while ensuring diversity in terms of public/private schools and geographic location and socio-economic factors in the country.

To respond to the objectives of understanding the process of integrating ICT into education particularly in relation to access to ICT, use of ICT, effects of ICT use and the durability of integration efforts, data was collected from six sources: official documents and other documents produced by schools, teachers, and students in the context of the teaching-learning process; literature on ICT in schools; opinion surveys; interviews; focus group discussions; and school and classroom observation.

The total number of persons who responded to the opinion surveys in the 36 schools included 66000 students and 3000 teachers. Individual interviews were conducted with school principals and other administrators, pedagogical advisors, computer lab monitors, teachers, students and parents. To reinforce interviews, focus group discussions were conducted with the teachers and students and some parents for more qualitative information and for the purposes of triangulating sources of data. Observations were carried out in all 36 sites by national and in many cases regional research teams to see the nature of the practices and the availability of resources.

5. Results from the research in five countries

Results are presented first in relation to student motivation. Then we review the kinds of information that students and teachers access on and offline. We will also look at how ICT use is related to academic learning and more active learning. ICT use promotes collaborative work involving learning across borders, intercultural learning, and learning through group work. Finally, we present student perceptions of linkages between ICT, securing employment and furthering formal studies.

Student motivation

In all of the schools studied, learners’ interest and motivation were heightened through the use of ICT. Students were found to be on time for classes, more research oriented and faster in learning their subjects when ICT was involved. ICT use even contributed to decreased absenteeism in some schools. Computer labs open during recreation periods are usually full of individual and groups of students who send messages to classmates, review or deepen

subjects covered in class, research answers to GlobalTeenager quizzes from other schools, and even in some cases develop web sites or blogs for communicating and sharing with others. One student explained that “the computer ... helps me to know many things, to communicate, to discuss.”

Complimentary information from Internet and off-line sources

According to the interviews, teachers and parents feel that information accessed from Internet opens up new opportunities and thus contributes to higher quality training. Teachers update their lessons more regularly and students bring information from the Internet to bear in assignments and classroom discussions. Teachers and students who use Internet in relation to pedagogical objectives are more informed than before and teaching and learning processes are deepened to some extent; however it is too early to know the impact on academic success. “Its importance is undeniable, even if we cannot quantify what is not yet in our habits.”

As far as relevance of Internet content for teaching and learning in Africa, opinions are mixed. Teachers and students both provide long lists of materials consulted for coursework. Biographies of historical figures, for example, are researched on the Internet, however, students claim that the works of literary figures from Africa are harder to find even if their biographies are available. Science teachers are known to take visuals from Internet to support lessons on human anatomy. Sometimes computer animations, especially for those who do not have the privilege of using a science laboratory at school, help students better understand concepts in the physical world, for example related to astronomy and geology. Geography teachers explained that they save time by printing a map from Internet as opposed to taking several minutes at the beginning of class to draw it on the board. One student explained that Internet “helps me ... to see the lessons.” Civic education teachers have produced course materials, incorporating information available on the Internet, when manuals for that subject at the appropriate grade level had not yet been produced. Math and language teachers suggest sites to their students for additional explanation and practice of concepts covered in class, and language teachers refer students to sites with online and self correcting exercises in grammar. The materials consulted and used come from sites off the continent as well as a few sites on the continent, not to mention Microsoft Encarta encyclopedia on CD-ROM.

Teachers use ICT to produce typed texts, multimedia presentations, and other visuals to enhance their teaching. Students conduct Internet searches for information to compliment classroom discussions. Some schools also produce Web sites as a window for interfacing with students and former students and schools in other countries.

However, both teachers and parents complain that current Internet content is not sufficient for the needs of learners. Adaptation is required. They encourage efforts to support the production of appropriate digital learning materials, i.e. by Africans for Africans.

Parents, whether literate or not, support ICT use by their children, while expressing concerns not only about inappropriate or pornographic content but also about tendencies to become machine dependent and less interested in reading and writing. Parent teacher associations dedicate financial resources to ensuring that their students have access to ICT at school and individual parents, especially in Ghana, insist that governments make more efforts to ensure such access to all children within the nation. Parents seem to believe that ICT use is part of the secret of success for their children as they move from school to university and the world

of work. Parents insist on access for their children but do not seem to be aware of or insist on the support teachers need to guide students in the pedagogical use of ICT.

In addition to citing the benefits of ICT for academic work, students also developed discourse on the necessity of ICT in today's "modern" world to "fit in" and "go far":

We are now in the computerized age and so for that matter anyone who doesn't know how to use the computer is a bit strange to this current world.

Information which used to be stored on sheets of paper is now being stored on the computer so it can be easily retrieved at any time.

Academic and active learning

Students explained how ICT helped them with schoolwork. "The work is easy when you know how to use the computer; it is a teaching method that helps to complete the lessons received in class. / Working on the computer helps us to learn. It stimulates us to work and to do research. / If we have not understood a lesson in class, Internet will help us to understand it. / We don't have to consider only what we have learned in class, Internet is there to complete our information." Students use computers and Internet to type notes and assignments, do exercises online or from a CD-ROM, and search for information related to lessons.

ICT use can promote more give and take between teacher and student, shifting not only more responsibility for learning but also means to the student. One student explained:

The teacher must do 40 percent of the job and the student must do 60 percent. When the teacher comes to teach biology if I don't understand something I need more information, so I go to a search engine, Google for instance. I type what I am looking for and it gives a whole lot of information. I print them out and then I add them to my notes so as time goes on, I refer to them. I compile huge questions and come and ask the teacher.

Students also described problem solving using digital educational materials such as CD-ROMs: "Some of the software helps me in ... solving certain mathematical problems. If someone asks me how I would find the area of a circle, I won't know, so I'd go there quickly and look and learn it."

With regards to whether the computer is actually enabling the students to learn more, students gave examples of being able to get additional information on the internet, beyond what available books provide, including about African politicians and writers:

I think the computer is allowing us to learn more because there is certain information you can't find in books but when you go to the internet, you can get a lot of information. For instance with what my friend is saying about Kwame Nkrumah, we have some books which are outmoded and which can't get you the needed information. But currently, we can get all the vital information about him from the net.

A science student explained that the net "acquaints me to the world. It helps me know what is going on around my sphere and my field of studies." And another student explains how the computer helps in learning by allowing students to practice what they are learning and learn by practice:

It's like hearing a story. It's difficult to remember most of those things, but if you do something practically, you can sit down and remember what you did practically. You are able to remember that more than just somebody coming to stand in front of you and telling you. So I think there is quite a gap between those who use ICT and those who don't.

While teachers said that educational software used in the schools is “not so foreign,” they also insisted that African countries get more involved in developing ICT-based learning materials. Though both teachers and students spoke of “living in a global village” and needing to access learning materials and information from around the world, there was also concern for the development of materials by Africans for Africa.

The majority of the learners held that the computer, to a very large extent, actually helps in academic work. The perceived level of importance of the use of the computer for general knowledge, research and the acquisition of jobs was almost similar between boys and girls. The main differences were found in the academic and communication purposes for which females readily valued and preferred the use of the computer more than the males did. In all, students found lessons of teachers using ICT more interesting than the others.

Learning across borders all life long

Students report that Internet “helps me to be connected with the world, to collaborate with other people. / I discuss with my correspondents to get and to give information. / I also send messages to my classmates. / It is worthwhile for research and knowledge.”

Students exchange with classmates and with students in other schools on and off the continent. This links them into a larger world. “I feel out of my country when I work on a computer, sometimes I have the feeling that I am traveling. / It helps me to be connected with the entire world, to collaborate with other people.”

Students access computers and internet at school, in cybercafés and at home though school was the most common place of access.

Students talked about lifelong and intercultural learning without referring to it as such:

You know learning nowadays is a global phenomenon, it's all round, you can't learn only in your country, so with the internet and its educational facilities, one is able to learn worldwide, learn around and not only focused on your country.

The initiation of ICT in Mozambican secondary schools was initiated in part to “accelerate sustainable development in the country by empowering secondary school graduates for lifelong learning” (Cossa & Cronje, 2004: 92).

Training and collaboration

Internet has been an impetus for collaboration among teachers. Teachers report sharing and reviewing together content and exercises from the net to improve courses. However, many complain that they have never been trained in the use of ICT though students in their school are expected to use it every week. Training activities may be planned but not realized, in large part due to teachers' busy schedules. One teacher, who could be characterized as a self-learner, explained, “I never wait for training, I learned myself by doing.”

The idea of students sharing and learning from each other through group work was prevalent in the interview transcripts:

I for instance, I did not know anything about [Web site development] until Aya taught me, so I think she is not all that greedy because she wants everybody to know the kind of things she does. She wants to share some ideas which is the idea behind group work.

When you are working on the computer, we work in groups because when we work in groups, the group members bring ideas about what you are doing so that whatever you are doing you do as a group and the accomplishment comes to all.

Other studies (Kozma, McGhee, Quellmalz, & Zalles, 2004: 369) confirm that technology supported projects that provide opportunities for collaboration among students are more likely to lead to the development of problem solving skills.

Group work with the computer and Internet was prevalent not only among teachers and students, but also to guide the integration of ICT into educational initiatives. The integration process requires leadership and teamwork. Schools that had a team of people with strong team leaders responsible for ICT at the school seemed to be on the path for durable integration.

Employment and further education

Students perceived linkages between knowing ICT, getting employment, and continuing their studies:

It's given me some talents I think I can use for life. Sometimes, you have to go to a whole business centre to learn how to use the computer. But since we are paying a little money at school to learn to use the computer, especially Excel, I can confidently finish school and look for a company that uses Excel and that would create employment for me.

Again, it creates employment. There are some white collar jobs around that you cannot get but when you go to the internet, there are some jobs that our qualifications suit nicely so it really helps us to learn it. You know even if you want let's say after your education you want an employment as even a storekeeper just to get you going until you go for further studies.

Well using Word for instance, I have been able to produce some documents for my self and using Excel, I have designed a template for our departmental accounts and also using paint I made an advert for an excursion and printed it. So it's created some employment for me.

Other students explained how they thought they had better chances of success on standardized examinations if they were ICT users and teachers and school directors confirmed that students who used ICT seemed more likely to receive scholarships to continue their studies.

6. Discussion of results in relation to gender and using ICT to prepare for University

Appropriate use of ICT in secondary schools contributes to a variety of changes. ICT use motivates students. Teachers find themselves updating their lesson more frequently and using more active teaching methodologies. Students become more active in their own learning and contribute both in and outside the classroom. In addition, learning crosses borders more fluidly, going for example beyond the classroom into homes and communities and other venues such as cybercafés. It also crosses national boundaries when schools enter into contact with each other through sustained electronic communication and cultural exchange.

The ERNWACA and University of Montreal study of 36 schools showed that ICT is first introduced into schools as a subject area. ICT use may be limited to a couple of administrators, the ICT teacher(s) and his or her students. However, it is when most teachers have the opportunity to learn and use ICT that we begin to see the pedagogical integration of ICT into teaching and learning processes. Then we will see that ICT is more than a subject but rather a mechanism to encourage more inquiry-based learning than textbook-based education in Africa could not previously support. We say that there is pedagogical integration of ICT when teachers actually use it to teach their various disciplines and, more importantly, get their students to use ICT to learn.

Students in urban cities in Africa have been frequenting cybercafés for almost a decade. However, the activities they engage in are not necessarily pedagogical (Noudogbessi, Azonhe, & Lodjo, 2002). Students need pedagogical guidance to ensure that their computer time is actually contributing not just to their leisure but to their intellectual development. However, some teachers, lacking orientation themselves yet feeling compelled to respond to new teaching requirements, send their students directionless to cybercafés to “conduct research.” There is a desperate need for teachers to learn how to guide their students’ research efforts at secondary level, discussing, for example the reliability of different sources of information available on the Internet and teaching how to synthesize information.

Learners, educators and parents alike have explained that exposure to ICT at secondary school level provides students with advantages as they transition from secondary school to higher education and the world of work, especially, as in other studies, because of “improved skills in reasoning with information, communication skills, knowledge of other cultures, better attitudes toward school and technology, and, of course, improved technology skills” (Kozma, McGhee, Quellmalz, & Zalles, 2004: 379). Students in several different countries who used computers (through the World Links program) even had higher end-of-year ratings on their abilities in these areas than students who do not (pp. 371-72).

Motivation, attitude and interest of students

The way ICTs are used can be a motivating factor in schools and contribute to positive attitudes toward learning. However, if ICT is used in traditional pedagogy in which students are not actively involved in their own learning, ICT is not likely to have motivational effects. For example, some teachers use ICT to deliver a “cours magistral” or to “keep students busy” rather than to develop their eagerness for learning (Karsenti, 2003b: 3). Students know many things learned outside school and can find school boring. ICT can bring various real worlds to students and provide stimuli and motivation for learning. In the 36 primary and secondary schools studied by ERNWACA and University of Montreal, it was found that learners’ interest and motivation were heightened through use of ICT. “Students were found to be on

time for classes, more research-oriented, and faster in learning their subjects when ICT was involved. Students had so much interest in their lessons that they hardly ever missed classes.” However, in these West and Central African contexts where computers were introduced in the schools beginning in the late 1990s and early 2000s, there was a certain “over concentration” on ICT courses as certain students explained they would be sure to come to school on days when ICT would be used but may continue to skip other days.

As far as differentiated interest and motivation level among girls and boys, research does not show significant differences, except that boys tend to like to play games on computers while girls consider it more of a tool for work and learning (Karsenti, 2003c: 2; ROCARE, 2006).

Reaching both female and male learners

Women and girls are poorly placed to benefit from the knowledge economy because they have less access to scientific and technical education specifically and education in general (Huyer 2003). These disadvantages have prevented women and girls from benefiting equally from opportunities that ICT can bring. Integrating ICT in secondary schools and ensuring access for both students and teachers should enable: a/ improved pedagogical practices making teachers and students real partners in the search for knowledge, b/ increased number of boys and girls transiting from primary to secondary and secondary to university education especially for girls, and c/ enhanced capacity in content areas and skills development for using computers in meaningful ways to establish a well motivated person ready for university learning. So the essence of integration should be to incorporate technology in a manner that will benefit learning at all levels and situations.

Technology usage as pointed out by Dockstader and Idaho (1999) means having the curriculum drive technology usage, not having technology drive the curriculum. With this principle ICT should be of value to both female and male students to enable them to address depth with content and move beyond the given, demonstrating understanding by applying and analyzing and transferring knowledge to different problem solving contexts. Children exposed to ICT very early in nursery and primary schools as is the case of École Oiselets in Bafoussam in Cameroon would have the added advantage of being accustomed to using ICT, consequently getting acculturated with its characteristics that intimidate in particular girls from becoming computer literate. Being material for university education depends on many factors and one of these is the modernized pedagogic strategies that are gender sensitive and should be built in the curriculum process to enhance learning and improve on the learning capacity of the learner.

The concept of information technology as an important development mechanism is still a fairly recent phenomenon in many developing countries (Liverpool, 2002). Today many students use ICT to create knowledge and develop skills. But the issue of gender and ICT remains complex as demonstrated by low female participation rate, which has been attributed to a temporal factor inhibiting commitment to learning new programs and browsing the internet for research, and even low level of interest shown towards ICT related tasks, the absence of role models and negative cultural attitudes (Liverpool, 2002: 2). ICT is sometimes perceived as male dominated just as the profession of computer engineer. Females are considered not to have the potential to cope with using the computer. Explanations of gender differences in the use of ICT may draw on the structural differences from a biological perspective as we make reference to the right and left hemispheres and the hypothesis that the female brain is very active as it uses its resources and does so quickly. The female brain,

which is never at rest, has a true learning advantage (Gauvain, 2001). The issue of brain-based gender differences has created a gender advantage/disadvantage hypothesis, in which girls in particular are seen to be disadvantaged in acquiring technological skills. Yet literature is replete with marginal gender differences on this account (Maccoby & Jacklin, 1974). But there exist some functional differences that perhaps can explain enduring female behavior of which teachers are not very aware. Gender differences could be discussed with regards to gender differentials in meta-cognitive skills that support the knowledge acquisition and management process; skills that are necessary for the use of ICT. Where weaknesses are identified referrals and consequently intervention mechanism should be put in place for remediation.

Yet using ICT for learning does improve learning capacity and makes the learner focused on the process for acquiring knowledge and at the same time the content of knowledge. Of course, the active uses of ICT require many competencies. If the emphasis in learning focuses more on the constructivist paradigm in knowledge and skill acquisition does this have a gender implication, where boys are always more active than girls in the acquisition process? It is a truism that knowledge is not simply acquired; it is created and recreated on the basis of previous learning. Knowledge is co-constructed. Therefore schools have a major role to ensure that all its clients irrespective of gender should be made to contribute equally to the knowledge construction process. Surely, all human beings are constantly searching for meanings; this is the case for both female and male learners. So the question raised is gender differentials in the use of ICT to enhance concentration on cognitive processes and consciousness on how knowledge is acquired in formal learning contexts. Emerging is whether there are gender differentials in learners' motivational and belief systems and attitudes, the degree of which should have cultural implications. Preparing children for transitions and in particular transitions to university education necessitates reconstruction of the educative process and in particular its pedagogic strategies. What is most important is not the content per se but how to go about obtaining meaningful content. There may be individual differences as concern gender and even social class. How is such knowledge use to strengthen the learner?

Support from the aforementioned can be found in the findings of the transnational study presented in this document. Evidence showed that access through integration has increased expectations, which has affected students' and even teachers' motivation. In addition absenteeism has reduced and participation in school increased. In this way, the effects could be far reaching in also reducing dropout rate which is usually more common among girls than boys. Boys were seen to demonstrate more positive attitudes than girls towards the impact of access to ICT such as: "It enriches me with information as a student. / It is interactive. / It helps me understand my lessons. / It helps me know as many things as my teacher." They further affirmed that the use of computer is indispensable today. Piaget and Vygotsky made references in their respective theories about the role of peer tutoring. This was well demonstrated particularly as one of the major problems facing girls in the use of ICT is manipulating the machines. Peers helped solve problems of their classmates who ran into technical difficulties. There were no gender differentials in this kind of support because girls, besides scoring high evaluation marks, were also identified as experts who teach others how to connect to the computer and operate it. Pertinent issues observed in the findings were comparability between boys and girls and their use of computers (66.7%) and girls concentrating more once they gain control and skill in use. Many more girls (61%) focus on computer literacy. The students, most especially the girls (34%) said computer is something "very important."

Richards (2005) also reports on a number of studies that highlight the fact that computers are widening the gender gap in schools, as boys spend their spare time playing games on the computer while girls use them for homework. Computer sciences applied to education have been causing a real revolution in the teaching and learning process. Learners are active in constructing their own knowledge and social interactions are important to knowledge construction. Students interact with other students and with teachers in ways that stimulate both knowledge construction and cognitive growth. Access plays a great role in students' meta-cognitive processes for judging, organizing, and acquiring new information (Bruning, Schraw, Norby, Ronning, 2004). Based on these views ICT can provide learning opportunities for girls as well as for boys preparing for university education that require strong research skills. But there is the need to understand ICT and the way it can pedagogically constrain or enable particular activities.

From the transnational study reported above, gender parity in internet access seems less serious a problem than the inherent sexism in patriarchal school culture that intimidates the girl. What emerged is the fact that boys are more aggressive users of ICT than girls because of cultural and institutional barriers in some if not most cases. Girls need to be encouraged to address their knowledge and skills in ICT; they possess already such potentials but need to better harness them with support from teachers knowledgeable and competent in using ICT in teaching and learning.

Changing pedagogical approaches that incorporate participation – through small group work and collaborative and peer tutoring – demonstrate the enabling effect of these approaches in instituting gender parity in ICT classes, as observed in the transnational study. It was observed that girls with more autonomy and intrinsic motivation were able to control activities in the same way as the boys and were seen to offer support to peers requesting such support, as in the case of Longla Comprehensive College in Bamenda in Cameroon.

Wentz (1997) referred to an agenda converging to transform students' learning and accomplishment. Among the issues mentioned was integrating new technological advancements. Research (Wentz, 1997) supports the theory that technology and use of computers can add value to learning when thoughtfully integrated into the curriculum. Teachers using technologies report that they are more comfortable with students working independently and are able to present more complex materials. Universities in the ECOWAS and CEMAC zones are adopting the BMP/LMD model: Bachelors degree, Master and PhD. The focus is student-centred instruction, tailoring instructions more to meet individual needs of students, and actually expecting more student input (Poole, 1997: 10). Using ICT has great implications for the development of critical thinking, for example when students have to make decisions about which material to select from the Internet.

Both boys and girls acknowledged that using ICT has increased their productivity as students. However, both boys and girls tend to be equally disadvantaged in using these tools. AAUW (2000) posited the goal that, “instead of trying to make girls fit into existing computer culture, the computer culture must become more inviting for girls.” There is therefore the need to develop gender specific indicators on ICT and mainstream and monitor gender perspectives in all ICT initiatives.

7. Recommendations: ensuring quality and equitable ICT use in secondary school for higher education

Six major recommendations flow from the research on use of ICT in secondary school that can enhance the use of ICT so as to better prepare learners for higher education.

- Policies for integration of ICT in education

A coherent national policy and multi-year action plan provides a framework and supports educators and institutions in their attempts to integrate ICT. African countries may have a national ICT policy, but not all have policies for integrating ICT in education.

- Subsidized Internet connections for educational institutions and curriculum development

Educational institutions more and more need computers and access to Internet. Government can assist by removing levies from computer equipment and ensuring there are special Internet rates for educational institutions. Financially well off parents contribute to use of ICT at school, but government needs to ensure that all secondary school teachers and students have the opportunity to learn and use ICT, regardless of geographic location and socio-economic factors. Beyond access, government and other partners should facilitate efforts for African-based development of digital content at national and regional levels.

- Going beyond teaching ICT and getting students to actively use ICT to learn

ICT is most effective not just when teachers use it but when they get learners to use ICT to learn. This is in keeping with the need to integrate more socio-constructivist teaching methods and move toward more active pedagogies. This will lead to less teaching and more learning.

- Training and mobilizing the pedagogical team

School directors are the first teacher trainers. They must create an environment conducive to learning and professional development. They should encourage innovative teaching initiatives and recognize creativity. One person cannot be responsible. Pedagogical change requires shared commitment and teamwork.

- Participating in networks and communities of learning

Teachers also need to be responsible for their own professional development and should take the initiative to become involved in committees, associations and other groupings where peer exchange and learning is nurtured. They can help involve the school and students in communities of learning that extend beyond school and national boundaries.

- Developing and managing partnerships

ICT integration in teaching and learning requires new skills at the institutional level, namely in the developing and managing partnerships. Schools that do not breed these skills in their personnel risk becoming overly dependent not only on government but on private contractors and other commercial adventurers.

8. Conclusion

We truly hope that this paper has demonstrated that ICT plays a significant role in preparing secondary school students for higher education. In this manuscript, we tried to bring both theory and empirical evidence to bear on our argument. Among others, we highlighted the very real benefits of ICT for deepening the quality of learning.

We also pointed out that, although many efforts are underway, including the noteworthy PanAf¹ project and the many initiatives undertaken by ERNWACA,² little research has been conducted on the process of integrating ICT into African education systems or on training teachers to use ICT effectively. This paper attempts to contribute to fill that gap.

The Educational Research Network for West and Central Africa (ERNWACA) and the University of Montreal have investigated the integration of ICT in education with students, teachers, school directors and parents involved in 36 schools in Benin, Cameroon, Ghana, Mali and Senegal. Scientific publications and books will soon be published based on the empirical data collected. Preliminary results clearly show that the use of ICT helps secondary school students get ready for higher education. How? By developing both the technological and cognitive skills they need for higher education and for life, but only when *helped* by appropriate pedagogies in the classroom. As explained in this paper, teachers who pedagogically integrate ICT into their curriculum nurture student learning in a variety of ways. Moreover, they tend to embrace more open teaching strategies that help prepare high school students for a world that will never stand still, and where learning becomes a dynamic process. It is not how much we know that matters, but how well we learned how to learn, and how well we can adapt, communicate and create. African students using ICT to engage more actively in their learning. These new trends in education need to be understood by teachers so they may maximize the benefits of ICT for pedagogical reform and improved quality of education.

The six key recommendations aim to enhance the use of ICT in order to help prepare learners for higher education and for the 21st century, worlds in constant evolution.

Bibliography

AAUW. (2000). Tech-Savvy: Educating Girls in the New Computer Age:

Adésinà, J. (2006). When is 'techno-talk' a Fatal Distraction? ICT in Contemporary Development Discourse on Africa. *Africa Development*, 31(3), 120-153.

African Union. (2006). The 2nd Decade of Education for Africa: 2006-2015 Plan of Action. Addis Ababa, Ethiopia.

Akouete Hounsinou, F., Azonhe, T., Adjibodou, A.A., Biaou, A., Dakpo, P., & Noudogbessi, T. (2005). *Intégration des TIC dans l'éducation en Afrique de l'Ouest et du Centre: étude d'écoles pionnières, cas du Bénin*. Rapport de recherche. Porto Novo, Bénin : ROCARE-Bénin.

www.rocare.org/RapporFinal_BJ-Phase1TIC2005.pdf

Anderson, L.W. & Krathwohl, D.R. (2001). *A taxonomy for learning, teaching and assessing: A revision of Bloom's taxonomy of educational objectives*. New York, New York, USA: Longman.

Bahi, A. (2006). Les universitaires ivoiriens et Internet. *Afrique et développement* 31(3), 154-176.

¹ www.observatoire-tic.org

² www.ernwaca.org

Bandura, A. (1993). Perceived Self-Efficacy in Cognitive Development and Functioning. *Educational Psychologist*, 28(2), 117-148.

Barrette, C. (2005, March). Vers une métasynthèse des impacts des TIC sur l'apprentissage et l'enseignement dans les établissements du réseau collégial québécois. *Clic Bulletin collégial des technologies de l'information et des communications*, 57.
<http://clic.ntic.org/cgi-bin/aff.pl?page=article&id-1060>

Beukes-Amiss, C.M., & Chiware, E.R.T. (2006). The impact of the diffusion of ICTs into educational practices: A review of the Namibian situation. *NERA Journal*, a publication of the Namibian Educational Research Association (NERA), 2005/2006, 29-45.

Borgartz, L. (2002). *Digital Media and Cultural Exchange: Representation, Self-representation and the Fiankoma project*. Digital Media MA Report. Consulted 28 January 2007 at:
www.fiankoma.org/pdf/Digital%20Media%20and%20Cultural%20Exchange.pdf

Boshier, R. (1999). Lifelong Education and the World Wide Web: American Hegemony or Diverse Utopia? *International Journal of Lifelong Education*, 18(4), 275-285.

Bruning R.H., Schraw, G.J., Norby, M.M., & Ronning, R.R. (2004). *Cognitive psychology and Instruction* (4th ed.). Upper Saddle River, New Jersey and Columbus, Ohio: Pearson Merrill Prentice Hall.

Chisholm, L, Dhunpath, R., & Paterson, A. (2004). *The use of ICTs in the curriculum in Botswana, Namibia and Seychelles*. By Southern African Comparative and Historical Education Society (SACHES) for Southern African Development Community Education Policy Support Initiative (SADC EPSI). Consulted 16 February 2008 at:
www.nied.edu.na/publications/other%20resources/ICTs%20FINAL%20REPORT.ag.8.6.2004.pdf

Cossa, G.G., & Cronje, J.C. (2004). Computers for Africa: Lessons learnt from introducing computers into schools in Mozambique. *International Journal of Learning Technology*, 1(1), 84-99.
www.schoolnetafrika.net/fileadmin/resources/Computers_for_Africa.pdf

Cruz, E. (2003). Bloom's revised taxonomy. In B. Hoffman (Ed.), *Encyclopedia of Educational Technology*.
<http://coe.sdsu.edu/eet/articles/bloomrey>

Defise, R., & Simbagoye, A. (2007). *Gestion de classe et acquisitions en français dans un processus d'intégration des TIC dans les apprentissages de base d'élèves d'une école élémentaire au Sénégal*. Dakar, Sénégal : Editions des Ecoles Nouvelles Africaines (EENAS).

Depover, C., Karsenti, T., & Komis, V. (2007). *Enseigner avec les technologies : favoriser les apprentissages, développer des compétences*. Québec, Canada : Presses de l'Université du Québec.

Dewey, J. (1990). *The School and Society: The Child and the Curriculum*. Chicago, Illinois, USA: University of Chicago Press. Originally published in 1956.

Diouf, A.M., Sene, P.A., & Wone, M. (2005). *Intégration des technologies de l'information et de la communication dans l'éducation en Afrique de l'Ouest et du Centre : étude d'écoles pionnières, cas du Sénégal*. Dakar, Sénégal : ROCARE-Sénégal.
www.rocare.org/RapportFinal_SN-phase1TIC2005.pdf

Djédjé, V.L. (2007). *Emergence et apports d'une communauté virtuelle dans un processus d'intégration des TIC dans les apprentissages de base d'élèves d'une école élémentaire au Sénégal*. Dakar, Sénégal : EENAS.

Dockstader, J., & Idaho, J. (1999). Teachers of the 21st Century know the What, Why and How of Technology Integration. In J.J. Hirsch Buhl, & D. Bishop (Eds), (2000), *Computers in Education*. Guilford, Connecticut, USA: McGraw-Hill/Dushkin.

ERNWACA. See also ROCARE below.

ERNWACA-Cameroon. (2005). *Integration of Information Communication Technology in Education in Central and West Africa: A Case study of Pioneer Schools in Cameroon*. Yaoundé, Cameroon: ERNWACA-Cameroon.
www.rocare.org/Rapportfinal_TICICM2005.pdf

ERNWACA-Ghana. (2005). *Integrating ICT in teaching and learning in West and Central African schools: case studies of pioneer schools in Ghana*. Research report.
www.rocare.org/RapportFinal_TICIGH2005.pdf

Fonkoua, P. (2006). Approche conceptuelle de la « Ticelogie » ou Science de l'intégration des TIC dans la formation des formateurs. In P. Fonkoua (Dir.), *Intégration des Tic dan le processus enseignement-apprentissage au Cameroun* (pp. 223-234). Yaoundé, Cameroun : Editions Terroirs; ROCARE-Cameroun.

Fonkoua, P. (2006). *Quels futurs pour l'éducation en Afrique*. Paris, France : l'Harmattan.

Fonkoua, P., & Amougou, R.E. (2006). TIC et enseignement à l'Institut des Techniques des Sciences et des Enseignements de Mendong, Yaoundé (ITSE). In ROCARE-Cameroun (Ed.), *Intégration des Tic dans le processus enseignement-apprentissage au Cameroun* (pp. 169-189). Yaoundé : éditions terroirs.

Forehand, M. (2005). Bloom's taxonomy: Original and revised. In M. Orey (Ed.), *Emerging perspectives on learning, teaching, and technology*.
www.coe.uga.edu/epltt/bloom.htm

Gauvain, M. (2001). *The Social Context of Cognitive Development*. New York, New York, USA: Guildford.

Huffman, D., & Goldberg, F. (2003). Using computers to create constructivist learning environments: Impact on pedagogy and achievement. *Journal of Computers in Mathematics and Science Teaching*, 22(2), 151-168.

Huyer, S. (2003). *Gender, ICT, and Education*.
www.wigsaf.org/engenderedict.pdf

James, T. (2005). *La mise en réseau d'institutions d'apprentissage – SchoolNet*. Dakar, Sénégal : CRDI; CODESRIA.

Jonnaert, P. (2007). *Le constructivisme comme fondement des réformes contemporaines des systèmes éducatifs*. Dakar, Sénégal : EENAS.

Karsenti, T. (2003a) Favoriser la motivation et la réussite en contexte scolaire : Les TIC feront-elles mouche? *Vie pédagogique*, 127, 27-32
www.thierrykarsenti.ca/pdf/publications/2003/vp127_27.pdf

Karsenti, T. (2003b). Plus captivantes qu'un tableau noir : l'impact des nouvelles technologies sur la motivation à l'école. *Revue de la fédération suisse des psychologues*, 6, 24-29.
http://karsenti.scedu.umontreal.ca/p_scientifique.php

Karsenti, T. (2003c) Problématiques actuelles et axes de recherche prioritaires dans le domaine des technologies de l'information et de la communication (TIC) en contexte Africain, préparé pour le Centre de recherches pour le développement international (CRDI) du Canada.

Karsenti, T., & Larose, F. (2001). *Les TIC ... au coeur des pédagogies universitaires*. Québec : Presses de l'Université du Québec.

Karsenti, T., Tchombé, T., Touré, K., Ngamo, S.T., & Maïga, M. (forthcoming in 2008). *ICT for quality education in the 21st century: Lessons from pioneering schools in Africa*.

Kozma, R.B., & Anderson, R.E. (2002). Qualitative case studies of innovative pedagogical practices using ICT. *Journal of Computer Assisted Learning*, 18, 387-394.

Kozma, R.B. (2003). Technology and Classroom Practices: An International Study. *Journal of Research on Technology in Education [formerly Journal of Research on Computing in Education]*, 36(1), 1-14. Consulted 13 March 2008 at:
www.robertkozma.com/images/kozma_jrte.pdf

Kozma, R., McGhee, R., Quellmalz, E., & Zalles, D. (2004). Closing the digital divide: Evaluation of the World Links program. *International Journal of Educational Development*, 24(4), 361-381. For "in press" format see:
http://robertkozma.com/images/kozma_closing_ijed.pdf

Liverpool, L.S. (2002). Women Information and Communication Technology (ICT) and Education: Analysis of the 1998 Internship Program at University of Jos, Nigeria.

Maccoby, E., & Jacklin, C. (1974). *The Psychology of Sex Differences*. Stanford, California, USA: Stanford University Press.

Maïga, H.O. (1993). *From Whole to Part, The Gao School Museum: Restoring a Learning Tradition that Achieves School Success by Bridging Classroom, Curriculum and Community*. Mali: Author.

Maiga, H.O. (2006). *La contribution socioculturelle du peuple Songhoy en Afrique*. Alger, Algerie: Maghreb Press Edition.

Matchinda, B. (1999) *Repères psychopédagogiques: moins enseigner pour plus apprendre*. Yaoundé, Cameroun : Editions CEDRES.

Mbangwana Atezah, M., & Mambeh Tani, C. (2006). Instructional Use of ICT in Cameroon State Universities. In P. Fonkoua (Dir.), *Intégration des Tic dan le processus enseignement-apprentissage au Cameroun* (pp. 145-168). Yaoundé : Editions Terroirs; ROCARE-Cameroun.

Moumouni, A. (1998). *L'éducation en Afrique*. Dakar, Sénégal : Présence Africaine.

Muchie, M. (2004). Resisting the Deficit Model of Development in Africa: Re-thinking through the Making of an African National Innovation System. *Social Epistemology*, (18)4, 315-332.

Ndoye, B., Dione, B., & Kane, A. (2002). *NTIC et stratégies pédagogiques : vers un nouveau paradigme*. Rapport de recherche. Dakar, Sénégal : ROCARE Sénégal.
www.rocare.org/smallgrant_senegal2002.pdf

Newhouse, C.P. (2002). Literature review: The impact of ICT on learning and teaching. For Western Australian Department of Education.
www.eddept.wa.edu.au/cmisis/eval/downloads/pd/impactreview.pdf

Noudogbessi, T., Azonhe, T., & Lodjo, B. (2002). *Introduction des nouvelles technologies de l'information et de la communication dans l'enseignement secondaire au Bénin*. Rapport de recherche. Cotonou, Bénin : ROCARE-Bénin.

Nyamnjoh, F.B. (2005). *Africa's Media: Democracy & the Politics of Belonging*. Pretoria, South Africa: Unisa.

Nyamnjoh, F.B. (2004). A relevant education for African development – some epistemological considerations. *Africa Development*, 29(1), 161-184.

Obanya, P. (2004). *Educating for the Knowledge Economy*. Ibadan, Nigeria: Mosuro

Obanya, P. (2007). *African Education in the EFA Decade*. Ibadan, Nigeria: Mosuro.

Okuma-Nyström, M.K. (2003). *God Turns the Chapter and Everything Changes: Children's Socialization in Two Gambian Villages*. Stockholm, Sweden: Akademityck AB, Edsbruck; & Institute of International Education, Stockholm University

Onguene Essono, L.M., & Onguene Essono, C. (2006). TIC et Internet à l'école : analyse des nouvelles pratiques enseignantes dans les salles de classes d'Afrique noire. In P. Fonkoua (Dir.), *Intégration des Tic dan le processus enseignement-apprentissage au Cameroun* (pp. 55-75). Yaoundé, Cameroun : Editions Terroirs; ROCARE Cameroun.

Osunade, O., Osunade, O.M., & Ahisu, E.V. (2003). *Evaluation of the impact of Internet browsing on students' academic performance at the tertiary level of education in Nigeria*. Research report. Lagos, Nigeria: ERNWACA Nigeria
www.rocare.org/smallgrant_nigeria2003.pdf

PanAf Edu, no 2. (2008, January). Newsletter of the Panafrican research agenda on the pedagogical integration of ICT. Bamako, Mali: ERNWACA / ROCARE.
www.ernwaca.org/panaf/spip.php?article131

Piette, J. (2003, novembre-décembre). Développer la pensée critique des élèves par l'éducation aux médias. *Vie Pédagogique*, 129, 42-46.

Poole, B.J. (1997). *Education for an Information Age: Teaching in the Computerized Classroom* (2nd ed.). Boston: McGraw-Hill.
www.pitt.edu/~poole/InfoAgeindex2.html

Richards, P. (2005, August 29). Computers widen gender gap for boys. *The Guardian*.
www.guardian.co.uk/technology/2005/aug/29/schools.elearning

ROCARE. (2006). *Intégration des TIC dans l'éducation en Afrique de l'Ouest et du Centre: étude d'écoles pionnières*. Rapport technique soumis au CRDI. Montréal, Canada : Université de Montréal ; Bamako, Mali : ROCARE / ERNWACA.
www.rocare.org/Edu&TIC1_RapportFinal2006.pdf

Stake, R. (1995). *The art of case study research*. London, United Kingdom: Sage.

Tarlinton, D. (2003). Bloom's Revised Taxonomy. Presented for Pupil Free Day.
www.kurwongbss.eq.edu.au/thinking/Bloom/blooms-pres.ppt

Tchombe, T.M.S. (2004). *Psychological Parameters in Teaching*. Yaoundé, Cameroun : Presses Universitaires d'Afrique.

Tchombé, M.T. (2006). Integration of ICT in Education in Cameroon. In P. Fonkoua (Dir.), *Intégration des Tic dans le processus enseignement-apprentissage au Cameroun* (pp. 211-221). Yaoundé, Cameroun : Editions Terroirs; ROCARE-Cameroun.

Traoré, D., Guindo, B.M., Maïga, M., Cissé, D.D., Baby, K.M., & Tamboura, Y. (2005). *Intégration des technologies de l'information et de la communication dans l'éducation en Afrique de l'Ouest et du Centre : étude d'écoles pionnières, cas du Mali*. Bamako, Mali : ROCARE-Mali.
www.rocare.org/RapportFinal_ML-Phase1TIC2003.pdf

Trucano, M. (2005). *Knowledge Maps: ICT in Education*. Washington, DC, USA: InfoDev/World Bank.
www.infodiv.org/en/Publication.8.html

Tsafak, G. (2000). *L'enseignement secondaire au Cameroun: tendances organisationnelles et résultats d'apprentissage des élèves*. Yaoundé, Cameroun : Presses Universitaires de Yaoundé.

UNESCO. (2007). *EFA Global Monitoring Report*.

Vygotsky, L.S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, Massachusetts, USA: Harvard University Press.

Vygotsky, L.S. (1986). *Thought and Language*. Cambridge, Massachusetts, USA: Massachusetts Institute of Technology.

Wentz, C. (1997). Research Findings in Technology in Teaching and Learning. *International Yearbook on Teacher Education. Proceedings from the 44th World Assembly of the International Council on Education for Teaching (ICET)*. Muscot, Sultanate of Oman.
www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/15/d6/ef.pdf

Authors

Professor Tchombe is a full professor at the University of Buea and Dean of the Faculty of Education as well as the regional president of the scientific committee of the Educational Research Network for West and Central Africa (ERNWACA). She was formally Head of department of Sciences of Education at the Ecole Normale Supérieure, University of Yaounde1. She obtained her PhD in Psychology and Education with specialization as developmental cognitive psychologist at the University of Bristol, Great Britain. She teaches Issues and Theories of Child Development in Contemporary Africa, Cultural Psychology, Cognitive Development, Advance Theories of Learning, Research Methods, and General Teaching Methods. She is particularly concerned about pedagogical tools to enhance teaching and learning and holds that integration of ICT would make a difference that will ensure quality in pedagogical practices. She is also interested in gender sensitive pedagogy and sees the integration of ICT as vitally important. Through her initiation the University of Buea through the Faculty of Education now offers distance education for practicing nursery and primary school teachers for a Bachelors Degree in Nursery and Primary Education. She does consultancy with UNESCO, UNICEF, ADB, WB, WHO and PLAN.

Professor Karsenti is a full professor at the University of Montreal, where he teaches the pedagogical integration of ICT. He has obtained several Awards of Excellence from the Canadian Association of Distance Education for teaching and pedagogical innovation. He has also earned distinction for his research contributions to the quality of university pedagogy. His research interests lie in the pedagogical integration of new technologies, pedagogical practices of teachers, open and distance learning, and motivation. Professor Karsenti is the principle designer and overseer for the first distance Ph.D. program in Education with a specialization in ICT integration.

Kathryn Touré has 15 years of experience in partnership development, networking, and administration of international and intercultural learning and research programs. She is the sixth regional coordinator of the Educational Research Network for West and Central Africa (ERNWACA) and is involved in research projects on the pedagogical integration of technology. She worked at Africa Online in the early days of Internet and contributed to the development of online content for African newspapers and businesses. She was responsible for interdisciplinary studies and outreach programs at the Center for International and Comparative Studies at the University of Iowa in USA. She is working toward her doctorate in education for 2009 from University of Montreal.

Mohamed Maïga. 1979 - 1983 : Doctorat 3ème cycle (Écologie) Université de Paris 6. **2001-2002** : DESS UTICEF (Utilisation des Technologies de l'information et de la communication pour l'enseignement et la Formation) – Université Louis Pasteur de Strasbourg en France. Département de Biologie, Faculté des Sciences et Techniques, Bamako, Mali. Inspecteur d'Enseignement Secondaire, Bamako, Mali. **2007** : DEA Sciences de l'Éducation. **2007** : DEA Sciences de l'Éducation. **2006 – 2007** : Tuteur au Ph.D en Sciences de l'Éducation et TIC – Formation à distance organisé par l'Université de Montréal avec le concours de l'AUF. **2005** : Microprogramme en Intégration Pédagogique des TIC – UNESCO Université de Montréal. . Chercheur ROCARE sur l'intégration des TIC dans l'éducation en Afrique.

Moses Mbangwana is Associate Professor of Education. He obtained a PhD in educational technology from Southern University at Carbondale, Illinois in USA in 1991. He is currently

with the regional office of the at the Educational Research Network for West and Central Africa in Bamako where he is Research Program Manager for the Panafrican Research Agenda on the Pedagogical Integration of Information and Communications Technologies (ICT), a project sponsored by IDRC. He was formally a lecturer at the Ecole Normale Supérieure Yaoundé, Cameroon, where he taught causes in educational technology and methods of evaluation. He has participated in many ICT conferences and methods workshops.

Mamadou Lamine Diarra, nationalité malienne. Ecole Nationale d'Ingénieurs (ENI) de Bamako (Géométrie) de 1983-1985. A obtenu le Certificat d'Etudes Spécialisées (CES) en gestion de système d'information et micro-informatique (ADRASS-AIRES, Paris 1988-90). Fortes expériences professionnelles en gestion de l'information sur la recherche et le développement, les réseaux de recherche, les unités d'information, les nouvelles technologies de l'information et de la communication. Il a obtenu en 2005 et en ligne le Diplôme d'Etudes Supérieures Spécialisées (D.E.S.S), 2^e cycle en intégration pédagogique des nouvelles technologies, Faculté des Etudes Supérieures, Université de Montréal, Montréal, Québec, Canada. Travaille depuis fin 2002 avec le Réseau Ouest et Centre Africain de Recherche en Education (ROCARE) en qualité de chargé d'information.