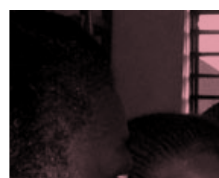


Research Agenda

Panafrican Research Agenda on the Pedagogical Uses of ICTs



Prepared by



Thierry Karsenti

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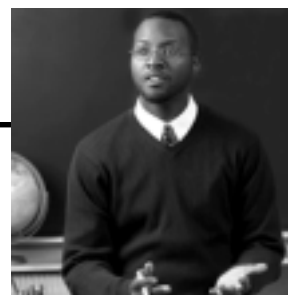


Information and communication technologies
are not a panacea or magic formula, [...]
But they can improve the lives of everyone on this planet.

Kofi Annan, 2005



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INTRODUCTION



In the 1970's, a few of the wealthier African schools were already dealing with the audio-visual crisis: fragile and cumbersome equipment that was very costly, repairs that took a great deal of time, complex compatibility issues among the different equipment. But what appears to be the fundamental reason for the failure of audio-visual use in schools is that its introduction came about on the outskirts of pedagogy. As highlighted by Michel (1981, p. 1), it was a question of not knowing what to do with unfamiliar tools. Moreover, teachers asked themselves *"what global strategies should be used (integration in all subject areas, independent, individual or collective work...)*. *The audio-visual era suffered at once from the fears it provoked and the hopes it generated."*

It is within this context that the first computers slowly made their way into African schools...

Computers first made their appearance in certain North American schools at the end of the 1960's, especially for management applications. It was not until the beginning of the 1970's that they began to be more widely present across North America and Europe. In Africa, it to the end of the 1970's that we can trace back the appearance of the first computers in educational establishments. Among others, the LOGO project was implemented in Senegal in collaboration with the Massachusetts Institute of Technology (MIT).

At the time, the governments seemed lit by two wills: that of initiating students to computers but also to the use of some software. Two trends were very present: programmed teaching promoted by Skinner, and LOGO language developed by Papert. LOGO, the first computer language for children, found immense popularity, especially in North America. Seymour Papert, the creator of LOGO, had completed his studies with Piaget in Geneva and was working at the time at MIT. His most famous work, *Mindstorms – Children, Computers and Powerful Ideas*, was quoted everywhere. Papert's primary goal was to develop educational tools and software with constructivist potential. More specifically, he wished to create a language that would allow students to construct their own knowledge. The LOGO software was first developed for Apple II, then for IBM computers.

Thus, in Africa, for more than a decade, courses were offered to introduce students to computers in a few high schools and several universities, etc. At the time, no mention was made of information and communication technologies (ICTs); it was simply computer science, as a subject area which needed to be tamed rapidly. The urgency in Africa was especially felt in January 1983, when *Time Magazine* recognized the importance of the computer by giving it its Personality of the Year Award, the first in history to be given to a machine (Figure 1).





Figure 1
Cover page of *Time Magazine* 1983¹.

So began the teaching of computer technology in Africa, still present in many of the schools of the 54 African countries. Then, in particular with the omnipresence of the behaviorist approach in education, focus turned to computer-assisted instruction (CAI). This was followed by a concern for imparting certain knowledge through the help of technologies. From the teaching of computer technology *per se*, to computer assisted instruction, the move was made to the era of computer-based education, very popular in North America and Europe. Within only a few years, an array of tutorials was developed for the school context. The tutorials were software designed to help the learner acquire knowledge or develop certain skills (Clark and Mayer, 2003). It was only at the beginning of the 1980's that we truly began to hear of new-technology based education. Finally, as of the 1990's, discourse in education turned to the use of information and communication technology (ICT) within various subject areas. It was hoped that teachers could better teach within the various subject areas with the help of information and communication technologies, and that students could learn more and with greater ease, through these same technologies. Since the mid-1990's, the pedagogical use of ICTs across the curriculum has appeared to dominate most education reforms. This has led, in many countries in Europe and North America, to the formalization of the use of information and communication technologies as a cross-curricular competency in education, for students and teachers.

In 2006, Internet will be celebrating its 37 years of existence. Over the space of just a few years, this tool initially reserved for the army and then for universities has become an indispensable element in the daily lives of an increasing number of individuals from all continents. The number of Internet users around the world, that has grown from 16 million in 1995 to more than 650 million in 2006, highlights this rapid evolution. This exponential presence of technologies equally announces a long-anticipated revolution in the world of education. The world knowledge society promised in the 1970s, extolled in the 1980s and envisaged in the 1990s with mixed feelings of fear and incredulity, has become, in the XXIst century, an inevitable reality for all people.

As Kofi Annan indicated at the last Information Society World Summit held in Tunisia in November 2005, we are living in an era of rapid changes in which technologies play a role that has become more and more central in all areas of activity in our lives. In fact, ICTs have an important influence on the evolution of all societies on the planet and significantly affect all economical, social and cultural dimensions. With ICTs, everything changes: our way of living, learning, teaching, working, even earning a living. As stated by many, these societal metamorphoses must in no way be simply watched as they pass by, nor should people the world over passively submit to them. On the contrary, citizens of all countries – and notably those from Africa who already lag behind in many areas – must be the creators of their destiny and, therefore, take an active role in this technological world.

¹ Source : <http://www.timemagazine.com>



In an address to students at Nairobi University, democratic Senator Barack Obama recently criticized the inertia of many African countries with regard to technology and education. He noted, for instance, that South Korea's economy 40 years ago was similar to Kenya's, but is now more than 40 times superior, in particular because technologies are used in a vast array of the South Korean society, including education.²

If technology has accelerated the birth of the information era, it is therefore the duty of all peoples to participate actively in edifying this information society so that no one will be prevented from accessing knowledge now available on the Internet and, in so doing, from profiting from a better future, the globalization of markets and the global economy.

This document presents the first steps in the elaboration of a panafrican research agenda on the pedagogical integration of information and communication technologies (ICTs) in an African school context. More specifically, we have attempted to identify the main challenges inherent to the pedagogical uses of ICTs in education. Pedagogical integration of ICTs takes place when the use of technology allows for either improved teaching or enhanced learning (Karsenti and Larose, 2005). This issue, based upon the the relatively scant existing African literature but also on the much more abundant European and North-American scientific literature, has enabled us to identify key research questions which the International Development Research Centre - Canada (IDRC) could emphasize within the framework of an important project on the pedagogical integration of ICTs in the educational systems of the African continent. Research objectives complete this report.

² *Speech rendered on August 28, 2006.*



CONTEXT (PROBLEM)

From digital to techno-pedagogical divide



Although information and communication technologies occupy a place that has become more and more important in the daily lives of a large number of persons, it must be recognized that this influence of ICTs on societies does not manifest itself in a uniform manner. This is what is commonly called the “digital divide” between countries said to be developed and those in the process of development. In fact, numerous countries in Africa, notably among the poorest on the planet, find themselves to be increasingly in a context of technological deficit, lacking access to knowledge now available on the Internet.

The OECD (2006) recently showed that due to the absence of a basic network infrastructure and to poor international relations, the digital divide is much more pronounced in areas of the world where revenues are at their lowest. Concretely, other than in countries said to be at war, it is the countries in Western and Central Africa that seem to be most behind those of the western world. Countries such as Niger regularly appear at the head of two different top ten lists: the poorest, but also the countries in which information and communication technologies are slowest to arrive.

This is why if Africa gives itself the mission to prepare citizens for the challenges of the third millennium, it must also promote an in-depth integration of information and communication technologies, a daily and regular pedagogical integration of ICTs in education in order to make the best use of the new, inviting, promising and diversified possibilities. However, it must be stated that in Africa, Internet connection initiatives are not in their starting phase. In fact, despite the important gap with Northern countries, despite the divide found within certain countries, even within some regions, the presence of technologies in Africa seems to be progressing in an exponential manner. It can be noticed, for example, that in Dakar, the capital of Senegal, more and more homes are hooked up to high-speed Internet, a fact that seemed almost inconceivable just a few years ago. Moreover, a recent study funded by IDRC (Karsenti et al., 2005) revealed that close to 75 % of students in some high schools in Senegal’s capital have an email address. Nevertheless, particularly in the south of this country, a good number of schools still do not have electricity. The digital divide phenomenon is not just between countries said to be North and South. It can also be found within the African continent, even within some countries.



A result of the whole of social, economic, political and environmental factors, the digital fracture is therefore a complex issue that remains very important in Africa. Nonetheless, in our view, there is an increasing concern, perhaps even a more important concern: that of the pedagogical integration of ICTs in the schools of Africa. For if ICTs struggled to penetrate the African society, in schools the divide seems even more worrisome, as in terms of the pedagogical integration of ICTs, Africa still seems to be at square one.

Africa: why ICTs in education?

Despite breakthroughs that began as of the end of the 1970's, we notice that, some 30 years later, in the world of education in Africa, the introduction of information and communication technologies appears laborious and, according to several researchers, much too slow.

It has been voiced by many that it is unrealistic to speak of technologies in education in a continent where numerous schools lack electricity or running water and this when there even is a school. A close look at the present situation of African educational systems would lead us to believe that ICTs do not have their place in the school environment, for school politics consider that the needs to be met are so enormous that other choices should be privileged. Priority could not be given to technological equipment, and even less to the pedagogical integration of ICTs. As a consequence, needs linked to the use of ICTs by students and teachers are often neglected. These arguments are important indeed, but should not allow technologies to be eliminated from education in Africa. Education must serve to prepare Africans for the modern reality, and this is of utmost importance. Nonetheless, to bridge the significant gap holding back the African world of education, we must think of preparing the children for the world of tomorrow, while helping them remember the past so that the technologies do not become the Trojan horse of a masked form of cultural or intellectual imperialism.

Why ICTs in education? Because, as we already indicated, ICTs profoundly affect the political, economic and social conditions of the evolution of societies. Therein lies the necessity for the key actors in education in Africa – teachers, school principals, specialists, parents of students and administrators in government positions – to actively concern themselves with the goal of ICTs, their content and above all with their pedagogical integration into education. Furthermore, it is important to be concerned with ICTs in education because it is recognized that they will continue to have an influence on all societies on the planet by significantly impacting on all economic, social and cultural dimensions. Education cannot escape this tendency. If in the Northern countries, ICTs have largely made their way into the schools, Africa still greatly lags. For several years, African educational systems have been faced with a great deal of difficulties and



several countries have undertaken reforms which, for the most part, grant little importance to ICTs. As for the ADEA (2002), it stressed that ICTs represent a learning channel with the potential to improve greatly the quality of teaching at the level of basic education. Yet, as emphasized by the World Bank (2002), as well as in the last report of the American Educational Research Association (2005), there is a significant lack of research in ICTs in Africa, with regard to the efficiency of their presence in school as well as in terms of their potential impact on the improvement of the quality of education in Africa. Moreover, an exhaustive review conducted in 2003 for the IDRC (Karsenti, 2003) clearly showed that few studies exist on the integration of ICTs in Africa, aside from the works of some researchers from South Africa.

In fact, the observation is striking: just as African societies are increasingly influenced by ICTs, paradoxically, the school is not so. The upheaval in education is therefore not yet there. Is there reason to be concerned about its arrival? Or should we not ask ourselves whether we should stop questioning the presence or absence of ICTs in the school? That schools should take more time to absorb social changes is not something to be surprised or worried about. After all, the aim of a school as an institution is to instruct and educate. For this reason, it is not so much the speed of arrival of ICTs in the classroom that is important, but their judicious and pedagogical use in teaching for the attainment of school goals. Hence, according to us, the need to go beyond the discourse on the digital divide and concern ourselves more with the pedagogical integration of ICTs in education.

Finally, it is important to highlight that technologies, as many studies have shown (see BECTA, 2005), could have an important impact if they are pedagogically integrated, leading to:

- a better mastery of fundamental competencies;
- a better mastery of technologies themselves;
- a better preparation for the competencies inherent to the knowledge society;
- an increased motivation of learners toward school and pursuing their studies at the university level.

Why information and communication technologies (ICTs) in education in Africa?

- To help students remember their past;
- To prepare students for the current reality;
- To guarantee the future of students and of Africa.



IDENTIFICATION OF ISSUES PERTAINING TO THE PEDAGOGICAL USES OF ICTS IN AFRICA



The difficulties or obstacles linked to the integration of ICTs by teachers seem to stem from several sources as, for instance, inadequate pre-service education, insufficient motivation, non-existence of technical support, school organization that does not lend itself to ICTs, lack of support from the school principal, etc. (see Cuban, 2001; Dede, 1998; Means, Penuel & Padilla, 2001). In order to profile the numerous obstacles inherent to the pedagogical integration of ICTs in education, we have grouped these in two categories: the *external factors* (linked to the school, to the society, etc.), and the *internal factors* (linked to the teacher or to teaching). Among the principal *external* obstacles, the issue of equipment often stands at the forefront (McCrory Wallace, 2004).

Challenges linked to the integration of ICTs: the case of industrialized countries

In countries said to be industrialized, the obstacles linked to the integration of ICTs would fall within three categories: equipment, software and technical support. An increased investment in these three areas would enable the fostering of a pedagogical integration of ICTs in education. However, as shown in the research conducted by Cuban (1997, 1999), access to technologies is essential to but not sufficient for the promotion of the integration of ICTs by teachers: investing in equipment and in technical training simply does not suffice. Cuban's standpoint is based on the result of a series of investigations conducted with professors at Stanford University: a relatively privileged establishment where, for more than twenty years, professors have had access to the latest technologies and important technical support. The studies by Cuban reveal that the professors at Stanford use little or no ICTs in their teaching, despite all the resources at their disposal. In his view, the use of ICTs by the professors at Stanford is: "[...] limited and unimaginative instructional use of computers". According to Cuban, it corresponds exactly to the use made by primary or secondary teachers who have neither the technical nor material resources of those in charge of training at this university. Hence, Cuban (1997) does not deny that equipment and technical support are essential for pedagogical integration in education. He rather calls attention to the fact that these conditions are not sufficient as teaching can not be considered as a factory in which it is possible to increase productivity – to gain time – by investing in technological resources. Teaching, as defined by Rousseau (1966, p. 112), is an art where one can not always seek to gain time: "*Dare I expose here the greatest, the most important,*



most useful rule in all education? It is not to gain, but to lose time". The works of Depover & Strebel (1996, p.24), undertaken in schools in Belgium, are in line with those of Cuban when they reveal, among other things, that:

Many studies have shown that the pedagogical efficacy of ICTs relies more on the capacity of teachers to integrate and present new technologies in a relevant pedagogical context than in the available computer infrastructure.

The international scientific literature (Becker, 1994, 2000; Cuban, 1997; Scottish Board of Education, 2000; Pouts-Lajus & Riché-Magnier, 1998) has, in the past few years, highlighted eleven main problems linked to the pedagogical integration of ICTs:

1. lack of time (integration of ICTs is not seen as a priority in the teaching load and the task is already demanding);
2. material difficulties (lack of equipment, difficult access to equipment, out-of-date or defective equipment, lack of adequate peripherals such as printers, Internet connections that are too slow or not functional, etc.);
3. technical difficulties (technical problems met while using technologies);
4. absence or lack of technical support at the time of ICT integration;
5. absence or lack of support from the school principal;
6. absence or lack of support, training or technopedagogical skills (problem linked to inadequate pre-service education for new teachers, and continuing education that is non-existent or not adapted for current teachers);
7. problems linked to classroom management that limit potential technopedagogical innovations in the classroom;
8. problems linked to group size (too many students in the classroom to enable the integration of ICTs);
9. problems linked to constraints and organizational obstacles of the system or school establishment;
10. heterogeneity of groups with regard to technological skills that complicate the pedagogical integration of ICTs;
11. absence or lack of suitable pedagogical material.



The first problem encountered by teachers seems to be a lack of time (Cuban, 1997). Indeed, ICTs can be time-consuming and are also feared by a number of teachers who, out of breath, intimidated, are too overwhelmed to make what has been commonly known for a number of years as “the technological switch in education” (Karsenti & Larose, 2001). As Chenevez (2002) indicates, it is certainly not easy to prepare the students of today for the technological challenges of tomorrow when teachers are often already weighed down by their daily routine. It is also true that ICTs, at first, often complicate the teacher’s task, even though after a certain adaptation period, we are able to observe interesting outcomes (Pouts-Lajus & Riché-Magnier, 1998).

Some studies, such as those of Depover (2005) and Leclerc (2003) show that teachers’ beliefs and resistances to change that characterize the school environment play a fundamental role in the use or non-use of ICTs. The SCE (Superior Council of Education, 2000) and Fullan (2001) underline the importance of informing and making all actors aware of the pertinence of ICT integration in school. Without the commitment of teachers, it would be difficult to think of succeeding in this integration (Isabelle & Lapointe, 2003; SCE, 2000).

According to numerous authors (Leclerc, 2003; SCE, 2000; Isabelle, Lapointe & Chiasson, 2002; Rogers, 2000; Sherry, 1998; Depover & Strebel, 1996; Bibeau, 1996; Fullan, 2001), the use of ICTs in education is faced with organizational, administrative, human, pedagogical, training, information, technical, financial and technological problems. The lack of training and time required to learn how to use technologies and to develop appropriate courses would be obstacles dreaded by the teaching institutions that plan on adopting or integrating ICTs in their education portfolio (Tunca, 2002; SCE, 2002; Pajo & Wallace, 2001).

At the organizational, administrative and human level, barriers include the absence of vision and strategic planning (Bibeau, 1996), the scattering of efforts, the lack of coordination and concentration between sectors and users, the inadequate modes of organization.



Challenges linked to the integration of ICTs: the case of Africa

In Africa, many reasons could explain the lack of success in the use of ICTs for pedagogical purposes in some school environments (see Karsenti, 2003). According to Howell & Lundall (2000), the main factors that prevent school establishments from using computers as teaching and learning tools are the lack of financial means, the insufficient number of computers, the lack of ICT-skilled teachers, the inability of teachers to integrate the computer across the curriculum and the absence of appropriate programs for the integration of ICTs in education.

As we have already indicated, the evolution in the use of the computer is not uniform in Africa. In fact, in a country such as South Africa, some pockets of the school-age population use the computer for educational purposes at levels comparable to those of developed countries, while in most of the countries of Sub-Saharan Africa, people are still looking to explore ways and means of connecting school establishments to the Internet, as many remain at the introduction and launching phase.

Overall, according to the studies consulted, equipment is still the major constraint for an equitable use of innovative technologies. Weakness in structures and the high cost of equipment could render quite complex the ratio of computer use per groups of students. Nevertheless, all 54 African countries are connected to the Internet (Jensen, 2002). But, a ratio of one computer per 10 students and 100% connection rate at the primary, secondary or higher education level is a standard seemingly beyond reach for most school establishments in Africa. For example, a ratio of 139 pupils for 1 computer is cited in the context of the WorLD (2000) project.

Other studies show that the problems that prevent school establishments from equipping themselves with computers are, in order of decreasing importance: the absence of electricity, lack of funds, insufficient welcoming capacity, lack of qualified personnel and insecurity. Moreover, there exists but a small amount of equipment for the strict use of ICTs. In Sub-Saharan Africa, the weak density of telephone networks and the high costs of installation and maintenance of telephone lines remain a major obstacle.

Many authors (Oladele, 2001; Intsiful, Okere and Osae, 2003; Sellinger, 2001; Tunca, 2002; Bakhoun, 2002) also mention lack of tools, inoperative logistics, lack of or defective technological infrastructure such as a shortage of telephone lines, indigent communications network, disparate, inadequate and obsolete, fluctuations in power surges, recurrent power shortages and failures, the poor state of the roads, etc. In fact, particularly in most African countries, there would not exist the required infrastructural potential to receive a connection, to ensure national coverage and support installation costs. Hence, UNESCO revealed that the rate of penetration of the Internet would only be around 1,5% for Africa, with considerable differences among the different regions. Yet these working conditions are significant – though not sufficient – to familiarize students with the use of ICT



The African States, with the support of NGOs like Wordlinks have definitely made great progress with regard to technology-related equipment and the connection of school establishments to the Internet. The relatively strong penetration of computer equipment in numerous high schools and colleges now seems evident in many cities and countries. Nevertheless, as revealed in a recent study funded by IDRC, these financial investments are insufficient to ensure a true pedagogical use of ICTs. In fact, the study showed that once the Worldlinks funding ended, many of the computer projects in the targeted schools also slowly came to a close, with only a few, rare exceptions where teachers were mobilized to become ICT-competent (see Karsenti et al, 2005).

Most often added to these variables that are linked to elements difficult to control, are student populations high enough in numbers to enable a generalized, rational use of computers for pedagogical purposes. That is, although Depover (2005) indicates the rates of schooling in basic education in Africa barely surpass 50 percent and access to secondary education is still accessible to only a minority of students.

In addition, the question of ICT-use also becomes of essence when looking at the problem of ICTs accessibility to women. In most cases, women do not have the possibility to benefit from the opportunities afforded by ICTs. In many regions, they fall far behind in the process of autonomy enabled by the digital era. Cultural barriers in some contexts where girls do not have the same educational opportunities as boys are added to the obstacles of effective use of ICTs in school (Draxler & Haddad, 2002 ; Karsenti et al. 2005).

Based on the works conducted in six countries of francophone Africa (Benin, Cameroon, Burkina Faso, Mali, Mauritius and Senegal) between 2004 and 2005, researchers (Gibigaye *et al.*, 2005) established that women globally have a third of a chance less than men of accessing the benefits of the African information society in which they are reserved a very secondary role as consumers. The research presents not only the scope of the gender inequality in the area of ICTs, but also constitutes an appeal for more equity in the digital revolution.

In most African universities the limits in face-to-face education are stretched with the overpopulation of amphitheatres and classrooms by hundreds if not thousands of students. Open and distance education and learning (ODEL) is one of the responses to this problem. Nevertheless, the success of ODEL, seen by many, such as l'Agence universitaire de la francophonie and the African Virtual University, as a panacea to educational problems in Africa, supposes appropriate uses of ICTs, if not the successful integration of ICTs.



Other than time and space that constitute obstacles in the development of ICTs in the field of education in Africa, the use and maintenance of existing infrastructures would seem to be confronted to a lack of local expertise and insufficient knowledge of technologies by user groups.

Among the questions with which we should concern ourselves, aside from the thorny problem of necessary infrastructures for the use of ICTs in teaching establishments, there would therefore be those of human resources required for the implementation of technological applications and those pertaining to the design of teaching programs (Murphy, Anzalon, Bosch & Moulton, 2002). With regard to the use of ICTs, just as in any pedagogical context, the human factor is the essential variable. Relying on a trained teaching staff could lead to the appearance in students of competencies that the school rarely has the occasion to develop. And it would no longer be surprising to note, for instance, that the majority of Africans who use ICTs are consumers rather than producers of resources (see Karsenti, Touré and Ngamo, 2006). The lack of information, of training, of experience, of pedagogical, professional, technical and financial support could be standing in the way of the development of uses, the creation of teaching contents adapted to African students, and the construction of an educational portal managed by teachers.

Among the deficiencies in human resources, the most important one is, without a doubt, the teachers. In general, pre-service teacher education does not emphasize the use and integration of ICTs (Karsenti, 2006).

To ensure the participation of all teachers in the process of ICT integration or to generate their interest and bring them to use ICTs in their practice, it also seems of essence to create conditions that promote their participation. This seems to be particularly the case since in many African schools there is no specially set up room and convenient time-space for teachers who wish to work on the computer to prepare their lessons.

In fact, in most of the African countries, frequency and length of access to the computer at school remains minimal and rarely suitable for the teachers and students. The pedagogical strategies used by teachers are inappropriate and the degree of familiarity with the media remains weak. The nature of these deficiencies compromises the pedagogical use of ICTs because of the absence of uniformity in subject-related knowledge and prior technological skills of students, and the variety of learning styles.

The integration of ICTs in education also gives rise to new challenges for teachers who find themselves faced with student work that is literally plagiarized from the Internet. In addition to the limited pedagogical value of such an act, made possible through ICTs, the teacher is faced with the difficult task of unveiling cheaters. And when the burden of proof befalls the teacher, it becomes an almost impossible mission if the teacher is not ICT competent.



ICTs are also a threat to the teacher's power in the classroom: ICTs seduce the student and could, in certain contexts, lead the teacher to believe that he/she no longer has control over the learners. Indeed, this is a risk, especially for those with traditional or encyclopedic practices. However, current research (see BECTA, 2005) indicates that ICTs will never replace the teacher with open pedagogies; they will instead support practice by improving activities and facilitating student learning. A child is quickly seduced by a story told on an educational CDROM: the pictures, animations, sound effects are among enhancers that the teacher is not able to reproduce alone. Nevertheless, the child will soon ask the teacher to look at the story with him/her, to clarify certain elements of the story or to explain why the story ends in such a way.

James (2001) points out that even in South Africa, which seems to be far ahead of the other African countries, less than 5% of school establishments equipped with computers plan budgets to train teachers in the use of ICTs, when we know that the investment in human capacities is of essence in guaranteeing the durability of the use of ICTs in teaching.

In many countries of Sub-Saharan Africa, there exists a real and favorable political will to introduce ICTs in education. But national politics in the area of ICTs are not clearly formulated. Technology is more or less taken into account in the official programs of school establishments. Budgets allocated to school establishments do not cover ICTs. Budgets for equipment and functioning of ICTs generally come from tuition fees, fundraising operations, gifts from NGOs and national and international partners, even if in some countries like Nigeria or Cameroon, certain grants are funded by the state. And yet the importance of adopting policies and budgets that are both stable and recurrent in the matter is repeatedly observed in research studies (Karsenti & Larose, 2005).

Aside from the failure to promote human resources and the development of sufficient capacities to design, install, maintain and use the new infrastructures and ICT applications, one of the major challenges in the use of ICTs in African societies would be to envisage the dissemination and use of these technologies in school establishments in rural, enclosed or distant zones (Chéneau-Loquay & N'diaye Diouf, 1998). The Internet cybercafés are, in many African countries, an important venue for the use of ICTs and contribute to the increase in the number of users in regions where access remain limited.



Apart from the problem of unequal distribution of technological equipment in different regions at the national level, the concern for equity regarding the use of ICTs constitutes a major challenge in the African context where a considerable number of children do not have the opportunity to use computers in the classroom or at home, as is generally the case in developed countries.

These difficulties are likely to compromise the pedagogical integration of ICTs in numerous school establishments in Africa. This is true when we take into consideration the recent and quite limited steps taken by Africa towards ICTs, the lack of appropriate equipment, the lack of qualified human resources and the large number of underprivileged populations. In addition, the currently accepted opinion that more time is needed to become familiar with the computer and discover its potential before this tool can revolutionize classroom activities is a serious handicap.



IMPORTANCE OF CONDUCTING RESEARCH ON THE PEDAGOGICAL USES OF ICT



The majority of the strategic studies on ICTs in education in Africa differ from one country to the next. Objectives vary from collaborating with learners to supplying information to the community. Some of the stated objectives seem vague. Objectives may be more precise and measurable or, again, more general and instructional across a study that clearly enables the emergence of applications of ICT variables in African school establishments.

We can thus see emerging the importance of a most interesting study that promotes rational uses of ICTs to foster learning (The TLT Group, 2004) and the development of education. More specifically, it becomes of essence to conduct research that indicates how ICTs are used to facilitate the application of the best educational principles such as those proposed by Chickering & Gamson (2004), namely to :

1. multiply contacts between students and teachers;
2. develop reciprocity and collaboration among students;
3. encourage active and deep-rooted learning;
4. give rapid and meaningful feedback;
5. dedicate the best of one's time to the task;
6. express high and gratifying expectations;
7. respect the diversity of talents and learning styles.

This research would thus enable the pedagogical uses of ICTs in different learning contexts in Africa to be brought to light, and in several areas such as student learning, programs and pedagogy, online education, professional development, assessment, etc. In fact, the results of the first phase of the transnational study on the integration of ICTs in the Pioneer ICT Schools of Africa (see Karsenti et al., 2005) clearly show that uses of ICTs are not sufficiently documented in Africa as in the rest of the world.

This is also underlined by UNESCO (2004)

[...] monitoring and evaluation are the weakest components in most ICT in education programmes. While a number of stocktaking research studies have been conducted on ICT infrastructure penetration and access in schools, there have been minimal monitoring and evaluation of ICT integration and its impact on teaching and learning. Evaluation is an important phase in the formulation and implementation of an ICT in education programme. Evaluation, both formative and summative, means that policies, practices, and activities are documented, interpreted and analyzed (p. 135).



Experiments centered on the pedagogical uses of ICTs focus on a variety of situations, such as visual projections, the preparation of course notes, self-training in distance education. Attempting to define in a global manner the diverse experiments in the uses of ICTs in learning appears to be a promising exercise. The long-term effects of uses of ICTs at the national level as well as at the panafrican level are still not clearly outlined.

It also seems urgent to reflect on the pedagogical uses of information and communication technologies in teaching, particularly in Africa where the learning process with these tools happens to be very complex. ICTs alone do not foster learning creativity in students and learning the scientific methodology without the implementation of pedagogical situations in which these technologies, among others, facilitate the use, treatment and production of relevant information. For no matter how good the equipment, it cannot be of benefit to education without the mastery of its uses. As such, research in education has the responsibility to shed scientific light on training in the pedagogical uses of ICTs which represent an enormous stake in society.

As a region clearly behind in the adoption, use and innovation of ICTs, Africa does not yet enable its populations to benefit from a better education, from the possibilities and investment opportunities afforded by ICTs in education. However, if we consider investment in ICTs as an investment in the future, many countries remain convinced that the use of ICTs is a necessary economic development strategy. This allows for a glimpse at the potential uses of ICTs for the development of Africa and a reorganization of knowledge based on foundations that take into account local African realities.



KEY RESEARCH QUESTIONS AND OBJECTIVES WITH REGARD TO THE PEDAGOGICAL INTEGRATION OF ICTS IN AFRICA



In light of the first sections of this document, several stakes and perspectives emerge that the present study could explore, from types of uses, to important sectors, to pedagogical approaches and the main favorable or inhibiting factors in the use of ICTs in education. A review of the literature enabled us to formulate a general research question, centered on the uses of ICTs in the different training and learning contexts of Africa:

In light of the actual state of introduction of ICTs in the African educational system and its limitations, how can adapted and effective pedagogical uses of ICTs be made to improve the quality of teaching and learning?

In line with this general research question, we present numerous specific research questions (Table 1). The questions thus raised could serve as guideposts from which further research on the pedagogical integration of ICTs in African educational systems could be conducted. These questions are categorized according to the educational actors (principals, teachers, students, parents, governments, etc.) to which they could be linked during empirical studies.

These are some of the essential questions upon which it would be beneficial for the current research to focus. The answers to these research questions could facilitate the comprehension of the true potential of ICTs in education in the African context in order to offer greater visibility to the uses that exist in the different areas of pedagogical practice and promote sharing and dissemination. Finally, the goal of these questions is to guide the development of a panafrikan research agenda on the pedagogical uses of ICTs in education, headed by IDRC.

With the research questions presented, it is possible for us to emit a general research objective:

To understand how the pedagogical uses of ICTs improve the quality of teaching and learning in Africa.

This general research objective gives rise to specific objectives (Table 2) that might be interesting to put forth in order to promote the development of research on the pedagogical integration of ICTs in Africa.

Finally, Table 3 highlights a first draft of the main indicators of the ICT observatory to be put in place in Phase I.



TABLE I: RESEARCH QUESTIONS

	Teachers/Trainers	Pupils/Students	Schools/Principals	Other school personnel	Parents/community	Government	Other
1. What are the state policies with regard to ICTs in education? - How can their development be encouraged? - How can their implementation be promoted?			X			X	
2. What is the state of connectivity? - How can it be increased? - What are the options for schools and individuals?			X			X	
3. How are teachers trained to use ICTs in education? - What are the best teacher education programs? - What are the best professional development strategies? - What are the needs?			X			X	
4. What are the pedagogical uses of ICTs? - What are the factors increasing the use of ICTs? - What are the factors limiting the use of ICTs? - What are the necessary skills for the pedagogical use of ICTs?	X	X	X	X	X		
5. What are the impacts of the integration of ICTs in education? - What are the factors to consider when analyzing the impacts? - Are ICTs changing the way individuals learn/teach? - Are ICTs changing what individuals teach/learn? - Can ICTs be integrated into the actual curricula? - What is the impact of ICTs on culture?	X	X	X	X	X		
6. What are the best strategies to ensure equal access to ICTs? - What about gender? - What about socio-economic differences?			X			X	X
7. What is the role of the school principal and the community in the integration of ICTs?			X		X		
8. What is the technical support available for teachers and school principals?	X	X	X	X	X	X	

ICT-OBSERVATORY MAIN INDICATORS

In each relevant case we wish to gather data for learners, educators, and administrators, at primary, secondary, tertiary and vocational institutions/ levels, in individual countries, regions and across the continent?

Tertiary institution refers to post-secondary education institutions (including teacher-training institutions).

National, per-institution indicators should note the number of institutions, per country, from which the data is drawn.

Percentages and ratios will be calculated automatically by the observatory (for learners, educators, administrators, institutions, primary/secondary/tertiary/vocational, countries, regions, or the continent).

BACKGROUND/STRUCTURE

Objective 1.0

To portray ICT-related policies in Africa.

1.1 To better understand the nature of ICT-related policies. (Phase I)

1.2 To better understand how to favour their inception. (Phase II)

1.3 To better understand how to favour their implementation. (Phase II)

Indicators 1.0

Details/example

National policies on education & ICTs

The availability of national ICT policy documents.

Country:
Names/dates of documents:
Sources/links/attached files:
Summaries/explanation
(150 words each):

The availability of sector (education) ICT policy documents.

Country:
Names/dates of documents:
Sources/links/attached files:
Summaries/explanation
(150 words each):



The availability of national curriculum on ICT (or ICT as a stand-alone subject).

Country:
Names/dates of documents:
Sources/links/attached files:
Summaries/explanation
(150 words each):

The availability of national regulations or incentives for ICT resources (connectivity, equipment, training) in educational institutions.

Country:
Names/dates of documents:
Sources/links/attached files:
Summaries /explanation
(150 words each):

Others

The presence of ICT (in education) in local development plans.

Country:
Names/dates of documents:
Sources/links/attached files:
Summaries/explanation
(150 words each):

Others

The ICT-connectivity rank per country.

Country:
Names/dates of documents:
Sources/links/attached files:
Summaries/explanation
(150 words each):

Others

The Gross Domestic Product (GDP) rank per country.

Country:
Names/dates of documents:
Sources/links/attached files:
Summaries/explanation
(150 words each):



Objective 2.0

To portray the state of connectivity and equipment, and its management, in African institutions.

- 2.1 To better understand the distribution of equipment, and its condition (Phase I).
- 2.2 To better understand the quality of technical support available for school personnel (Phase I).
- 2.3 To better understand the best connectivity options for institutions and individuals (Phase II).
- 2.4 To better understand how to increase connectivity (Phase II).

Indicators 2.0

Connectivity, equipment and education

The number and percentage of (primary, secondary, tertiary and vocational) institutions with computers.

Details/example

Country:
Total number of primary institutions:
Total number of primary institutions with computers:
% of computer-equipped primary institutions:

Country:
Total number of secondary institutions:
Total number of secondary institutions with computers:
% of computer-equipped secondary institutions:

Country:
Total number of tertiary institutions:
Total number of tertiary institutions with computers:
% of computer-equipped tertiary institutions:

Country:
Total number of vocational institutions:
Total number of vocational institutions with computers:
% of computer-equipped vocational institutions:



The number and percentage of (primary, secondary, tertiary and vocational) institutions with internet connectivity.

Country:
Total number of primary institutions:
Total number of primary institutions with internet connectivity:
% of primary institutions with internet connectivity (database calculates automatically):
Types of connection and bandwidth (per institution):

Country:
Total number of secondary institutions:
Total number of secondary institutions with internet connectivity:
% of secondary institutions with internet connectivity (database calculates automatically):
Types of connection and bandwidth (per institution?):

Country:
Total number of tertiary institutions:
Total number of tertiary institutions with internet connectivity:
% of tertiary institutions with internet connectivity (database calculates automatically):
Types of connection and bandwidth (per institution):

Country:
Total number of vocational institutions:
Total number of vocational institutions with internet connectivity:
% of vocational institutions with internet connectivity (database calculates automatically):
Types of connection and bandwidth (per institution):



The ratio of computers to educators per institution (primary, secondary tertiary and vocational).	Country: Name of institution: Number of educators: Total number of computers in the school: Number of computers available for educators: Ratio of computers to educators:
The ratio of computers to learners per school	Country: Name of institution: Number of learners: Total number of computers in the school: Number of computers available for learners: Ratio of computers to learners:
The presence of a technopedagogical assistant (or ICT advisor / technician) in education institutions.	Country: Institution (primary): Technician YES/NO: Country: Institution (secondary): Technician YES/NO: Country: Institution (tertiary): Technician YES/NO: Country: Institution (vocational): Technician YES/NO:
Others The types of software applications used in educational institutions.	Country: Name of institution: Names/types of software used (proprietary, freeware, shareware...):
The rank of ICT-enablement by institution (primary, secondary, tertiary, vocational). (Phase I)	Country: Rank:



Objective 3.0

To portray how African educators are trained with regard to the pedagogical uses of ICT.

- 3.1 To better understand how ICT is integrated into teacher education programs (Phase I).
- 3.2 To better understand how educators are trained to help learners learn with ICT (Phase I).
- 3.3 To better understand the impact of ICT-related skills on education (Phase I?).
- 3.4 To identify the most important next steps for further pedagogical integration of ICT (Phase II).
- 3.5 To identify best practices for pre-service teacher education (Phase II).
- 3.6 To identify best practices for professional development (Phase II).
- 3.7 To identify the main strategies developed to finance educators' professional development (Phase II).

Indicators 3.0

Details/example

The number of teacher training institutions.	Country: Number of teacher training institutions (name/code, type, level): Country:
The number of teacher trainers per institution.	Number of teacher trainers (employed at above institutions):
The ability of teacher trainers to use ICTs (basic skills).	Country: Number and percentage of teacher trainers with email addresses:
The number of teacher trainers who use ICTs to train educators.	Country: Number of teacher trainers who use ICTs:
The number of pre-service educators.	Country: Number of pre-service educators:
The percentage of pre-service educators who have their own email address.	Country: Number of pre-service educators with email addresses::
The presence of ICT in teacher training curriculum.	Country: ICT in initial training YES/NO: Description (150 words): Country: ICT in professional development (continuing education) YES/NO: Description (150 words):



The ICT resources (types of equipment?) made available to pre-service educators, and their trainers, during teacher training.

(from Indicators 2.0 tertiary?)

The existence of (nationally regulated?) incentives for continuing education / professional development (which include ICT integration?) for educators.

(from Indicators 1.0?)

The percentage of (primary, secondary, tertiary and vocational) educators who have participated in continuing education/professional development, which included ICT integration.

Country:

Number of educators (primary):
Number of educators (primary) who have participated in (graduated/type of diploma?) less than 50 hours of continuing education/professional development:

Included ICT integration YES/NO:

Country:

Number of educators (primary):
Number of educators (primary) who have participated in (graduated from?) 50-100 hours of continuing education/professional development

Included ICT integration YES/NO:

Country:

Number of educators (primary):
Number of educators (primary) who have participated in (graduated from?) over 100 hours of continuing education/professional development:

Included ICT integration YES/NO:

Country:

Number of educators (secondary):
Number of educators (secondary) who have participated in (graduated/type of diploma?) less than 50 hours of continuing education/professional development:

Included ICT integration YES/NO:

Country:

Number of educators (secondary):
Number of educators (secondary) who have participated in (graduated from?) 50-100 hours of continuing education/professional development

Included ICT integration YES/NO:



Country:
Number of educators (secondary):
Number of educators (secondary) who
have participated in (graduated from?)
over 100 hours of continuing
education/professional development:
Included ICT integration YES/NO:

Country:
Number of educators (tertiary):
Number of educators (tertiary) who
have participated in (graduated/type
of diploma?) less than 50 hours of
continuing education/professional
development:
Included ICT integration YES/NO:

Country:
Number of educators (tertiary):
Number of educators (tertiary) who
have participated in (graduated from?)
50-100 hours of continuing education/
professional development
Included ICT integration YES/NO:

Country:
Number of educators (tertiary):
Number of educators (tertiary) who
have participated in (graduated from?)
over 100 hours of continuing
education/professional development:
Included ICT integration YES/NO:

Country:
Number of educators (vocational):
Number of educators (vocational) who
have participated in (graduated/type
of diploma?) less than 50 hours of
continuing education/professional
development:
Included ICT integration YES/NO:

Country:
Number of educators (vocational):
Number of educators (vocational) who
have participated in (graduated from?)
50-100 hours of continuing education/
professional development
Included ICT integration YES/NO:



	Country: Number of educators (vocational): Number of educators (vocational) who have participated in (graduated from?) over 100 hours of continuing education/professional development: Included ICT integration YES/NO:
The rank of teacher-education institutions, by ICT-integration training. (Phase II)	Country: Institution: Rank:



CURRENT PRACTICE

Objective 4.0

To portray the uses of ICT in African institutions.

4.1 To identify the factors encouraging the pedagogical use of ICT (Phase I?).

4.2 To identify the factors limiting the uses of ICT (Phase I?).

4.3 To identify the skills inherent to the integration of ICT (Phase I?).

Indicators 4.0	Details/example
The frequency of ICT use by educators.	Country: ICT use by educators (primary) hrs/ week: Country: ICT use by educators (secondary) hrs/ week: Country: ICT use by educators (tertiary) hrs/ week: Country: ICT use by educators (vocational) hrs/ week:
The frequency of ICT use by learners.	Country: ICT use by learners (primary) hrs/ week: Country: ICT use by learners (secondary) hrs/ week: Country: ICT use by learners (tertiary) hrs/ week: Country: ICT use by learners (vocational) hrs/ week:
The types of ICT use by (primary, secondary, tertiary and vocational) educators.	Country: Types of ICT use by educators (primary) (ex. ppt, list?): Country: Types of ICT use by educators (secondary) (ex. ppt, list?):



	Country: Types of ICT use by educators (tertiary) (ex. ppt, list?): Country: Types of ICT use by educators (vocational) (ex. ppt, list?):
The types of ICT use by (primary, secondary, tertiary and vocational) learners.	Country: Types of ICT use by learners (primary) (ex. internet search, list?): Country: Types of ICT use by learners (secondary) (ex. internet search, list?): Country: Types of ICT use by learners (tertiary) (ex. internet search, list?): Country: Types of ICT use by learners (vocational) (ex. internet search, list?):
The number of ICT (as subject matter) courses being taught.	Country: Number of nationally recognized ICT courses (primary): Country: Number of nationally recognized ICT courses (secondary): Country: Number of nationally recognized ICT courses (tertiary): Country: Number of nationally recognized ICT courses (vocational):
The percentage of (primary, secondary, tertiary and vocational) courses taught using ICT.	Country: Number of courses in primary education: Number taught using ICT: Country: Number of courses in secondary education: Number taught using ICT: Country: Number of courses in tertiary education: Number taught using ICT: Country: Number of courses in vocational education: Number taught using ICT:



The number of courses and subjects that have been successfully modified to be taught with ICT.	Country: Number of courses (above) which existed but did not include ICT (in 1990?):
The factors supporting the use of ICT by educators.	Country: Factors given in support of ICT use (list from interviews with educators?) in primary institutions: Country: Factors given in support of ICT use (list from interviews with educators?) in secondary institutions: Country: Factors given in support of ICT use (list from interviews with educators?) in tertiary institutions: Country: Factors given in support of ICT use (list from interviews with educators?) in vocational institutions:
The challenges to the use of ICT by educators.	Country: Factors given as challenges to ICT use (list from interviews with educators?) in primary institutions: Country: Factors given as challenges to ICT use (list from interviews with educators?) in secondary institutions: Country: Factors given as challenges to ICT use (list from interviews with educators?) in tertiary institutions: Country: Factors given as challenges to ICT use (list from interviews with educators?) in vocational institutions:
The factors supporting the use of ICT by learners.	Country: Factors given in support of ICT use (list from interviews with learners?) in primary institutions: Country: Factors given in support of ICT use (list from interviews with learners?) in secondary institutions: Country: Factors given in support of ICT use (list from interviews with learners?) in tertiary institutions:



	<p>Country: Factors given in support of ICT use (list from interviews with learners?) in vocational institutions:</p>
The challenges to the use of ICT by learners.	<p>Country: Factors given as challenges to ICT use (list from interviews with learners?) in primary institutions:</p> <p>Country: Factors given as challenges to ICT use (list from interviews with learners?) in secondary institutions:</p> <p>Country: Factors given as challenges to ICT use (list from interviews with learners?) in tertiary institutions:</p> <p>Country: Factors given as challenges to ICT use (list from interviews with learners?) in vocational institutions:</p>
The competencies required for ICT use (in education) by educators.	<p>Country: Competencies required for ICT use (list from interviews with educators?) in primary institutions:</p> <p>Country: Competencies required for ICT use (list from interviews with educators?) in secondary institutions:</p> <p>Country: Competencies required for ICT use (list from interviews with educators?) in tertiary institutions:</p> <p>Country: Competencies required for ICT use (list from interviews with educators?) in vocational institutions:</p>
The competencies required for ICT use (in education) by learners.	<p>Country: Competencies required for ICT use (list from interviews with learners?) in primary institutions:</p> <p>Country: Competencies required for ICT use (list from interviews with learners?) in secondary institutions:</p> <p>Country: Competencies required for ICT use (list from interviews with learners?) in tertiary institutions:</p>



	Country: Competencies required for ICT use (list from interviews with learners?) in vocational institutions:
ICT in education-related research publica- tions	Country (of origin of the author): Institution (of origin of the author): Reference, link, attached document:
Pioneering initiatives in ICT in education (Phase II).	Country: Institution: Individual: Initiative:
Others The rank of ICT-integration by institution (primary, secondary, tertiary). (Phase I)	Country: Rank:



IMPACT OF CURRENT PRACTICE

Objective 5.0

To better understand the impact of ICT in education.

- 5.1 To better understand how ICT change the way we teach and learn (Phase I).
- 5.2 To better understand how ICT change what we teach and learn (Phase I)..
- 5.3 To better understand how ICT can be implemented within actual curricula (Phase II).
- 5.4 To better understand the challenges and possible next steps for ICT use in certain subject matters (Phase II).
- 5.5 To better understand how ICT can accompany educational reforms (Phase II).
- 5.6 To better understand which factors must be taken into account when studying the impact of ICT (Phase II?).
- 5.7 To better understand how ICT impacts cultural and social contexts.
- 5.8 To better understand how people access knowledge in Africa?
- 5.9 To better understand how social impact of ICT in education.

Indicators 5.0

Details/example

Impact on educators and teaching

The impact of ICT on teaching (primary, secondary, tertiary, vocational).

Country:
Institution:
Stated impact (by educators) on lesson-planning:

Country:
Institution:
Stated impact (by educators) on in-class teaching:

Country:
Institution:
Stated impact (by educators) on evaluation methods (exams, etc.):

Country:
Institution:
Stated impact (by educators) on educator-learner communication:

Country:
Institution:
Stated impact (by educators) on reflection on teaching :



Impact learners and learning

The impact of ICT on learning (in general) (primary, secondary, tertiary, vocational).	Country: Institution: Stated impact (by learners) on learning: Stated impact (by educators) on (learners') learning:
The impact of ICT on learner access to knowledge (primary, secondary, tertiary, vocational).	Country: Institution: Stated impact (by learners) on access to knowledge: Stated impact (by educators) on (learners') access to knowledge:
Documentation produced by learners using ICT (primary, secondary, tertiary, vocational).	Country: Institution: Stated impact (by learners) on documentation produced: Stated impact (by educators) on (learners') documentation produced:
Others The levels of learners achievement and other learning outcomes in courses that are taught with and without ICT (primary, secondary, tertiary, vocational). (Phase II)	Country: Institution: Metric for learner achievement/ learning outcomes in courses without ICT: Metric for learner achievement/ learning outcomes in courses with ICT:
The impact of ICT on the level of learner-centred learning (primary, secondary, tertiary, vocational). (Phase II)	Difference:
The impact of ICT on learner engagement, enthusiasm and motivation (higher-order thinking and reasoning skills, creativity...?). (primary, secondary, tertiary, vocational).	Country: Institution: Stated impact (by whom?) on learner-centred learning:
The demonstration by learners of an understanding of the benefits, disadvantages and challenges in information technology. (primary, secondary, tertiary, vocational).	Country: Institution: Stated impact (by whom?) on learner engagement:
The impact of ICT on learner's getting, processing, arranging, distributing and keeping information. (primary, secondary, tertiary, vocational).	Country: Institution: Stated impact (by whom?) of an understanding of the benefits, disadvantages and challenges of ICT:
	Country: Institution: Stated impact (by whom?) on learner's information management:



SUSTAINABILITY/EQUITY

Objective 6.0

To better understand the role of the leadership of principals, school management personnel, and the community in the integration of ICT.

- 6.1 To better understand the role of school principals in the arrival of ICT in institutions (Phase I).
- 6.2 To better understand the role of school principals for the ongoing use of ICT in institutions (Phase I).
- 6.3 To better understand the role of school principals in the professional development of educators (Phase I).
- 6.4 To identify the best strategies to make learners aware of proper uses of ICT (Phase II?).

Indicators 6.0

Details/example

School management & ICTs

The number of institutions with ICT integration plans.

Country:
Number of primary institutions with ICT integration plans:

Country:
Number of secondary institutions with ICT integration plans:

Country:
Number of tertiary institutions with ICT integration plans:

Country:
Number of vocational institutions with ICT integration plans:

The number of institutions with a strategy in place to maintain and renew their ICT equipment.

Country:
Number of primary institutions with a strategy in place:

Country:
Number of secondary with a strategy in place:

Country:
Number of tertiary institutions with a strategy in place:

Country:
Number of vocational institutions with a strategy in place:



The number of institutions that provide access to their ICT infrastructure for the community.	Country: Number of primary institutions that provide access to their ICT infrastructure: Country: Number of secondary institutions that provide access to their ICT infrastructure: Country: Number of tertiary institutions that provide access to their ICT infrastructure: Country: Number of vocational institutions that provide access to their ICT infrastructure:
The number of managers trained to use ICT (in education).	Country: Number of primary institution managers trained to use ICT: Country: Number of secondary institution managers trained to use ICT: Country: Number of tertiary institution managers trained to use ICT: Country: Number of vocational institution managers trained to use ICT:
The impact of ICT on education management practices. (primary, secondary, tertiary, vocational).	Country: Institution: Stated impact (by managers) on education management practices:
The impact of ICT on which curriculum is taught (mathematics, science, language arts, etc., or in teaching or curriculum section?). (primary, secondary, tertiary, vocational).	Country: Institution: Stated impact (by managers) on which curriculum is taught:
The impact of ICT on continuing education / professional development programs (for administrators?). (primary, secondary, tertiary, vocational).	Country: Institution: Stated impact (by managers) on continuing education / professional development programs:
The ability of managers to use ICTs (basic skills).	Country: Number and percentage of managers with email addresses:



Others:

The major barriers (as identified by principals) hindering the achievement of their school's ICT-related goals for learners (the obstacles noted grouped into three categories: those relating to hardware and software, those relating to instruction, and those relating to the training of educators.) (Phase II)



Objective 7.0

To identify the strategies ensuring equity with regard to ICT usage in education.

- 7.1 To better understand the impact of the “digital gap” on education (Phase I).
- 7.2 To better understand the role of gender in the integration of ICT in education (access, types of uses, etc.) (Phase I).
- 7.3 To better understand how to increase the development of African-relevant educational content and material (Phase II).
- 7.4 To better understand the roles of the public and the private sectors in the integration of ICT in education (Phase II).
- 7.5 To better understand the role of socio-economic stratification in the integration of ICT in education (Phase II).

Indicators 7.0	Details/example
The existence of (national?) equity policy documents related to ICT.	Country: Names/dates of documents: Sources/links/attached files: Summaries/explanation (150 words each):
The number of female learners who have access to computers (primary, secondary, tertiary, vocational).	Country: Number of female learners: Number who have access to computers:
The number of female learners in relation to the number of male learners who use (have access to?) ICT in institutions (the changes that occur in terms of time among female and male learners?). (primary, secondary, tertiary, vocational).	Country: Number of male learners who have access to computers: Number of female learners who have access to computers: Difference: Country: Number of male learners who have access to computers (1990): Number of female learners who have access to computers (1990): Difference:
The ratio of male to female educators who have received training and are subsequently using ICT. (primary, secondary, tertiary, vocational).	Country: Male educators who have received training and are subsequently using ICT. Female educators who have received training and are subsequently using ICT. Difference:

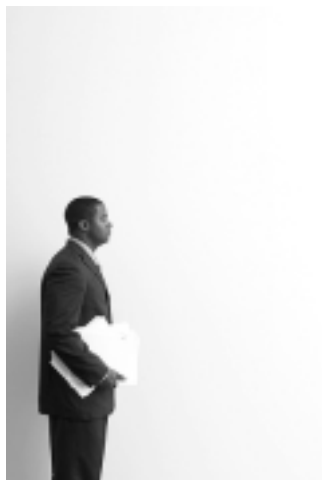


The percentage of institutions in, urban areas that have access to technology in comparison with semi, and non, urban areas.. (primary, secondary, tertiary, vocational).	Country: Percentage of institutions in urban areas that have access to technology: Percentage of institutions in semi urban areas that have access to technology: Percentage of institutions in non, urban areas that have access to technology:
The student to computer ratio in urban areas in comparison with semi, and non, urban areas. (primary, secondary, tertiary, vocational).	Country: Student to computer ratio in urban areas that have access to technology: Student to computer ratio in semi urban areas that have access to technology: Student to computer ratio in non, urban areas that have access to technology:
Equity of access to ICT in education, by ethnicity.	Country: Ethnic minorities: Learner to computer ratio, by ethnicity: Country: Ethnic minorities: Educator to computer ratio, by ethnicity: Country: Ethnic minorities: Educator ICT training background, by ethnicity:
The impact of ICT on the development of African educational content. (primary, secondary, tertiary, vocational).	Country: Stated impact (by managers) on the development of African course content:
The percentage of learners with special needs who have access to ICT in their institutions. (primary, secondary, tertiary, vocational).	Country: Institution: Number of learners with special needs: Number of learners with special needs who have access to ICT: Difference:



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