9. Introduction of ICT in Schools and Classrooms in Cameroon

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ABSTRACT

The introduction of information and communications technologies (ICT) in education reflects and responds to present and future needs of people functioning in an intensely changing and challenging intellectual environment. If ICT based education is a gateway to participation in future culture, society and economy, what should be the nature and form of educational infrastructures? Human, pedagogical, physical, technological and organisational aspects must be considered. ICT, when appropriately used, can serve as a vehicle and a platform for meaningful educational reform geared towards a shift from didactic "instructionism" to constructivism. However, our literature review and empirical evidence from eight schools in Cameroon, reveal that the integration of ICT in Africa remains sporadic and without clear direction. Access to ICT by students and teachers has begun, yet its use supports traditional teaching rather than the shift to new roles and pedagogical practices. Policy implications include the need to develop expertise within the nation, provide training opportunities, and encourage initiative and innovation on the part of teachers.

Keywords: access – ICT – secondary schools – pedagogy –constructivism – teacher training – partnerships – local expertise – partnerships – Cameroon

RESUME

L'introduction des technologies de l'information et de la communication (TIC) dans l'éducation reflète et répond aux besoins actuels et futurs des personnes évoluant dans un environnement de défis intellectuels intenses et renouvelés. Si l'éducation basée sur les TIC est une passerelle vers la participation à la culture de demain, à la société et à l'économie, que devraient être la nature et la forme des infrastructures éducatives? Qu'ils soient d'ordre humain, pédagogique, ou physique, les aspects technologiques et organisationnels doivent être pris en considération. Les TIC, lorsqu'elles sont utilisées de manière appropriée, peuvent servir de véhicule et de plateforme utile pour la réforme de l'éducation visant à passer de « l'instructionisme » didactique au constructivisme. Toutefois, notre revue de la littérature et des données empiriques de huit écoles au Cameroun montre que l'intégration des TIC en Afrique demeure sporadique et sans orientation claire. L'accès des étudiants et des enseignants aux TIC a commencé, mais certains enseignant(e)s privilégient l'utilisation des techniques d'enseignement traditionnel plutôt que le passage à de nouveaux rôles et pratiques pédagogiques. Les implications politiques comprennent la nécessité de développer une expertise au sein de la nation, offrir des possibilités de formation, et encourager l'initiative et l'innovation de la part des enseignants.

Mots clés : accès – TIC – écoles secondaires – pédagogie – constructivisme – formation des enseignant(e)s – expertise locale – partenariats – Cameroun

Introduction

Information and communication technologies (ICT) are simply technologies arising from scientific and technological progress in computer sciences, electronics and telecommunications. They enable us to process, store, retrieve and disseminate valuable information in text, sound and video form. In an increasing interconnected world, brought about by the application of technological advances to all sectors of society, quality education necessitates active and innovative exploration to maximize the benefits of ICT and develop and maintain the partnerships that use of ICT in education requires. This calls for re-conceptualising and restructuring the educational enterprise, so as to confront the technological challenges of this millennium. With rapid changes within society and radical transformations in the way people acquire knowledge, new teaching paradigms are required, ones that tune educational systems to modern times and ensure quality training for large numbers of persons.

This paper is concerned with how ICT such as computers and internet are being integrated into Cameroonian classrooms at the outset of the 21st century. We will briefly review experiences in other African countries and divergent research results on the pertinence of computing for teaching and learning. That background will help contextualize results from the first major study on the use of ICT in primary and secondary schools in Cameroon.

Introduction of ICT into African classrooms

Despite the fact that Cameroon and other African countries are in the initial stages of introducing ICT into schools, there are documented experiences on the continent on which we may draw as we move forward.

Miller (1997) for example developed the Evolutionary Model for understanding the integration of computers into education. The model includes five phases: 1/ introduction, 2/ entry, 3/ intermediate, 4/ penultimate, 5/ creation. She found that a South African high school selected for in depth study was at the entry phase in 1996.

As of 1998, Cossa & Cronjé (2004) evaluated the process of introducing computers, into schools in Mozambique. Despite general socio-economic struggles, the negative influence of working conditions of teachers brought about by structural adjustment programs, and an employment rate of 65% (p. 91), by 2001, 13 secondary schools in 4 different cities (p. 92) had been involved in the "Internet for Schools Project." Partners included the Centre of Informatics at the University of Eduardo Mondlane (CIUEM), the Ministry of Education, the Embassy of the Netherlands, World Links or the World Links for Development Program (WorLD),[1] at times the Acacia program of the Canadian-funded International Development Resource Centre (IDRC), and eventually SchoolNet Mozambique. The researchers used Miller's five-phase model of technology integration in schools and found that over three years some schools had moved to the penultimate phase in which there were "changes in instructional strategies" (Cossa & Cronjé, 2004: 90) such as "gradual change of the role of teachers from facilitator to collaborator of learning" and in which collaborative projects and interdisciplinary work may have become the "embryo of team

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[1] World Links is a non profit organization launched by the World Bank Economic Development Institute in 1997 to expand access to digital learning resources in developing countries and now serves 1000 secondary schools in 26 countries (Kozma, McGhee, Quellmalz, & Zalles, 2004: 362). Ghana, Mauritania, Mozambique, Senegal, South Africa, Uganda and Zimbabwe were the first African countries to participate in the programme (Kozma, McGhee, Quellmalz, & Zalles, 2004: 366).

teaching" (Cossa & Cronjé, 2004: 97). The researchers explained that three years was too short a period to reach the unending "creation" phase in which students create knowledge, students and teachers demand frequent technology updates, and new teachers receive training in new technologies (p. 90).

There were several obstacles to the integration of computers and internet in Mozambique, typical of other experiences and worth mentioning. On the technical front equipment shipments were delayed, the quality of second-hand equipment could not run word processing applications, the fragile telecommunications infrastructure made the internet connection unreliable, and technical support via email stopped when schools had their telephone lines cut for non-payment of bills (Cossa & Cronjé, 2004: 96). In relation to human resources, there was some demoralizing corruption (p. 98), there was insufficient expertise in ICT-based education for hiring pedagogical support for school-based project managers (p. 96), and the 486 computers could not be repaired locally (p. 98), leading the researchers to conclude that "[t]raining of staff is more important than the selection of technology" (p. 98).

It is interesting to note that while the integration of ICT in education in Africa has lead to changes in pedagogical approaches in formal education in several different countries (Cossa & Cronjé, 2004; INEADE, 2007: 3; ROCARE, 2006), there are few examples of curriculum change (Cossa & Cronjé, 2004: 97), which could make ICT integration more meaningful in some cases. One teacher in Uganda, when asked why the computer lab was empty during the day but packed after classes, explained that "there is little fit between the use of computers and the national curriculum and examination system" in the country (Kozma, McGhee, Quellmalz & Zalles, 2004: 379). Research involving 174 case studies in 28 countries including one African country, South Africa, showed that 18% of the cases reported a change in curriculum goals or content. Where technology-supported curricular change did occur "it was because teachers provided a more in-depth coverage of a single subject, or schools gave students more responsibility for determining their own learning, or they emphasized a certain curricular theme" (Kozma, 2003b).

Introduction of computers into classrooms in Cameroon
In 1995 when educational experts met in Yaoundé to discuss how the educational system could be improved upon, nothing was mentioned about the use of ICT in the classroom. The Cameroon education law 9/004 of 14 April 1998 does not make mention of ICT in the school system. Teacher training colleges are only now making provision for teaching ICT and its use for pedagogical purposes. This implies that the teaching core is to a great extent computer illiterate.

In his February 2001 message to the youth, the President of Cameroon called for embracing the knowledge economy (République du Cameroun, 2007c: 3). In preparation, he promised the introduction of computing in schools and the endowment of computer rooms to schools. The impact of this Presidential speech accelerated in 2002, with the introduction of ICT in secondary general and technical schools. Numerous schools have benefited from presidential "gifts" of multimedia centres connected to internet. Official programs of ICT were designed for secondary schools in 2003. (ERNWACA-Cameroon, 2005: 11)

The ministry of education recently developed a strategy for the implementation of the national ICT policy in basic education over 2007-2015. The strategy includes mention of training in ICT for teachers and school directors and integration of ICT into the curriculum (République du Cameroun, 2007a: 21-24). It also drafted national guidelines for teaching ICT

in pre-school and primary schools, with six different modules adapted to each level, from discovery and presentation skills to applying skills to knowledge construction and finally learning health and safety issues related to the use of ICT. The teacher modules include productivity and research, applying ICT to teaching and learning, evaluation, and lastly, social, moral, and human questions related to ethics and equality. (République du Cameroun, 2007a)

Though these efforts are still in an experimental stage, they have nonetheless lead to some moves from traditional pedagogical and administrative culture, moves from teacher-centred pedagogies and memorization as a learning technique to a more constructivist, pupil-centred approach, with pupils assuming more responsibility because of increased development of research and problem solving skills through the use of ICT. (ERNWACA-Cameroon, 2005: 11)

Divergent views of the pertinence of computing for teaching and learning
The rationale around much of the argument against the use of computers in the school system focuses more on the deployment of critical resources at times of economic and fiscal hardship than on research on the pertinence of ICT for African classrooms. Clark (1985) argued that there is no medium (including computers) which has any distinct advantage over another. He maintained that it is the uncontrolled effects of instructional method and content, together with a novelty effect, that account for any learning improvements that may be observed with the use of computers. A meta-analysis by Fletcher-Flinn and Gravatt (1995) revealed a learning advantage for Computer Assisted Instruction (CAI), but its authors explained that the apparent gain in proficiency could often be attributed to poor research design which did not show the difference between the quality of software and computer use.

They reminded us that achievement gains are only one of a number of criteria from which we should determine the advantages of any educational intervention. They recommended the consideration of other issues such as time savings for students and teachers; cost effectiveness; the presentation of realistic situations which require inquiry and collaborative problem solving; and forms of evaluation.

It is thus apparent that research results about the use of ICT in schools and their impact are equivocal. What is generally recognised is that ICT are an important part of our lives today, but there are divergent views about the role that schools should play in promoting use and fluency of the tools, and their primacy as resources in classrooms. Generally, the arguments against computers tend to focus on the fact that at a time when financial resources are limited, policy makers should not be spending money on machines, but rather on people and books and other supplies for teaching and learning. At the other end of the spectrum, supporters of the use of ICT in schools say that they need to be integrated into education so that children can learn in new and dynamic ways and be prepared for the challenges of life in the 21st century.

In view of the integration of computers in education in Cameroon and the divergent views of researchers as to their contribution, as educational researchers in Africa, we sought to investigate the role of computers in schools in Cameroon and their pertinence for teaching and learning at pre-university levels.

Methodology

To answer our research question, ERNWACA[2] researchers decided to participate in a transnational study on ICT in education in West and Central Africa. The case study approach, using primary and secondary schools as "cases," was used with the following qualitative and quantitative data collection approaches:

- semi directed interviews with school directors, administrators, pedagogical advisors, and parents;
- focus group discussions with pupils and teachers;
- videotaped classroom observations and photographs of school environments;
- review of school documents on ICT and teacher and student productions;
- questionnaires for quantitative data from pupils and teachers on access, usage and training.

Sampling

Eight schools were selected for study in Cameroon. Selection was not based on a statistical model but on the significance of the case for the objectives of the study. Diversity factors taken into consideration for the selection of schools included gender, level of education, enrolment (600 pupils for primary to 5200 students for secondary), and geographic location. We referred to the schools as ICT "pioneer schools." They were characterized by the following:

- teachers trained in ICT;
- pupil access to computers for at least two hours per week during coursework and two hours for autonomous use;
- use of ICT as a pedagogical tool (in teaching, learning, auto-learning and research);
- intranet connected with internet 24 hours a day;
- access to information related to the establishment (school results, training needs of school teachers, calendar, etc.);
- commitment to making achievements in ICT durable.

The schools selected for the study are listed in Table 1 below.

Table 1. Study sample

School	Type	Language of Instruction
Lycée Bilingue Yaoundé	Public	French and English
Lycée Général LeClerc Yaoundé	Public	French
Collège des Lauréats Douala	Private	French
Lycée Joss Douala	Public	French
Lycée Technique Garoua	Public	French
Lycée Technique Bafousam	Public	French
Longla Comprehensive College Bamenda	Private	English
Ecole Oiselets Bafoussam	Private	French

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[2] Educational Research Network for West and Central Africa

The eight selected schools which are located in the provincial headquarters were made up of a bilingual secondary school, an English speaking school, and six French speaking schools. Three of the schools were private and the others public. All the government schools were connected to internet by the Government of the Republic of Cameroon except Lycée Technique Bafoussam which was connected by the Parent Teacher Association. All the private schools were connected with school funds.

Computers are kept in a computer laboratory commonly called the multimedia centre, with up to 75 computers connected to internet. These computers are often networked to printers and scanners. Teachers as well as students have daily access to the centres. A multimedia centre is managed by a head of centre who draws up a timetable for teachers and students to take turns using its resources. The multimedia centre heads are selected amongst teachers of science subjects and given special training. They in turn train other teachers besides the students. It is because of this extra ICT teaching that such teachers claim that they need extra financial motivation.

School visits, timeline and difficulties

Schools were visited as part of the pre-selection and selection process, but the visits to all schools for data collection ran from April through May 2004. Quantitative data was collected first. After interviewing the principals, we proceeded with encounters with teachers and students. In some schools, especially in Douala, it was difficult to meet with parents. In others, these meetings were facilitated by the school principal or the Parent Teacher Association.

Results and discussion

Integration of ICT into schools in Cameroon corresponds to the first three levels in the Miller (1997) model: introduction, entry, and intermediate. The introduction phase is present in the schools studied because computers are installed and teaching training has begun. ICT makes its way into teaching in the entry phase as teachers begin to loose their fear of ICT. They use it to support traditional teaching methods, for example by using drill and practice, and word processing. There are only a few examples of the intermediate phase, where teachers' roles and practices begin to change, they use ICT as a tool to achieve an educational objective and we witness peer learning.

Student access to ICT

ICT in public schools in Cameroon was introduced in 2002 following the President of the Republic's speech to youth in February 2001. In private schools, ICT came through private initiatives and individual efforts since 1998 and 1999.

Student access varies from school to school. Except for Lycée Bilingue Yaoundé and Lycée Général Leclerc Yaoundé, where students access ICT following a specific schedule (once every two weeks), in the other pioneer schools, ICT access is on a daily basis.

Access by students to email depended on their socio-cultural context and parental beliefs about the impact of access on moral development. Such beliefs seem to be influenced by the availability of a computer and internet in the home. Data showed that students varied as follows in possessing an e-mail address: 100% in Lycée Bilingue Yaoundé, 83.3% in Lycée Leclerc Yaoundé, 53.3% in Lycée Technique Bafoussam and 15.4% in Ecole Maternelle et Primaire Bilingue les Oiselets, Bafoussam.

Teacher access to computers and internet at school

Teacher access to ICT also varies widely. For example, all teachers of Lycée Général Leclerc Yaoundé have access to ICT. Contrarily, only 10% of teachers who are trained have access to ICT in Lycée Bilingue de Yaoundé. In this school, heads of departments go to the computer centre every week to obtain information to be shared with colleagues. According to the Principal at Lycée Joss, 50% of teachers use ICT at school. "The multimedia head and three monitors were trained and train teachers on a regular basis according to a prearranged schedule." But this same observation does hold true for College Lauréats where only 25 to 30% have access as pointed out by the principal.

ICT user access ratio

The ICT user to computer ratio, eliminating the two extremes, ranged from 33 to 77 users per computer. In schools where ICT equipment was provided by government, attention is still focused on the state to increase the ratio. But in private schools, individuals are seeking new ways of expanding their stock of computers. For instance, the principal of one private school explained that he was awaiting a consignment of 60 computers to add to the existing stock of 70, thanks to contacts maintained with someone abroad who had formerly volunteered at the school.

Discussion of findings on access

Access, and more especially equity of access particularly from a gender perspective, was evident but what was not clear is equity with regards to disadvantaged students. Dede (1998) pointed out that most of society's current attempts to shrink the widened equality gap that new educational technologies create focus on access and literacy. The issue of time and scheduling presented a challenge for access. Another problem was not being able to locate software needed for particular disciplines.

There is no firm strategy for replacement of computers and continuous maintenance is also a problem. The regular functioning of the internet is compromised by irregular supply of electricity.

It was clear from discussions with teachers, students and even parents that children engage in watching pornographic films, playing games and chatting. Marcroft (1998) in this regard affirmed that filtering brings peace of mind to educators and parents. Schools' efforts to monitor student use, for example via software, enable parents to welcome the internet. Teachers also act as filters as they move about in class interacting with the students during sessions. Amongst other considerations regarding access to ICT in Cameroon schools is the challenge it poses to cultural and moral values so treasured by Cameroonians.

Using ICT for pedagogical purposes to enhance teaching and learning

What came clear from the study is that access made both teachers and students potential participants in the great enterprise of knowledge construction because of the availability of information.

Teachers in all eight schools indicated that the ICT is useful to students because it enables them to obtain information, do research, learn and understand better, and communicate. The teachers use ICT for documentation, to access teaching and learning material for their classroom use. In most cases, computer lab monitors download information for teachers who make such requests. In addition to using ICT to prepare lessons, many teachers also use it to calculate marks. At Lycée Bilingue Yaoundé, the Head of

the Computer Unit said, "science and math teachers particularly those teaching geometry make profuse use of the multimedia centre to search for information." In the case of Lycée Technique de Garoua, the internet is exploited in teaching such subjects as accounting and management.

We observe some shift from textbook-based schooling to web-supported community of inquiry. Though a culture of inquiry in schools has been a pedagogical ideal as evident in the writings of Dewey (1938) and Bruner (1966), it has not been an enduring reality. Knowledge resources available in content-thin textbooks and limited libraries in Africa could not sustain inquiry oriented pedagogy.

A major concern should be programs for training specialist teachers in using ICT as a pedagogical tool.

Implications for policy and practice

The literature review and research findings have implications for education actors in Cameroon. For government we suggest that local expertise be built to support the integration of ICT in teaching and learning. For schools, leadership and teacher training are as paramount as infrastructure and equipment issues. For teachers, they must take the initiative to learn about ICT and its potential for enhancing their teaching. This will take place formally and informally. Examples and practice will be required.

For government

Training should be a compulsory and compensated policy for all personnel in all organizations. This will facilitate access to information flow and reduce unnecessary physical movement of files and personnel from provincial headquarters to Yaoundé. Government should reduce or eliminate import duties on ICT equipment which are used for training. This would greatly reduce the hardware and software prices currently in Cameroon and would motivate people to buy this equipment. For example, the ministry of higher education encouraged university lecturers by buying and supplying teachers with desktops and laptops at greatly reduced taxes.

Government departments should create ICT departments which will be responsible for advising on current training needs and designing teaching programs, in line with technological advancements. Government should avoid looking for foreign experts for technical expertise because they are very expensive. For instance, an expert from Paris will be very expensive because of the following reasons:

1/ telephone bills for consultation between France and Cameroon;
2/ airfare from France to Cameroon;
3/ out of station allowance which may be ten times that of an indigenous expert;
4/ housing allowance which might be about ten times that of an indigenous expert;
5/ car allowance which is extremely very high.

It is very clear that the foreign experts may give expert advice but government should train their own experts in their poly-techniques who will understand the needs of the country better. Indigenous experts should be trained so that they can assure sustainability of projects. Many projects developed and implemented by expatriates are bound to fail because certain technical specifications are often never released to the end users. Government gave the contract for computerizing some schools to a company called CFA Stephenson but no one within these schools has the technical reports in case there is breakdown. No person knows what is to be replaced when and where. For this reason the

government is in danger because if there is a breakdown somewhere she is forced to bring the expert or leave the breakdown and allow for project failure. An example to buttress this fact is the bilingual training centre at *Ecole Normale Supérieure* (ENS) Yaoundé, whose doors have not been opened for close to twenty years because of lack of technical specifications.

For schools

The integration of ICT can be effective in the teaching-learning process if the following conditions are fulfilled.

1- Effective leadership. The school administrator must facilitate access to ICT by teachers, students, and the administrative staff. Money allocated for the equipment should be used judiciously rather than embezzled. School administrators should be committed people.

2- Building renovation. Most of the classrooms in Cameroon were built without the idea that ICT would be used. Most classrooms do not have electrical installations, air conditioners, window protectors and solid doors. It is therefore difficult to use electrical installations in such spaces.

3- Teacher training. Once teachers have access to ICT they are more likely to learn on their own and to put into practice knowledge and skills gained through formal training or informal inquiries from colleagues. Students get more benefits from ICT when teachers use them for pedagogical purposes and such practice thrives best in an environment conducive to learning and innovation.

4- Equipment maintenance. Some equipment is supposed to be changed at specific times and the cleaning of the multimedia centres is very necessary for the functioning of the machines. The school should train their personnel to do the maintenance rather than depend on commercial technicians.

5- Effective multimedia centre supervision. The school administrators should make an inventory of the equipment in the centres and make sure they inspect the state of the centre and the equipment on a regular basis. They should provide optimum access to the centre and its resources through careful scheduling, including of training opportunities for teachers.

For teachers

Teachers use technology to access information, model problem solving, and develop simulations that provide greater understanding of how technology is used in the work world. Teachers should continue to use technology to guide and engage students in self-directed and group learning activities. There has to be an appropriate matching of teachers' knowledge of content, appropriate uses of technology, and the desired learning objectives. Teachers should increase the number of hours they go to the internet to search for information to update their teaching. Through their internet connections, they will have access to resources that even a few years ago would have been impossible even for university researchers.

Teachers' active participation in seminars and workshops is highly recommended. Professional development may also include just-in-time study groups, online seminars, action research, and collaboration with colleagues. The teacher is also an administrator at a lower level in the classroom. ICT can be used to increase administrative efficiency. For this reason, classroom teachers should improve their skills in simple programs like Excel, for

calculating marks and storing important data for the school. Electronic messaging can be used to encourage sharing and collaboration among students.

It has been noted that a teacher may have the best computer, the most sophisticated curriculum software, and the fastest internet connection, but if that teacher does not know how to use any of that, it is not going to improve the teaching/learning process. Teachers must have opportunities to familiarize themselves with hardware and software and to learn through example and practice how to use ICT to deepen their teaching and the learning of their students.

Conclusion

The experimenting or "pioneer" schools studied are responding timidly to the information age and the knowledge economy through the use of ICT which today permeates many aspects of urban life. Yet it seems that action plans related to the use of ICT in schools are not clearly articulated. The use of ICT in educational settings is marginal and in many instances perceived as an "add on" to regular schoolwork. ICT is used to perpetuate and reinforce the curriculum taught in the traditional way. ICT is taught as a discipline rather than as a set of tools that can be used for more in depth and interactive teaching and learning.

Integration of ICT into schools in Cameroon is an important value component of government rhetoric to modernize the country and open future citizens up to the world fast becoming more and more a global village. Similar perspectives were voiced by teachers and students in focus group discussions who addressed the value that access to computer and internet has brought to learning and to school administration.

Challenges relate to policy, explosive school demographics, teacher numbers and quality, access to equipment and training opportunities, and moral concerns. From all indications it was clear that there is absence of clear policies guiding core issues such as program design, teacher training and sustainability.

Bibliography

Bruner, J.S. (1966). *Toward a Theory of Instruction*. New York, NY, USA: W.W. Norton.

Clark, R. (1985). Evidence for Confounding in Computer-based Instruction Studies: Analyzing the Meta-analyses. *Educational Communications and Technology Journal, 33*(4), 249-262. Consulted 20 May 2008 at:
www.springerlink.com/content/e46480u4x92553h2/

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. Consulted 20 May 2008:
www.schoolnetafrica.net/fileadmin/resources/Computers_for_Africa.pdf

Dede, C. (1998). Evaluating the Effectiveness of Technology Initiatives. In J.J. Hirsch Buhl, & D. Bishop (Eds.) (2000), *Computers in Education*. Guilford, CT, USA: McGraw-Hill/Dushkin.

Dewey, J. (1938). *Experience and Education.* New York, NY, USA: Macmillan.

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. Consulted 20 May 2008 at:
www.rocare.org/Rapportfinal_TICICM2005.pdf

Fletcher-Flinn, C.M., & Gravatt, B. (1995). The Efficacy of Computer Assisted Instruction (CAI): A Meta-Analysis. *Journal of Educational Computing Research, 12*(3), 219-42.

INEADE [Institut national d'étude et d'action pour le développement en éducation]. (2007, août). Synthèse de recherche collaborative sur l'intégration des TIC dans les apprentissages de base à l'école élémentaire au Sénégal. *Les TICE à l'école,* bulletin l'INEADE, Ministère de l'éducation du Sénégal. Consulted 13 March 2008 at:
www.ore.uqam.ca/Framatice/Documents/PBineade01.pdf

Karsenti, T., & Tchaméni-Ngamo, S. (2007). Qualité de l'éducation en Afrique: le role potentiel des TIC. *International Review of Education, 53*(5-6), 665-686.

Kozma, R.B. (2003a). 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.B. (2003b). *Technology, Innovation, and Educational Change: A Global Perspective.* Eugene, OR, USA: International Society for Educational Technology (ISET). Abstract consulted 13 March 2008 at:
www.sitesm2.org/mod2.html

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:
www.robertkozma.com/images/kozma_closing_ijed.pdf

Marcroft, T (1998). Do Schools Need Internet Filtering? In J.J. Hirsch Buhl, & D. Bishop (Eds.) (2000), *Computer in Education*. Guilford, CT, USA: McGraw-Hill/Dushkin.

Miller, P.A. (1997). *Integration of Computers at Pinelands High School: A Case Study.* Mini-thesis, MEd, University of Pretoria, South Africa. Consulted 19 May 2008 at:
http://upetd.up.ac.za/thesis/available/etd-08062003-202836/

République du Cameroun (2007a). *Mouture de programme nationale des technologies de l'information et de la communication des écoles maternelles et primaires*. Yaoundé, Cameroun : Inspection de pédagogie chargée de l'enseignement de l'informatique, Ministère de l'éducation de base. Consulted 25 May 2008 at:
www.observatoiretic.org/documents/show/100

République du Cameroun (2007b). *Stratégie de mise en œuvre de la politique TIC dans le secteur de l'éducation de base, 2007-2015*. Yaoundé, Cameroun : Inspection de pédagogie chargée de l'enseignement de l'informatique, Ministère de l'éducation de base. Consulted 25 May 2008 at:

www.observatoiretic.org/documents/show/98
First draft for 2007-2012 in English: www.observatoiretic.org/documents/show/80

République du Cameroun (2007c). *Stratégie nationale de développement des technologies de l'information et de la communication*. Yaoundé, Cameroun : Agence nationale des technologies de l'information et de la communication (ANTIC). Consulted 25 May 2008 at:
www.observatoiretic.org/documents/show/87

ROCARE/ERNWACA. (2006). *Intégration des TIC dans l'éducation en Afrique de l'Ouest et du Centre : étude d'écoles pionnières*. Rapport technique soumis au CRDI. Bamako, Mali: ROCARE/ERNWACA. Consulted 16 February 2008 at:
www.rocare.org/Edu&TIC1_RapportFinal2006.pdf